

## Special Advertising Feature




# THE NEW RULES OF LNG

Illustration  
by Alex Williamson

by Michael Stoppard, Chris Holmes, and Terrell Benke

The long wait is over. In recent years, billions of dollars of investments have gone into liquefied natural gas — LNG — the means by which natural gas is shipped across the world's oceans. As a result, the industry is on the cusp of a rapid expansion in production: Global supply is expected to increase by more than one-third over the next five years, from 247 metric tons (mt) in 2015 to as much as 356 mt in 2020. This year marks the start of the step-up. Much of the new supply will come from Australia and the United States, which are now poised to join the current leading producer, Qatar, to comprise a new Big Three of LNG by decade's end.

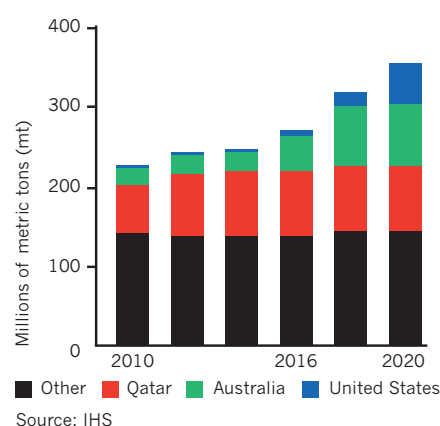
Yet the industry faces a big question: What will happen next? The new supply is coming on line just as demand has slackened, due to falling oil prices and the economic slowdown in China. This is a major turnaround from the first half of the decade, when increased LNG imports from Japan — in the wake of the Fukushima nuclear accident in 2011 — and from emerging economies made for robust demand. Until recently, sellers were so much in the driver's seat that one LNG specialist who negotiated on behalf of buyers famously took a sabbatical, declaring in exasperation that "Negotiation has turned to dictation!"

But now all that has changed, and buyers have the upper hand. Gas prices have cratered, and the name of the game for producers is to secure access to the highest-value markets in a period of oversupply, or in trading parlance, "to control the shorts."

The recent shift in the supply-demand balance may be enough to overturn long-standing practices in the LNG industry. Traditionally, the LNG market has been dominated by bilateral, long-term contracts, which extended for as much as 25 years. Such contracts were seen as essential to enable the underwriting of multibillion-dollar investments in both upstream gas production and downstream pipelines and power stations. LNG suppliers would typically invest only after a large portion of their future output was already sold, and having long-term contracts in hand was

## Global LNG Supply

2010-2015 Actual, 2016-2020 Projected



often a prerequisite to secure financing. One veteran of the industry put it well: "My whole business life has been about mitigating risk, not taking it! You don't gamble with billions." The long-term contracts prevalent in the industry were based not only on detailed terms, but also on trust and the personal relationships that emerged from committed business relationships. LNG has long been a relationship business.

Reliance on long-term contracts was reinforced by the reality that there was no single global price for LNG. Because gas prices vary widely between different regions — for example, prices in Europe and Asia are much higher than in North America — there is no suitable industry reference point on which to base a global LNG price. Instead,

## Global Gas Reset

A major new study on the global natural gas industry

Natural gas, and LNG in particular, will play an increasingly important role in the investment plans of oil and gas companies and the portfolios of power utilities. This multiclient study will focus on three primary topics — supply costs, market competition, and trading rules — over 2016-2025. The study will support investment and procurement decisions over the next 2-3 years for projects slated to start during the first half of the next decade. For more information, contact [Peter.Augustini@ihs.com](mailto:Peter.Augustini@ihs.com).

the price of LNG was usually linked to the price of oil. The prevalence of bilateral contracts left limited room for the traders who characterize the global oil business. Veterans of the LNG industry summed this up with a joke: "Oil is dating; LNG is marriage."

But LNG may be changing. The past year has already seen several remarkable developments. The first is the rise of competitive tenders from buyers. These are not the traditional drawn-out talks across a table between two parties of professional negotiators, hammering out the fine print for a 25-year contract. Instead the mechanism in these competitive tenders is an arm's-length auction, with price as the key bidding point, one that applies for only a short, prescribed period of time. The track re-

cord, trust, and personal relationships of sellers still matter to buyers, but their impact is sharply blunted by the discipline of short-term, anonymous price offers.

The second development, related to the first, is the increasing, if still small, role of commodity trading houses, looking to exploit arbitrage opportunities in a growing but imperfect market. These companies have shown a willingness to enter higher-risk markets, assume some trading and credit risk, and act as go-between to connect traditional buyers and sellers. Their entry appears to be more successful than the prior, largely abortive entry of commercial banks in the latter part of the last decade, which found an asset-light approach to the LNG business difficult to sustain.

It's important not to overstate the pace of change. The role of traders remains small. IHS estimates they accounted for only about 2 percent of total LNG sales last year. And traders often remain very dependent on a single producer for their supply: Much of the trader volume is now being sourced out of Qatar. But trading is the wave of the future, and the role of traders is likely to grow in coming years.

Long-term contracts are changing as well. Terms are now being renegotiated to reflect the new era of lower LNG prices and abundant supply. Recent contract revisions for shipments into

Continued



## To Readers

The oil price collapse, along with economic uncertainty and roiled geopolitics, is driving turbulence in the energy industry. These developments raise important questions: How will the extended period of low prices affect the overall global energy industry, as well as companies, countries, and regions that produce oil and gas? Will the global economy regain higher growth rates or will it remain mired in the new normal of "the new mediocre"? Are there new transformative innovations on the horizon that could have an impact comparable to that of hydraulic fracturing, which came to be adopted at scale less than a decade ago? At what rate will renewables gain market share in the years ahead? And finally, what role will policy and regulation play, especially in light of the agreement at the U.N. climate talks in Paris last December and the U.S. Clean Power Plan? These will be among the many questions and topics at IHS CERAWEEK 2016.

This special section, *Energy Transition: Strategies for a New World*, addresses several key issues at the heart of the current energy picture:

- the big changes underway in the global liquefied natural gas (LNG) industry;
- the growing role of natural gas and renewables in the U.S. electric power industry's generation mix;
- how the Chinese economy's shift from heavy industry to services is affecting its energy demand.

Yesterday's special section addressed the new world of oil in the aftermath of OPEC's recent decision to eschew production quotas; Europe's green-brown contradiction, where rapid growth in renewables is occurring alongside the persistence of coal; implications for the energy industry from the U.N. agreement reached in Paris last December; and the IHS Global Energy Scenarios.

We are pleased to partner again in these special sections with *The Wall Street Journal* during the 35th IHS Energy CERAWEEK conference, February 22-26, in Houston, Texas. IHS CERAWEEK is recognized as the preeminent gathering for the global energy industry. This year's conference will feature presentations and interactive sessions by more than 200 senior executives, government officials, thought leaders, and IHS experts. We anticipate attendance of more than 2,500 participants from more than 55 countries.

As we embark on our 35th IHS CERAWEEK conference, we invite you to share new perspectives on the energy future through the insights in these pages.

## Daniel Yergin

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## Special Advertising Feature



WHAT DOES THE FUTURE HOLD FOR THE

# U.S. ELECTRIC POWER GENERATION MIX?

By Jone-Lin Wang

The U.S. electric power industry is undergoing a rapid transformation. Power plants are being retired at a record rate, matched by new construction unlike anything seen in previous decades. The impact will be felt across the entire power industry and the broader economy. What the future holds for coal, natural gas, nuclear, and renewables will be central for power companies, their investors and suppliers, fuel producers, and carbon emissions for decades to come.

The change is dramatic. In the 1990s and much of the 2000s, coal and nuclear were the mainstays of power supply, providing 70 percent of total U.S. power generation (see chart). Since 2009, however, the shale gas revolution plus dramatic declines in costs of wind and solar photovoltaic (PV) have set in motion changes that may last for decades.

The power generation mix in 2015 shows the beginning of this dramatic change: 14 gigawatts of coal-fired power plants, about 5 percent of the coal fleet, retired in a single year. Coal's share of power generation was down to only 33 percent, from about 50 percent for the two decades to 2008, while the natural gas share rose to 32 percent, almost matching coal's share for the first time. Renewable power, mostly wind and solar PV, reached 7 percent, up from just 2 percent in the previous decade. On top of all of this, a major power company announced the retirement of two nuclear plants well ahead of their license terms and physical lives.

Rapid change is not unprecedented in power generation. In 1970, nuclear power, a new technology, accounted for a negligible share of the total. During the next two decades, construction of larger-sized plants plus better performance propelled nuclear's share to 20 percent. Not even the 1979 nuclear accident at Three Mile Island (TMI) halted the rise in nuclear's share. But eventually post-TMI construction cost overruns curbed new plant construction; the nuclear share has held at about 20 percent from 1990 until now. The oil share went up and down, from single digits in the 1960s to a high of 17 percent in the mid-1970s, only to shrink again to a negligible share after the oil price shocks of the 1970s and early 1980s.

One of the most valuable things about electric power is its flexibility. You can turn just about anything containing energy into electricity — coal, oil, natural gas, uranium, wood chips, sunlight, wind, ocean waves, biomass, trash, even used tires. This means that fuel shares can change dramatically over time. So what does the future hold for various forms of power generation?

Let's start with the two fuels that have in recent years been in fierce competition for power generation: coal and natural gas. Shale gas is a game changer. Shale gas resources continue to grow in size and drop in cost. A newly released IHS assessment — *Shale Gas Reloaded* — shows that more than 800 trillion cubic feet (Tcf) can be produced at no more than \$3 per MMBtu (2014 dollars) and that 1400 Tcf can be produced at no more than \$4 per MMBtu. This means that we have at least enough low-cost gas for domestic consumption plus exports for several decades to come.

The prospect of low-cost gas in the long term gives new combined-cycle gas plants a substantial cost advantage over coal, even without considering carbon emissions. In addition, low-cost gas is pushing down wholesale power prices, which in turn reduces profit margins at existing coal plants. Gas is also becoming cheaper than coal in power dispatch at some locations, further eroding the economics of existing coal plants and leading to retirements. So with no prospects for new construction and the number of existing plants dwindling, coal will continue its long-term decline.

Natural gas will play a key role in replacing retired coal plants and fueling power demand growth. But it will have to share the growth with the newcomers — wind and solar PV — where declining costs and government support have led to sharp increases in their share of power generation over the past five years. The extension of wind and solar tax credits in the federal spending bill signed into law last December will further boost the renewable share, from about 7 percent today to 14 percent in 2022 and 18 percent in 2030.

Low gas prices and the resulting low wholesale power prices will also lead to a decline in the nuclear share. In construction, new nuclear plants are being challenged on costs by combined-cycle gas plants. Furthermore, low wholesale power prices are leading to premature retirements of some well-performing existing nuclear plants, with more likely to follow. The ongoing construction of five nuclear units, set in motion before the consequences of the shale gas revolution were recognized, will offset retirements. But with prospects for new construction low, the nuclear fleet will at best hold its own, and more likely shrink, beginning next decade, reducing a large source of carbon-free electricity.

So the future of U.S. power generation points to a continuation of trends experienced over the past few years: coal shrinking as renewables and gas grow. The nuclear share will shrink modestly as it struggles to maintain the total size of its fleet.

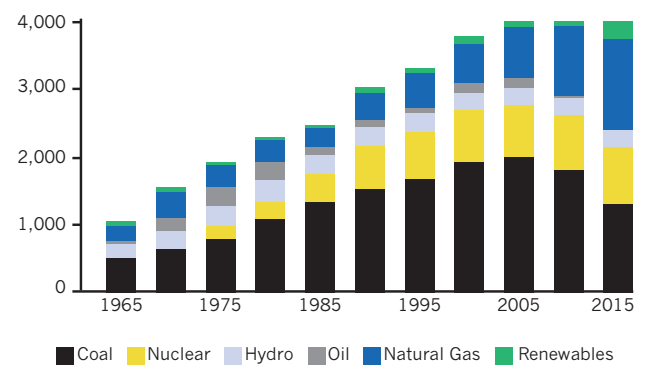
What could change this trend? Earlier this month, the U.S. Supreme Court temporarily halted the implementation of the Environmental Protection Agency's Clean Power Plan (CPP). Would a permanent halt to the CPP stop coal's decline? It would slow the decline but not stop it, according to our analysis. Rapid shifts in the power generation mix are being driven by the shale gas

revolution and the forces described above that are pushing renewable growth.

What about carbon emissions? Declining coal consumption coupled with renewable growth will lead to further declines in power-sector carbon emissions, about 15 percent below 2005 levels in 2014 and 20-25 percent below 2005 levels a decade from now, by our estimate. In the longer term, however, the decline will slow or even reverse, as coal-to-gas substitution runs its course. If more stringent carbon policies are implemented in the next decade, we will probably see even faster changes. Power generation will continue to take in several sources of energy, and diversity of sources will continue to be an important issue for energy security. But don't expect much from used tires.

Jone-Lin Wang is Vice President of Global Power at IHS Energy.

## U.S. Power Generation Mix, 1965-2015 Terawatt hours (TWh)



Source: IHS

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## Special Advertising Feature



# CHINA'S NEW ENERGY REALITY: OVERSUPPLY AS CATALYST FOR REFORM

By James Taverner and Xizhou Zhou

China is not experiencing the much-discussed “hard landing” in its economy. Its traditional heavy industrial sector, however, is going through a major downward shift — an “industrial hard landing” — with a turbulent impact on the world’s largest energy market.

The “commodity super cycle” — in which a decade of high demand caused surges in prices of fuel and many other commodities and overinvestment in supply projects — is over (see chart below this article). Demand has slowed or stalled across nearly all commodities in China, with major repercussions for international suppliers to be felt for many years to come. Global players are being forced to adjust to China’s new energy reality. These difficult conditions, however, have laid the foundation for more sustainable domestic economic growth in the future, as the government seeks to accelerate long-awaited reforms and continue rebalancing towards a larger consumer/service segment. While substantial risks remain, the new policy program is poised to open up many segments of the energy business to greater competition.

## ENERGY CONSUMPTION DRAGGED BY THE INDUSTRIAL SLOWDOWN

In 2015, China fell just short of its GDP growth target for the second successive year — a clear signal of a shift in a country where past headline economic targets were not only routinely achieved but often far exceeded.

The final estimate of 6.9 percent for 2015 obscures big changes. Services contributed over half of GDP, with finance the fastest-growing segment. The contribution of industry to the overall economy continued its downward trend, a structural shift underway for at least a decade. In 2012,

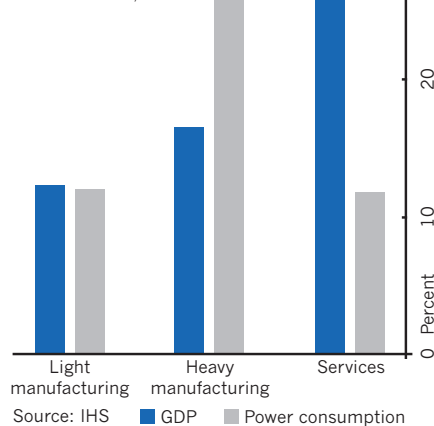
China’s secondary sector — industry and construction — fell below 50 percent of GDP for the first time since at least 1978, and has continued to decline to 40-41 percent in 2015. This narrative of China’s growing services sector is well-known, but it is the trends within the industrial sector — where heavy manufacturing and mining are suffering the most while lighter manufacturing seems to be still holding up — that are having a greater impact on energy.

Electricity consumption growth — often considered the best proxy of China’s economic health — ground nearly to a halt to a mere 0.5 percent in 2015, compared with the average annual growth rate of over 10 percent during the previous 15 years. But this growth is no longer the key indicator of the overall economy. Industry is the most electricity-intensive sector, accounting for over 70 percent of consumption. Demand in this segment fell by 1.5 percent in 2015, the first decline in at least two decades. By contrast, the residential and commercial sectors continued growing strongly, a clear indication of broader macroeconomic shifts. The components of China’s economic and energy growth are increasingly misaligned, with changes in the heavy industrial sector having an outsize impact on energy demand (see chart at right).

With power generation and big industries accounting for the majority of the country’s coal consumption, the current economic transition has disproportionately weighed on coal as well. Coal prices continue the downward spiral that began in 2011, with levels now comparable to 2004 — almost as if the decade-long supercycle never happened. Global coal suppliers are feeling the squeeze — from Australia and Indonesia to as far as South Africa and Colombia — as Chinese coal imports fell more than 30 percent, leading the global steam coal trade to contract in 2015, the first time since the 1990s.

## China's Sectoral GDP vs. Electricity Demand

Chinese GDP and power consumption by selected sector, share of total, 2013



Another sign of the industrial slowdown was in natural gas, where China has long been the barometer for the expansion of the global traded market. In 2015, gas demand grew just 2.6 percent — a dramatic fall from 10.3 percent in 2014, which was already the lowest figure for China in 10 years. Total LNG imports into China in 2015 were flat from 2014, with Chinese state companies finding themselves overcontracted and seeking to sell their excess supply abroad, sending shockwaves into an already oversupplied market.

Even in oil markets, the recovery in Chinese demand in 2015 was marred with weaknesses, especially from industrial fuels like diesel, where real growth was a mere 0.7 percent during the year, as demand from factories and heavy-duty transport sectors decelerated dramatically. There was strong growth in gasoline demand, where robust passenger vehicle sales — especially for SUVs — in the previous year set a good foundation for expansion. But weaker car sales in recent months — combined with the expansion of ownership and license plate restrictions in more Chinese cities and more electric vehicles — will likely moderate gasoline demand growth in the future.

On top of real-demand growth, crude oil stock-build across China accelerated in 2015, creating an increased import requirement of around 300,000 barrels per day — a significant contributor to global oil export growth. The government’s buildout of strategic petroleum reserve capacity toward a target of 90 days forward import cover has been a major driver behind the increased in-

ventories. New planned capacity additions over the next few years will, however, be lower. As a result, 2015 is likely to be the highpoint of China’s demand response to weak oil prices.

## A RARE OPPORTUNITY FOR REFORM IN THE ENERGY SECTOR AND BEYOND

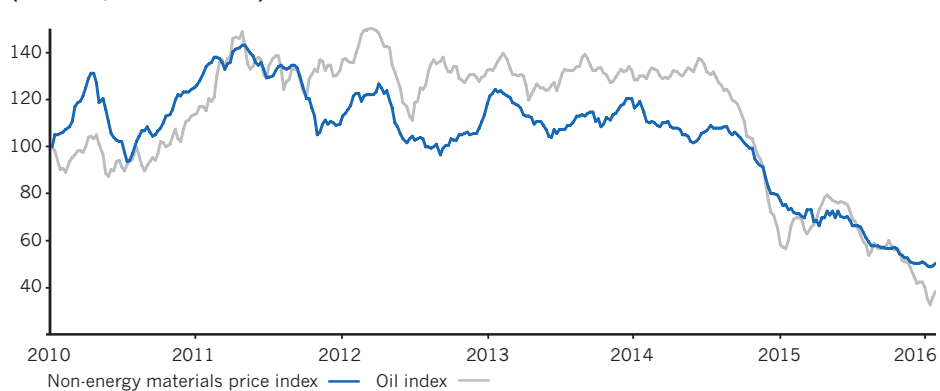
This difficult period of oversupply is proving to be a catalyst for market reform. Low fuel prices have reduced the risk of spikes from tentative moves toward more market-based pricing and highlighted opportunities for the energy sector to become more open and competitive. Indeed, during 2015 the government announced and implemented many groundbreaking reforms, including the liberalization of crude oil import licenses and quotas to allow independents access to the international oil market, a new round of comprehensive power sector reforms that aim to create a competitive wholesale electricity market, and accelerated efforts to create a more independent and transparent midstream for natural gas transportation and storage.

In many ways, energy-market reforms mirror what Beijing would like to implement economy-wide. For example, in its top economic policymaking gathering, the Central Economic Work Conference in December 2015, policymakers highlighted key tasks to focus on in 2016. The most eye-catching among them were plans to resolve industrial overcapacity, an issue that has plagued the economy and the state-owned sector in recent years. The summary document pledged to control new capacity expansions strictly and prevent further industrial overcapacity, as well as to support mergers and reorganizations, implement legal bankruptcy conditions, and provide fiscal support for re-employment. Each of these measures would require reforms in their respective areas, be they financial reforms or legal reforms, but they point strongly toward increased efforts to make the Chinese economy more efficient and allow markets to play a more prominent role in resource allocation. These market reforms will create risks for participants in the Chinese energy sector, but also fresh opportunities in many segments of China’s energy value chain previously closed to foreign investment.

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## Non-Energy Materials Price Index vs. Oil Index

(Week 1, 2010 = 100)



Source: IHS Pricing and Purchasing Service

## New Rules of LNG continued

India have been the most high-profile of these price adjustments.

Two big questions still loom for the industry: Will liquid physical trading hubs emerge? And how will LNG be priced?

There are various initiatives to develop LNG trading hubs, and candidate locations include Singapore, the Chinese coast, Japan, or Rotterdam. The development of liquid, workable trading hubs is likely to take time. The development of Europe’s gas pipeline hubs, which required 20 years, provides a useful comparison. The journey was painful for many stakeholders, and repeated regulatory intervention was needed to create the gas supply infrastructure access terms that were a prerequisite to achieving the required levels of liquidity. The prospect of similar regulatory intervention is lacking for the global LNG trade.

As for gas pricing, practices are now in flux. Traditional oil indexation re-

mains the dominant choice but is being supplemented by indexation to U.S. and European spot gas prices. With the lack of a credible spot LNG reference price, further blending of different pricing mechanisms, rather than a single reference price, is likely in the future — and with different pricing mechanisms come arbitrage opportunities.

Despite the shifts underway, LNG is not the “new oil.” It will continue to operate under its own distinct rules, even as those rules evolve in the face of changing circumstances and new market players, and as LNG assumes a greater role in meeting the world’s energy needs.

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