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ASIA'S ENERGY SECURITY
AMID GLOBAL MARKET CHANGE

By Muhamad Izham Abd. Shukor, Clara Gillispie, Antoine Halff, Mikkal E. Herberg, Meghan L. O'Sullivan, Leslie Palti-Guzman, and Cecilia Tam

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AMID GLOBAL MARKET CHANGE

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INTRODUCTION

With recent major shifts in global energy markets, prospects for advancing Asia's long-term energy security have improved dramatically. Energy security has for decades been a key strategic concern for Asia. However, from 2003 through 2013, the region faced an even more challenging period characterized by a growing sense of energy scarcity, historically high prices, and severe strategic and economic insecurity for import-dependent economies. This environment aggravated an already pronounced zero-sum atmosphere in Asia in which countries competed for control of energy supplies and both maritime and overland transportation routes, which in turn led to heightened prospects for conflict. But with the huge and unexpected rise in North American unconventional oil production since 2007, the region's narrative of energy scarcity has changed profoundly. The continuing resilience of the United States' unconventional oil output—along with the simultaneous return of Iranian oil, rising Iraqi oil production and exports, and modest but steady growth in global oil demand—now seems likely to herald a period of very ample global oil supplies and lead to an extended outlook of "lower for longer" oil prices. As a whole, these developments have been viewed positively among the region's major importers from South Korea to Japan, even as they have raised new questions and challenges for exporters such as Russia.

Such a major transformation in energy security prospects goes beyond what is happening in oil markets. Markets for liquefied natural gas (LNG) have also undergone a profound readjustment from the extremely tight markets experienced in recent years. Enormous new supplies are now entering the market from rising Australian production and the advent of the United States as an emerging shale natural gas producer and exporter. Asia's LNG markets now appear headed for a lengthy period of ample supplies and moderating prices. This has helped ease the region's deeply ingrained concerns over future LNG supply availability and prices, which has been a major contributor to the underutilization of gas in Asia relative to other regions of the world. The new supply picture also seems likely to increase the flexibility in LNG contracts, including by reducing the emphasis on oil-linked pricing and fostering a more liquid and responsive LNG market in Asia. Overall, these shifts could strengthen the opportunity to usher in a "golden age of gas" in Asia, enabling gas to penetrate new markets, replace coal use, and help reduce air pollution and the rate of growth in carbon emissions.

This new era of energy abundance potentially brings a range of other important benefits to the region. As ample supplies bring the potential to temper the region's competitive and nationalistic atmosphere over energy supplies and transit routes, this in turn should improve prospects for much-needed regional energy cooperation. This includes collaboration on supply development, emergency oil stockpiles, and shared energy infrastructure—areas that have long been identified as fertile ground for cooperation but that have been held back by deep insecurities. Lower oil and natural gas prices have also helped create political space for Asian governments to reduce expensive and counterproductive energy subsidies that have historically absorbed huge budgetary resources that are desperately needed for investments in infrastructure, health, and education. A number of countries, including China, India, Indonesia, and Malaysia, have already made important progress in reducing energy subsidies. An era of relative abundance, lower prices, and much-lower costs for

energy imports also could help boost economic growth for countries across the region. High prices on energy imports have been a serious drag on Asian economic growth over the past decade.

Altogether, a period of abundant oil and LNG supplies could have a wide range of very important benefits for Asia's energy outlook and security. Nevertheless, the balance sheet in the longer term is potentially much more mixed. While energy security concerns have receded somewhat for the time being, today's favorable environment may prove temporary.

Most importantly, global investment in the development of future oil supplies has declined significantly. Planned investments worth hundreds of billions of dollars have been canceled or delayed as a result of falling oil prices. Even investment in U.S. unconventional oil has been sharply reduced, leading to a substantial drop in oil output from its peak in 2014. Declining investment globally raises the risk of a serious shortage in a few years as supply growth diminishes and demand continues to rise. Moreover, many key oil exporters are facing greater political instability in the wake of a collapse in their oil revenues, increasing the risk of supply disruptions. The Organization of the Petroleum Exporting Countries (OPEC) is under extreme pressure and is struggling to manage its own production growth and control an internal battle for market share. Hence, anxieties over energy insecurity in Asia could return soon as oil markets tighten over the next several years. Recent history suggests that this adjustment could be very sharp and destabilizing.

A prolonged period of lower oil prices also has potentially less favorable implications for Asia's energy security goal of diversifying sources of oil imports. Low prices will dramatically slow the development of new supplies from many areas around the world on which Asia has been depending to diversify its oil imports away from the volatile Middle East. The region will likely become more dependent on the lowest-cost areas, such as the Middle East, where production can still increase at lower prices. Asian countries need to reconsider how to respond to a challenge to their efforts to reduce this dependence.

Another serious concern revolves around the potentially negative impact of a period of fossil fuel abundance and moderate prices on Asia's progress toward a cleaner and more sustainable energy mix. As the largest source of future growth in energy demand and therefore carbon emissions, the region is crucial to meeting global climate goals; indeed, the Asia-Pacific already accounts for five of the world's top-ten carbon emitters (or six, if you include the United States—the world's largest emitter per capita and second-largest emitter overall). Abundant oil supplies and moderating prices have the potential to accelerate already rapidly rising oil demand in the region and slow the development and deployment of cleaner transportation technology. Lower coal prices also have the potential to slow Asia's transition from coal to natural gas, renewables, and nuclear energy. These trends could risk reducing the urgency of the region's commitments to slowing the growth in carbon emissions and meeting the targets set at the 21st Conference of the Parties (COP21) in Paris.

Hence, Asia's policymakers need to avoid complacency in their efforts to shift toward a cleaner energy mix and act quickly to take advantage of the current favorable environment. The window of opportunity for building stronger regional energy governance, strengthening energy markets, and pursuing key energy reforms may begin closing relatively soon.

In view of these complex, crosscutting implications of a new era of energy abundance and opportunity, the National Bureau of Asian Research (NBR) convened its 2016 Energy Security Program under the theme "Asia's Energy Security amid Global Market Change." Each year this

program examines a major development in Asian energy markets and considers how regional policymakers should respond to the environmental and geopolitical implications of relevant market and policy changes. The 2016 program focused on a range of issues, with key themes including the prospects for global and Asian oil markets, the geopolitical implications of the major shifts in global energy markets, the outlooks for Asia's LNG and natural gas markets, and options for addressing environmental and climate policy goals.

To explore these issues, NBR commissioned four essays by authors with expertise on oil and LNG markets, geopolitics, and Asian environmental policy. Their preliminary findings were discussed in detail at a high-level workshop in Washington, D.C., on July 8, 2016, featuring senior representatives from the U.S. and foreign policymaking communities, research specialists, and leading industry and geopolitical specialists. The authors then incorporated the feedback they received at the workshop to further strengthen their essays, which are published collectively here for the first time.

In the opening essay, Antoine Halff from the Center on Global Energy Policy at Columbia University analyzes the short- and longer-term impact of low oil prices on Asian countries and assesses the risks to regional energy security. He suggests that the recent shifts in oil markets are unprecedented in scope and duration and reflect deep structural changes in the oil industry as a result of the advent of shale oil. However, while lower prices have brought some benefits to Asia, the overall impact has been a mixed blessing of stronger oil demand and relatively limited economic benefits. Halff focuses on the risks that reduced oil investment will limit future growth in global oil production capacity and concentrate Asia's oil dependence on the Middle East. He recommends that Asian countries implement policies to build stronger strategic petroleum reserves, including more transparency and regional coordination, domestic energy policy reforms to enhance competitiveness and lower energy costs in domestic oil markets, the reduction of costly energy subsidies, and measures to strengthen Asia's leadership on regional and multilateral energy cooperation.

In the second essay, Meghan L. O'Sullivan from Harvard University's Kennedy School examines the geopolitical implications of the new energy environment. She argues that this new era of energy abundance has profound effects on the way Asian countries interact both with one another and with the rest of the world. She contends that this new environment has undermined Russia's pivot to Asia, has strengthened a broader Chinese approach to foreign policy that goes well beyond scarce resources, and will tie Asia and the Middle East more closely together. From this, O'Sullivan suggests that Asian oil importers must come to terms with the need for more active engagement in the Middle East in the interest of achieving greater regional stability and energy security. She also contends that Russia and China's increasingly robust energy engagement will likely be transactional rather than strategic in this new environment. Finally, she argues that the new environment will strongly influence China's approach to either accepting or seeking to remake the international order.

Next, Leslie Palti-Guzman from the Rapidan Group examines the vital issue of Asia's changing LNG market in the context of recent shifts in pricing and the demand environment brought on by an increasingly abundant supply outlook. She argues that current and potentially sustained low prices will stimulate demand for LNG in developing Asia and temper the decline in demand from more mature importers such as Japan and South Korea. Both countries will have a strategic interest in ensuring that LNG is priced competitively and transparently for a whole range of

important economic, security, and environmental reasons. China, India, and other South and Southeast Asian importers will see competitively priced LNG as a new opportunity to reduce coal use, particularly in the power sector, and meet goals for reducing both air pollution and carbon emissions. This expansion of the LNG market would be very good news for achieving the region's environmental and energy security goals.

Finally, Cecilia Tam and Muhamad Izham Abd. Shukor from the Asia-Pacific Economic Cooperation (APEC) Energy Research Center consider one of the region's most pressing issues for its efforts to achieve the goals outlined in the Paris climate accord: whether the current environment of lower energy prices risks slowing Asia's progress toward a cleaner and lower-carbon energy mix. They argue that at present most APEC economies have aspirational or firm targets for energy efficiency and renewable energy, but the specific goals are still insufficient to meet targets for environmental sustainability and energy security. While near-term momentum on clean-energy transitions is likely to remain strong, the longer-term picture is more mixed, given concerns over cataclysmic air pollution and impacts on public health, especially if policymakers do not begin to take greater action now. This new era of lower energy prices will require governments to strengthen their regulations and policies to encourage consumers to make the right choices. If Asia is to meet its goal of doubling the share of renewable energy in the energy mix by 2030, countries need to introduce additional incentives for renewables and work more diligently to limit the inefficient use of fossil fuels. The good news is that developments in renewable energy technology are dramatically reducing costs and making wind and solar increasingly competitive in power generation, while more efficient end-use technologies are helping lower overall growth in energy demand. Accelerating the further development of energy technology will be critical to meeting environmental and security goals.

This group of essays provides a clear vision for how the new era of energy abundance is altering energy markets, with geopolitical implications for energy security in Asia and beyond. Shifting oil markets require Asian governments to bolster their regional and global energy cooperation efforts and prepare for potential new supply shocks in the not-too-distant future. This new environment has the potential to reduce the politicization of energy markets and relationships while intensifying pressure on Asia's big oil importers to deepen their engagement with the Middle East. Lower LNG prices likewise could help reduce carbon emissions and air pollution as they facilitate wider use of natural gas throughout coal-intensive Asia. Finally, the advances in renewable energy technology, and the resulting lower costs, are likely to support the efforts in the region to strengthen energy and environmental policies and achieve more ambitious targets, even in an era of lower prices for fossil fuels.

NBR's Energy Security Program owes its ongoing success to the efforts of many participants, partners, and collaborators. First and foremost, we are grateful for the sponsorship of the Asian Development Bank, Chevron, ConocoPhillips, ExxonMobil, the Korea Energy Economics Institute, and the Center for Energy Governance and Security at Hanyang University. Their generous support has enabled us to address some of the most critical energy security challenges facing the Asia-Pacific—and to do so in a comprehensive, integrated manner that brings together the region's leading experts from the research, business, and policy communities. We are also grateful to our co-host of this year's Energy Security Workshop, the Woodrow Wilson International Center for Scholars, and to Michael Kugelman, whose insights on South Asia contributed immensely to these critical discussions. NBR's own Andy Nguyen also played a

critical role in synthesizing this year's final recommendations. We appreciate his tireless efforts in strengthening both our program agenda and the report's final essays.

Next, we would like to extend our deep appreciation to all the current and former senior U.S. government representatives who participated in our 2016 program. Of these individuals, we would like to extend special thanks to Paula Gant, principal deputy assistant secretary of the Office of International Affairs at the U.S. Department of Energy, and Melanie Nakagawa, deputy assistant secretary for energy transformation in the Bureau of Energy Resources at the U.S. Department of State. Their in-depth remarks offered invaluable perspectives on the role of and need for U.S. leadership in an era of energy abundance, and we are grateful for their willingness to share their expertise.

Finally, we are deeply indebted to all our program authors and panelists. Many of them literally traveled across the country or around the world to join in these discussions, and we appreciate the time, effort, and critical eye that they lent to testing and debating the core findings and recommendations in the report. Ultimately, this year's program was able to convene more than 150 senior stakeholders representing a wide range of perspectives, countries, and professional backgrounds. We hope that you find the results as immensely rewarding as we do.

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The Outlook for Asia's Oil Market in a Lower-Price Environment

Antoine Halff

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EXECUTIVE SUMMARY

This essay examines the short- and longer-term impact of low oil prices on Asian countries and assesses the risks to energy security.

MAIN ARGUMENT

The collapse of oil prices that began in June 2014 is unprecedented in scope and duration and reflects deep structural changes in the oil industry as a result of the advent of shale oil and global shifts in oil consumption. As the world's largest oil-importing region by far, and one in which the share of global oil demand is expected to grow even more in the next twenty years, Asia is uniquely affected by these developments. While lower oil prices have brought the region some benefits, this trend has been a mixed blessing and carries significant risk for the future. Low prices have stimulated oil demand but not economic growth, with the notable exception of India. The price decline has also slashed investment in future oil-production capacity and increased Asia's dependence on exports from the Middle East at a time of rising political risk in that region. These considerations call for Asian countries to adopt conventional precautionary measures, reform their domestic oil sectors, and expand their engagement in multilateral energy-related organizations.

POLICY IMPLICATIONS

- Developing strategic petroleum reserves (SPR) now can offer a cushion in the event of a disruption. However, building reserves on such a large scale has its own risks. To manage these risks, SPR policies must become more transparent and better coordinated, whether through the International Energy Agency (IEA) or ad hoc channels.
- Asian countries should aggressively pursue domestic reforms to enhance the liquidity, transparency, and competitiveness of their domestic oil markets and reduce the oil intensity of their economies. As part of this program, Asian countries should take advantage of their lower oil-import bills and oil-subsidy burdens to step up investment in renewable energy, clean-tech infrastructure, and efficiency programs.
- At a time of rapid and profound transformation in oil and energy markets, Asia's emerging economies should assume greater leadership in reforming and remodeling existing institutions, such as the IEA and International Energy Forum, to increase their participation or by designing new institutions to better articulate their vision for global energy governance.

Global oil and energy markets are undergoing a significant transformation. The emergence of shale oil in the United States has helped trigger the steepest, longest-lasting price collapse in the history of the oil trade. It has also changed the dynamics of the oil market and the nature of risk for buyers and sellers in important ways. Advances in extractive technologies have unlocked vast reserves that had previously been thought too costly to develop, replacing past fears of a coming supply peak with a newfound perception of abundance. Meanwhile, shale oil companies, operating on a short business cycle and with low initial capital requirements, challenge the traditional business model of oil companies. On the demand side, too, owing to a combination of climate and environmental policies, technological advances, and shifts in the global economy, market participants are focusing on the possibility that peak oil demand—not peak supply—may be in sight.

The impact of these developments is global in scope and by no means limited to Asia.[1] Yet nowhere are they more evident than in this region. Asian economies already make up the world's largest oil-consuming group, taking the lion's share of global oil trade flows.[2] Their share of the oil market is only expected to increase in both absolute and relative terms as projected income and population growth in Asia continues to expand energy requirements.[3]

Although Asia, as the world's top crude importer, should in theory be the main beneficiary of a prolonged downturn in oil prices, the reality is more nuanced and varies from country to country. Meanwhile, the longer-term consequences of sustained low prices—specifically, the twin risks of a violent price reversal following years of underinvestment in production capacity and of increased dependence on imports from a small group of relatively low-cost but politically unstable producers—are concerning. In a matter of years, Asia's economies may face both a steep rebound in their import bills and potentially crippling supply disruptions.

Yet the outlook for Asian oil markets is not all bleak. While the drop in oil prices might not on balance have provided as strong a stimulus to the region's economies as could have been expected, the shale revolution has nevertheless transformed energy systems in ways that broad measures of economic performance cannot capture. Change offers both opportunity and risk for Asia. Should oil prices stay low, regional players should treat this extended period of plentiful, affordable oil supplies as a window of opportunity to further bolster their long-term strategic reserves and take additional steps to boost the liquidity and transparency of their oil markets. At the same time, mindful of the inevitability of a price rebound, governments should resist the temptation of complacency and actively pursue all avenues to lower the oil intensity of their economies. Given not only Asia's expanding energy footprint but also the growing interdependence of the world's

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[1] For a general discussion of the transformative power of shale oil production, see the International Energy Agency (IEA), Medium-Term *Oil Market Report* 2015 (Paris: Organisation for Economic Co-operation and Development [OECD]Publishing, 2015); and Antoine Halff, testimony before the U.S. Senate, Committee on Energy and Natural Resources, Washington, D.C., January 19, 2016, available at http://energypolicy.columbia.edu/sites/default/files/energy/Halff%20Senate%20ENR%20Testimony_2016.01.19.pdf. Oil-exporting economies from regions as diverse as Latin America, North and sub-Saharan Africa, the Middle East, and Eurasia have been struggling with acute fiscal and social pressures brought on by an unexpected, protracted shortfall in export revenues, sometimes with tragic effects. Those countries that are highly dependent on oil revenues without the benefit of large financial buffers have been hit particularly hard. Venezuela is a case in point: the collapse in oil prices, compounding the legacy of years of mismanagement of the oil sector, has triggered not only political turmoil but a full-blown humanitarian crisis. The effect on oil importers, while less dramatic, has by no means been less meaningful.

[2] According to the BP Statistical Review, Asia-Pacific crude oil imports averaged 20 million barrels per day (bpd) in 2015, accounting for just over half of global trade. Refined product imports totaled 8.9 million bpd and exports were 6.3 million bpd, compared with global trade of 21.5 million bpd. BP plc, "Statistical Review of World Energy 2016," June 2016, http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

[3] In 2015, the IEA forecast that Asian crude imports would reach 33.8 million bpd by 2020, including 8.2 million bpd to China, 4.3 million bpd to OECD Asia, and 7.4 million bpd to other Asia-Pacific countries, accounting for nearly 59% of global crude oil trade. IEA, *Medium-Term Oil Market Report 2015*, 82–86.

leading economies, any steps that Asian countries can take in this direction will ultimately benefit not only the region but the global market.

The essay begins by taking a quick look at the ripple effects of the U.S. shale oil revolution on global oil markets, in particular the new oil supply and price reality facing Asian consumers. Next, I provide a snapshot of the short-term consequences of this new reality for Asia: negative growth in relatively high-cost oil supply and surprisingly tepid economic growth across most of the region except India. I go on to note, however, that there has been a decoupling of Asian oil demand and economic growth; despite the relatively anemic economic performance of the region, Asian consumers have shown a healthy appetite for low-priced refined products, and stockpiling has taken off, rapidly filling new tank farms. Finally, I consider the longer-term threats posed by "lower-for-longer" oil prices for the region and offer recommendations for dealing with these challenges.

Anatomy of a Price Collapse

Price corrections are as old as the oil market itself, but this one is both deeper and longer than past corrections. Daily Brent prices plunged by more than 75% from $115/barrel in June 2014 to a low of $26/barrel in January 2016 and since then have only managed a partial recovery to the $45–$50/barrel range. At the time of writing, the price correction had dragged on for 27 months, longer than any prior downturn. Until the Organization of the Petroleum Exporting Countries (OPEC) met in September 2016, speculation was rife that prices would remain low for another two to three years, or even longer. The meeting failed to fully dispel expectations of such an extended low-price period.

From the onset, the market downturn seemed bound to last. As early as February 2015, still in its relatively early stages, the International Energy Agency (IEA) cautioned that the rebalancing and price recovery, inevitable as they may be, might differ in pattern and duration from previous ones.[4] Investment bank Goldman Sachs made headlines by forecasting a protracted rebalancing and slower price rebound than usual.[5] Expectations that prices would stay low gained further ground after OPEC oil ministers at their December 2015 meeting formally gave up their long-standing goal of maintaining a collective production ceiling. Several analysts projected then that oil prices could stay depressed for an extended period of time and fall to around $20/barrel.[6]

The protracted nature of the downturn in oil prices since June 2014 goes beyond the normal cyclicality of commodity markets. The unusual steepness and stickiness of the correction reflect in part the severity of the underlying imbalance between supply and demand, also evidenced in the record-busting oil inventory build to which it has led.[7] Expectations of prices remaining lower for longer also stemmed, from the onset, from the transformative impact of shale oil and the shockwaves that its rapid rise as a supply source has sent across the industry. Not only did shale

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[4] According to the IEA, "the issue is how [the] necessary rebalancing, and the price recovery that will accompany it, might depart from those that followed similar price drops in the past." See IEA, *Medium-Term Oil Market Report 2015*, 10. For full disclosure, I edited this report and penned the executive summary from which the quote is excerpted.

[5] Jake Rudnitsky, "Goldman Sees Oil Staying Lower for Longer to End Supply Glut," Bloomberg, August 6, 2015; and Goldman Sachs, "The New Oil Order: Lower for Even Longer," September 11, 2015.

[6] "Investors Brace for Oil Price 'Lower for Even Longer' after OPEC," Reuters, December 7, 2015.

[7] As of the end of July 2016, oil inventories in OECD countries had reached of 3,111 million barrels, an all-time record. See IEA, *Oil Market Report*, September 13, 2016.

oil producers log the fastest supply growth ever for oil, but they also operate in ways that differ radically from those of traditional oil companies. Unlike the rest of the industry, which is driven by large, slow-moving, and deep-pocketed firms, shale operators are small, nimble, and highly leveraged. They work on a fast business cycle with short lead times, quick payback times, and steep initial decline rates. Larger and wealthier companies find it hard to compete with these deeply indebted upstarts.

Although shale oil still only accounts for less than 5% of the global market, it has changed the rules of engagement for the remaining 95%. Shale oil makes it difficult for OPEC to act according to market expectations in a price collapse—namely, by cutting production—since any drop in OPEC output would presumably run the risk of becoming a de facto shale subsidy. Shale producers could, at least in theory, take advantage of any price increase that results from an OPEC cut to boost their investment and quickly raise production. They could thus deprive OPEC of the benefit of its supply cut and quickly grab any market share that OPEC exporters would relinquish. Hence, the group made the landmark decision in November 2014 not to lower its production target in the face of lower prices, and in December 2015, following further price declines, it dispensed with supply ceilings altogether.[8] Shale oil makes it challenging for most non-shale producers—whether OPEC or non-OPEC—to invest in future production, given the uncertainty about future prices, expectations of shale oil's high price elasticity, and the capital squeeze and exacting profitability threshold caused by the price collapse.[9] Since the price drop, the only place where the rig count has not plummeted has been the Middle East, which is dominated by relatively low-cost producers. Thus, the outlook for future production growth is becoming increasingly concentrated in just two regions: the U.S. shale patch and the oil monarchies of the Persian Gulf.

Given the unprecedented nature of the shale oil industry, its outlook remains highly uncertain. How easily its success in the United States can be replicated elsewhere is unclear, as is the likely duration of the U.S. shale boom. Given the potential for continued improvements in shale technology and the existence of large shale oil deposits in Russia, China, Latin America, and elsewhere, shale production may remain high, and even grow, for decades to come. In that case, oil prices would remain under sustained downward pressure, undermining investment in other oil plays outside the Middle East.[10]

In any event, as discussed above, shale has already had a bearish overall impact on oil markets. OPEC's initial decision to raise rather than cut production has turned the shale-driven supply glut into an even larger one, resulting in unprecedented inventory builds. Shale companies were the first to cut production in response to the price drop, with the U.S. shale supply having declined by

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[8] On September 28, 2016, OPEC ministers appeared to backtrack on that decision at an exceptional meeting in Algiers and agreed to set a new production target for the fourteen-state group of 32.5 million bpd to 33.0 million bpd. The decision did not amount to more than a declaration of intent, however, as the details of its implementation were left to a later OPEC meeting scheduled for November 30, 2016, in Vienna. In practice, the accord seemed bound to have only a limited impact, if any, on actual production levels. The top of the proposed production range was very close to the group's production levels at the time of the meeting, and the likelihood that members would agree on how to share the burden of any production limit seemed doubtful. See Antoine Halff, "OPEC's Elusive Course Out of the Doldrums," Columbia University, Center on Global Energy Policy, October 5, 2016.

[9] The shale oil industry is exceptionally fragmented. The most successful shale oil producers are comparatively small and exclusively dedicated to shale oil production. Given the success of these pure-play shale producers, traditional oil companies have sought exposure to the shale oil sector but for the most part have had only limited success. Bradley Olson and Sarah Kent, "Too Big to Frack? Oil Giants Try Again to Master Technology That Revolutionized Drilling," *Wall Street Journal*, August 16, 2016. For serviceable and entertaining journalistic histories of the shale oil industry, see Gregory Zuckerman, *The Frackers: The Outrageous Inside Story of the New Billionaire Wildcatters* (New York: Portfolio/Penguin, 2013); and Russell Gold, *The Boom: How Fracking Ignited the American Energy Revolution and Changed the World* (New York: Simon and Schuster, 2014).

[10] Many questions remain about technical constraints to further large-scale shale supply gains, the continued availability of capital for shale suppliers, and offsetting impacts on non-shale production. While both Russia and Argentina, for instance, boast of large shale deposits, those face much higher hurdles to production than in the United States.

1.1 million barrels per day (bpd) in June 2016 from its April 2015 peak. Yet they are also positioned to react more rapidly than the rest of the oil industry in the event of a market recovery. Should prices rebound, shale's presumed capacity to respond by ramping up production in short order would likely put a cap on markets and prevent, at least for some time, the emergence of super-cycles such as those that were experienced in previous downturns. On the flip side, low prices as a result of the shale revolution have discouraged longer-term investment in non-shale supply, even as they have accelerated rates of decline by incentivizing producers to delay field maintenance. That combination of faster decline and underinvestment in long-term production capacity potentially sets the stage for a steep price rebound in the future.

The Economic Impact of Low Oil Prices in Asia and Beyond

Just as the supply of oil has been undergoing deep changes, so has demand. Low oil prices would normally be expected to provide a strong stimulus to the global economy, yet so far that has not been the case overall. For the most part, global economic growth has remained sluggish. Oil-exporting countries, which had been among the world's leaders in terms of economic growth, have been particularly weakened by the price collapse. Saudi Arabia, the world's largest oil exporter, saw annual economic growth fizzle from 3.6% in 2014 and 3.5% in 2015 to a projected 1.2% for 2016, according to the International Monetary Fund.[11] Other oil-exporting economies have sunk into recession. Russia, the world's second-largest oil exporter, hit by both lower oil prices and international sanctions following its annexation of Crimea, went from anemic GDP growth of 0.7% in 2014 to a steep contraction of 3.7% in 2015. The country's GDP is projected to further decline by 1.2% in 2016.[12]

Economic trouble in oil producers has triggered contagion effects across the world: Russia's economic meltdown has rippled through the neighboring economies of Central Asia and Eastern Europe. Likewise, slow growth in Middle Eastern oil monarchies has cut remittances from Indian, Pakistani, Filipino, and other expatriate workers and taken a toll on their home countries.

It is worth remembering that economic growth had already weakened before the collapse of oil prices. In fact, slow growth had been an important driver of the price correction, compounding the effect of rising shale supply. China, which had been the leading engine of global oil demand and a major factor behind high oil prices for much of the previous fifteen years, is a case in point. Chinese GDP growth fell gradually in recent years, slipping to 7.3% in 2014 from double-digit growth in the 2000s and a recent high of 9.5% in 2011. It slid further to 6.9% in 2015 and is projected to drop to 6.6% in 2016.[13] Economic growth in the advanced economies of the Organisation for Economic Co-operation and Development (OECD) was also exceptionally sluggish in the run-up to the price collapse, averaging just 1.9% in 2014, including growth of just 2.4% in the United States, 0.9% in the eurozone, and 0% in Japan.[14]

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[11] International Monetary Fund (IMF), "Uncertainty in the Aftermath of the U.K. Referendum," World Economic Outlook Update, July 2016, http://www.imf.org/external/pubs/ft/weo/2016/update/02/pdf/0716.pdf.

[12] IMF, "Uncertainty in the Aftermath of the U.K. Referendum"; and IMF, "Russian Federation," IMF Country Report, no. 16, July 2016, http://www.imf.org/external/pubs/ft/scr/2016/cr16229.pdf.

[13] "IMF Executive Board Concludes 2016 Article IV Consultation with the People's Republic of China," IMF, Press Release, August 12, 2016, http://www.imf.org/en/News/Articles/2016/08/11/20/37/PR16374-China-IMF-Executive-Board-Concludes-2016-Article-IV-Consultation.

[14] IMF, "Uncertainty in the Aftermath of the U.K. Referendum."

In several countries, swings in foreign exchange rates have partially offset lower crude prices in local currency terms, so consumers have not seen the full benefit of the price declines. Due to the collapse of the ruble in 2014–15, for example, Russian refined product prices have not fallen nearly as much in domestic currency terms as crude oil prices in dollar terms. Thanks to the strong appreciation of the U.S. dollar, the same is true, to varying degrees, of retail prices in most other economies whose currency is not pegged to the dollar. Against the backdrop of deflationary pressures across several leading oil-consuming economies, weak oil prices may also have fueled expectations of further deflation, thus discouraging investment and spending and ultimately undermining—rather than supporting—economic growth.

Evidence of a strong economic benefit from low prices is particularly lacking in the Asia-Pacific. With a few notable exceptions, such as India and select countries in the Association of Southeast Asian Nations (ASEAN), including Vietnam and Thailand, most of the region's economies—both advanced economies and emerging ones—saw their GDP decline from 2014 to 2015. This applies to Australia, China, Hong Kong, South Korea, and Taiwan as well as Indonesia, Malaysia, Mongolia, and the Philippines. Japan recovered in 2015 from the previous year's recession, but just barely, with growth below 0.5%.[15]

In sum, as the world's largest oil-importing region, Asia would normally be expected to be the prime beneficiary of low prices, but so far the impact has been mixed at best. Low prices have undermined local crude production while failing to stimulate economic growth, as subsidy reforms, local currency depreciation, and structural changes in the Chinese economy have largely offset the economic benefits typically associated with falling oil prices.

The Impact on Asian Crude Production

Although a large net crude importer, Asia nevertheless includes several large crude producers. Indonesia, in particular, remains a significant crude oil exporter, with output averaging roughly 690,000 bpd in 2015. Growing domestic demand, however, has transformed the country into an importer of refined products and a net oil importer since 2004, leading it to suspend its membership in OPEC in December 2008. Indonesia later rejoined the organization in 2015, following the election of President Joko Widodo the previous year, ostensibly to gain better access to crude supplies through strengthened cooperation with oil-exporting countries and to serve as a link between producers and consumers. China, with average crude production of 4.33 million bpd in 2015, ranks as the world's fifth-largest crude producer, having depended on domestic production for roughly 40% of its own oil needs that year.[16] Other Asian producers include India (870,000 bpd), Malaysia (710,000 bpd), and a variety of smaller market participants with aggregate production of 1.18 million bpd in 2015.[17]

As elsewhere, Asian crude producers have suffered greatly from the price collapse. The impact on China has been especially severe. Chinese crude production is projected to fall to 4.07 million bpd from an estimated 4.33 million bpd in the previous year, reversing three years

[15] IMF, *World Economic Outlook: Too Slow for Too Long* (Washington, D.C.: IMF, 2016), available at http://www.imf.org/external/pubs/ft/weo/2016/01/weodata/index.aspx.

[16] Percentage based on IEA estimates. See IEA, *Oil Market Report*, August 11, 2016, tables 2 and 3.

[17] Ibid., table 2. These figures exclude production from Russia's Far Eastern fields.

of output gains.[18] Production in mature fields like Daqing has an official breakeven price of $45/barrel—though unofficial estimates are substantially higher—but it cannot easily be suspended when prices fall below that level, thereby forcing companies to operate at a substantial loss. Capacity closures and attendant layoffs also pose a significant social risk for China: riots have reportedly caused oil-sector layoffs in oil-producing regions.[19] Despite these obstacles to shutting production, China's crude output has started to fall, increasing the country's reliance on imports and harming employment and social stability.[20] In addition, diminishing profits from other oil exporters also have indirectly harmed China by undermining demand for its manufactured goods.

The Impact on Asian Economic Growth

On balance, Asian economies, as elsewhere, do not appear to have benefited from the oil price collapse so far, as growth has remained sluggish through the downturn. As discussed above, the region's weak overall economic performance, and especially China's slowdown, were in fact major drivers of the oil price collapse, compounding the effect of supply-side factors such as rising shale oil supply and OPEC's decision not to cut production. Economic research has shown that price declines are less likely to serve as a catalyst of economic growth when they are driven in part by demand-side factors.[21] According to a recent World Bank report, the effects of oil prices on economic activity and inflation depend on the underlying source and direction of the changes in prices. Whereas price changes driven by supply shocks are often associated with significant changes in global output and transfers of wealth between oil exporters and importers, the World Bank notes that demand-driven price changes "tend to lead to weaker and, in some studies, insignificant effects."[22] Plunging oil demand growth in Asia and beyond in the second quarter of 2014 was a major, if somewhat underappreciated, factor behind the oil price plunge of June 2014, which may go some way to explaining the lack of initial economic response in the region to lower prices.

Several economic studies also document that the impact of oil prices on output has weakened over time. Reasons for this trend range from the falling energy intensity of economic activity to

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[18] See IEA, *Oil Market Report*, August 11, 2016; and IEA, *Annual Statistical Supplemen*t, August 11, 2016. Chinese crude production in June 2016 averaged 4.08 million bpd, 375,000 bpd lower than a year earlier, as operators cut output at many of the country's largest oilfields. State oil company China National Petroleum Corporation (CNPC) reported earlier in 2016 that oil prices had fallen below break-even levels at its main onshore oilfield at Daqing. CNPC's Daqing Oilfield Company pegged local production costs around $45 per barrel. The IEA quoted CNPC as saying that the field's profit fell by 54.2 billion yuan to 10.2 billion yuan in 2015 from the previous year, and at the start of 2016 the field was losing money. In the *Oil Market Report* dated July 13, 2016, the IEA stated that "Chinese crude supplies slipped to their lowest level in nearly three years in May [2016] as hefty spending cuts by major producers continue to impact. According to the latest data from the National Bureau of Statistics, China produced 3.97 mb/d [million barrels per day] of crude oil in May, a drop of 65 kb/d [thousand barrels per day] from April, and 300 kb/d lower than a year earlier. China's leading producer, CNPC, is targeting crude output of 2.53 mb/d in 2016, a drop of nearly 5% from last year. Sinopec is also expecting its crude oil production to fall by around 5%, or 50 kb/d, this year, to just over 0.9 mb/d while CNOOC [China National Offshore Oil Corporation] is targeting supplies of around 1.3 mb/d this year compared with output of around 1.35 mb/d on average in 2015." IEA, *Oil Market Report*, July 13, 2016.

[19] Although CNPC affiliate Daqing Oilfield Company estimates the field's production costs at $45 per barrel, industry insiders privately peg costs as high as $60 per barrel. While price declines are reported to have forced some production cuts, officials privately note that CNPC continues to operate the field at a loss in order to preserve jobs, due to concerns over the effect of layoffs on social stability. Field economics would dictate steeper production cuts than have so far been implemented. Author's private communication, Beijing, June 30–July 1, 2016.

[20] As of September 2016, the IEA forecast that Chinese crude supply would decline further to an average of 3.96 million bpd in 2017. IEA, *Oil Market Report*, September 13, 2016.

[21] It may be argued, however, that Asia's economic performance would have been even weaker in the absence of an oil price decline. Japan's economy also likely benefited greatly from the steep decline in liquefied natural gas (LNG) prices in 2015–16, compared to the highly elevated levels triggered in part by the earthquake and tsunami of March 2011 and the surge in Japanese LNG import requirements that followed the shutdown of the country's fleet of nuclear reactors.

[22] World Bank, "Understanding the Plunge in Oil Prices: Sources and Implications," in *Global Economic Prospects: Having Fiscal Space and Using It* (Washington, D.C.: World Bank, 2015), 158, https://www.worldbank.org/content/dam/Worldbank/GEP/GEP2015a/pdfs/GEP2015a_chapter4_report_oil.pdf.

more flexible labor markets, which lowered rigidities associated with price markups, to stronger monetary policy frameworks.[23]

The Indian Exception

While Asia's economic response to the collapse of oil prices has generally been weak, India bucks the trend. Booming growth in the country had preceded the onset of lower prices and was further supported by it, with a drop in the oil-import bill likely accelerating the impact of the Narendra Modi administration's economic reforms. Indian business sentiment surged in response to Modi's election as prime minister in 2014. As chief minister of Gujarat, he had been widely credited for the state's rapid economic growth. His nomination as prime minister of India took effect in May 2014, less than one month before the onset of the oil price decline.

India's strong economic growth and the scale of its oil imports as the world's third-largest crude importer have placed the country in a position to better benefit from lower oil prices than its slower-growing neighbors. Because the country's crude imports make up about one-third of total imports by value, or some $135 billion per year since 2011 (partly offset by product exports), "fluctuations in the oil price are therefore fundamentally important to the Indian economy," according to the IEA. When oil is priced at $60/barrel, the IEA reckons that India trims its import bill by $70 billion compared with an average oil price of over $100/barrel, which prevailed from 2011 until mid-2014. The resulting savings are equivalent to fourteen times the government's allocation to the health sector. Lower prices have a positive impact on the Indian economy through higher consumer spending by households (around 30% of energy expenditure in India's cities is allocated to gasoline and diesel), a reduced current account deficit, lower government spending on energy subsidies ($3.5 billion is spent annually on liquefied petroleum gas, or LPG, subsidies), and reduced inflation (oil products represent the fourth-largest component on the Indian consumer price index).[24]

India, however, is an outlier. Elsewhere in Asia, the trouble with inflation is not that it is too high, but that it is not high enough. This problem is compounded rather than alleviated by low oil prices. For the first time since World War II, the global economy has been facing deflationary pressures. The economic literature on deflation—let alone on oil price impacts in a deflationary environment—is relatively thin. With the exception of Japan, the world has not experienced much deflation since World War II. The case of Japan, however, does suggest that low oil prices may exacerbate deflationary pressures and thus undermine—rather than stimulate—economic growth.

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[23] World Bank, "Understanding the Plunge in Oil Prices," 158.

[24] IEA, *World Energy Outlook 2015* (Paris: OECD Publishing, 2015), 468. The *World Energy Outlook 2015* includes a special report on India, with different projections based on different oil price assumptions. In the "new policies scenario," or central case, the benefits of low prices dissipate as strong demand and weak supply send oil prices back up to $128/barrel by 2020–40. That takes the edge off of India's thirst for oil-based mobility and lifts its oil and gas import bill up to nearly $480 billion by 2040, from $110 billion in 2015. In contrast, the "low-oil price scenario" assumes that oil prices remain in a $50–$60/barrel range until the mid-2020s, before rising slightly to $85/barrel by 2040. The impact on India is expected to be mixed. On the upside, the economy grows faster, as does oil demand in transportation and other sectors. Power generation benefits from lower costs for transporting coal, and LNG plays a larger role in the fuel mix. Average household incomes rise, the fiscal deficit is better contained thanks to a lower subsidy burden, and the government has more money to spend on physical and social infrastructure. On the downside, high-cost domestic oil and gas production is hard hit, and oil output is 10% lower than otherwise. The adverse effect on supply is compounded by stronger demand growth, lifting oil imports and making the country more dependent on Middle Eastern suppliers, the main source of low-cost oil. Energy security is thus undermined.

Based on this evidence, some analysts have suggested that in a deflationary context low prices may feed into expectations of price declines, thus leading to slower, rather than faster, growth.[25]

The Impact of Low Prices on Asian Oil Demand

While the collapse of oil prices has failed, in aggregate, to provide a clear economic stimulus to Asia, its effect on demand is another story. Asian oil imports and implied demand have surged to record levels in the last two years. This growth, however, has not been evenly distributed across the barrel; rather, headline gains in total demand mask strong disparities between products.[26] Asian oil inventories have also exhibited strong growth. While stock building has been a worldwide phenomenon since the onset of the price drop, inventory gains in Asia have been particularly steep and have been facilitated by dramatic increases in oil storage capacity. In 2016 the region has led the world by a wide margin in storage capacity expansion, including, but not limited to, Chinese and Indian strategic reserves.

Against the backdrop of weak economic growth and China's "new normal"—Beijing's policy switch away from energy-intensive, export-oriented manufacturing in favor of consumer-focused sectors of the economy—regional demand for those oil products that are most closely related to industrial activity has been exceptionally weak. This is consistent with the lack of economic response to declining oil prices. In contrast, end-user demand for products associated with consumer spending, such as those used for personal mobility or as petrochemical feedstock, has been far more robust. According to recent IEA estimates, demand in China averaged 11.5 million bpd in the first quarter of 2016, which is an increase of only 200,000 bpd from the previous year and a sharp reduction from earlier growth rates. For 2016 as a whole, the IEA projects sharply reduced demand for residual fuel oil (used in industry) and, to a lesser extent, gas oil and diesel (used in industrial processes and freight transport), offsetting growth in personal transportation fuels (gasoline and jet fuel), fuels used for cooking and residential space heating (LPG), and petrochemical feedstock (LPG and naphtha).[27] By September 2016, however, even gasoline demand had started to slow: "A dramatic deceleration in non-OECD deliveries has been the other major contributor to sharply slowing global oil demand growth," the IEA noted in its *Oil Market Report* dated September 13, 2016. The report explains:

> China has been the major non-OECD decelerating influence, with preliminary estimates of 3Q16 oil demand showing the complete absence of [year-on-year] growth for the first time since the end of the Great Recession of 2008–09. Lower 3Q16 numbers are mostly due to government efforts to ensure "blue skies" at

[25] Philip K. Verleger has brought attention to this issue. See Philip K. Verleger, "All the Rules Could Be Wrong," Notes at the Margin, October 27, 2014. See also IEA, *Medium-Term Oil Market Report 2015*. More recently, an IMF analysis showed that interest rates in the zero bound, where they currently are in most advanced economies, impede the stimulus impact of lower oil prices. If Central Banks cannot reduce interest rates further in response to falling oil prices, then lower inflation (due to falling oil prices) will translate to higher real interest rates, which, in turn, may hurt demand, output, and employment. See Maurice Obstfeld, Gian Maria Milesi-Ferretti, and Rabah Arezki, "Oil Prices and the Global Economy: It's Complicated," iMFdirect, March 24, 2016, https://blog-imfdirect.imf.org/2016/03/24/oil-prices-and-the-global-economy-its-complicated.

[26] The IEA forecasts stronger growth in global demand for consumer fuels until 2021 than for oil products used in electricity generation and industrial activity. IEA, *Medium-Term Oil Market Report 2016* (Paris: OECD Publishing, 2015), 17.

[27] The IEA noted in June 2016 that "big declines in gasoil/diesel and residual fuel oil demand provided the greatest offset to otherwise robust Chinese petrochemical and gasoline demand." It added that "the National Bureau of Statistics (NBS) cited Chinese industrial activity rising by 6.0% on a year-over-year basis in April, after gains of 6.8% in March and 5.4% in January–February, while the Caixin Manufacturing PMI has generally shown pessimistic readings since early 2015." For 2016 as a whole, the IEA projected contraction of 35.0% in residual fuel oil demand and 1.3% in gasoil/diesel demand, offset by growth of 6.1%, 5.3%, and 11.4% in gasoline, jet fuel, and LPG, respectively. See IEA, *Oil Market Report*, June 14, 2016, 10.

> September's G20 meeting in Hangzhou by encouraging factories nearby to cease production, which curbed industrial oil use. These factory closures, coupled with an ongoing economic slowdown and reports of heavy flooding, dented industrial oil use and transport fuel demand.[28]

Generally speaking, since the onset of the oil price collapse, lower prices have had a markedly different impact on economic growth and oil demand in Asia. This has been reflected at the demand level in diverging trends in industry and household consumption of oil products. Asian demand for transportation fuels and petrochemical feedstock, which is closely associated with consumer spending and domestic demand, has soared to new highs, while industrial fuel demand has lagged. In India, for example, the IEA has reported exceptionally "strong gains in the transportation and petrochemical sectors," which "will underpin India's demand growth at 0.4 mb/d [million barrels per day] in 2016, likely to be the biggest global volume growth."[29] It is worth observing that the petrochemical sector is widely forecast to be a leading driver of growth in global oil demand and that Asia is the world's largest petrochemical manufacturer, with China, South Korea, and Japan accounting for 13%, 8%, and 6%, respectively, of global oil consumption for petrochemicals.[30]

Asian demand for crude imports has surged even faster than end-user demand for refined products. In Japan, steep reductions in refining capacity, driven by government policy, have had no tangible effect on throughputs and have instead lifted refinery utilization rates. China shows a particularly strong contrast between overall economic growth and growth in demand for crude oil: crude imports rose to an average 6.71 million bpd in 2015 and 7.46 million bpd in the first four months of 2016, which is a much steeper pace of growth than that of refinery runs, let alone end-user demand.[31]

In China and the region more broadly, there is strong evidence that low prices have led to a spate of aggressive commercial and strategic stock building. Low prices have given crude importers a chance to build inventories at reduced cost. China is less than transparent about the scope and pace of its stock-building efforts: changes in commercial inventories are reported only in percentage terms, from month to month, while strategic reserves are not routinely disclosed. In September 2015, however, the IEA estimated that Chinese crude stocks had increased much faster since the price collapse than official statistics indicated. The report speculated that China had likely taken advantage of low crude prices to fill commercial storage tanks at newly built refineries and oil terminals and to speed up, as well as expand, its strategic petroleum reserve (SPR) program. The IEA noted that Beijing had allocated special funds to hasten the completion of the second phase of its crude SPR and reckoned that it might boost the reserve's total target capacity as high as 670 million barrels, up dramatically from an initial goal of 500 million barrels. Achieving that goal would require taking the third phase of SPR construction to 320 million barrels, following the

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28 IEA, *Oil Market Report*, September 13, 2016, 11.

29 IEA, *Oil Market Report*, June 14, 2016, 11.

30 IEA, *Medium-Term Oil Market Report 2016*.

31 Adam Rose and Chen Aizhu, "Amid Global Price Rout, China Crude Oil Imports Hit Record," Reuters, January 12, 2016, http://www.reuters.com/article/us-china-economy-trade-crude-idUSKCN0UR0DU20160113.

addition of an estimated 230 million barrels in phase two, well above Beijing's original target of 169 million barrels.[32]

Yet stock building has not been an Asian monopoly during the recent period of low prices. As noted, OECD commercial stocks have risen steadily since the onset of the price drop, reaching new records. Non-OECD stocks are poorly measured, but global balances of supply and demand imply dramatic increases there too. Inventory gains appear to be most dramatic in Asian economies, however, thanks in part to their ambitious expansion of storage capacity. For 2016, the IEA projected that Asia alone would account for roughly 80% of new global storage capacity, estimated at a total of 231 million barrels. China was expected to singlehandedly account for 145 million barrels of storage additions, or more than half the global increase. This includes 110 million barrels of new SPR tanks at Jinzhou, Huizhou, and other sites, as well as new commercial facilities in Yangpu, Dongying, Yunnan, and Shandong. India was forecast to follow suit by adding nearly 30 million barrels of capacity to its SPR, including 11.0 million barrels at Mangalore and 18.4 million barrels at Padur, to be completed by the end of 2016. A smaller 7.6 million barrel facility at Visakhapatnam, started in January 2008, was reportedly completed in 2015 and filled to capacity.[33] Likewise, Singapore was expected to add 4.5 million barrels of commercial storage capacity, with a further gain of 300,000 barrels in Maldives.[34] Outside Asia, the IEA estimated that most of the additions in global storage capacity for 2016 would occur in producer countries—in order to support new production capacity or facilitate exports—including gains of 36 million barrels in North America and 10 million barrels in Fujairah.[35]

In sum, Asian countries have responded to low oil prices by aggressively building their commercial and strategic oil stocks. Yet although on paper this provides these countries with a buffer against supply disruptions and thus improves energy security, low prices also increase the need for such protection by arguably heightening the risk of supply disruptions and setting the stage for considerably tighter oil balances down the road.

Asia's Changing Relations with Crude Exporters

One of the many effects of the shale revolution has been to redraw the oil trade map and speed up the shift in the direction of oil export flows from west to east, thus increasing the market power of Asian buyers. Rising U.S. and Canadian unconventional supply has cut both North American and European crude import requirements.

In North America, this shift has been a direct consequence of the growth in domestic production, which has decreased the region's crude-import requirements, as refiners have been able to source more feedstock locally. Moreover, even as crude imports have declined, product exports have increased: rising North American crude supply has helped boost refinery throughputs, turning the United States, long the world's top importer of refined products, into the largest net product exporter by far.

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32 IEA, *Oil Market Report*, September 11, 2015, 35. The IEA projected an SPR fill rate of 380,000 bpd for September–December 2015 and 260,000 bpd over 2016. It estimated that 78 million barrels were added to the SPR in the eighteen months to September 2015 and reckoned that two additional sites totaling 37.8 million barrels of storage capacity would be commissioned by the end of 2015. The IEA also reported that four more sites, with a total capacity of 94.5 million barrels, were in the latter stages of construction and expected to start up in 2016.

33 Author's communication with the IEA Emergency Preparedness Division, Directorate of Energy Markets and Security, October 12, 2016.

34 IEA, *Oil Market Report*, January 19, 2016.

35 Ibid.

In Europe, the effect of North American crude production has been more indirect. Rather than being displaced by competing crude supplies, European crude imports dwindled on the back of falling refinery throughputs, as European refineries struggled to stay competitive in the face of fast-growing product exports from the United States and elsewhere. Other factors have further undermined the competitiveness of Europe's aging refineries in a rapidly globalizing downstream market. As many as seventeen European refineries have shut down in recent years, causing European crude imports to decline even faster than the region's demand for product.[36] Meanwhile, even as European and North American crude markets started closing down for exports, global crude supply in search of outlets kept growing, as exporters from the Middle East and elsewhere responded to rising shale oil production by boosting, rather than cutting, their own output. Thus, crude exporters have had to compete more aggressively in a shrinking crude market increasingly focused on the so-called East of Suez region. The race for Asian market share has heated up dramatically.[37]

Unsurprisingly, these changes have had a dramatic effect on the pricing and marketing of crude oil in Asian markets, notably in China. As Asian buyers find themselves in a stronger position to bargain with crude exporters, the so-called Asian price premium, by which import-dependent Asian buyers pay more for crude than their counterparts in other regions, has narrowed and even reversed in recent years. Chinese buyers, in particular, led by the large oil-trading companies Unipec and China Oil, have enjoyed considerable market power.

After OPEC's failed attempt to agree on a production freeze in April 2016, the trade publication *Energy Compass* predicted that "the battle for market share among Mideast producers is only going to rage on." It observed that "the world's largest crude exporters—Saudi Arabia, Iran, Iraq, Kuwait, and the United Arab Emirates—have come to realize that the comfortable foundations that they have relied on for decades have crumbled." The newsletter added that "Mideast producers are learning that they need to be more proactive and that they really need to pay attention to crude markets." This "proactive" search for market outlets often revolved around pricing crude more aggressively in Asia, with Middle Eastern exporters undercutting each other in a desperate bid for market share.[38]

While geographic proximity has long made Asia a natural outlet for Middle Eastern producers, more distant crude exporters have had to extend their marketing reach while growing increasingly dependent on Asian buyers since the price collapse. Nigerian crude was long a staple of the U.S. East Coast refiners' feedstock diet but was suddenly backed out of that market by U.S. Bakken light, tight crude railed from North Dakota. As a result, Nigerian crude increasingly sailed eastward to China and India in 2015 and 2016. The country's dependence on Asian markets grew so much that on repeated occasions in 2015 Chinese and Indian buyers appeared to force a collapse in Nigerian crude prices, and as a result to pressure prices for Atlantic Basin benchmark Brent lower as well, by suspending or delaying purchases of Nigerian cargoes.[39] "Distressed" Nigerian cargoes became

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[36] In 2015 there was a partial reversal of that trend, as falling shale supply gave North American crude imports a small boost, while European refiners enjoyed unexpectedly good margins. But this reversal was likely only temporary.

[37] Heightened export competition among Middle Eastern (and other) producers in Asia has been further exacerbated by the growth in Iranian production, unshackled from international sanctions in the wake of the Iran nuclear deal and increased geopolitical tensions between Tehran and Riyadh.

[38] "Market Forces: Market Share Battle Rages On," *Energy Compass*, April 22, 2016

[39] The trade newsletter *Oil Daily* reported in November 2015 that "distressed cargoes, competing loading programs and rising exports are putting downward pressure on Nigerian crude prices, which are at 10-year lows." For further analysis of this trend, see Timothy France, "Unsold Nigerian Crude Drags Down Prices," *Oil Daily*, November 27, 2015.

a household term of crude markets, and this condition was occasionally attributed by market participants to Asian trading schemes. Market perceptions of Asian leverage, and specifically of the ability of Asian trading firms to force prices down, grew in proportion with the crude glut, but Asian traders were also seen as capable of manufacturing rallies. In 2015 and 2016, trading sources repeatedly attributed run-ups in fuel oil prices in Singapore to "squeezes" by Chinese buyers.[40] While such allegations cannot easily be proved, market perception of Asian pricing power became a fact of life in its own right.

Asia's growing importance to crude exporters has expressed itself not only in the price discounts that the latter have been increasingly willing to grant Asian buyers but also in the more flexible contractual arrangements that exporters have been prepared to offer to clinch new deals. Thus, in 2016, after independent Chinese refineries in Shandong Province received crude import licenses for the first time, Saudi Aramco reportedly agreed to sign spot contracts with those prospective buyers, an apparent departure from its preference for long-term contracts. The stakes were high, as the refineries' combined import quotas were reportedly large enough to support incremental shipments of up to 1 million bpd or more.[41]

Furthermore, there is anecdotal evidence of heated competition between the national oil companies of producer countries and international oil companies for the business of independent Chinese refineries. In June 2016, refinery officials in Shandong reportedly had representatives from Saudi Aramco, the National Iranian Oil Company, and a Western international oil company sit side by side at a common conference table to make their pitch, which marked a dramatic departure from the industry's traditional secretiveness.[42] More spot deals and groundbreaking practices can be expected in the near future as additional refineries receive crude import licenses. Meanwhile, both China and India have been able to secure long-term supply deals with Russia at low prices by providing needed financing to sanctions-hit Moscow. China has also used its deep pockets to secure pre-purchases of crude oil from Russia, Venezuela, and other embattled producers reeling from the effect of low prices and reduced capacity to access international capital markets.

Longer-Term Threats to Asian Energy Security

For all the near-term benefits low oil prices offer Asian buyers, they can also increase long-term risks to Asian energy security in several ways. First, sustained low prices increase Asia's exposure to supply disruption risks. The longer prices stay low, the greater the pressure on international oil companies and national oil companies alike to cut spending, resulting in delays in necessary upstream investment. By restricting upstream expenditures, low prices set the stage for an investment shortfall and potentially steep price rebound. Adverse effects on energy security will be further aggravated by the particularly harmful consequences of low prices on high-cost domestic production. In China, in particular, sustained low prices will erode costly domestic production capacity and make the country more dependent on imports, and thus more vulnerable to supply disruptions. Some of the shutdowns forced by low prices and spending cuts will likely result in permanent capacity losses. The IEA reckons that long-term low prices would similarly undermine

[40] Author's private communications with market participants.

[41] Freddie Yap, "Chinese Teapots Rock Crude Markets," *Energy Compass*, March 18, 2016.

[42] Author's private communication, Beijing, June 30, 2016.

India's domestic production capacity and increase the country's import dependence, adversely affecting its trade balance and supply security.[43]

Second, although low prices and the current oil glut have increased global competition for Asian crude markets and allowed regional importers to choose from an ever-expanding menu of crude grades, a sustained period of low prices would ultimately undermine supply diversity by focusing investment in two key regions: North America (specifically in U.S. shale) and the Persian Gulf. For Asia, that means not only heightened import dependence in the face of domestic supply losses but also greater reliance on a proverbially unstable region. While the oil monarchies of the Persian Gulf have so far been relatively insulated from the turmoil of the Arab Spring, political risk is on the rise. As conflict escalates in Iraq, Syria, and Yemen, Saudi Arabia and Iran fight proxy wars at their doorstep. Low prices are prodding member countries of the Gulf Cooperation Council to launch sweeping economic and social reforms that hold both promise and risk. Public acceptance of some of those policies, no matter how sound they may be, remains untested over the longer term. In Saudi Arabia, for example, there has already been some pushback against subsidy reductions. Should the political stability of the Gulf Cooperation Council be tested, Asia could find itself after a protracted period of low oil prices more vulnerable to the risk of supply disruptions than it would have been otherwise.

Asia's growing market clout may not last indefinitely. China's long-term crude purchases at fire-sale prices from embattled producers could backfire as producers teeter on the brink of collapse. China's financing deals with Venezuela are a case in point. Increasingly unable to repay its debt to China with timely crude shipments, Venezuela has proved willing to postpone deliveries to China and sell to trading houses for cash instead. The sides have reportedly worked out a deal to reschedule deliveries, though the details have not been made public.[44] China could also face a backlash when prices recover and oil-exporting countries find themselves on firmer negotiating grounds.

The willingness of Middle Eastern producers to sell spot cargoes in Asia and compete for the Asian crude market may also fade if they succeed in diversifying downstream, which would ultimately come at a cost for Asian countries. Saudi Arabia's broad reform agenda, Vision 2030, was triggered in part by the price collapse and calls for a broad reordering on the country's oil sector and overall energy strategy. Proposed measures include, but are not limited to, doubling the country's refining capacity and aggressively expanding downstream into petrochemicals products. Should Saudi Arabia succeed in executing this ambitious plan, Asia may or may not benefit. Among the most likely candidates for hosting expanded Saudi refining capacity are India, Indonesia, Malaysia, and Vietnam. The impact of new joint-venture Saudi refineries on those countries could prove double-edged. The projects would theoretically lock in a steady supply of Saudi crude but also could make them vulnerable to a dominant supplier whose own pricing power may recover as markets rebalance. Should Saudi Arabia face headwinds and experience the unrest and political turmoil that has engulfed many of its Middle Eastern neighbors, Asia could find itself badly exposed.

Third, although low oil prices could induce greater reliance on cheap oil, their long-term unsustainability means that there is no room for complacency in the regional countries' efforts

[43] See "India in a Low Oil Price Scenario," in IEA, *World Energy Outlook 2015*, 469.

[44] Corina Pons, Alexandra Ulmer, and Marianna Parraga, "Exclusive: Venezuela in Talks with China for Grace Period in Oil-for-Loans Deal—Sources," Reuters, June 15, 2016.

to improve efficiency, develop alternative sources of energy, and reduce the oil intensity of their economies. Several governments have already taken advantage of low prices to reduce oil subsidies.[45] China has also been looking to reduce the dependency of its transportation sector on oil products and to encourage both gas vehicles—cars that run on compressed natural gas and trucks that use liquefied natural gas—and electric vehicles. Many Japanese automakers, in particular Toyota and Nissan, are also developing their electric vehicle product lines, while Toyota is exploring, with government support, the potential for hydrogen fuel cell vehicles.

These measures are pointed in the right direction. The removal of oil subsidies, for example, will ensure that markets respond to price signals in the event of tightening supply. The development of electric vehicles and alternative energy also holds promise. However, even the aggressive deployment of electric vehicles will only gradually displace oil. China, which has made the expansion of this industry a strategic priority of its 13th Five-Year Plan, faces particularly daunting hurdles in terms of raising the quality standards of its products and ensuring that the needed electricity supply and charging infrastructure are available. The electric vehicle industry may also face higher lithium costs as it scales up if it remains dependent on lithium-ion battery technology. Greater R&D support will be needed to help manage these challenges.

Given the three major risks to energy security discussed above, continuing to build crude oil stocks is a good idea. But expanded stocks can only provide Asian countries with an emergency response to a short-term disruption by bridging supply until commercial responses materialize. This strategy cannot provide a long-term solution to underinvestment or help cope with the failure of producer states.

Conclusion: Opportunities to Reform Energy Systems and Global Governance

As the world's largest oil-importing region and the fastest-growing oil market, Asia is disproportionately affected by the current reconfiguration of the industry. Shifts in supply triggered by the rise of shale oil and new demand trends driven in part by the growing momentum of climate and environmental policies, technological advances, and shifts in the global economy will have long-term effects for the oil market as a whole and Asia in particular. Thus far, the collapse in oil prices has been a mixed blessing for the region. Though it has provided an economic stimulus in fast-growing India, the economic impact has been weaker in most other Asian countries, where the downturn occurred against a backdrop of an economic slowdown and deflationary pressures. Lower oil prices have undermined Asian oil production but appear to have encouraged end-user demand for transportation fuels and petrochemical products. These trends, however, seem unsustainable over the longer term. In the meantime, oil inventories, including Chinese and Indian strategic reserves, have increased dramatically, and Asian countries have used this opportunity to strengthen their negotiating position vis-à-vis crude exporters.

[45] India removed state control over diesel prices in October 2014 after liberalizing gasoline prices in 2010, and it lifted subsidies on LPG (used for home cooking) for some households in January 2016. Malaysia removed subsidies in late 2014 across the board and now adjusts prices monthly. Indonesia ended gasoline subsidies in January 2015. Rakesh Sharma, Maryelle Demongeot, Jason Fargo, and John van Schaik, "Market Forces: Cheap Fuel Fades Away," Energy Compass, April 8, 2016. See also "Asia's Subsidy Dilemma Poses Risk to Demand," *Petroleum Intelligence Weekly*, July 4, 2016; and Varun Sivaram and Jennifer M. Harris, "Sustaining Fuel Subsidy Reform," Council on Foreign Relations, Discussion Paper, October 2016.

Yet although China and other Asian countries have been flexing their muscles as the global crude oil market accelerates its migration to Asia, the global commercial and governance architecture does not yet reflect this shift. Most of the world's internationally traded crude remains priced off Atlantic Basin or inland U.S. crude benchmarks (Brent and WTI/ASCI), even though it is increasingly being shipped to Asia. The main crude futures markets, the ICE and CME, are still Western-based, while the Middle Eastern benchmarks Oman and Dubai, which are used for some Asian crude pricing, lack liquidity. To address these issues, Asia ought to develop local benchmarks to enable better price discovery and the formation of price signals more closely in line with the realities of Asian markets. To do so, it must support the formation of more liquid, transparent, and competitive domestic markets.

Awarding crude import licenses to independent Chinese refineries would help make local markets more active and liquid with the emergence of new crude buyers, thereby facilitating the establishment of a functioning futures or physical crude market in Shanghai or the region. But that is only a first step, given that licenses can be revoked or fail to get renewed. The emergence of widely adopted Asian crude benchmarks is overdue and would greatly improve market transparency and efficiency. Yet this is unlikely to occur unless markets are more fully liberalized.

China and other non-OECD Asian economies also deserve a seat at the table of international institutions that oversee the energy industry, notably the IEA. China and the IEA have indicated that they are working on establishing a joint research center in Beijing, and China is stepping up its engagement in other areas as well. Current IEA statutes, however, limit full membership to OECD member states, thus keeping the fastest-growing oil markets from fully participating in the organization. The engagement of emerging Asian economies will be limited until the IEA itself is reformed to allow for full participation from non-OECD countries. China recently took the helm of the International Energy Forum with the appointment of a former president of the CNPC Economics and Technology Research Institute as secretary general. This may be a good opportunity to raise the forum's profile. On the other hand, attempts by China to sponsor a "BRICs of energy" group have met with international resistance and have not borne fruit.

Over the longer run, low prices carry risks for Asia. While low prices could induce a false sense of complacency among the region's oil importers, the need for energy reform in Asian countries themselves is greater than ever. The potential for oil market tightness and a violent price rebound down the road adds urgency to implementing climate and environmental policies designed to enable the transition to a lower-carbon economy. Those policies should be strengthened and prioritized, while savings from lower oil prices and fewer subsidies ought to be invested in alternative energy, energy-efficiency measures, and the deployment of clean-energy infrastructure, such as charging stations for electric vehicles or gas and power distribution. Increased competition in domestic oil markets through reform and deregulation will also strengthen market integrity and boost the resilience of Asian economies in the event of energy shocks. Meanwhile, the more formalized the role of Asian countries in global energy governance institutions becomes, the more secure and reliable global energy markets will undoubtedly be.

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Asia: A Geopolitical Beneficiary of the New Energy Environment

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EXECUTIVE SUMMARY

This essay examines the implications of the shift from perceived scarcity to abundance in global energy supplies for the geopolitics of Asia and the region's interactions with the broader international scene.

MAIN ARGUMENT

In considering the impact of the new energy environment on Asia, much analysis has focused on the consequence of low energy prices and the resulting economic implications. Although these issues are important, a world in which energy is more abundant also has profound effects on how Asian countries interact with one another and with the rest of the world. There are three particular areas in which the geopolitical landscape has changed considerably in light of the new energy environment. The energy situation has (1) undermined Russia's pivot to Asia, (2) lubricated a broader Chinese foreign policy that goes well beyond the pursuit of scarce resources, and (3) tied Asia and the Middle East more closely together in ways that will require greater Asian engagement in the volatile region.

POLICY IMPLICATIONS

- While Asian countries will inevitably continue to seek to diversify their energy sources away from the Middle East, they should also come to terms with the notion that their active engagement—including in the domestic affairs of some countries—will be required to achieve regional stability and energy security.
- Russia and China will continue to develop a more robust energy relationship, but the new energy environment will help ensure that this relationship is more transactional than strategic in nature.
- The particular trajectory that the new energy environment takes will have implications for China's deliberations about whether to further integrate itself into the current international order or try to remake the order entirely to better suit its interests.

Asia is the most dynamic region of the world, partially on account of its rapid economic growth and the shifting balances of power such growth entails. Energy is among the drivers of this enduring dynamism. The shift from a world of perceived energy scarcity to one of actual energy abundance has dramatic consequences for the region. Economically, this shift helps alleviate one of the most feared constraints on Asian economic growth and development. But equally consequential are the impacts of the new energy environment for Asian geopolitics. Even if countries in Asia with substantial unconventional oil and gas resources do not develop these resources in the near term, the region will not only reap strategic advantages from increased flows of oil and gas in other parts of the world but also endure some unanticipated challenges as a result.

The link between energy and geopolitics is far from new. Energy has long shaped domestic and international events in Asia. During World War II, Japan's dwindling reserves of oil in the face of a U.S. embargo spurred its plans to take over the oil-laden Dutch East Indies, thereby precipitating the attack on Pearl Harbor. Decades later, the 1973 embargo of the Arab members of the Organization of the Petroleum Exporting Countries (OPEC) targeting Japan and several non-Asian countries led Tokyo to adopt various pro-Palestinian measures.[1] More recently, China's need to secure adequate energy resources to feed its massive industrial growth in part drove the expansion of Chinese influence on the African continent.

Thus far, the current entanglement of energy and geopolitics in Asia has received comparatively short shrift. Instead, many policymakers, analysts, and commentators have concentrated more on the economic implications of the energy boom—and low oil and gas prices, in particular—for Asian countries. While pockets of the region will lament low prices, most countries are both large consumers and importers and have welcomed dampened prices. While some analysts are quick to point out that low oil and gas prices have not stimulated the economy as much as expected, one should not forget that the environment of low energy prices at a minimum relieved Asian economies of stresses and created important economic opportunities. For instance, all other things equal, in the absence of the boom in U.S. tight oil production and the downward pressure it created on prices, China would have needed to allocate hundreds of billions more dollars to crude oil imports in 2014 and 2015.[2] In addition, Indonesia—a country that recently rejoined OPEC but is a net importer of oil—used the reprieve of lower prices to alleviate the heavy burden of energy subsidies long carried by the government. India has done the same; Prime Minister Narendra Modi can be thankful that India's emergence as the fastest-growing large economy has coincided with a period of low global energy prices. For Japan, the effects of low prices have been more mixed. They have cut electricity rates and made the loss of nuclear power after the Fukushima Daiichi crisis more manageable. But low prices also have complicated the efforts of the Abe government to

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[1] Roy Licklider, "The Power of Oil: The Arab Oil Weapon and the Netherlands, the United Kingdom, Canada, Japan, and the United States," *International Studies Quarterly* 32, no. 2 (1988): 214.

[2] The estimate of $354 billion should be considered a very rough one but indicative of the counterfactual. That amount was calculated using the findings of a study by the American Petroleum Institute in collaboration with the consultancy ICF International. The study suggested "that international Brent crude oil prices would have averaged $122 to $150 per barrel in 2013 without U.S. HMSHF [horizontal multi-stage hydraulic fracturing] crude oil [tight oil] and condensate production increases." Using the high-end number of $150, $354 billion was calculated by assuming that actual net crude imports in 2014 and 2015 would have materialized as they did, and determining the difference between importing those amounts at $150 per barrel and the actual prices paid. This calculation is of course imperfect, as higher prices would have meant less demand and fewer imports, but it does suggest that absent the unconventional boom in the United States, China would have paid significantly more to meet its energy needs. ICF International, "U.S. Oil Impacts: The Impacts of Horizontal Multi-Stage Hydraulic Fracturing Technologies on Historical Oil Production, International Oil Costs, and Consumer Petroleum Product Costs" (presentation to the American Petroleum Institute, Washington, D.C., October 30, 2014), http://www.api.org/~/media/Files/Policy/Hydraulic_Fracturing/ICF-Hydraulic-Fracturing-Oil-Impacts.pdf; and BP plc, "Statistical Review of World Energy 2016," June 2016, http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

boost inflation; inflation rates well below the official target of 2% have been perceived to dampen corporate investment and hold back economic growth.

Price, however, is hardly the only changing parameter that has potential strategic implications for Asian countries. In fact, structural changes in oil and gas markets may well be longer-lasting and equally significant over time. For both oil and gas, the shift from a seller's market to a buyer's one has been pronounced. The prospect of oil embargoes has diminished significantly, not only with the incapacitation of OPEC but also with the emergence of more suppliers. The global oil price, at least for the short to medium term, will be determined mostly by the market, introducing new elements of volatility. But the introduction of tight oil (whose production responds more quickly to price changes) likely means that the peaks and troughs in global prices will moderate.

The changes in natural gas markets may be particularly consequential for Asia. The region is home to the world's five largest importers of liquefied natural gas (LNG): Japan, South Korea, China, India, and Taiwan.[3] These countries will benefit not only from the massive increases in volumes of LNG from Australia, the United States, and elsewhere but also from the changed terms under which much of this new trade will occur. While the three dominant markets for natural gas will not fully merge, they will become more closely integrated. One can already see the trend materializing toward more flexibility and liquidity in the markets, gradual departures from the old practice of linking natural gas prices to oil prices, and the growth of spot markets. It is likely that the development of natural gas trading hubs in Asia will follow. In this environment, the allocation of resources will be more efficient, markets more dependable, and political influence over trade diminished.

However significant the changes above appear, there are even greater geopolitical ramifications of the new energy landscape for Asia. While no one factor will drive relations between Asian countries—or between the region and the rest of the world—energy is a strong candidate given the trends described above, and it will remain a significant determinant of Asian geopolitics in the years ahead. From undermining Russia's own pivot to Asia to lubricating a broader Chinese foreign policy and tying Asia more closely to the Middle East, energy is reshaping the geopolitics of the region. This essay will examine each of these trends and how they reshape Asia's engagement with the rest of the world.

Undermining Russia's Pivot to Asia

Russia's new focus on Asia predated the crisis between Russia and the West over Crimea and Ukraine in 2014. In 2012, speaking to a group of Russian energy officials, Vladimir Putin urged them to look east. Slowing growth in European demand, as well as the need to develop the Russian Far East, spurred Putin to order a reorientation of Russia's gas export strategy.[4] Just a few days later, Gazprom announced a project to pipe gas east and export it via LNG to Asian markets. "In the nearest future, we are able to create gas exporting capacity comparable to that of European gas exports," Alexey Miller, the CEO of Gazprom, declared.[5] The crisis over Ukraine and Crimea

[3] "World LNG Report—2015 Edition," International Gas Union, 10, http://www.igu.org/sites/default/files/node-page-field_file/IGU-World%20LNG%20Report-2015%20Edition.pdf.

[4] Denis Pinchuk and Alexei Anishchuk, "Putin Tells Russian Gas Exporters to Look East," Reuters, October 23, 2012, http://www.reuters.com/article/us-russia-putin-energy-idUSBRE89M0RR20121023.

[5] Gleb Bryanski, "Gazprom Unveils $38-Billion Gas Project to Conquer Asia," *Globe and Mail*, October 29, 2012, http://www.theglobeandmail.com/report-on-business/international-business/european-business/gazprom-unveils-38-billion-gas-project-to-conquer-asia/article4724687.

intensified the sense of urgency on the part of Russia's leaders to expedite this transition, both to demonstrate to the world that Russia was not isolated and to find new markets to supplement European ones that were either stagnating, politically at risk, or both.[6]

In a different energy environment, Russia might have successfully translated these ambitions into strategic as well as economic gains. Certainly, observers in the United States worried that it was doing so in May 2014, when Russia and China finally ended more than a decade of negotiations by clinching a deal in which Russia would send 38 billion cubic meters (bcm) of still undeveloped eastern Siberian natural gas to China's northeastern seaboard each year beginning in 2019.[7] Just months later, Beijing and Moscow inked a memorandum of understanding (MOU) for a project that would deliver another 30 bcm of Russian natural gas to China's western provinces starting that same year. In part to meet Putin's political needs, both deals were announced with much fanfare. According to earnest declarations by Chinese and Russian officials, energy would be the cornerstone of a broader strategic relationship between the two sides. After decades of false starts and icy interludes, the world's largest energy exporter and the world's largest energy consumer finally seemed aligned.

Russia's plans for pivoting to Asia were not limited to China. Russia also envisioned expanding energy trade with Japan beyond the relatively modest amounts of LNG it currently exports to become a major supplier of natural gas to Japan as well as South Korea.[8] Over the course of the 2000s, Russia proposed a variety of projects, with some plans resulting in the signing of MOUs and others remaining notional. These projects included building an overland natural gas pipeline from Siberia to a new LNG terminal at the eastern Russian port of Vladivostok from which Russia would then export more natural gas to Japan. Other proposals involved developing an undersea pipeline from Russia's Sakhalin Island to Japan and overland pipeline from Russia through North Korea to South Korea. There was also agreement on the expansion of the existing Sakhalin-2 LNG project and creation of a new Sakhalin-1.[9]

A range of factors, however, are working against Russia realizing these ambitions to capture markets in Asia.[10] Paramount among them is the new energy environment. Russia's plans to feed the appetite of Asian countries (apart from China) for natural gas depend to a great extent on its ability to develop additional large LNG projects. When global oil prices were high, prices for natural gas in Asia were correspondingly high, making such projects appear more commercially viable. The prospects for these same projects, however, look much less promising in an environment of low energy prices, particularly at a time when Russia is struggling to gain access to capital. Other projects may go the way of Vladivostok LNG, which was postponed—perhaps indefinitely—in June 2015.

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[6] In speaking to the Valdai Club in 2014, Putin explained, "Asia is playing an ever greater role in the world, in the economy and in politics, and there is simply no way we can afford to overlook these developments. Let me say again that everyone is doing this, and we will do so too, all the more so as a large part of our country is geographically in Asia. Why should we not make use of our competitive advantages in this area?" For the full transcript, see Vladimir Putin, "Meeting of the Valdai International Discussion Club," October 24, 2014, http://en.kremlin.ru/events/president/transcripts/copy/46860.

[7] "New Markets," Gazprom Export, http://www.gazpromexport.ru/en/strategy/markets.

[8] Japan currently buys 10% of its LNG from Russia. See U.S. Energy Information Administration (EIA), "Japan," January 30, 2015, https://www.eia.gov/beta/international/analysis.cfm?iso=JPN.

[9] For an excellent assessment of these various projects on economic and commercial grounds, see Edward C. Chow and Zachary D. Cuyler, "New Russian Gas Export Projects—From Pipe Dreams to Pipelines," Center for Strategic and International Studies, July 22, 2015, https://www.csis.org/analysis/new-russian-gas-export-projects-—-pipe-dreams-pipelines.

[10] Most of the projects mentioned above suffer from considerable commercial, as well as political or geostrategic, complications.

Sanctions, specifically the limitations on access to capital that they have entailed, have also dampened prospects for more Russian LNG behemoths. Energy has played a role in sanctions, both directly and indirectly. First, most obviously, many of the sanctions in place have targeted energy companies and energy technologies. Second, the new energy abundance has arguably helped facilitate the imposition of sanctions on Russia in the wake of its annexation of Crimea and destabilization of Ukraine.[11] Japan was concerned about joining the United States in imposing sanctions on Russia in 2014, in large part because it was looking to Moscow to ramp up natural gas exports to help meet Japanese demand.[12] The short-term prospect of becoming a large recipient of U.S. LNG, however, may have eased Japan's concerns about frustrating Russia's ability to deliver more natural gas to Japan, or its interest in doing so.

In short, the new energy abundance has significantly weakened the energy trade and thereby impeded Russia's ambitions to tie its future to Asian markets. At a minimum, it has forced Russia to downsize its plans from pivoting to Asia to merely pivoting to China.[13] Rather than developing more expensive LNG facilities such as Vladivostok to serve Japanese and South Korean markets, Russia doubled down on its bet on cheaper piped gas to China.

Moreover, the new energy environment, coupled with sanctions, has also frustrated Russia's effort to build a stronger strategic relationship with China on the back of projects to supply more affordable piped gas to the country. Roughly two years after the signing of the big Sino-Russian natural gas deals in 2014, neither arrangement looks to be in good health.[14] For one, Russia has struggled to amass the capital needed to finance development projects on its side of the border. But the combination of slower-than-expected growth in demand and the burgeoning of global natural gas supplies has meant that China's thirst for natural gas is no longer as insatiable as it once seemed. In fact, in late 2015 the China National Petroleum Corporation (CNPC) once again revised downward projections for how much natural gas China will consume in 2020.[15] If these numbers prove correct, China has contracted for far more natural gas in the future than it anticipates it will use. At the same time, the options for securing affordable natural gas are rapidly expanding as U.S. LNG comes online alongside even more Australian LNG and natural gas from additional sources.

Piped gas from Russia to China will continue to be important but will hardly be the critical strategic commodity it might have been in a different energy environment. Moscow's vision that energy could be the cornerstone of a strategic partnership among equals is no longer realistic. At best, energy will be a transactional component of a highly unequal relationship in which Beijing holds nearly all the cards. By heightening, rather than assuaging, traditional Russian insecurities, energy is as likely to irritate the bilateral relationship as it is to strengthen it. Russia's plan to play Europe and Asia off one another, economically and strategically, now seems like a pipedream.

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11 Japan, however, has demonstrated an enduring interest in securing Russian energy, as is indicated by continued conversations about Japanese finance for Russian energy projects in 2016.

12 At the time, 10% of Japan's LNG was sourced from Russia's Sakhalin-2 project.

13 See Morena Skalamera and Andreas Goldthau, "Russia: Playing Hardball or Bidding Farewell to Europe? Debunking the Myths of Eurasia's New Geopolitics of Gas," Harvard Kennedy School, Belfer Center for Science and International Affairs, Discussion Paper, June 2016, http://belfercenter.hks.harvard.edu/publication/26678/russia.html.

14 Olesya Astakhova and Chen Aizhu, "Russia Likely to Scale Down China Gas Supply Plans," Reuters, January 15, 2016, http://www.reuters.com/article/us-russia-china-gas-exclusive-idUSKCN0UT1LG.

15 Elena Mazneva, "China Gas Demand Forecast Cut by CNPC Researcher amid Slowdown," Bloomberg, September 29, 2015, http://www.bloomberg.com/news/articles/2015-09-30/china-gas-demand-forecast-cut-by-cnpc-researcher-amid-slowdown.

Lubricating a Broader Chinese Foreign Policy

Since China became a net importer of crude oil in 1995, the acquisition of energy resources, particularly oil, has been a major driver of its foreign policy. Whereas many Chinese leaders have argued that they would prefer to focus inwardly on domestic challenges for several more decades, the need to secure energy forced China beyond its borders and compelled it to develop relationships with countries from Latin America to Africa. Access to energy resources was the key to economic growth, which was the foundation of legitimacy for the ruling Chinese Communist Party. Perhaps no single variable better explained Chinese foreign policy in the 1990s and 2000s than the quest to meet burgeoning energy requirements.[16]

The shift from perceived global energy scarcity to actual energy abundance has not eliminated China's pressing need to secure oil and natural gas. But it has eased concerns that finite resources would become the source of conflict and competition and increased the government's confidence in the market as a means of delivering oil and gas resources. Moreover, reduced anxiety about supply comes at the same time that China is striving to transition its economy to a less energy-intensive trajectory, moderating demand growth over time.

The geopolitical implications of this shift in Chinese perceptions of the scarcity or abundance of energy are potentially massive. This shift, for instance, created an opportunity for China to significantly modify its "going out" strategy in parts of the world where that approach has become a focus of international criticism, a vehicle for significant corruption, or just downright uneconomical. Moreover, China can now broaden its engagement with these countries to go beyond the simple acquisition of oil; one already can see China widen the scope of its interactions with countries in Africa, Latin America, and other regions to focus not only on ownership of resources but on the whole value chain involved in their production, transportation, and sale. Opening the aperture in this way will make Chinese energy investments more profitable. More importantly, doing so can help China advance what has arguably become its most urgent overseas priority: exporting the excess capacity of Chinese firms to ease domestic unemployment and the political unrest that could accompany a serious economic slowdown.

The One Belt, One Road (OBOR) initiative introduced by President Xi Jinping in 2013 is the best example of how the new energy abundance has enabled China to transform energy from the primary end—or objective—of its foreign policy to a means—or instrument—of foreign policy. Some say that OBOR is a grand extension of the "going out" strategy.[17] If so, it is much more an evolution of the old strategy than a mere amplification of it. Energy is one of the key pillars of this ambitious initiative. As of November 2015, $89 billion of the $225 billion of Chinese investment in international projects was concentrated in the energy domain.[18] Energy infrastructure projects in particular are receiving priority. Yet, arguably, the purpose of these efforts is focused equally on extending Chinese influence and exporting excess Chinese capacity as on delivering energy resources to China.

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[16] Some analysts would say that Taiwan or Tibet have been equally important drivers of Chinese foreign policy over this time period.

[17] Ben Yunmo Wang, "China 'Going Out' 2.0: Dawn of a New Era for Chinese Investment Abroad," Huffington Post, June 11, 2015, http://www.huffingtonpost.com/china-hands/china-going-out-20-dawn-o_b_7046790.html; and Jiayi Zhou, Karl Hallding, and Guoyi Han, "The Trouble with China's 'One Belt One Road' Strategy," *Diplomat*, June 26, 2015, http://thediplomat.com/2015/06/the-trouble-with-the-chinese-marshall-plan-strategy.

[18] Kaho Yu, "Energy Cooperation in China's 'One Belt One Road' Initiative" (report of Harvard Kennedy School Energy Policy Seminar, hosted by the Belfer Center for Science and International Affairs, Cambridge, Massachusetts, May 2, 2016), https://www.hks.harvard.edu/m-rcbg/cepr/Yu summary final.pdf.

The new energy abundance may be a lubricant for the OBOR initiative in another, less anticipated way: by altering geopolitical competition in Central Asia. This region will always remain important to Russia, given the significant numbers of ethnic Russians living there, the historical importance of Central Asian countries as members of the Soviet Union, and the potential for instability in those countries to spill into Russia proper. However, one long-standing reason that Central Asia has been of critical interest to Russia—the region's natural gas resources—is essentially no longer relevant. Before the global recession of 2008, when demand for natural gas in Europe, and in Russia itself, was rising, Russia relied on natural gas from Central Asian countries to meet its contractual obligations to Europe. Given legacy infrastructure from the Soviet era, pipelines ran westward from Central Asia to Russia. From the collapse of the Soviet Union until the Turkmenistan-China pipeline began to carry natural gas eastward in 2009, Kazakhstan, Turkmenistan, and Uzbekistan had no other option for exporting their gas but to sell it to Russia. Russia took advantage of this situation by buying Central Asian gas at very low prices and reselling it to Europe at much higher ones. The rise of renewables, dramatic improvements in efficiency, and slowing economies have halted Europe's demand growth for natural gas at the same time that Russia's own domestic demand for gas has slowed. The era of funneling Central Asian gas through Russian pipelines to meet European demand is essentially over.

This new reality does not mean that Central Asia will be free of tension. But the nature of the competition has shifted from one in which Russia and China were competing for Central Asian gas to one in which Russia and Central Asia are competing for Chinese markets. Moreover, while Russia's diminished interest in securing gas from the region does not clear the field for China in Central Asia, it does lower tensions from where they might have been had China sought to commandeer Central Asian resources in the early 2000s.

Tying Asia More Closely to the Middle East

While the new energy abundance undoubtedly allows Asian countries the chance to diversify the sources of their natural gas imports, it may also increase the region's dependence on the Middle East for oil. This development will be particularly pronounced if very low oil prices return and continue for longer than most projections suggest. Such an environment would carry a number of implications for Asia—the region that consumes the most oil in the world and is the most dependent on imports, which will only be more the case in the decades ahead.[19] Even looking out only five or ten years, several important trends are evident. First, as is the case in most economies, lower oil prices translate into higher oil consumption and, in the case of Asia, higher dependence on imports. Second, global production patterns shift in a lower-price environment: OPEC and low-cost Middle Eastern countries will account for a greater percentage of global oil production, and U.S., Canadian, and European producers will account for less.[20] As could be expected, the Middle East's share of global crude oil exports rises significantly in this situation. According to

[19] This section uses projections from the EIA's low-price scenario, in which the Brent price of crude is $38 in 2020 and $43 in 2025. EIA, "Table: International Petroleum and Other Liquids Supply, Disposition, and Prices," in "Annual Energy Outlook 2016," August 2016, available at http://www.eia.gov/forecasts/aeo/data/browser/#/?id=19-AEO2016&cases=ref2016&sourcekey=0. BP projects that the Asia-Pacific's dependence on oil imports, having risen from 51% in 1990 to 73% in 2015, will rise to 82% in 2030. Dependence on gas imports has skyrocketed even more, from 1.3% in 1990 to 21% in 2015, and is projected to rise to 33% in 2030. BP plc, "Outlook to 2035—Energy Use to Rise by a Third," http://www.bp.com/en/global/corporate/energy-economics/energy-outlook-2035/energy-outlook-to-2035.html.

[20] Interestingly, the EIA projects that in an environment of low oil prices, Russia actually produces slightly more oil than it does in the reference case scenario. EIA, "Table: International Petroleum and Other Liquids Supply, Disposition, and Price."

the International Energy Agency, by 2040 the Middle East will account for 57% of all interregional trade in a low-price scenario, in comparison to just 50% in the reference (higher-price) scenario.[21] Finally, by 2040 Asia is expected to be the destination for 75% of all interregional oil trade.[22] The net effect of these trends is that in a low-price environment Asia will be even more dependent on Middle Eastern oil than it is today.[23] Correspondingly, the region will be more vulnerable to supply disruptions, particularly given that the vast majority of these imports will travel through one passageway, the Strait of Hormuz.[24]

This trend is and should be a source of concern for Asian countries, which have long sought to diversify their energy imports to reduce dependence on the Middle East. The urgency to do so is even greater in an energy-abundant world. The Middle East is likely to be an even more volatile region in the face of medium- to long-term low oil prices. While some countries—such as Lebanon and Jordan—benefit from cheaper energy, most of the populous and strategically consequential countries of the region suffer when the price of oil is low.[25] Their low costs of production will enable them to continue to pump barrels and make a profit, but nearly all of these countries' budgets have become too large to finance fully with long-term oil prices that do not exceed $50 per barrel. Already, many countries—from Saudi Arabia to the United Arab Emirates to Kuwait—have begun to cut subsidies and institute reforms in the hope of reaching a more sustainable status quo. Such ambitious reforms could enable these states to escape brutal economic consequences in the future. But pushing ahead with these measures could also invite political discontent, which governments will need to manage in the context of an increasingly volatile regional security environment. Moreover, growing competition between Saudi Arabia and Iran—two of the region's three largest producers—risks provoking acts of terrorism or sabotage against infrastructure or production facilities.[26]

A second cause for concern is that the new energy abundance has had the perceived effect of diminishing U.S. interest in the Middle East. A cold analysis of energy markets and trends would not actually suggest that the United States has dramatically fewer interests in the region than before the U.S. energy boom.[27] But many Americans and their elected leaders think otherwise, drawing what appears to be a simple conclusion: if the United States no longer needs to import Middle Eastern energy, it can pull back from costly and controversial political and military endeavors in the region. Given these and other political dynamics, Asian leaders should expect continued reluctance by the United States to play its traditional role in the Middle East. While some may think that reduced U.S. involvement will calm a roiled region, Chinese, Japanese,

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21 International Energy Agency (IEA), *World Energy Outlook 2015* (Paris: IEA, 2015), 188.

22 Ibid., 89.

23 As of 2015, Asia was dependent on the Middle East for 66% of its oil imports and 37% of its LNG. BP plc, "BP Statistical Review of World Energy 2016," June 2016, http://www.bp.com/content/dam/bp/excel/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-workbook.xlsx.

24 The IEA estimates that crude oil flowing through the Strait of Hormuz will rise from approximately 16 million barrels per day (bpd) in 2015 to 25 million bpd in 2040. IEA, *World Energy Outlook 2015*, 189.

25 Egypt is the notable exception to this statement.

26 See "Saudi Arabia Says Cyber Attack Aimed to Disrupt Oil, Gas Flow," Reuters, December 9, 2012, http://www.reuters.com/article/saudi-attack-idUSL5E8N91UE20121209.

27 See Meghan L. O'Sullivan, "North American Energy Remakes the Geopolitical Landscape: Understanding and Advancing the Phenomenon" (paper presented at the Goldman Sachs North American Energy Summit, New York, May 31, 2014), http://www.goldmansachs.com/our-thinking/pages/north-american-energy-summit/reports/mos-north-america-energy-remakes-the-geopolitical-landscape.pdf. For more on these issues, see Tom Cutler et al., "Adapting to a New Energy Era: Maximizing Potential Benefits for the Asia-Pacific," National Bureau of Asian Research (NBR), NBR Special Report, September 2014, http://www.nbr.org/publications/issue.aspx?id=305; and Mikkal E. Herberg, "U.S., Japanese, and Asian Energy Security in a New Energy Era," NBR, NBR Special Report, April 2015, http://www.nbr.org/publications/element.aspx?id=812.

South Korean, and other leaders no doubt realize that a security vacuum in the Middle East will not bode well for stability there.

An Asian strategist looking at this picture would be right to find looming trends disquieting or even intolerable. Sensible prescriptions would include helping Middle Eastern exporters find alternative routes for the export of their oil, continuing efforts to source oil from other countries, and taking measures to decrease consumption of oil overall. The strategies of Asian countries will undoubtedly include such steps, but these nations should be more ambitious in how they view their future in relation to the Middle East. While seeking to mitigate dependency, they should also prepare for a future in which they will need to be more engaged in helping stabilize the region. Such efforts will entail new capabilities, as well as new mindsets. Many of the Middle East's most challenging problems arise from the breakdown of states rather than interstate conflict. In this environment, remaining aloof from the internal problems of Middle Eastern countries will do little to help stabilize them. The burden will not, of course, fall fully to Asian countries; the United States may scale back but will not completely cease its engagement. As a result Asian governments can and should look for ways to work with the United States to collectively stabilize the region. Such efforts could build on already existent Chinese participation in counterpiracy operations in the Gulf of Aden or involve closer collaboration on political and economic issues, such as finding a political solution for Syria or rebuilding the Iraqi cities recently liberated from the Islamic State of Iraq and Syria (ISIS).

Conclusion

The new energy environment has significant geopolitical implications for the fastest-growing and most dynamic region of the world. In most respects, a more energy-abundant world will bring significant benefits to Asia. It will relieve stresses on economies, present Asian countries with more leeway in choosing their strategic partners, and give China at a minimum room to pursue a foreign policy that can better advance Beijing's changing interests. An environment of low energy prices, however, also holds some perils for Asia, including greater vulnerability to events in the Middle East, which can only be overcome by greater Asian engagement.

There are, of course, numerous other ways in which the new energy environment is having and will continue to have a large impact on geopolitics. While cooperation on technical energy matters between Asian countries has not yet catalyzed broader strategic rapprochement in the strained relationships between South Korea, Japan, and China, the potential exists.[28] In addition, the growing quantities of LNG that have begun to flow into Asia could have significant bearing on tensions in the South China Sea. The United States—and potentially even Canada—will become significant suppliers of natural gas to Asia in the coming years. With the expansion of the Panama Canal, it is now possible to send virtually all LNG tankers west rather than east through the Suez Canal or around the Horn of Africa.[29] Not only will this route be cheaper and quicker, but it will avoid the Strait of Malacca, potentially mitigating some of the tensions in that region. Moreover, India's growth trajectory, like that of China, suggests that securing energy will become a higher

[28] For more on the modest levels of multilateral energy cooperation in Northeast Asia, see Choi Jong Uk, "Energy Security Cooperation in Northeast Asia" (panel discussion at the UN Economic and Social Commission for Asia and the Pacific, Seoul, December 17, 2015), http://www.unescap.org/sites/default/files/Session%204-4%20Jong%20Uk%20Choi.pdf.

[29] Victoria Zaretskaya, "Expanded Panama Canal Reduces Travel Time for Shipments of U.S. LNG to Asian Markets," EIA, June 30, 2016, http://www.eia.gov/todayinenergy/detail.cfm?id=26892.

priority in its foreign policy. Efforts such as the Indian-Iranian plan to develop a port that could allow for the movement of Central Asian gas to India could increase competition between Beijing and New Delhi. Finally, although not widely discussed at this point, geopolitical concerns will likely surround the permeation of Asian gas markets by U.S. LNG as some customers question whether U.S. energy exports can truly be free of geopolitics.

The largest strategic implication of the new energy environment, however, remains far from certain. China is likely still debating whether the liberal international order can be adequately reformed to meet and represent Chinese interests or whether this order needs to be replaced wholesale with an international structure very different from the one that has shaped political and economic relations since the end of World War II. While by no means the only dimension that China needs to consider, the extent to which the country is able to meet its energy (and therefore economic) needs is a serious consideration. In a variety of ways, the new energy environment is likely to increase China's comfort in the existing international order by removing obstacles and presenting incentives to be a part of it—although it is far from certain that Chinese policymakers will view the situation in the same light. Should the new energy landscape encourage China to work with and within the current international order (with adjustments), the strategic benefits will be considerable, not only for Asia but for the world.

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Asia's LNG Prospects: Finally Entering a Golden Age

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EXECUTIVE SUMMARY

This essay examines the competitiveness of liquefied natural gas (LNG) in the fast-evolving Asian natural gas market and assesses key trends observed over the past two years, the demand response to a lower-price environment, and the implications of sustained competitive LNG prices for Asia's long-term energy mix.

MAIN ARGUMENT

Current (and possibly sustained) low prices will stimulate renewed or new demand for LNG among Asia's energy giants (China and India) and emerging importers in South and Southeast Asia, while tempering the decline in LNG demand in the more mature importers (Japan and South Korea). While prices are the most important driver of future Asian LNG demand, air pollution concerns—notably in major Asian cities—will provide a compelling motivation for countries to alter their energy mix by increasing LNG/gas use as an alternative to coal in power generation, partnering with renewables for use in creating "smarter cities," and using LNG as an alternative to oil products in transportation.

POLICY IMPLICATIONS

- Given that LNG will continue to play a large role in the two most mature Asian LNG-importing countries—Japan and South Korea—they have a strategic interest in making sure that LNG is priced competitively and transparently in the long term for economic, security, and environmental reasons.
- China sees competitively priced LNG as an opportunity to increase the contribution of the fuel in the country's energy mix in order to curb air pollution and provide leverage in contract negotiations with suppliers of pipeline or domestic gas.
- Emerging Asian LNG importers have not traditionally used LNG for power generation because of its lack of price competitiveness (notably compared with coal). But low prices have opened up markets in new importer countries and increased the appetite for LNG in both power and non-power sectors, which will have a positive impact on curbing emissions and improving air quality.
- Demand for city gas (for heating, cooking, and transportation) is less influenced by price; instead, the main drivers are safety, environmental, and health concerns, which will only increase with the rise of Asia's megacities.
- Following the 21st Conference of the Parties in Paris, more governments are ready to pay an environmental premium to promote switching from coal to LNG, as long as gas prices remain in an acceptable range relative to coal prices.

Gas consumption is growing in Asia at a much faster rate than in the rest of the world, with developing markets in the region increasingly dependent on imports of liquefied natural gas (LNG) to fuel their dynamic economies. Asia is the most populous continent, with an estimated 4.4 billion people, and every country but Japan and Kazakhstan is projected to see its population rise through 2050. Demand for energy will only grow further with the rise of the two energy giants, India and China, which together account for 36% of the world's total population.[1] Although LNG demand in the mature markets of Northeast Asia—mostly Japan and South Korea—faces uncertainty and experienced a decline in 2015, Asia as a whole still accounts for 72% of global LNG demand (down from 75% in 2014). The continued growth of China and the emergence of smaller and more fragmented Asian LNG buyers—mostly in South and Southeast Asia—will increasingly offset some of that decline in mature markets.

Particularly after the 21st Conference of the Parties (COP21) in Paris, there are strong expectations for all economies to advance global environmental goals, specifically by working to curb emissions. Meeting these goals will require coal-dependent Asian economies to find ways to reduce heavy greenhouse gas emissions, and LNG could play such a role in developing Asia. However, pricing, and to a lesser extent a country's prioritization of environmental issues, will determine the role of LNG in both the traditional and emerging Asian markets.

This essay begins with a discussion of the drastic shifts in the global LNG market over the past two years. The next section discusses the price elasticity of LNG demand in power generation, first in the mature LNG importers, then in China, and last in the emerging LNG importers of South and Southeast Asia. The essay then examines additional drivers of Asia's LNG demand, notably the rise of the region's large cities and the vital need for cleaner air. The concluding section discusses the quest among buyers for sustainable and competitively priced LNG as a prerequisite for the fuel to become a viable long-term source of energy in Asia.

The New Gas Order Has Improved the Competitiveness of LNG in Asia

In many respects, the past two years were transformative for global natural gas markets. Large price declines and waves of new LNG project start-ups have ushered in a new order for LNG markets, featuring greater flexibility in a buyer's market. This period has been marked by three trends in particular: the dramatic collapse of oil-indexed gas prices following the collapse of oil prices from the second half of 2014; the ongoing LNG supply glut, which put downward pressure on spot prices; and slower-than-expected demand growth in traditional Asian markets. The following subsections examine these trends in greater detail and highlight implications for gas outlooks in the region.

The Asian Price Premium Is Gone for Now

The Asian price premium significantly decreased in 2016, continuing the trend that began in the second half of 2014 when Asian and European prices started their downward convergence. Historically, Asian importers have imported gas at higher prices than those paid in North America and Europe due to Asia's import dependency, the region's distance from production centers, the lack of competition in domestic markets, and the predominance of oil-linkage in the

[1] "Asia Population 2016," World Population Review, August 6, 2016, http://worldpopulationreview.com/continents/asia-population.

formation of gas prices. The collapse of oil prices in 2014–16 has led to a sharp decline in long-term oil-indexed LNG prices. The Indonesian Brent-indexed LNG price in Japan—which lags changes in oil prices by three to six months—dropped from an average of $17.0 per million British thermal unit (mmBtu) in 2014 to $11.0/mmBtu in 2015 and $7.7/mmBtu in 2016 at the time of writing. Oil-indexed gas prices are expected to remain below $10/mmBtu through at least the end of 2017, which will reduce significantly the cost of imports for a number of LNG consumers, as has already been the case for Japan.[2]

Glutted Global Gas Markets

The ongoing LNG supply glut has led to sharply decreasing spot prices worldwide and reinforced downward pressures on global prices. The addition of roughly 125 million tons (mt) of incremental LNG capacity (originating mainly from Australia and the United States) between 2016 and 2021 will create a continuous overhang in the market, unless producers withdraw some supplies or demand picks up. This year alone, about 36 mt of new supply is entering the market from Australia, Malaysia, Angola, and the United States at a time when the needs of the world's largest buyers are already satisfied. Most of the overhang comes from the first exports from the U.S. shale boom, as well as from the full operation of the first trains of three new Australian projects, thereby adding capacity to a market where both demand and prices are much lower than initially anticipated.

The abundance of LNG supply has led to a dramatic narrowing of the spot price spread between the world's two largest gas-importing regions, Asia and Europe. Spot prices refer to short-term immediate delivery purchases that are better able to reflect supply and demand. The downward convergence at $4–$5/mmBtu between EU and Asian spot prices in the second quarter of 2016 has been a key theme so far this year. Despite a slight recovery in summer 2016, Asian spot prices will likely remain in the $5–$6/mmBtu range and could further decrease as the overcapacity expands in the next two years. Singapore's SGX LNG Index Group year-to-date average as of August 2016 is $4.8/mmBtu, while the Japan Korea Marker year-to-date average is $5.0/mmBtu, and Japan's Ministry of Economy, Trade and Industry (METI) spot arrival year-to-date average is $6.0/mmBtu (see **Figure 1**).[3]

Weaker Demand in Traditional Markets and Stronger Demand in Emerging Markets

Although LNG imports in mature markets, such as Japan, have limited upside potential and the decline observed in 2015 and 2016 will likely continue, low prices could temper the decline and possibly trigger a positive demand shock response. Meanwhile, LNG imports in emerging Asian economies will continue to grow rapidly due to attractive prices and increasing gas needs in the electricity-generation, commercial, residential, and transportation sectors.

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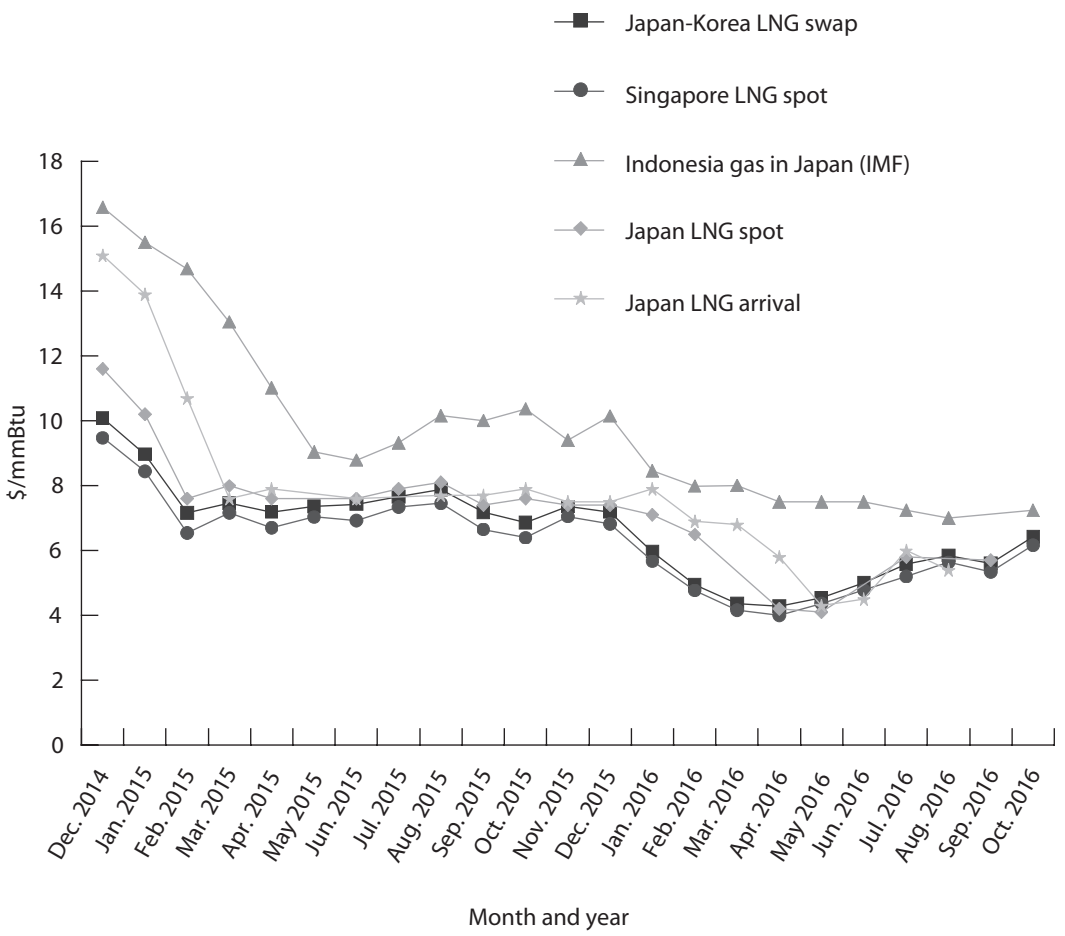
[2] In 2015, Japan's trade deficit fell 78% from a record high in the previous year, helped by a weakening yen and a plunge in oil and LNG prices. Japan experienced a $23.56 billion deficit in 2015, compared with a $121.56 billion deficit in 2011 following the Fukushima Daiichi disaster. See "Japan: Trade Balance from 2005 to 2015 (in Billion U.S. Dollars)," Statista, http://www.statista.com/statistics/263625/trade-balance-of-japan.

[3] Singapore's SGX LNG Index Group (SLInG) is a spot price index for Asian LNG buyers. The Japan Korea Marker (JKM) is the LNG benchmark price assessment for spot physical cargoes delivered ex-ship into Japan and South Korea. It is published by Platts. See "Platts JKM (Japan Korea Marker) Gas Price Assessment: Natural Gas Price Assessments," S&P Global Platts, http://www.platts.com/price-assessments/natural-gas/jkm-japan-korea-marker. The JKM averaged $7.4/mmBtu in 2015 and $12.0/mmBtu in 2014. All Asian LNG price indices (Japan landed LNG, China landed LNG, Northeast Asian spot LNG, and Japan customs-cleared crude) have converged at $5–$6/mmBtu in the first two quarters of 2016. Northeast Asian spot gas prices were down by half at $7.0/mmBtu in the fourth quarter of 2015 from an average of $14.0/mmBtu in 2014. European spot prices at the NBP hub dropped from $8.4/mmBtu in 2014 to $5.8/mmBtu by the fourth quarter of 2015.

FIGURE 1 Asian LNG prices



SOURCE: Bloomberg Terminal; Ministry of Economy, Trade and Industry (Japan); and International Monetary Fund.

NOTE: August 2016 data was not available at the time of writing for Japan LNG spot. September 2016 data was not available for Indonesia Gas in Japan and Japan LNG arrival. October 2016 data was not available for Japan LNG spot or Japan LNG arrival.

Both Japan and South Korea are unlikely to experience a large increase in demand from the current low-price environment. This is mostly due to the plateauing of demand in the power sector, which can be attributed to slowdowns in economic growth, competition between fuels, and ambitious non–fossil fuel goals. For Japan, the world's largest LNG consumer, a combination of factors—a slowing economy, rising renewables, the resurgence of coal, energy conservation, and the restart of two nuclear reactors (Sendai 1 and 2)—resulted in a 4% decline in LNG use in 2015, and a further 3% decline is projected in 2016, bringing imports to roughly 82 mt. Japan's average monthly LNG imports for the first seven months of 2016 were around 6.6 mt, compared with 7.0 mt over the same period in 2015 and 7.8 mt in 2014. Japanese LNG imports peaked in 2014 at 88.5 mt.[4]

[4] "Cedigaz: Eastern Asian LNG Imports Down 3.9 Pct in 2015," LNG World News, February 12, 2016, http://www.lngworldnews.com/cedigaz-eastern-asian-lng-imports-down-3-9-pct-in-2015.

For South Korea, Asia's second-largest LNG market and also a mature LNG buyer, demand fell 7.4% in 2015, but it could rebound to 2014 levels in 2016 (36 mt) due to normal weather conditions, lower prices, and the start-up of new long-term contracts.[5] That said, demand upsides are projected to remain limited as gas-powered generation loses market share to coal.

Taiwan, another historical importer, is experiencing a different growth trajectory compared with Japan and South Korea due to the new government's decision to phase out nuclear generation, which will create demand for LNG. Already in 2015, Taiwan's LNG imports grew 7.9% compared with the previous year as Taipei took advantage of lower contractual prices with Qatar's RasGas and more affordable spot prices.[6] In addition, supply from other energy sources (nuclear, coal, and crude oil) declined in 2015, which created more appetite for LNG.

Meanwhile, demand in nontraditional markets is growing. After declining in 2015 due to slower economic growth, China's LNG imports are likely to soar again in 2016 and 2017. They increased by 12% in the first quarter of 2016 relative to the previous year on heightened demand for gas to fuel the economy, the implementation of new environmental policies, and the opening of new facilities to import LNG. The Chinese market is also absorbing rising deliveries from recently inaugurated Australian export projects. China's long-term LNG commitments will likely rise to roughly 19 mt per annum (mtpa) by the end of 2016, but China National Offshore Oil Corporation (CNOOC), PetroChina, and Sinopec may resell some volumes on the spot market, adding to the supply of uncommitted flexible cargoes. The resale of their extra cargoes could be a key bearish driver going forward. Meanwhile, second-tier Chinese companies will continue to sign new LNG deals. ENN has already signed two term contracts with Total and Chevron for a combined capacity of 1 mtpa, both starting in 2018–19. The new agreements are for smaller volumes and are more competitive on pricing structure and contract terms. Reflecting this trend, China's LNG imports are expected to grow from 20 mt in 2015 to 26 mt in 2016 and 32 mt in 2017.[7]

For India and the rest of South and Southeast Asia (specifically, Malaysia, Singapore, Thailand, and Pakistan), LNG imports will continue to grow exponentially. One sector in which this trend will be especially noticeable is power generation, due to more affordable LNG prices, insufficient domestic supplies, and increasing energy needs to fuel economic growth.

Implications

For now oil-indexed prices have regained their competitiveness, making LNG from established suppliers (such as Qatar, Russia, and Australia) more affordable and attractive to Asian buyers with existing long-term supply contracts.[8] However, as long as the overwhelming majority of gas sold in Asia remains oil-indexed, Asian LNG prices will continue to be affected by the gyrations in oil prices. The recent increase in oil prices is expected to put upward pressure on LNG contract prices over the remainder of 2016 and possibly beyond, while persistent LNG oversupply will ensure that spot prices remain low. Thus, spot LNG prices will become increasingly decoupled

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5 "South Korea LNG Long-Term Outlook 2016," Wood Mackenzie, June 2016, https://www.woodmac.com/reports/lng-south-korea-lng-long-term-outlook-2016-39217435.

6 "Cedigaz: Eastern Asian LNG Imports Down 3.9 Pct in 2015."

7 Yao Li, "Rise of the Independents and Impact on Competitive Landscape," SIA Energy, slideshow, http://www.oilandgascouncil.com/sites/default/files/files/Yao%20Li%20-%20SIA%20Energy.pdf.

8 Average prices for LNG delivered to Japan declined 11% in the first quarter of 2016 to around $6.50/mmBtu. Average prices for LNG delivered to South Korea and China, where prices remain oil-indexed for more than 70% of LNG, declined by 7% to $6.86/mmBtu in the case of South Korea and 5% to $6.30/mmBtu in the case of China. The pricing information for China and South Korea is from the Bloomberg Terminal. The pricing information for Japan is from METI.

from oil-indexed, long-term prices. This decoupling will put pressure on suppliers to adjust their long-term prices to remain competitive with spot prices, resulting in additional downward pressure on prices.

The global LNG glut has shifted the market to one that favors buyers. Suppliers are competing for market share, while buyers have more supply options from which to choose. The increased bargaining power of LNG buyers has already led several of them to successfully renegotiate their existing long-term contractual commitments to better align oil-indexed and spot LNG prices, assuring further price discounts in years to come. For example, in 2015 India's Petronet won substantial concessions from Qatar's RasGas, which resulted in more favorable pricing and flexible terms. Several other LNG contracts—primarily signed by Asian buyers—are undergoing similar renegotiations. The current market glut and increased leverage for buyers will ensure more affordable LNG at least through the end of the decade.

Overall, the 2016 global gas market is a buyer's market with greater flexibility, growing competition between exporters, the entry of more diverse LNG players, a convergence of European and Asian spot prices in the $5–$6/mmBtu range, and a wait-and see approach on investments in LNG infrastructure.

The Elasticity of Asia's LNG Demand for Power Generation: Price Matters

The responsiveness of LNG demand to pricing differs in various countries across Asia, depending not only on the maturity of their gas markets but also on their energy mix, gas use, environmental goals, and economic growth. Having examined the current dynamics of the gas market in Asia in the previous section, the following discussion analyzes the price elasticity of LNG demand in the power-generation sector—first, in the mature importers Japan and South Korea, then in China, and last in the emerging importers of South and Southeast Asia—in order to understand the impact of lower prices on LNG demand throughout the region.

Mature LNG Importers: Lower Prices Could Help LNG Reclaim Market Share

For Japan and South Korea, the historically large importers and consumers of LNG, prices have never been the main reason to switch to LNG for electricity generation. Thus, they are slower to react to a new pricing environment. In addition, their primary concerns have traditionally been security of supply and environmental considerations rather than pricing. When switching to LNG in the 1960s, Japan was willing to pay a premium over coal or fuel oil in order to produce cleaner electricity.[9] It just so happened that Asian LNG prices were below $2/mmBtu in the 1960s and 1970s, which certainly contributed to making the transition more appealing. Conversely, lower prices have done little to date to reverse the trend of declining LNG imports to Japan and South Korea. Recently, weaker demand in Asian industrialized markets is driven by structural economic factors (slower growth) and intense competition with other fuels (nuclear, renewables, and coal),

[9] Price was not the main consideration in its early reliance on LNG in the 1960s. Japan started to import LNG as a substitute for dirtier fuel oil out of concern for air quality due to the country's predominantly oil-fired power-generation fleet at the time. Imported natural gas—in the form of LNG—was initially seen as a cleaner alternative to coal and oil in the electricity sector.

as well as by increased energy efficiency. Similar to Europe, gas demand in both Japan and South Korea is squeezed between the growth of zero-emission renewables and cheap coal.[10]

However, even in mature industrialized markets LNG could play a larger role, especially if the consensus view on Japan's declining demand proves wrong or if cleaner and competitively priced LNG reclaims market share over other fossil fuels. The Japanese government's 2015 plan for electricity generation through 2030 indicates a strong political will to see the revival of nuclear generation, while also avoiding too much reliance on one source of energy. The government envisions an energy mix of 20%–22% nuclear energy, 22%–24% renewables, 27% LNG, and 26% coal.[11] But this plan may not turn into reality because those projections rely heavily on two uncertain outcomes: restoring a robust nuclear power capability and achieving an ambitious goal for energy efficiency.

There are reasons for doubting the consensus view that Japanese LNG consumption is set to decline sharply. First, there remains uncertainty regarding Japan's nuclear restart. Japan only has three reactors in operation at present (Sendai 1 and 2, Ikata 3), and the scope of future restarts will depend on two unanswered questions: (1) whether the government will allow operational lifetime extensions beyond 40 years[12] and (2) whether a spate of successful lawsuits will gain momentum and disrupt expected reactor returns.[13] There is a scenario in which delays to nuclear restarts will push Japan to focus on renewables as part of its Kyoto and COP21 commitments as well as to reduce the share of coal and oil in the power and industry sectors, which will provide room for some growth in LNG demand. Second, there will be difficulties with improving energy efficiency. Although the goals stated in Japan's 2015 plan follow a route similar to the one taken in the 1970–90 plan—a plan that saw great improvements—repeating this success will be difficult, as Japan is already considered the sixth-most energy-efficient nation in a worldwide survey.[14]

Moreover, while Japan's share of long-term contracted LNG imports will decline, this trend could well be offset by a larger pool of spot purchases as long as they are priced competitively. Ongoing liberalization of the electricity market and looming deregulation of the domestic gas market mean greater uncertainty about Japanese LNG demand. As a result, Japanese utilities are favoring short-term LNG purchases over longer-term commitments. Uncertainty regarding the post–market deregulation landscape has dampened the appetite of incumbent power providers and made them reluctant to enter into new long-term LNG contracts for fear of losing market share. Such uncertainty will lead to more spot purchases by Japanese players, more joint procurements, and more utilities turning into traders to hedge risks, but it does not necessarily mean reduced LNG demand for the country as a whole.[15]

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[10] The big difference with European buyers is that Japan's and South Korea's dependence on LNG imports is much higher because they do not have pipeline connections or indigenous supplies. This has historically deprived both countries of additional leverage in seeking lower prices.

[11] Howard V. Rogers, *Asian LNG Demand: Key Drivers and Outlook* (Oxford: Oxford Institute for Energy Studies, 2016), https://www.oxfordenergy.org/wpcms/wp-content/uploads/2016/04/Asian-LNG-Demand-NG-106.pdf.

[12] "Nuclear Power in Japan," World Nuclear Association, August 2016, http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/japan-nuclear-power.aspx.

[13] "Ikata Restart Ruling Prompts Kepco to Raise Threat of Countersuits," *Japan Times*, March 27, 2016, http://www.japantimes.co.jp/news/2016/03/27/national/ikata-restart-ruling-prompts-kepco-raise-threat-countersuits/#.Vw1UGvkrJbc. Of 42 operable reactors, 7 are likely to restart over the next several years, down from the 14 that had been expected to restart in a 2014 survey. The fate of the remaining reactors remains uncertain. For more on this issue, see "Japan Nuclear Power Outlook Bleak despite First Reactor Restart," Reuters, September 1, 2015, http://www.reuters.com/article/usjapan-nuclear-restarts-analysis-idUSKCN0R022Q20150901.

[14] "The International Energy Efficiency Scorecard," American Council for an Energy-Efficient Economy, http://aceee.org/portal/national-policy/international-scorecard.

[15] "Tokyo Gas, Kansai Electric in LNG Procurement Partnership," *Downstream Business*, April 11, 2016, http://www.downstreambusiness.com/tokyo-gas-kansai-electric-lng-procurement-partnership-575446.

Meanwhile, the Japanese government is clearly preparing for a scenario in which LNG will continue to play a major role in the country's economy, as stated in METI's "Strategy for LNG Market Development."[16] It thus has a long-term strategic interest in trying to shape LNG markets to improve the security of supply and sustain reasonable prices. Yet even if LNG continues to play a larger role than anticipated in the Japanese economy after 2020, long-term LNG upsides in Japan are questionable and will be highly dependent on pricing.

Similarly, in South Korea—the second-largest importer of LNG globally—growth in LNG demand will be limited due to structural changes. The country's LNG imports fell by 10% in 2015, following a 7% dip in 2014.[17] India overtook South Korea in 2015 as the world's second-largest importer of LNG on a spot and short-term basis. South Korea is aiming to peak its nuclear capacity by 2029, but coal, rather than gas, may increase because prices remain competitive with gas. Although South Korea's energy strategy has incorporated COP21 goals for limiting greenhouse gas emissions, reducing coal use has taken a back seat to developing renewable energy capacity and improving energy efficiency.[18] Increased shares of coal and renewables in the energy mix and greater energy efficiency mean a reduced role for LNG. For LNG to regain market share in South Korea, it will have to be priced competitively in the long term.

In Taiwan, LNG demand should grow as long as power generation continues an upward trend, the island curbs reliance on coal, and LNG prices remain reasonable. Under these conditions, LNG can compete with coal as nuclear energy is being phased out over the medium term.[19] Nuclear power, which accounts for nearly 20% of the island's total power supply, has been a debated topic in Taiwan since Japan's Fukushima Daiichi disaster. The construction of a fourth nuclear power plant was halted following the 2014 Sunflower Movement, and Taiwan's other three nuclear plants have been set for decommissioning between 2018 and 2025, which would create an important energy security vulnerability. Although uncertainties remain about whether the decommissioning of the three existing nuclear plants will be delayed, Taiwan's need for LNG will very likely increase in the coming years. Tsai Ing-wen, the leader of the Democratic Progressive Party and now president, advocated during her presidential campaign for a complete phaseout of nuclear power by 2025. While she plans to replace nuclear with renewable power, realistically Taiwan will have to increase its dependency on fossil fuel imports, which is already above 90%.[20]

Therefore, the trajectory of LNG demand in Taiwan depends on growth in power demand and future policies centered on coal usage. With the phaseout of nuclear energy, coal and gas use will likely grow steadily.[21] In theory, however, the growth of renewables should eventually slice into coal's share of the energy portfolio. By 2030, the government aims for renewables to account for 16.1% of generation capacity.[22]

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16 METI (Japan), "Strategy for LNG Market Development: Creating Flexible LNG Market and Developing an LNG Trading Hub in Japan," May 2, 2016, http://www.meti.go.jp/english/press/2016/pdf/0502_01b.pdf.

17 "Cedigaz: Eastern Asian LNG Imports Down 3.9 Pct in 2015."

18 Rogers, *Asian LNG Demand*.

19 "Full Text of President Ma's New Year's Day Address," *Focus Taiwan*, January 1, 2016, http://focustaiwan.tw/news/aipl/201601010013.aspx.

20 "The Taiwan Elections: What to Expect," *New York Times*, January 13, 2016, http://www.nytimes.com/2016/01/14/world/asia/taiwan-elections.html; and "Taiwan Business Leaders Quiz Opposition Presidential Candidate," Channel NewsAsia, December 22, 2015, http://www.channelnewsasia.com/news/taiwan-business-leaders/2370468.html.

21 Rogers, *Asian LNG Demand*.

22 Ibid.

The bottom line is that traditional Asian importers still have a strategic interest in ensuring that LNG is priced competitively and transparently in the long term, despite current projections that their LNG growth will remain sluggish. If this outcome is achieved, these countries' governments may be even more inclined to increase their reliance on LNG as a transition fuel to a low-carbon economy.

China: The Growing Role of Competitively Priced LNG

Competitively priced LNG will play a growing role in the Chinese economy, gaining market share from pipeline and domestic gas. Greater reliance on LNG will also help curb air pollution through coal-to-gas switching and as a partner to renewables.

Although when it comes to China the number of data sets and projections abound, and assessing real trends is sometimes hard, it has become clear that gas's contribution will increase in the country's economy. Gas is already China's fastest-growing fuel—with demand quadrupling in the last decade—and the government sees gas as constituting 10% of its energy portfolio by 2020, up from 6%–7% currently and 2% in 2012.[23] The biggest domestic and international policy commitments supporting China's demand for gas are (1) the 2014 joint plan with the United States to reduce emissions, (2) China's COP21 commitments, and (3) the 13th Five-Year Plan (2016–20). Specifically, the 13th Five-Year Plan has made reducing excess capacity of steel and coal a top priority. U.S. president Barack Obama and his Chinese counterpart Xi Jinping ratified the Paris Agreement at the end of September, which will support further coal-to-gas switching in China.

The Chinese government is increasingly using natural gas to offset cuts in coal. Gas has become China's indispensable tool to meet vital targets for reducing emissions due to its cleaner-burning characteristics compared with coal. Health and environmental considerations have created a larger role for gas as the government issues stricter policies toward the use of coal. A recent study showed that burning coal causes the most deaths from air pollution in China, and Beijing has finally acknowledged the public health costs by limiting construction of new coal-fired power plants and retiring some existing plants.[24] In addition, the government aims to cut annual coal consumption by 160 mt by 2020.[25] Coal consumption declined 3.3% in 2015 and is already down 5.1% in the first half of 2016 over the same period last year, driven by a mix of environmental restrictions and a weakening manufacturing sector.[26] However, the fact that coal is still in overcapacity, continues to be the most affordable way to generate base power, and is a critical source of employment for local communities will pose lingering challenges to the government's political will to curb coal usage.[27] That said, the historically low utilization rates of coal last year signal ongoing structural changes in China's power market.

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23 Jude Clemente, "China's Rising Natural Gas Demand, Pipelines, and LNG," *Forbes*, April 24, 2016, http://www.forbes.com/sites/judeclemente/2016/04/24/chinas-rising-natural-gas-demand-pipelines-and-lng/#4fc0dc2b6a38.

24 "Burden of Disease Attributable to Coal-Burning and Other Air Pollution Sources in China," Health Effects Institute, August 2016, https://www.healtheffects.org/publication/burden-disease-attributable-coal-burning-and-other-air-pollution-sources-china. Chinese and American researchers discovered that burning coal caused 366,000 premature deaths in 2013 in China and produces the worst health consequence of any source of air pollution. See Edward Wong, "Coal Burning Causes the Most Air Pollution Deaths in China, Study Finds," *New York Times*, August 17, 2016, http://www.nytimes.com/2016/08/18/world/asia/china-coal-health-smog-pollution.html.

25 Rogers, *Asian LNG Demand*.

26 "China Sees Effects of Coal Capacity Cuts: Top Economic Planner," Xinhua, August 8, 2016, http://news.xinhuanet.com/english/2016-08/08/c_135575303.htm.

27 Eduardo Porter, "The Challenge of Cutting Coal Dependence," *New York Times*, August 30, 2016, http://www.nytimes.com/2016/08/31/business/economy/the-challenge-of-cutting-coal-dependence.html.

Gas use will also potentially rise as the fuel increasingly complements China's build-out of renewable capacity. But for this scenario to play out, gas prices must remain low. China's goal is for renewable energy to satisfy 20% of its total energy demand by 2020. Because intermittent renewables still need to be complemented by another source—the best partner being the one that is the most flexible, clean, and affordable—gas will provide critical support as China increases its use of renewable energy. China is already adding a combination of renewables and flexible gas turbine technology to reduce emissions, but it is still weighing different options for the type of gas technology.[28]

LNG imports are a crucial component of the government's plan to switch from coal to gas, but Beijing is pursuing an "all of the above" gas strategy where pipeline imports and domestic production also help quench China's thirst for gas. While the growth of Chinese LNG imports declined slightly in 2015, it was little more than a bump in the road on an otherwise upward trajectory. In addition, adjustable pipeline import flows from Turkmenistan and Myanmar, further delays in Russia's Power of Siberia pipeline, and shortfalls in domestic production mean sustained LNG demand for now. But to guarantee long-term LNG growth, supplies to China must remain competitively priced to avoid being displaced by pipeline gas and domestic production.

Emerging Asian LNG Importers: The Crash in Prices Generates New Demand

Competitive Asian LNG prices are already stimulating demand from smaller buyers, new entrants, and nontraditional LNG users. Imports in the Asia-Pacific (excluding Japan, South Korea, and China) rose 14% from 32.5 mt in 2014 to 37.0 mt in 2015. The result has been a more fragmented Asian LNG market.

Inter-fuel competition. Sustained low LNG prices can make the difference in the competition between fuels for power generation, which is one of the most price-sensitive sectors. As LNG prices move closer to coal prices, some countries are inclined to increase the share of LNG in their energy mix. In India, LNG imports continue their stellar growth (see **Figure 2**), including in price-sensitive sectors like power and fertilizer that have benefited from New Delhi's "gas-pooling policy," which was implemented in March 2015 to help boost power production and provide LNG to stranded power plants. Under this policy, the central and state governments forgo taxes and levies; gas transporters and terminals lower transportation tariffs, marketing margins, and regasification charges; and power plants quote an LNG tariff through reverse bidding, with Gas Authority of India Limited (GAIL) responsible for importing the LNG.[29] Despite such incentives, most companies did not take advantage of the policy right away. Only recently have more power companies made use of it, as LNG spot prices decreased to $4–$5/mmBtu in the first half of 2016. Even though this price is still higher than the coal-based power tariff, it is within the range agreed on by India's state electricity boards.

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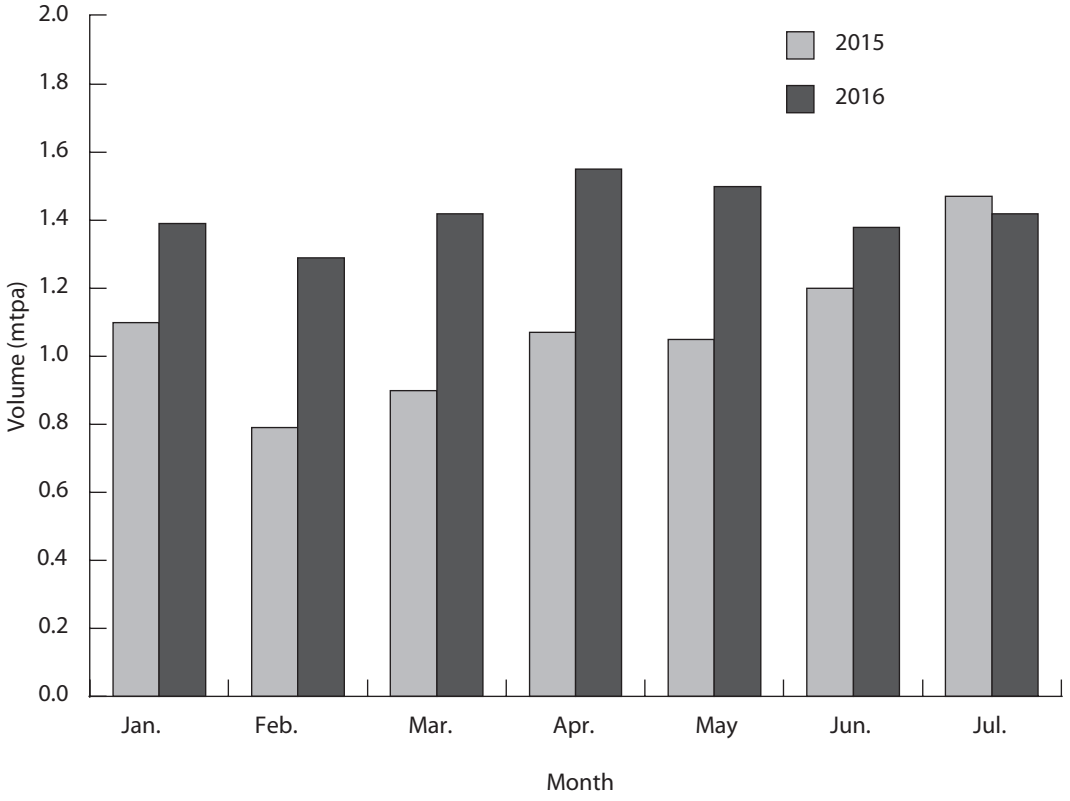
[28] M. Rajagopalan, "Smart Power Generation Can Help China Stop Curtailing Its Wind Power," Wärtsilä, In Detail, April 25, 2016, http://www.wartsila.com/twentyfour7/in-detail/smart-power-generation-can-help-china-stop-curtailing-its-wind-power.

[29] For more on Indian price pooling, see "Approval to Innovate Mechanism for Utilization of Stranded Gas Based Generation Capacity," Press Information Bureau (India), Press Release, March 25, 2015, http://pib.nic.in/newsite/PrintRelease.aspx?relid=117698.

FIGURE 2 India's monthly LNG imports



SOURCE: Ministry of Petroleum and Natural Gas (India), Petroleum Planning and Analysis Cell.

Going forward, if spot LNG prices remain in the same price range, consumption of LNG in the power sector is expected to increase as more power plants make use of the price-pooling program.[30] Imports are already up 31% in January–July 2016. In addition, recent contract renegotiations are improving the odds of lower long-term prices, which will increase LNG's appeal in India's highly price-sensitive sectors.

Interest in spot LNG purchases. Low prices have already stimulated greater appetite for opportunistic spot LNG purchases, as illustrated this year by India, Pakistan, and several Southeast Asian nations. India started to increase its participation in the spot market when prices tumbled in 2015–16 and even overtook South Korea as the world's second-largest importer on a spot and short-term basis. In 2015, India imported 9.7 mt of spot LNG, compared to 6.0 mt for South Korea. However, 2016 may see an even higher increase in spot LNG purchases because

[30] Under this program, power plants quote a tariff for LNG through reverse bidding. The government subsidizes the winning bids and arranges LNG through GAIL. Cost incentives are provided across the chain, with a reduction in state value-added tax, a 50% discount for pipeline tariffs, and marketing margins on LNG. The LNG-pooling scheme for the fertilizer sector is similar and is still managed through GAIL but excludes concessions over the value chain as compared to that for power. The aim of the policy is to ensure that sufficient quantities of natural gas are always available for adequate production of urea. To facilitate LNG procurement, GAIL has signed 25 master sales purchase agreements with various LNG suppliers, including BG, Shell, and Total, for spot purchases. See Ministry of Petroleum and Natural Gas (India), "Guidelines for Pooling of Gas in Fertilizer (Urea) Sector," May 20, 2015, http://www.petroleum.nic.in/docs/gp/20.5.2015POOLING%20GUIDELINES_-english%20version%20(3).pdf.

sustained low LNG prices have further incentivized gas imports, including in the power and fertilizer sectors.

Pakistan is increasingly relying on the spot market to cope with winter surges in demand. As a direct consequence of cheaper, more accessible LNG, Islamabad joined the LNG market in 2014 to address its problem of acute gas shortages. The Ministry of Petroleum and Natural Resources estimates that Pakistan will be among the top-six LNG importers by 2020, importing 15 mtpa (2 billion cubic feet per day) for power generation, compressed natural gas (CNG), and fertilizer. Pakistan is already planning to increase spot LNG purchases for winter needs and for its second import terminal, which will start operations in 2017. LNG spot supplies are needed to meet domestic needs in the upcoming winter season (household consumption for heating and cooking accounts for 22.5% of Pakistani gas consumption—second after only the power sector). In addition, Pakistan will seek additional short-term deals to supply its second import terminal, Pakistan GasPort, through a series of tenders (totaling 0.75–1.5 mt). These recent developments confirm that Pakistan is emerging as one of the world's top LNG consumers as the country prioritizes this energy source, which is currently more affordable than potential pipeline supplies from Iran.

Pakistani spot imports are also likely to increase in coming years as more diverse players, including private companies, could be allowed to supply LNG directly to the domestic market. Two new proposed private LNG terminals have emerged in 2016, signaling a big shift in Pakistan's LNG market, which is still dependent on the government for handling sales, purchases, and supply.

Pakistan is even pursuing LNG imports over pipeline gas in the near and medium term due to more competitive pricing and lower geopolitical risk. Islamabad revealed that it will pay $4.78/mmBtu (oil-indexed at 13.4% of Brent) for Qatari LNG—the cheapest price in South Asia and cheaper than the gas to be imported through the competing Iran-Pakistan and Turkmenistan-Afghanistan-Pakistan-India pipelines.[31] The Qatari LNG deal makes even indigenous Pakistani gas look expensive in comparison.[32] In 2016, Islamabad also inked shorter-term LNG contracts with Gunvor and Shell and is in active discussions with Russia.[33] As long as prices remain low, LNG imports will continue to be at the center of Pakistan's strategy to overcome its power crisis.

In Thailand, where natural gas dominates the power mix, lower spot prices have made LNG more competitive than domestic production. LNG imports nearly doubled from 1.4 mt in 2014 to 2.7 mt in 2015 as the country tried to replace declining volumes from indigenous resources and diversify away from gas imports from Myanmar. This upward trend has continued in 2016, as the decline in oil prices has helped make Thailand's oil-indexed LNG contract with Qatar more competitive. Moreover, spot LNG is now priced at $4–$5/mmBtu, which is cheaper than the cost of gas production in the Gulf of Thailand.[34]

Smaller buyers. Several Asian countries that could not afford LNG when prices were in the double-digit range are now considering imports due to the low-price environment, making the region one of the most promising in terms of LNG demand growth. Technological advances

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31 "LNG Deal with Qatar 'Cheapest' in South Asia," *Nation* (Pakistan), February 12, 2016, http://nation.com.pk/national/12-Feb-2016/lng-deal-with-qatar-cheapest-in-south-asia.

32 With this sixteen-year deal, Qatar prioritized a volume-over-pricing strategy to secure market share ahead of competitors.

33 "Putin Expected to Visit Islamabad Soon to Seal $2b LNG Deal," *Express Tribune*, February 16, 2016, http://tribune.com.pk/story/1047869/putin-expected-to-visit-islamabad-to-seal-2b-lng-deal.

34 Damon Evans, "Thailand Looks to LNG as Production Cut Looms," *Natural Gas Daily*, March 11, 2016, http://interfaxenergy.com/gasdaily/article/19546/thailand-looks-to-lng-as-production-cut-looms.

such as floating storage and regasification units are also enabling countries to add necessary infrastructure to more quickly join the LNG market, while also reducing the costs involved with scaling up imports related to the use of more traditional terminals. South Asia is expected to see a 155% increase in its regasification infrastructure between 2016 and 2020 to meet electricity demand and capitalize on low prices. Several countries, such as Bangladesh, have taken more concrete steps to import LNG in the past two years as a result of low prices. The government of Bangladesh agreed in June to a deal with Excelerate Energy and its project partner Astra Oil to import $1.6 billion worth of LNG per year through the state's first import terminal, a 3.5-mtpa floating storage and regasification unit based at Moheshkhali in the Bay of Bengal.[35] Delivery of LNG is unlikely before 2017 or 2018, despite earlier hopes that imports would begin this year. A second LNG import project with Reliance Power also is expected to be operational by 2018. It remains to be seen whether other, less creditworthy countries, such as Sri Lanka, also regard LNG as an affordable alternative to coal.

Regasification infrastructure data in Asia's emerging economies may be a surprisingly good indicator of future volumes of imports (whereas globally many import terminals are underutilized). Trends in other developing Asian markets seem to suggest that LNG terminals will be fully utilized if built. India's Dahej terminal, for example, is currently running at 111%–120% of its capacity, pointing to the need for additional infrastructure to improve connectivity. Aggregated South Asian regasification capacity (including India) will reach 88.5 mtpa by 2020—a level equivalent to Japan's imports in 2013, when the country was still recovering from the Fukushima Daiichi disaster. It must be noted, however, that opportunistic demand for electricity use from new and smaller buyers in South Asia may be fickle if prices increase, as countries would lean toward coal as a substitute. For a summary of current plans to expand import capacity in South and Southeast Asian countries, see **Table 1**.

Summary

The International Energy Agency projects that imports from Japan and South Korea will decline between 2015 and 2021, while imports from emerging Asian LNG importers (including China and India) will increase by more than 80 mt over the next six years.[36] However, there are risks to the consensus view that this trend will continue, as the evolving pricing environment could affect policies, commercial decisions, and consumer behavior. Sustained competitive LNG prices could reverse or at least temper the decline observed among traditional Asian LNG importers, especially if their non–fossil fuel goals are underperforming. Conversely, a return of the Asian premium could abruptly end the promising LNG growth in emerging Asian markets.

Additional Drivers of Asia's LNG Demand

As the preceding section noted, the power sector is highly price-sensitive and could see demand decline if prices rally. On the other hand, demand for city gas distribution—also called non-power—will continue to grow regardless of pricing levels due to safety, health, and environmental concerns.

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35 "Bangladesh Approves Moheshkhali LNG Terminal," *LNG World Shipping*, June 23, 2016, http://www.lngworldshipping.com/news/view,bangladesh-approves-moheshkhali-lng-terminal_43441.htm.

36 International Energy Agency, *Medium-Term Oil Market Report 2016* (Paris: OECD Publishing, 2016).

TABLE 1 Plans for expanding import capacity in South and Southeast Asia

Country	Existing import capacity (mtpa)	Planned import capacity by 2020 (mtpa)	Expansion plans
Bangladesh	NA	5.7	Bangladesh has signed two LNG infrastructure agreements, one with Excelerate Energy for a floating storage and regasification unit (FSRU) with 3.7 mtpa capacity and the second with Reliance Power for a 2 mtpa FSRU and 750 MW power plant. Both projects are planned to be operational by 2018. Petronet has shown willingness to set up an additional 5 mtpa terminal in Bangladesh that has yet to be approved by the government.
India	21.0	50.0	India is looking to expand its natural gas network across the country, with a particular focus on the eastern coast. The government is planning to build four new terminals (with capacities of 5 mtpa each). Even though the first terminal is supposed to come online in 2016, the timeline remains unclear.
Indonesia	3.5	5.0	Although Indonesia is one of the largest LNG exporters, its domestic demand is rising and expected to double by 2020 (compared with 2014). Declining production will alter the country's import/export balance toward imports in the coming decade.
Malaysia	3.8	7.3	Malaysia is a major LNG exporter, but gas shortages in the western demand centers have prompted construction of LNG import terminals to augment pipeline supplies. With large reserves and a desire by Petronas to carry out long-term export contracts, the import market should remain flat.
Myanmar	NA	NA	In 2015, Myanmar signed an agreement with Shell, Italian-Thai Development, and LNG Plus International for its first LNG terminal, but nothing has happened since then. Although the country has proven natural gas reserves of around 11.8 trillion cubic feet, most of the gas is locked in long-term contracts with Thailand and China.
Pakistan	2.9	11.7	Pakistan has approved its second LNG import terminal at Port Qasim, with a capacity of 4.4 mtpa, which is scheduled to be completed in 2017. Its third LNG plant, to be developed at Gwadar, will also have a capacity of 4.4 mtpa and will be constructed and financed by the Chinese government, making the total capacity of the two new LNG terminals 8.8 mtpa. Global Energy Infrastructure Limited announced that it will develop Pakistan's fourth LNG plant at Port Qasim but has yet to specify the plant's capacity.

Table 1 continued

Country	Existing import capacity (mtpa)	Planned import capacity by 2020 (mtpa)	Expansion plans
Philippines	NA	1.5	The Philippines is expected to become an LNG importer, as its long-awaited integrated facility with power plants, a storage bunker, and an FSRU becomes operational in 2017. The Philippines is also looking to add more LNG terminals, as its domestic reserves continue to decline and the country seeks to increase the share of natural gas in its energy mix.
Singapore	6.0	11.0	Gas currently accounts for 95% of electricity generation. Singapore plans to supplant long-term piped-gas contracts with LNG by 2024. LNG terminal regasification capacity will increase 6 mtpa to 11 mtpa by 2017, with potential expansion to 15 mtpa after 2020.
Sri Lanka	NA	NA	Sri Lanka is planning to develop its first LNG terminal after canceling an India-supported coal power plant. The timeline for the project, however, remains unclear. Reliance Power has offered to set up a 1 mtpa terminal, but no agreement has been signed by Sri Lanka.
Thailand	5.0	11.5	While LNG demand has been tempered for 2016, import capacity has grown rapidly. Almost 20 mtpa worth of regasification capacity will be added by 2022. LNG demand should continue to increase, as 70% of Thailand's power generation is fueled by natural gas. LNG imports will supplant Myanmar-sourced gas while domestic production decreases.
TOTAL	***42.2***	***103.7***	

SOURCE: Rapidan Group analysis of various news outlets.

City Gas Distribution Is on the Rise for Health Reasons

The city gas distribution sector includes residential, commercial, industrial, and transportation use. In many developing Asian economies, it refers predominantly to piped natural gas (PNG) used in homes for cooking and heating and to CNG used in vehicles. Demand for city gas is less influenced by price because the main driver is of a vital nature (i.e., health concerns related to air pollution) and will only increase with the ongoing growth of Asia's large cities, notably in China and India. The World Health Organization states that the deterioration of urban air quality increases the risks of heart disease, lung cancer, and chronic and acute respiratory diseases, including asthma. Common drivers of air pollution include diesel-powered vehicles, use of coal or

diesel generators, and heavy construction activities. If air pollution is not addressed, large Asian cities will lose their attractiveness and become less competitive than other cities around the world as wealthier and educated segments of the population migrate elsewhere to raise their families. Hence, air pollution raises an economic issue.

Although city gas is also on the rise in mature Asian markets, its larger growth potential lies in emerging markets. City gas consumption is 30% of total gas demand in Japan, 54% in South Korea, 21% in Taiwan, and 13% in India.[37] Japan's city gas consumption has been dominated by the industrial sector, where demand has increased by 2.6% per year through 2013, while residential and commercial consumption have stagnated.[38] By contrast, South Korea's city gas demand has seen both residential and industrial consumption rise (2.0% and 4.8% per year, respectively).[39]

The demand for city gas is growing in emerging Asian countries as well due to safety, health, and environmental concerns. India's city gas distribution sector is continuing to grow irrespective of price levels because the government is pushing to improve the safety and air quality of its cities. Ten of the world's twenty most polluted cities are in India.[40] Due to high pollution levels, particularly air pollution, New Delhi is promoting the use of CNG in all vehicles. On top of the 340 existing CNG stations in the capital, an additional 104 stations are being set up to promote CNG demand.[41] These stringent measures for controlling pollution in New Delhi are expected to extend across the country—where sufficient gas infrastructure exists—to most major Indian cities, which currently suffer from similarly high levels of air pollution. These measures will further boost national demand for gas. Pan-India coverage for city gas (covering all large cities) could be achieved next decade, once major cross-country pipelines are completed. Furthermore, the government has mandated that all city gas companies accelerate PNG connectivity across the country as part of its ambitious "smart city scheme." The primary objective is to transfer liquefied petroleum gas (LPG) consumption from urban to rural areas, ensuring that most of the urban consumers that have better connectivity will shift from LPG to PNG. The urban shift to PNG will ensure a continuous and adequate supply for heavily populated areas with no need for refillable gas cylinders. Moreover, PNG offers safety advantages in that it is less flammable than LPG and dissipates upon leakage rather than leaving a hazardous residue like LPG.[42]

Despite these advantages, there are two main constraints on city gas demand in India. One major limiting factor is the inadequate infrastructure in place. Second, if gas prices were to skyrocket, the Indian government could lose its resolve to follow through with these goals.

China is another country where environmental concerns may prevail over cost considerations, especially for city gas. Over the next ten to twenty years, the emergence of megacities with more than ten million inhabitants will boost gas use to guarantee clean air, clean water, and safe food for the population as long as natural gas remains competitive enough to encourage the Chinese government to make necessary structural changes. In addition, China will have 221 cities with over one million people by 2025, meaning that the challenge of reducing air pollution will only increase. The country

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37 Rogers, *Asian LNG Demand*, 16, 21–22.

38 Ibid., 15.

39 Ibid., 21.

40 Bindu Shajan Perappadan, "Delhi Not 'Most Polluted,' but Dirty Air Fouls Many Cities," *Hindu*, May 13, 2016, http://www.thehindu.com/news/cities/Delhi/delhi-is-not-the-most-polluted-city-in-the-world-who/article8589775.ece.

41 "Petroleum and Natural Gas Minister Dedicates 36 New CNG Stations in Delhi and NCR," Ministry of Petroleum and Natural Gas (India), Press Release, April 7, 2016, http://pib.nic.in/newsite/PrintRelease.aspx?relid=138673.

42 PNG also offers easier solutions for households to isolate gas flow through quick valve shutoffs. In contrast, LPG poses more difficulties due to its high expansion rate (250 times as high as PNG). "PNG Benefits," Indraprastha Gas Limited, http://www.iglonline.net/BenefitsPNG.aspx.

as a whole has been encouraged to improve urban air quality since the 13th Five-Year Plan, which calls for the replacement of coal with natural gas and electricity in non-power sectors.[43] Given that non-power sectors account for 45% of coal use, this target is significant.

Interestingly, the level of pollution (especially PM2.5, a fine particulate matter that is dangerous to regularly breathe) in the Beijing-Tianjin-Hebei area dropped 23% in the first quarter of 2016 compared with the same period last year due to a slowdown in the coal and steel sectors.[44] The region is on track to achieve its goal of reducing PM2.5 levels 25% by 2017 as it implements an aggressive action plan that involves "decommissioning the highest-emitting vehicles, prohibiting construction of any new polluting industries, and replacing coal with renewables and natural gas." Beijing aims to reduce coal consumption by 57% overall by 2017 and by 16% in the Beijing-Tianjin-Hebei region. Natural gas power plants are replacing part of this retired coal capacity.[45] Although it is too early to understand exactly what is driving the improved air quality (whether policies controlling pollution or the economic slowdown), the early signs point to structural changes in China's power market that will have a positive impact on efforts to improve air quality and achieve other climate goals.

Smart grids and new technologies will also offer big cities new ways to curb pollution while integrating natural gas. Beijing, for instance, is promoting "distributed energy" systems that involve energy generation from a sustainable supply (natural gas or renewables) at an industrial complex, hospital, or university campus. Chinese gas distributor ENN has already completed seven "micro-grid" projects that can be connected to the main power grid for backup supply in order to meet customers' various energy needs, including heating, cooling, and electricity. Natural gas is a great partner for these new systems, which are cleaner and more efficient than large-scale, long-distance energy transmission.

Meanwhile, Pakistan has made an even bigger bet on CNG vehicles, which will further stimulate LNG demand and reduce air pollution across the country. The government has recently allowed the All Pakistan CNG Association to buy LNG directly for its 3,395 CNG stations, as CNG is still 30% cheaper than petrol at the current rates.[46]

Post-COP21 and the More Acceptable Environmental Premium to Use LNG

Although it is too early to tell whether a post-COP21 mindset means increased appetite for gas, it appears that the agreement will support LNG consumption in the medium term for emerging Asian economies and smaller markets that have environmental concerns. However, not all Asian countries can afford to pay the environmental premium that comes with cleaner sources of energy. This is why the use of gas as a transitional fuel on the path to a greener economy has better odds of succeeding if gas and LNG prices remain competitive and transparent.

For poorer economies, such as Bangladesh and Sri Lanka, the LNG-to-power choice is more complicated, but current low prices are making it easier.[47] The Sri Lankan government is looking

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43 Clemente, "China's Rising Natural Gas Demand."

44 Li Jing, "Where in China Can You Find the Worst Air Pollution? You Might Be Surprised…," *South China Morning Post*, April 20, 2016, http://www.scmp.com/news/china/policies-politics/article/1937381/where-china-can-you-find-worst-air-pollution-you-might.

45 "Case Studies in Improving Urban Air Quality," International Gas Union, 2015, http://www.igu.org/sites/default/files/IGU_Urban%20Air%20Quality%20FINAL%20for%20web%20etc.pdf.

46 "LNG Initiative," All Pakistan CNG Association, http://apcngassociation.com/lng-initiative.

47 LNG-to-power is the integration of LNG import terminals (often small-scale floating storage and regasification units) with adjacent power plants. This cuts the need to build long-distance pipelines and reduces connectivity issues as the power plant sits at the regasification terminal.

to construct a new LNG power plant and convert existing coal power projects to LNG in order to minimize environmental damage and benefit from low gas prices.[48] Uncertainty persists over whether coal-to-LNG conversion is economically viable, but the government remains keen to establish the country's first LNG terminal and build surrounding infrastructure (i.e., pipelines and power plants) that can ultimately be used to burn domestic gas.[49] Although Sri Lanka does not currently produce any natural gas, the country does have offshore gas reserves.[50]

Similarly, after years of hesitation due to high costs, Bangladesh is seriously exploring LNG imports as a way to meet its growing electricity generation needs while limiting its reliance on dirtier coal. Bangladesh is eager to take advantage of cheaper, more accessible LNG to meet growing demand for gas for power generation and industrial use.

In the post-COP21 era, more governments will very likely be willing to pay what they see as the environmental premium necessary to promote measures to switch from coal to LNG as long as LNG prices remain in an acceptable range relative to coal prices. However, Asian stakeholders are aware that a change in the region's LNG price structure is needed for LNG to grow as a long-term, viable energy source, and they will play a key role in this process.

The Quest for Sustainable LNG

Looming changes in the pricing structure of Asian gas could guarantee a long-term role for LNG in Asian economies. Asian buyers are trying to replace the current system of oil-indexed LNG pricing that is still predominant in the region. They are increasingly favoring one or more Asian benchmarks as a way to price LNG according to regional supply and demand fundamentals rather than an obsolete linkage to oil. The key outcomes anticipated by buyers under an Asian LNG hub model include rational, competitive, and transparent gas pricing and energy security. Thus, both suppliers and consumers could benefit from the establishment of trusted Asian LNG price indexes, which would reduce the long-term threats of demand uncertainty and underinvestment.

The Asian LNG Price Premium Could Return

In the absence of a move away from oil-indexed prices, the Asian LNG price premium could return. The overwhelming majority of gas sold in Asia is indexed to the price of oil and will continue to be affected by fluctuations in oil prices. Short-term purchases represent less than 30% of Asian LNG imports, and real spot transactions make up only 5%–10% of the total LNG trade.[51] During the next cycle of high oil prices, oil-indexed Asian prices will rise again, while spot prices will likely remain low until the supply/demand balance tightens (which is unlikely to happen before the next decade). But this means that the average Asian gas price will trend upward at a

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48 "Sri Lanka to Build LNG Power Plant in Kerawalapitiya: Power Ministry," Lanka Business Online, May 6, 2016, http://www.lankabusinessonline.com/sri-lank-to-build-new-lng-power-plant-in-kerawalapitiya-power-ministry; and Chamath Ariyadasa, "Sri Lanka Wants LNG-Driven Power, to Shift Away from Coal: Govt Official," Lanka Business Online, May 6, 2016, http://www.lankabusinessonline.com/sri-lanka-wants-lng-driven-power-to-shift-away-from-coal-govt-official.

49 Ifham Nizam, "The Power Generation Mix," *Sunday Leader*, May 15, 2016, http://www.thesundayleader.lk/2016/05/15/the-power-generation-mix; and "Sri Lanka Revives Natural Gas Power, LNG Deal with Qatar Mooted," EconomyNext, March 29, 2016, http://www.economynext.com/Sri_Lanka_revives_natural_gas_power,_LNG_deal_with_Qatar_mooted-3-4597-8.html.

50 "Norway Keen on Sri Lanka Natural Gas Deposits," EconomyNext, June 10, 2016, http://www.economynext.com/Norway_keen_on_Sri_Lanka_natural_gas_deposits-3-3944-8.html.

51 GIIGNL, "The LNG Industry in 2014," 2015, http://www.giignl.org/sites/default/files/PUBLIC_AREA/Publications/giignl_2015_annual_report.pdf.

time when LNG prices in other regions, notably Europe, remain low as the European gas hub, abundant supply, and internal market competition keep prices in check. Even if oil prices remain in the $50–$65 range in the coming years, the volatility of crude prices will make oil-indexed gas prices just as unstable, causing unpleasant conditions in the market. Long-term oil-indexed prices can no longer accurately reflect gas market fundamentals, while spot prices are reflecting more correctly the current price and real value of the fuel at a given time. The divergence between LNG and oil in terms of price and fundamentals has been striking so far in 2016 and reinforces the realization that their decoupling is imminent.

Another scenario that could trigger the return of the Asian premium is a tightening of the LNG market in the next decade, with demand outpacing supply as a result of an investment shortfall or higher-than-expected price elasticity of demand. As such, the market could tilt again toward sellers, with buyers losing their leverage to renegotiate long-term contracts to include price discounts, changes in price formation, or more flexible terms. The result would be an abrupt end to the current low-pricing environment. Because of the current market conditions, many LNG projects with pre-final investment decisions are back on the drawing board, with companies now taking a fresh look at demand, costs, prices, and timing before launching new projects. Numerous final investment decisions on proposed liquefaction projects in North America and East Africa, for instance, have been postponed. Globally, over 100 mtpa of LNG are at risk of late arrival to market or even non-entry. And while projects with investment decisions deferred to 2017, 2018, or later could still come online early in the next decade, this may not be soon enough to prevent the market from tightening after 2021.

Initiatives to Ensure Competitive Asian LNG Prices

Changes in pricing dynamics will not be solely a result of market forces. Regional governments from importing countries have identified a series of measures to ensure that Asian LNG prices remain competitive in the long term. These endeavors involve several ongoing government-led initiatives, including the establishment of new pricing benchmarks and plans to conduct joint purchasing among the major LNG importers.

Asia's first LNG hubs. In order to guard against the risk of oil-linked Asian gas prices being pushed higher by a longer-term recovery of oil prices, Japan and Singapore are eager to capitalize on current LNG market conditions and establish transparent regional pricing benchmarks that accurately reflect supply and demand. The emphasis on hubs based solely on LNG transactions is unique. The two most advanced Asian LNG trading hubs, forming in Singapore and Tokyo, are different from existing European natural gas hubs—which rely on numerous gas interconnections, routes, and sources—and do not require the same conditions to succeed. Asian LNG hubs will thrive on increasing flexibility and liquidity in markets. Their use will accelerate with the looming rise in spot transactions, supported by U.S. LNG exports and the removal of destination restrictions.

These new pricing indexes, likely to be trusted and recognized over time, will stimulate spot demand from smaller buyers, new entrants, and nontraditional gas users at a time when suppliers are proactively trying to find new outlets for the current LNG overcapacity and buyers do not want to commit to long-term contracts but prefer instead to rely on short-term transactions. The existence of reliable price benchmarks will promote incremental LNG trade flows. These structural pricing

changes will be a win-win outcome for suppliers and buyers during uncertain times—i.e., long-term LNG demand and investment outlook—and will support the future stability of the LNG industry.

Joint LNG procurements. The push by Asian governments to cooperate on joint LNG purchases is another initiative to guarantee sustainable and reasonable prices. Cooperation between Asian governments, rather than competition and dwelling on historical rivalries, should be pursued to achieve the common goals of fair LNG prices, increased energy security, and sustainable economic growth. India is in talks with Japan and South Korea (and potentially China) to form a purchasing alliance for LNG.[52] The idea to cooperate rather than compete for LNG procurement is not new, but previous attempts at regional cooperation that were agreed to on paper in 2012, 2013, and 2014 have translated into little action.[53] This time, however, the impulse comes from India (driven by Dharmendra Pradhan, the minister of petroleum and natural gas), whereas previous joint initiatives were mostly driven by the mature markets Japan and South Korea. India is anticipating that LNG will be a major component of its energy mix in the coming decades, and the country must play an instrumental role in shaping future LNG markets to protect its strategic interests. Although there is less incentive to form a buyers' cartel in a low-price environment, Asian buyers are developing strategies to prepare for the next cycle of tightness. These initiatives will enable gas to remain competitively priced and ensure that Asia remains a strong LNG market in the years to come.

Conclusion

Prices are only one factor that will have an impact on LNG demand, but they are by far among the most important. The availability of ample, affordable LNG will likely further boost gas demand in Asia for power generation, including demand from historical importers (especially in the event that their non–fossil fuel goals are underperforming). But that demand is highly sensitive and can reverse quickly if the Asian gas premium returns. Meanwhile, low prices will help curb carbon emissions in Asia's emerging economies. The use of LNG in megacities is set to rise regardless of price levels, given that environmental and health concerns will prevail in the post-COP21 era. This trend increasingly suggests that emerging Asian LNG importers will consider paying an environmental premium to justify using LNG instead of coal. The success of Asia's main LNG importers in guaranteeing a sustained, transparent, competitively priced supply—through multiple initiatives, including the emergence of the region's first LNG hubs and related price indexes—will determine the long-term viability of LNG in these countries' energy mixes. The combination of favorable market conditions, a desire to increase the standard of living, the pursuit of economic growth, and a determination to meet goals for reducing emissions will result in a golden age of LNG in Asia, which is already happening in developing Asian countries.

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[52] Promit Mukherjee, "India Seeks Better LNG Deal by Teaming Up with South Korea and Japan," Reuters, June 15, 2016, http://in.reuters.com/article/india-energy-idINKCN0Z01QW.

[53] For more on these various agreements, see "Tokyo Gas, Kogas Pen LNG MoU," LNG World News, September 25, 2014, http://www.lngworldnews.com/tokyo-gas-kogas-pen-lng-mou; Yuji Okada, "South Korea, Japan to Discuss Joint LNG Purchasing, Kogas Says," Bloomberg, September 18, 2012, http://www.bloomberg.com/news/articles/2012-09-19/south-korea-japan-to-discuss-joint-lng-purchasing-kogas-says; Shigeru Sato and Yuji Okada, "Japan Said to Plan Talks with South Korea on Joint LNG Purchases," Bloomberg, March 5, 2013, http://www.bloomberg.com/news/articles/2013-03-06/japan-said-to-plan-talks-with-south-korea-on-joint-lng-purchases; and "Chubu and GAIL Sign MoU on Joint LNG Purchases," LNG World News, March 24, 2014, http://www.lngworldnews.com/chubu-and-gail-sign-mou-on-joint-lng-purchases.

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The Impact of Prolonged Low Energy Prices on APEC's Transition to a Low-Carbon Energy Mix

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EXECUTIVE SUMMARY

This essay explores the drivers of the transition to a low-carbon energy system and assesses how prolonged low energy prices could affect this shift.

MAIN ARGUMENT

The energy choices made in the Asia-Pacific Economic Cooperation (APEC) will have global impacts on energy security and environmental sustainability. APEC governments have implemented and announced major changes to energy policy, which will shape the region's energy future. Although most APEC economies now have set either firm or aspirational targets for energy efficiency and renewable energy, the stated goals are encouraging but still insufficient. The need to affordably meet the growing energy demand associated with population growth and rising incomes will put pressure on both energy security and environmental sustainability.

POLICY IMPLICATIONS

- Energy efficiency and conservation efforts can help curb growing energy demand, but in an environment of low energy prices tougher regulation will be required to encourage consumers to make the right choices. While most APEC economies have introduced policies to support energy efficiency, these policies vary greatly in effectiveness and will need to be strengthened.
- Renewables represent the fastest-growing energy source. However, if APEC is to achieve its goal of doubling the share of renewables between 2010 and 2030, governments will need to introduce additional incentives or implement policies to limit or discourage the use of fossil fuels. Achieving the longer-term climate ambitions agreed on at the 21st Conference of the Parties in Paris will require even higher shares of renewables use.
- Technology development continues to play a major role in shaping the energy sector. Dramatically declining costs are making wind and solar photovoltaic (PV) energy increasingly competitive with fossil fuels in power generation, while more efficient end-use technologies are helping lower energy demand. Accelerating energy technology development and deployment is central to establishing more secure and environmentally sustainable energy systems.

The Asia-Pacific Economic Cooperation (APEC) is a regional economic forum established to leverage the growing interdependence of the Asia-Pacific. The 21 economies of the APEC region together account for about 60% of global energy demand. Based on current policies and trends, by 2040 APEC's energy demand is expected to rise by 2,780 million tonnes of oil equivalent (Mtoe)—equivalent to the current energy demand in the United States and that of APEC Southeast Asia—and more than 80% of the region's energy mix will still come from fossil fuels.[1] Assuming a business-as-usual (BAU) approach, energy-related emissions would rise by 24% in this scenario, falling well short of the commitments outlined at the 21st Conference of the Parties (COP21) held in Paris in December 2015.

Recognizing that such an increase in energy demand and emissions is clearly unsustainable, APEC energy ministers have pledged to work together to accelerate the deployment of low-carbon energy technologies. This includes, for example, sharing know-how on the implementation of policies to improve energy efficiency and the development of renewable energy and other low-carbon energy supply technologies (such as nuclear and clean fossil technologies). Additionally, APEC economies have established voluntary targets to reduce the region's energy intensity by 45% by 2035 compared with 2005 levels and to double the share of renewables in the final energy mix by 2030 compared with 2010 levels. The combined impact of both of these targets would allow emissions to peak by 2020, falling afterward to 18.5 gigatons (Gt) of carbon dioxide (CO_2) by 2040, or 27% lower than BAU assumptions.

Early signs of a shift to a more efficient, lower-carbon energy system can be seen in parts of the APEC region, including in China, the United States, Japan, and Australia. Energy consumption is already falling below projected levels in some economies, while others are also seeing investments in renewable power surpassing investment in fossil fuels. However, the current environment of low energy prices has raised questions about how to best sustain these trends. One concern is that a period of prolonged low prices could alter consumer behavior and make energy efficiency and low-carbon energy sources less attractive. Given that tougher policies to promote energy efficiency and conservation, as well as stronger incentives for the deployment of renewables, will be needed for APEC to achieve its energy targets, member economies must avoid this form of complacency.

This essay examines the outlook for accelerating Asia's transition to a low-carbon energy mix. The first section provides an overview of current energy demand and supply trends in the APEC region. The essay then highlights key developments within different APEC subregions and examines the potential impact of low energy prices on clean-energy initiatives within each subregion. The third section considers three different scenarios that could help decarbonize the electricity sector and lower the region's energy-related emissions. The essay concludes with recommendations for policymakers.

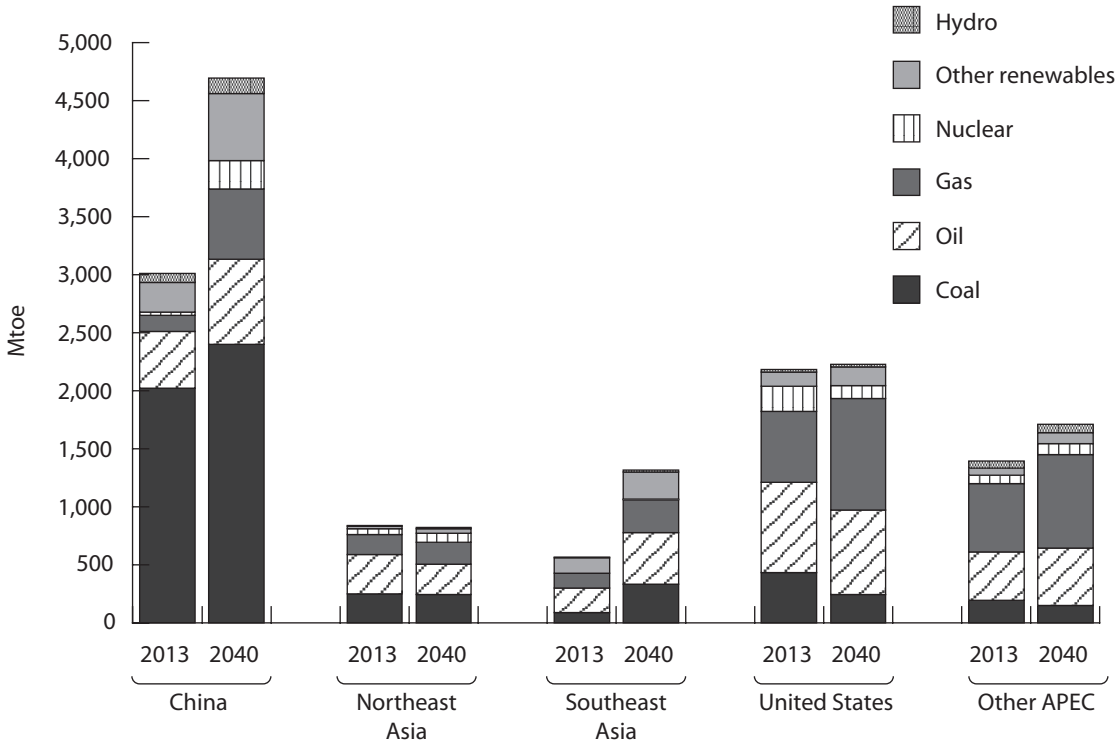
APEC under a BAU Scenario

The Asia Pacific Energy Research Centre (APERC) released the sixth edition of its *APEC Energy Demand and Supply Outlook*, which provides detailed projections of APEC's energy demand, supply, and CO_2 emissions to 2040. Its BAU scenario reflects current policies and trends within the APEC energy sector; thus, its projections largely extend the past into

[1] APEC Southeast Asia comprises Brunei, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

the future. Under the BAU scenario, total primary energy demand in APEC reaches 10,770 Mtoe in 2040, rising 34% compared with 2013 levels, with China and Southeast Asia being the main drivers of growth.[2] As **Figure 1** shows, China accounts for more than half of this new demand due to expectations related to its sheer size and continued economic growth. Aggressive, strategic efforts to control growth in energy demand over the next decade, however, prove effective for China and demand flattens after 2030. Energy demand in Southeast Asia more than doubles owing to rapid economic development, as well as low current rates of per-capita energy consumption.

FIGURE 1 Total primary energy supply by APEC region under a BAU scenario, 2013 and 2040



SOURCE: *APEC Energy Demand and Supply Outlook*, 6th ed. (Tokyo: Asia Pacific Energy Research Centre, 2016), http://aperc.ieej.or.jp/publications/reports/outlook.php; and International Energy Agency (IEA), *Key World Energy Statistics 2015* (Paris: IEA, 2015).

NOTE: Northeast Asia includes Hong Kong, Japan, Korea, and Chinese Taipei. Southeast Asia includes Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam. Other APEC includes Australia, Canada, Chile, Mexico, New Zealand, Papua New Guinea, Peru, and Russia.

[2] *APEC Energy Demand and Supply Outlook*, 6th ed. (Tokyo: Asia Pacific Energy Research Centre, 2016), http://aperc.ieej.or.jp/publications/reports/outlook.php.

Under the BAU scenario, APEC will remain reliant on fossil fuels to meet growing energy demand, with fossil fuels accounting for 83% of the energy supply mix in 2040, down only slightly from 86% in 2013. Coal will remain the leading source for power (41% of the generation mix in 2040, compared with 49% in 2013) due to rapid growth in electricity demand, particularly in China and Southeast Asia. With an average annual growth rate of 2.1%, natural gas shows the highest growth among fossil fuel sources and is the second-fastest growing fuel after renewables.[3] Many economies, such as China, are trying to diversify their fuel mix from being overreliant on a single fuel (particularly coal) by choosing different fuel that has lower or no emissions. In this regard, renewables have been the obvious choice, but due to limitations such as intermittence, gas will be used to support renewables development. This is because gas is a reliable, highly flexible supply (offering fast start-up for power plants and the ability to meet peak-load or base-load demand). The abundance of low-priced gas in certain economies also offers an attractive option to reduce energy-related emissions in the short term.

APEC's Energy-Related Emissions under a BAU Scenario

Energy-related emissions under a BAU scenario reach 25.3 Gt of CO_2 in 2040, an increase of 24% over 2013 levels, due to high energy demand and growing reliance on coal-fired power in many APEC economies. The power sector contributes the largest share (64%) of the increase in APEC emissions, as over 670 gigawatts (GW) of net additional coal-fired capacity and 800 GW of net additional gas-fired capacity are added between 2013 and 2040.[4]

As vehicle ownership rises in line with higher income levels, the number of vehicles in the APEC region increases by 610 million between 2013 and 2040, pushing transportation-related emissions up by nearly 1 Gt of CO_2 by 2040 and making transportation the second-fastest-growing emitter.[5] As **Figure 2** depicts, China and Southeast Asia show the largest increases in transportation emissions, as their combined vehicle stock increases by 453 million by 2040. But the trend is not universal: while APEC transportation emissions rise overall, many regions—including the United States, Other Northeast Asia, and Russia—show a reduction as a result of improvements in fuel economy and the introduction of advanced vehicles.

China shows the largest absolute increase in emissions, adding approximately 2.8 Gt of CO_2 between 2013 and 2040. Emissions from the electricity sector account for more than 75% of the total increase, with the remainder mainly coming from the transportation sector. Emissions continue to rise in all sectors in Southeast Asia as industrialization and economic development are at much earlier stages in these economies. In fact, emissions growth for this period is higher in Southeast Asia (160%) than in China (34%), indicating the need for measures to help control the overall growth in emissions. Alternatives to coal-fired power and tougher fuel economy standards are two of the most important measures for regional economies to pursue. In Other Northeast Asia, by contrast, slowing economic growth, declining populations, and more successful energy efficiency efforts (particularly in Japan and Hong Kong) will help reduce emissions by 12% over 2013 levels.[6]

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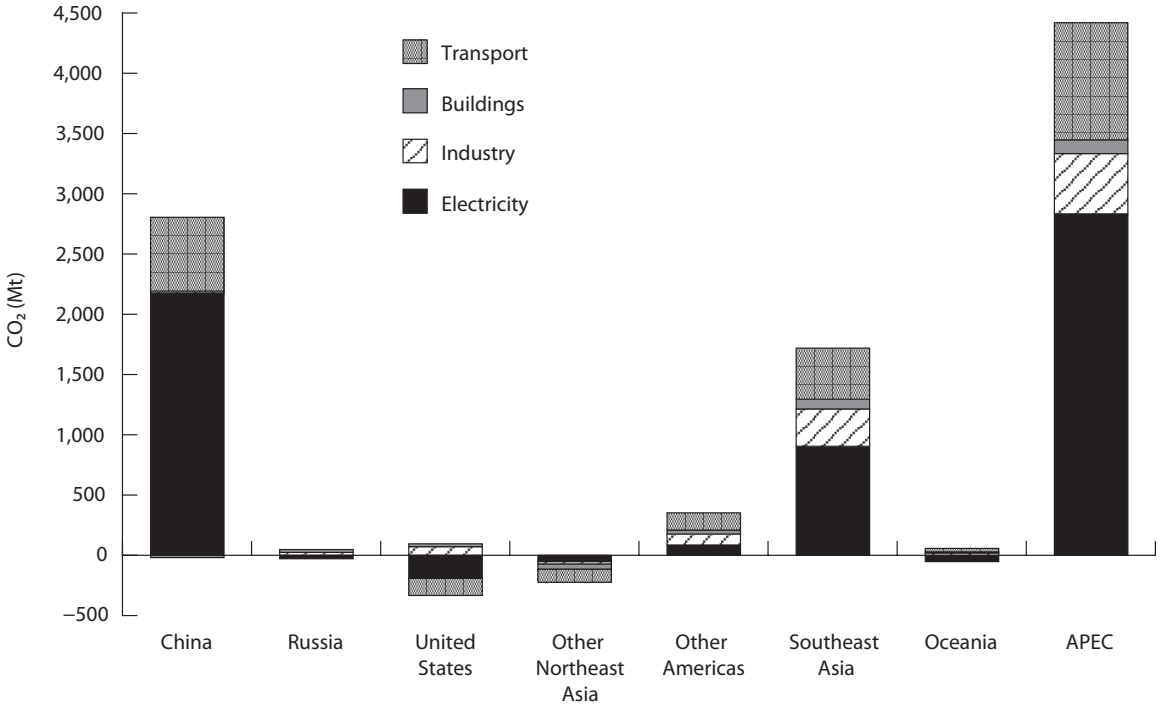
[3] *APEC Energy Demand and Supply Outlook.*

[4] Ibid.

[5] Ibid.

[6] Ibid.

FIGURE 2 Changes in energy-related CO_2 emissions, 2013–40



SOURCE: *APEC Energy Demand and Supply Outlook*; and IEA, *Key World Energy Statistics 2015.*

Overall, the BAU scenario highlights that current policies and trends do not adequately address the APEC region's energy challenges, with APEC missing targets for both energy intensity and renewables. To improve this situation and prevent the BAU scenario from becoming a reality, two key recommendations emerge. First, leaders must take urgent action to support decarbonization of the power sector in APEC, particularly in Asia where coal remains the preferred source given its relative abundance and low cost. Early transition away from coal will have long-lasting benefits, particularly avoiding the "lock in" associated with the long lifespan of coal-fired plants (over 40 years). Second, governments need to prioritize energy efficiency and conservation. Lower energy demand will help reduce the need for new power plants and ultimately result in a stronger energy security outlook. Alternatively, should such actions not be pursued, it is clear that growth in energy-related emissions is on an unsustainable path and, if left unchanged, will lead to a global temperature increase of 5°C to 6°C.

The Impact of Low Energy Prices on the Shift to Cleaner Energy Sources

Understanding the above projections, it is clear that BAU is unsustainable, and indeed policymakers have expressed and undertaken efforts to avoid it. Yet the current environment of low oil and gas prices has raised questions about the longer-term impacts of a shift toward cleaner energy sources should this low-price environment be maintained beyond the next couple of years.

Traditionally, low energy prices have led to higher energy demand, and in particular higher consumption of fossil energy. Some have raised doubts about whether current policies to control energy demand and spur development of renewables will be able to overcome a prolonged period of low energy prices.

In the APEC region, however, there are reasons to believe that this concern is unfounded. Declining domestic supplies of fossil energy, concerns over future dependence on imports, and concerns with local air quality will help maintain and accelerate policies toward the development of low-carbon energy sources. At a more granular level, in China the addition of renewables capacity has outstripped coal-fired additions. Northeast Asia has also provided strong support for accelerating initiatives to both improve energy efficiency and develop renewables, while in Southeast Asia declining natural gas reserves will lead economies to turn to coal and renewables to diversify their energy mix. These trends are explored in greater depth in the following subsections.

China

Strong policy direction in China should help keep the economy's transition to a low-carbon energy system on track. The rapid growth of electricity fueled by coal has had detrimental impacts on local air quality, leading Chinese policymakers to impose a cap on coal usage, introduce carbon markets, and offer incentives for developing renewable power. With this in mind, China has stated that by 2030 it intends to achieve peak CO_2 emissions and increase the share of non-fossil fuels in its total primary energy supply to around 20%.[7] Most recently, the country's 13th Five-Year Plan has called for a system to control consumption of energy, water, and developed land. More generally, it promised an "energy revolution" to replace fossil fuels with clean, safe resources (wind, solar, biomass, water, geothermal, and nuclear), while exploring deposits of natural shale and coal-bed methane. Energy-intensive industries—such as the power, steel, chemical, and building material industries—will be subject to regulations to control CO_2 emissions. Such policies will help curb energy demand growth in China.

This momentum has helped make China the leading manufacturer of solar photovoltaic (PV) and wind turbines, and in 2014 China overtook the European Union as the leader in the development of renewables. Several factors underpin China's impressive scaling up of renewable power, particularly wind and solar. First, public support and government determination to improve the quality of the environment have provided stable policies, which have reassured investors about the commitment to renewables. In particular, a driving consideration here is that in addition to addressing climate change, the development of renewables will help diversify China's energy mix and improve energy security by reducing energy imports and raising the level of self-sufficiency. Second, a portion of investment capital is directed toward research on how to manufacture state-of-the-art technologies at competitive prices. Third, a feed-in-tariff system supports quick and large-scale deployment of renewable energy.[8] Finally, the rapid increase of demand for electricity facilitates the deployment of wind and solar generators given the preference to meet rising demand with clean energy sources.

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[7] See the intended nationally determined contribution (INDC) that China submitted to the UN Framework Convention on Climate Change (UNFCC) on June 30, 2015, available at http://www4.unfccc.int/submissions/INDC/Published%20Documents/China/1/China's%20INDC%20-%20on%2030%20June%202015.pdf.

[8] A feed-in-tariff is a policy mechanism used to encourage the deployment of a certain technology, in this context, renewable energy. A feed-in-tariff usually guarantees the owner of an eligible renewable energy source a fixed price for energy fed into the system.

Under an assumption of prolonged low oil prices ($68 per barrel in 2020 and $78 per barrel in 2040), APERC modeled the impact on transportation energy demand in China and found only a modest 4% increase as policies are implemented to control future growth. To stem energy demand in the transportation sector, the Chinese government is committed to improving public transportation by developing intercity rail and encouraging green commuting. By 2020, China aims to have public transportation account for 30% of total motorized transportation in large and medium-sized cities.[9] The integration of these systems is a key element, with intercity railway systems being built so that people can travel by train between medium-sized or large cities and also connect to urban transportation systems (e.g., subways and light railways) within large cities. High-speed railway systems will also be expanded quickly to connect China's major cities. Fuel-economy standards for vehicles will become increasingly stringent as old vehicles are retired.

In order to improve energy efficiency and reduce CO_2 emissions in the transportation sector, China is fostering the adoption of advanced vehicles. In June 2012, the State Council published a plan to reduce the growth in energy use for domestic transportation and promote the development of the advanced vehicle industry. China also set an ambitious target to have five million electric vehicles and fuel cell electric vehicles by 2020.[10] To support this target, the government has rolled out a set of measures to promote the use of advanced vehicles, including tax exemptions, subsidies for car purchases, and requirements for the government car fleet to include more advanced vehicles. Collectively, these efforts could offset the increased energy consumption, especially with regard to the use of fossil fuels in the transportation sector. In all, lower energy prices are expected to have a limited impact on the shift to cleaner energy in China, as the government will strive to continue policies that accelerate the development of low-carbon energy sources.

APEC Northeast Asia

Economies in APEC Northeast Asia can be characterized as developed economies that are resource-poor, using nuclear power in order to compensate for the lack of indigenous energy resources.[11] Efforts to improve energy efficiency in this region—combined with negative or low population growth—will help reduce future energy demand as well as lower emissions. By 2040, the total primary energy supply in Other Northeast Asia (that is, not including China) is projected to shrink by 2.2%, with a 24% and 2% decline in oil and coal demand, respectively.[12]

Gas demand for the power sector is expected to increase by 18% in this region by 2040, with most of the new demand coming from South Korea (a 22% increase) and Chinese Taipei (a 65% increase). The accident at the Fukushima Daiichi Nuclear Power Plant in March 2011 eventually forced policymakers to go back to the drawing board in formulating their energy policies. Prior to the 2011 accident, Japan's energy mix was among the cleanest in Northeast Asia, with nuclear energy supplying more than 25% of power generated in 2010. The accident has significantly raised public concern about the safety of nuclear generation and made it more difficult to resolve plant siting issues, especially regarding the location of a high-level radioactive waste disposal facility.

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[9] See the INDC that China submitted to the UNFCC on June 30, 2015.

[10] State Council of the People's Republic of China, *Guo wu yuan guan yu yin fa jie neng yu xin neng yuan qi che chan ye fa zhan gui hua 2012—2020 nian de tong zhi* [The Development Plan for Energy Saving and New Energy Automobile Industry (2012–2020)] (Beijing, 2012), http://www.gov.cn/zwgk/2012-07/09/content_2179032.htm.

[11] APEC Northeast Asia comprises Hong Kong, Japan, South Korea, and Chinese Taipei. Nuclear power in Hong Kong is imported from the Daya Bay plant in China.

[12] *APEC Energy Demand and Supply Outlook*.

Under its latest Strategic Energy Plan, Japan will decrease nuclear dependence while strengthening energy efficiency and expanding use of renewable energy. The government aims for a well-balanced power mix in which nuclear energy accounts for 20%–22% of total generated electricity, renewables for 22%–24%, liquefied natural gas (LNG) for 27%, coal for 26%, and oil for 3%, all by 2030.[13] The share of nuclear energy is smaller than before the earthquake (when it was around 30%), thus lowering Japan's nuclear dependence. Within renewables, the two largest sources are hydro (8.8%–9.2%) and solar (7.0%). With this energy mix target, coupled with its intended nationally determined commitment (INDC) and radical energy savings, Japan is set to continue pursuing low-carbon economic growth in the future.

In 2014, South Korea launched the 2nd National Energy Master Plan covering 2014–35.[14] Taking its cue from the Fukushima accident, the government revised the share of nuclear energy in the economy's generation capacity, which is expected to be kept at around 29% by 2035, a decrease from the 41% share set out in the 1st National Energy Master Plan in 2008.[15] Besides that change, the South Korean government indicated that renewables will account for 11% of the total primary energy supply and 13.5% of total electricity by 2035 in the 4th New and Renewable Energy Basic Plan of 2014, with the development of solar and wind as major energy sources.

The Fukushima accident encouraged the Chinese Taipei government to phase out nuclear power after 2020, which will require the economy to add significant amounts of new coal- and gas-fired generation. Renewable electricity generation is also expected to nearly double. Both solar and wind power are expected to increase sixfold by 2040, as the government's efforts to achieve INDC targets spur investments in renewables.

APEC Southeast Asia

In APEC Southeast Asia, energy demand in 2013 was 2.5 times demand in 1990, and this high growth rate is expected to continue in the years to come. With abundant reserves in some economies, natural gas has been the fuel of choice for the electricity sector (with a 37% share in 2013). Current low energy prices provide opportunities for governments to rationalize and eliminate energy subsidies. By 2040, gas demand for power generation in Southeast Asia is expected to be nearly double 2013 levels, reaching 120 Mtoe. Despite this increase, however, the share of gas in total power generation is projected to decline from 44% in 2013 to around 30% by 2040, as high economic growth spurs strong electricity demand and leads to depleting domestic gas reserves.[16]

Coal demand is expected to more than triple by 2040, growing at a rate of 4.9% annually as more than half of all new capacity will be fueled by coal. Solar and biomass capacity should see even sharper increases, rising twentyfold and fourfold, respectively. China and Southeast Asia will account for nearly 75% of the growth in renewables in the APEC region.

In 2015, despite the environment of low oil prices, the Association of Southeast Asian Nations (ASEAN) energy ministers set an aspirational target to increase the component of renewable energy to 23% of ASEAN primary energy by 2025, as well as to reduce energy intensity by 20%

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[13] Ministry of Economy, Trade and Industry (Japan), "Chouki enerugi jukyumitooshi" [Long-Term Energy Supply and Demand Outlook], July 2015, http://www.meti.go.jp/press/2015/07/20150716004/20150716004_2.pdf.

[14] Ministry of Trade, Industry and Energy (South Korea), *2cha eneoji gibon gyehoeg* [2nd National Energy Master Plan] (Seoul, January 2014), http://www.motie.go.kr/common/download.do?fid=bbs&bbs_cd_n=16&bbs_seq_n=78654&file_seq_n=3.

[15] Ibid.

[16] *APEC Energy Demand and Supply Outlook*.

in 2020 based on the 2005 level.[17] As seven ASEAN states are also APEC members, these targets are in line with the trend projected by APERC. ASEAN rolled out measures and strategies that need to be taken to achieve these targets, such as improving project financing and bankability, establishing a better network for renewables R&D, and conducting market studies on renewables (including bioenergy).

At the level of the economy, Indonesia has set a target for renewables to be at least 23% of primary energy in 2025 and at least 31% in 2050, while oil should be less than 25% of primary energy in 2025 and less than 20% in 2050.[18] These targets and those set by other Southeast Asian economies demonstrate their commitment toward a greener, low-carbon environment.

In fact, some economies have already translated this commitment into policy action. Malaysia plans to increase its renewables generation capacity by 26 times from 217 megawatts (MW) in 2011 to 5,729 MW in 2040.[19] To achieve this target, Malaysia introduced a feed-in-tariff system in 2011 for biomass, biogas, mini-hydro projects, and solar power (with capacity less than 30 MW). In 2016, Malaysia further reformed its policy by introducing a net-metering scheme, which is expected to improve solar take-up among domestic users.[20] As the third-largest solar panel manufacturer in the world in 2015, Malaysia should be able to benefit from these policies and incentives better than any other economy.[21]

Thailand, another economy with strong demand for biofuels, has set a target to boost renewables in terms of final energy consumption from 12% to 30% by 2036.[22] The Thai government aims to increase bioethanol consumption from 1.2 billion liters in 2015 to 4.1 billion liters by 2036, and biodiesel consumption is targeted to be at 5.1 billion liters by 2036. Southeast Asia has the potential to increase biofuel consumption due to the huge presence of agriculture-based industry such as palm oil (with Indonesia and Malaysia being the two largest producers in the world) and sugarcane (with Thailand being the fourth-largest producer in the world), which can be reliable feedstock sources for biofuels.

The next section will consider alternative scenarios and examine each scenario's implications for climate change and energy security in order to assess which will provide the best improvements to emissions targets and energy security goals.

Alternative Scenarios: The Transition to Low-Carbon Energy in a Low-Price Environment

As part of the post-2020 framework discussed at COP21, APEC economies submitted their INDCs, which outline voluntary commitments to reduce future emissions and formed the basis

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17 ASEAN Centre of Energy, "ASEAN Plan Of Action For Energy Cooperation (APAEC) 2016–2025," 2015, http://www.aseanenergy.org/wp-content/uploads/2015/12/HighRes-APAEC-online-version-final.pdf.

18 Ministry of Energy and Mineral Resources (Indonesia), "Peraturan pemerintah Republik Indonesia nomor 74 tahun 2014 tentang kebijakan energi nasional" [Government Regulation Number 74 Year 2014 on National Energy Policy], 2014, http://jdih.esdm.go.id/peraturan/PP%20No.%2079%20Thn%202014.pdf.

19 Only hydroelectric projects not exceeding 30 MW are considered under Malaysia's plan.

20 The net-metering scheme allows residential and commercial customers who generate their own electricity from solar power to feed electricity they do not use back into the grid. In the United States, 43 states have adopted a net-metering policy.

21 "Malaysia Aims to Become World's Second Largest PV Producer by 2020," *Malay Mail Online*, October 5, 2016, http://www.themalaymailonline.com/money/article/malaysia-aims-to-become-worlds-second-largest-pv-producer-by-2020.

22 Department of Alternative Energy Development and Efficiency, Ministry of Energy (Thailand), *Alternative Energy Development Plan: AEDP2015* (Bangkok, 2015).

of a new global agreement. COP21 achieved the expected outcome of establishing a starting point for discussion of the post-2020 framework, and further negotiations on the new global climate framework will take place in coming years. All APEC economies that are party to the UN Framework Convention on Climate Change made pledges, which signals a clear commitment from the region to take action on climate change. Based on an evaluation of the various INDCs, APERC estimates that total emissions in 2030 will range from 19.5 Gt of CO_2 to 21.6 Gt of CO_2, representing an increase in energy-related emissions of between 7% and 19% compared with the 2010 level of 18.5 Gt of CO_2.

In all, current efforts to reduce emissions and accelerate the transition to low-carbon sources under the BAU scenario fall well short of APEC's goals and are even farther away from the goals set in Paris. As a result, APERC developed three additional scenarios—alternative power mix, high renewables, and improved efficiency—to outline potential ways for APEC to meet its energy goals and transition to a more sustainable energy system.[23] The alternative scenarios assessed by APERC show that there is a great opportunity to stem the growth of emissions in the APEC region that is expected under the BAU scenario.

100% High Gas Case of the Alternative Power Mix Scenario

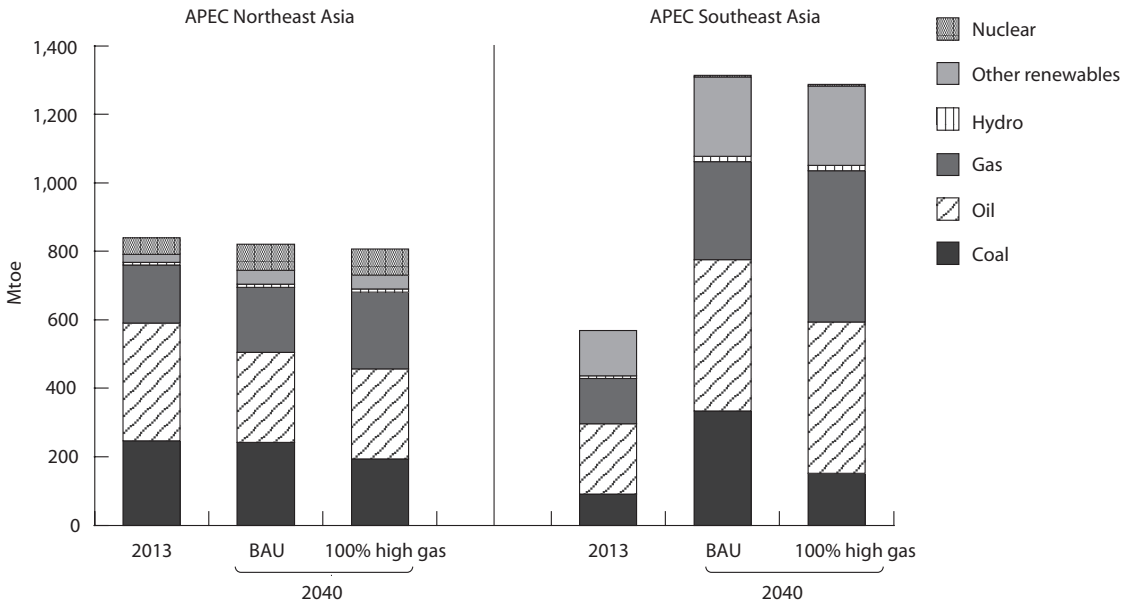
The 100% high gas case (one of four cases in the alternative power mix scenario) explores the emissions benefits of replacing all new coal-fired generation with gas. As **Figure 3** shows, the higher efficiency of gas-fired plants allows total primary energy supply in APEC Northeast Asia to decline by 4% by 2040 compared with 2013 levels. Total coal consumption decreases by 35 Mtoe compared with the BAU scenario. Overall, the 100% high gas case results in an 8% reduction in emissions compared with the BAU scenario, or 5.3% below 2013 levels. Gas-fired generation is over 50% higher, leading to a 2.5-fold increase in gas import requirements.

In the 100% high gas case, total primary energy supply in 2040 for Southeast Asia falls by 2% compared with the BAU scenario, as coal demand declines 55%, while gas demand rises 53% due to the higher efficiency of gas-fired plants. Although the current low energy prices may be seen as an opportunity for economies to expand their gas share, this expansion will rely on increasing gas imports in those economies with insufficient domestic reserves. Indonesia, with abundant coal reserves, may favor coal-fired generation, as domestic gas reserves are insufficient to keep up with strong growth in demand for electricity. In addition, under the 100% high gas case, Malaysia becomes a net gas importer sooner than expected. While low energy prices may provide some short-term incentives for higher gas demand in the longer term, concerns over energy security due to the risks associated with increased dependence on imports may limit such a shift.

The use of natural gas to replace all additional coal-based capacity offers the largest potential to reduce CO_2 emissions by the electricity sector across APEC. Nevertheless, achieving this potential requires expanded natural gas imports, which consequently raises the costs of electricity generation. The huge challenge in securing this gas supply could be used to more vigorously promote the trade of LNG and pipeline gas imports among member economies, as well as to explore the development of domestic conventional and unconventional gas resources.

[23] The alternative power mix scenario evaluates trade-offs among the use of cleaner coal, gas, and nuclear energy in the electricity sector and comprises four cases: the cleaner coal case, the 50% high gas case, the 100% high gas case, and the high nuclear case. For additional information on APERC's alternative scenarios, see *APEC Energy Demand and Supply Outlook*.

FIGURE 3 Total primary energy supply in APEC Northeast Asia and Southeast Asia under a BAU scenario and a 100% high gas case, 2013 and 2040



SOURCE: *APEC Energy Demand and Supply Outlook*; and IEA, *Key World Energy Statistics 2015*.

Accelerating the gas trade by reducing tariffs and providing economic incentives to private developers across the value chain might result in more pipeline gas and LNG projects. This could significantly benefit economies that lack domestic gas resources, as well as those with potential gas resources that currently lack the commercial signals to stimulate development. APEC is an excellent forum to explore cooperative mechanisms that favor more extensive LNG trade, closer dialogue between sellers and producers, more flexible contracting and investment schemes, and integration for sellers and purchasers all along the LNG value chain.

High Renewables Scenario

The high renewables scenario sets out a least-cost pathway to achieve the APEC goal of doubling shares of renewables by 2030 (and even to surpass these levels by 2040).[24] Under this scenario, increasing the share of renewables in power generation and boosting biofuel production and use bring the share of renewables in total final energy demand to 10.4% in 2030, double the 2010 level of 5.2%.

Renewable electricity generation in APEC increases at an average annual growth rate of 4.5% (1.7% higher than in the BAU scenario) over the outlook period, from 2,716 terawatt hours (TWh) in 2013 to 7,109 TWh in 2030 and 8,911 TWh in 2040. The share of renewables in the power mix reaches 33% in 2030 and 37% in 2040, compared with just 22% in 2030 and 24% in 2040 under the BAU scenario. Installation of an estimated 1,692 GW of additional renewable generation

[24] Due to data limitations, the analysis for the high renewables scenario was limited to the power and transportation sectors.

capacity (i.e., an average of 100 GW per year) is needed to achieve the goal of doubling renewable electricity generation by 2030. While posing a formidable challenge given APEC's renewable capacity additions of just over 100 GW in 2015, this rate of additions is in line with current rates of renewable investment in the region.

Tremendous opportunity exists to increase the utilization of renewables in APEC. In 2013, only 31% of the total economic potential was utilized, much of this dominated by hydropower. Large unutilized potential exists, particularly for wind and solar energy. In the high renewables scenario, APEC solar and wind capacity expands by 62 GW/year over the outlook period—a faster rate than the 50 GW of capacity additions in 2013—providing over 75% of all new renewables capacity.

In the transportation sector, biofuel demand grows at an average annual growth rate of 3.7% over the outlook period (1.5 percentage points higher than in the BAU scenario), rising from 29 Mtoe in 2010 to 87 Mtoe in 2030 and 95 Mtoe in 2040. This projection assumes stronger government support through policies on mandated and target blend rates and incentives for greater use of biofuels. As a result, the share of biofuels in transportation more than doubles from 2.3% in 2010 to 4.9% in 2030 and 5.4% in 2040.

Under the high renewables scenario, CO_2 emissions continue to grow, reaching 23.0 Gt of CO_2 in 2035 before declining to 22.8 Gt of CO_2 by 2040, a 10% savings compared with the BAU scenario and an increase of only 12% from 2013 levels. In addition, doubling the share of renewables will lead to a more diversified electricity and energy mix as dependence on fossil fuels declines.

Improved Efficiency Scenario

The improved efficiency scenario was conceived to explore opportunities in APEC economies to help APEC meet its target of reducing energy intensity by 45% between 2005 and 2035. However, given that APEC will almost meet this target under the BAU scenario (based on existing policies and current trends), the objective changed to assess the potential savings that could be obtained from implementing energy-efficiency measures that are cost-effective today in all sectors.

Measures considered in the improved efficiency scenario result in an energy demand reduction of 735 Mtoe (11%) by 2035 and 921 Mtoe (13%) by 2040 compared with the BAU scenario. These savings translate into a 45% reduction in energy intensity by 2035 and a 56% reduction by 2040, suggesting that significant cost-effective opportunities exist for APEC to boost its target even higher.

APEC's total energy demand under the improved efficiency scenario still grows compared with current levels. But unlike in the BAU scenario, demand peaks at 6,256 Mtoe in 2028 as the additional energy-efficiency policies enable APEC to decouple economic and population growth from energy demand. This is significant, as in the BAU scenario energy demand continues to grow throughout the period, with its associated costs, emissions, and security issues. Under the improved efficiency scenario, CO_2 emissions peak in 2023 and then decline to 20.4 Gt of CO_2 in 2040, a reduction of 19% compared with the BAU scenario and in line with emissions in 2013, which were also 20.4 Gt of CO_2. By reducing demand for additional energy, including the need for new capacity to generate electricity, enhanced efforts to improve energy efficiency clearly have the largest impact on reducing overall emissions.

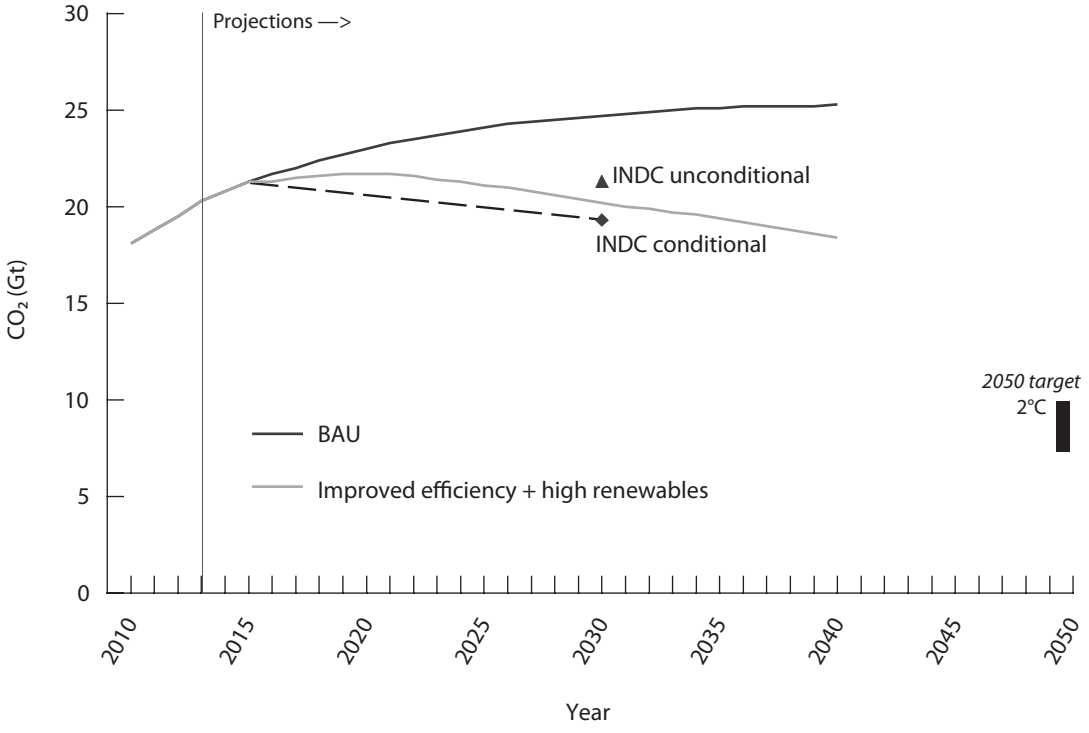
Improved Efficiency with High Renewables

While greater efficiency alone can maintain emissions at current levels, neither the improved efficiency scenario nor the high renewables scenario results in an overall reduction. This highlights the need to pursue a combined strategy to decarbonize the energy supply. Pursuing even higher shares of renewables must be combined with other measures to reduce CO_2 emissions, including a switch to lower-carbon fossil fuels (i.e., from coal or oil to gas), the deployment of nuclear energy, and the development of carbon capture and storage (CCS).

APERC ran a fourth scenario to examine the impact on CO_2 emissions of doubling the share of renewables in parallel with accelerated energy efficiency (see **Figure 4**). As demand for electricity and transportation energy falls in the improved efficiency scenario, applying the expansion of renewables capacity reflected in the high renewables scenario results in a greater share of renewables in both electricity generation and the primary energy mix. In this combined scenario, efficiency pushes down demand and associated emissions, while a greater share of renewables reduces the carbon intensity of the energy supply.

Declining demand means it is possible to reach the goal of doubling the share of renewable electricity generation earlier—even by 2025. If the projected effort is sustained, the share would actually reach 39% by 2040 compared with just 22% under the BAU scenario. At the same time, the use of fossil fuels in the total primary energy supply would decline by 15% compared with

FIGURE 4 APEC energy emissions, 2010–40



SOURCE: *APEC Energy Demand and Supply Outlook*; and IEA, *Key World Energy Statistics 2015.*

NOTE: Black bar for 2°C is drawn directly to the figure to represent 8–9 Gt of CO_2.

the high renewables scenario, saving 1,530 Mtoe of fossil fuels, equal to roughly 70% of current consumption in the United States.

The decline in fossil fuel consumption in the combined scenario reduces emissions by 27% by 2040 compared with the BAU scenario. Total emissions are 18.5 Gt of CO_2, which is actually 9% lower than in 2013. While this scenario is encouraging, emissions nonetheless remain more than double the estimated 8–9 Gt of CO_2 needed to achieve the goal of limiting the global rise of temperatures to 2°C. In 2030, the resulting emissions under the combined scenario are 20.2 Gt of CO_2 and fall between the conditional and unconditional levels of APEC's INDC commitments. As a result, economies must make additional efforts to further decarbonize energy supplies and curb energy consumption if APEC is to realize the ambitious reduction in emissions needed to achieve the 2°C target.

Mitigating Dependence on Fossil Fuels and Achieving Energy Self-Sufficiency

The speed at which the APEC region can achieve a significant break from its dependence on fossil fuels will be determined primarily by the strength of policies implemented in these economies to reduce the growth in future energy consumption. Another factor will be how quickly the market can deploy low-carbon energy sources, such as renewables, nuclear, and CCS.

In the BAU scenario, as the share of renewables rises, the diversity of the primary energy supply improves, although rapid growth in energy demand results in rising imports, which leads to a slight drop in energy self-sufficiency. While the APEC region continues to be self-sufficient in coal, oil self-sufficiency drops from 86% to 75% and gas self-sufficiency falls from 100% to 92%. By 2040, more than half of all APEC economies experience a reduction in primary energy self-sufficiency and face growing dependence on imports to meet energy demand. The most dramatic changes occur in Southeast Asia, where energy demand rises the most quickly and Brunei is the only economy that remains self-sufficient across all fuels. Vietnam is the worst hit by the rapid increase in energy demand, as its level of self-sufficiency deteriorates by two-thirds from 2013 levels. A few economies such as South Korea and Japan in Northeast Asia, by contrast, will see an improvement due to higher nuclear power usage in 2040.

As energy demand in the APEC region continues to increase, concern grows regarding the need to balance the security of the energy supply and the environmental effects of the chosen energy mix. As **Table 1** shows, the alternative scenarios reveal interesting differences with respect to the impact on energy security. All economies see an improvement in the level of primary energy self-sufficiency under the high renewables scenario because higher penetration of renewables will help economies reduce future energy imports, especially Japan, South Korea, and China. The improved efficiency scenario offers somewhat greater self-sufficiency, albeit for most countries at lower levels than under the high renewables scenario. (China, it should be noted, is more self-sufficient under the improved efficiency scenario than under the high renewables scenario.) However, in reality both scenarios should be implemented together in order to increase the level of security and lower emissions.

Japan, Vietnam, and the Philippines show improvements in energy self-sufficiency under the 100% high gas case compared with the BAU scenario, as the high efficiency of gas leads total fossil fuel imports to decline. However, one may dispute whether replacing coal imports with imports of high gas improves an economy's energy security given the difficulty of storing gas, larger fluctuations in prices, and high investment requirements for infrastructure. While the current low energy prices may increase the attractiveness of gas, there remains significant uncertainty

TABLE 1 Comparison of APEC Asia's share of primary energy self-sufficiency between a BAU scenario and alternative scenarios, 2013 and 2040

Country	2013 (%)	2040 (%)			
	Actual	BAU	Improved efficiency and change from BAU	High renewables and change from BAU	High gas 100% and change from BAU
Brunei	100	100	100 (±0)	100 (±0)	100 (±0)
Vietnam	100	33	35 (+2)	39 (+6)	35 (+2)
China	85	77	88 (+11)	82 (+5)	74 (-3)
Indonesia	84	64	68 (+4)	70 (+6)	53 (-11)
Malaysia	84	57	63 (+6)	60 (+3)	56 (-1)
Thailand	59	27	30 (+3)	33 (+6)	27 (±0)
Philippines	55	37	48 (+11)	50 (+13)	41 (+4)
South Korea	16	23	26 (+3)	26 (+3)	23 (±0)
Chinese Taipei	12	5	5 (±0)	8 (+3)	5 (±0)
Japan	6	14	17 (+3)	19 (+5)	15 (+1)
Singapore	3	2	2 (±0)	3 (+1)	2 (±0)
Hong Kong	1	1	1 (±0)	2 (+1)	1 (±0)

SOURCE: *APEC Energy Demand and Supply Outlook*; and IEA, *Key World Energy Statistics 2015.*

with respect to energy prices in the medium and long term. Geopolitical considerations represent another constraint on the future security of the gas supply.

Although the various scenarios discussed above demonstrate numerous opportunities for improving energy self-sufficiency within the APEC region, many challenges remain to implementing key parts of the scenarios. Chief among these is the challenge of securing sufficient energy supply, particularly for major importers as well as those economies with both declining domestic reserves and rapid growth in energy demand. For example, Malaysia faced a gas supply crisis in 2011 due to fires on one of its major gas platforms, which resulted in the first cross-border commercial sale of electricity from Singapore to Malaysia.[25] This situation highlights the exposure that Malaysia's economy faced with respect to the impact of supply disruptions. On the other hand, this incident could pave the way for a well-functioning regional electricity market—one that is not just physically connected but better integrated—by demonstrating that better regional integration can help to alleviate the risk of supply disruptions.

[25] See "Malaysia's Petronas Reports Fire on Bekok C Platform," Reuters, December 13, 2016, http://www.reuters.com/article/idUSL3E6NE07420101214; and "Malaysia Tenaga Buys Power from Singapore's Power Seraya," Reuters, June 9, 2011, http://uk.reuters.com/article/tenaga-powerseraya-idUKL3E7H90W520110609.

Policy Recommendations

Investing in energy efficiency and renewable energy will clearly enhance APEC's energy security. Economies in the region should formulate policies to incentivize public and private sector investment in green technologies that are more efficient and that can optimize renewable energy. Enabling frameworks are needed to attract sufficient investment both in low-carbon energy technologies and in measures to enhance energy security. Public-private partnerships can help spur greater investments from the private sector. Investment should not be confined to physical infrastructure but should also include soft investments, such as improving data availability, developing domestic capabilities and know-how, and supporting R&D.

Accelerating the development and deployment of new technology is central to establishing more secure and environmentally sustainable energy systems. Regional cooperation through the sharing of best practices and lessons learnt and enhanced collaboration on a range of low-carbon technologies—including renewables, energy efficiency, nuclear energy, and cleaner fossil fuel technologies—also may help lower emissions. As enhancing energy efficiency will be a core element of this transition, governments need to provide greater support to facilitate the adoption of cost-effective energy-efficient technologies.

The impacts of the two APEC goals under the combined improved efficiency and high renewables scenario illustrate that even as energy-related emissions peak and begin to fall, they will remain above the levels needed to limit the rise of the global temperature to 2°C. APEC should consider increasing the ambition of its existing energy targets and potentially introducing additional targets that could help support a more dramatic transformation of the energy sector. Individual APEC economies, for their part, should monitor and re-evaluate their INDCs, strengthening where possible commitments that will lead to a faster decarbonization of the energy sector.

Energy Security Program

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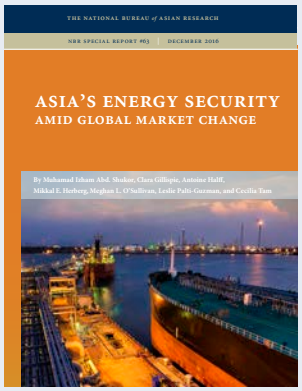

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