

## **Gas Geopolitics: Visions to 2040**

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Natural gas is rapidly gaining in geopolitical importance. Over the last 100 years, gas has grown from a marginal fuel consumed for specialized purposes in regionally disconnected markets to a fuel that is transported globally and used in many different economic sectors. In the last four decades, especially, natural gas has become a fuel of choice for consumers seeking its relatively low environmental impact, especially for electric power generation. Over the next four decades, world demand for gas is expected to double, surpassing coal as the world's number two energy source and potentially overtaking oil's share in many large industrialized economies.

The vision for a world shifting to gas is not constrained by the physical abundance of gas. The world's known ("proved") gas reserves are sufficient for nearly 70 years of production at today's levels; the total base of conventional gas resources is estimated to be at least twice as large.<sup>1</sup> Like oil, however, the richest gas deposits are far from the areas where demand for gas is expected to rise most rapidly. About three-quarters of the world's proven gas reserves are located in the former Soviet Union and the Middle East.

The integration of gas markets is the byproduct of a steady and cumulative improvement in technologies for long-distance transportation of gas—pipelines and liquefied natural gas (LNG). Regional and local gas trading networks are based on pipeline interconnections, and

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<sup>1</sup> Reserve estimates are from BP (2005) and resource estimates are from USGS (2000), consistent with sources quoted earlier in this text. USGS "conventional" resource estimates include associated and non-associated natural gas, but does not include vast potential gas production from coal-bed methane or methane hydrates.

very long distance transportation is increasingly the province of LNG. International trade in LNG has been occurring for over 40 years and involves shipments from close to a dozen countries. In the 1990s, roughly 5% of world natural gas consumption moved as LNG, but this is expected to rise with higher demand for imported gas, particularly in North America, as locally available sources become depleted. Indeed, construction of transportation infrastructure is currently the major barrier to increased world natural gas consumption. Simulations of the gas future presented in chapters 11 and 12 of this volume suggest truly massive investments in gas trade infrastructures, both pipeline and LNG over the coming three and one-half decades. These results are supported by previous studies cited in chapter 1, such as the International Energy Agency's *World Energy Outlook*, which suggests that cumulative investment needs in the global natural gas supply chain between 2001 and 2030 will total \$3.1 trillion, or \$105 billion per year.

This book investigated the geopolitical roots and consequences of a shift to gas. We looked historically via seven case studies that illuminate how firms and governments have mobilized capital and managed international gas trading infrastructures—both pipelines and LNG (see chapters 3-9). The case studies concentrated on countries that lack the stable legal and political environments that are often seen as essential to attracting private investors. The expansion of gas as a global fuel depends in large part on success in attracting investment within such political, institutional and economic environments. The studies covered projects in Algeria, Indonesia, Russia, the southern cone of Latin America, Turkmenistan, Qatar and Trinidad and Tobago (see the introduction in chapter 2 and the summary of case studies in chapter 10).

In addition to the perspective of history, we also peered ahead to the possible futures for the next four decades. To aid in that effort, the book presented results from a new model of world gas trade. It offered a reference scenario (chapter 11) as well as several scenarios that examine the impacts on the global market of various geopolitical, economic, and technological factors on the development of gas infrastructure (chapter 12). Looking to the future, we also explored the important geopolitical topic that is already rising in attention: whether major gas exporters could form a cartel akin to the Organization of Petroleum Exporting Countries (OPEC) scheme for oil (chapter 13).

In this conclusion, we identify four broad findings from the study. First, we find that an integrated global gas market is emerging, in which events in any individual region or country will affect all regions. Second, we conclude that the role of governments in the development of natural gas markets is changing dramatically—away from the direct providers of capital and infrastructure and toward facilitators of markets in which private firms and investors take most of the risks. Third, we predict that among the many geopolitical aspects of a global gas market will be growing attention to supply security. Finally, we discuss the many ways that a rapid shift to a prominent global gas market could falter. We find that a key risk to the gas future is that governments may not create a context in which investors will be willing to invest the huge sums of capital needed for an expanding global gas infrastructure. Our study highlights the importance of the internal governance of gas-rich countries.

## EMERGENCE OF AN INTEGRATED, GLOBAL GAS MARKET

This book considers the implications of a major shift from a world of regionally-isolated natural gas markets to a new more interdependent, increasingly global, marketplace for gas. The driving forces for this shift to a global gas market include the increasing preference for gas as a fuel, technological advances that are reducing the cost of producing and delivering gas to markets, and liberalization of gas markets. The rising importance of gas as a primary energy source brings with it concerns about gas pricing and security of gas supply. Globalization of the natural gas trade will have large ramifications for consumers and gas producers alike. Just as policy makers in large consuming countries have focused on the macroeconomic effects of variable oil prices, similar concerns are already evident about natural gas prices as the fuel begins to play a larger role in world economies. Producing countries will also have to worry about income effects of global natural gas pricing trends.

Results from the study's economic modeling suggest that the shift to a global market will render each major consuming or producing region vulnerable to events in any region. The timing of major gas export projects coming online, as well as discontinuities in supply or demand, will ripple throughout a global market. For example, as shown in the base runs of the model presented in chapter 12, in a world of fully integrated natural gas markets, gas users in Japan will have a vested interest in stability of South American gas reaching the U.S. West coast; those in the United States will have concern about natural gas policy in Africa and Russia, and the EU will be compelled to monitor the political situation in gas-producing regions as remote as the Russian Far-East and Venezuela.

Major consuming countries will have to learn to adjust to the interdependencies of a global gas market. In the past, policy makers in large gas importing countries have focused on key supply relationships, such as the large pipelines from the Soviet Union and Algeria that fed Europe or the multitude of pipelines that sent gas from Bolivia to Brazil and from Argentina to Chile (see chapters 5, 3, and 6, respectively). Sustained attention from governments will continue to be critical to creating an attractive environment for these massive capital investments. However, a narrow focus on one-off trading relationships is unlikely to prove an effective means to providing supply security in a future where a much more fungible global market will set prices in all major markets and determine the movement of gas supplies.

Our research conclusions suggest that Russia will play a pivotal role in price formation in this new, more flexible and integrated global natural gas market (chapter 11). Russia was one of the first major gas exporters to the European market, it controls a huge pipeline network that serves greater Europe, and it is already the largest exporter of natural gas worldwide (see chapter 5). In addition to gas deposits that it controls directly, Russia also exerts strong leverage on price and export quantities from the rich gas deposits of land-locked Turkmenistan (see chapter 7). If economics alone were to determine gas exports, more than half of total European demand after 2020 would come from Russian suppliers. Already, policy makers in the European Union are debating the ramifications of depending Russia for about one-quarter of its supply (see chapters 5 and 10). Russia's rich deposits of gas in Eastern Siberia are also well-situated for export to China—an outcome that the model suggests would occur over the next decade if economic factors reigned. Strategically positioned to move large amounts of gas both east and west, the

presence of low cost Russian pipeline gas in both Asia and Europe will serve to link Asian and European gas prices. The model also suggests that Russia also will eventually enter the LNG trade in both the Atlantic and Pacific, via the Barents Sea and Sakhalin respectively, providing an additional link between gas prices in North America, Europe and Asia.

Several nations in the Middle East—such as Qatar, Iran and Saudi Arabia—are also geographically situated to become swing suppliers that could interconnect regional gas markets into a global system of gas trading. The rise of this role has been delayed, partly, by the large fixed costs for the new infrastructure that will be needed to carry their gas to the lucrative European and Asian markets. (In contrast, the existing Russian export infrastructure to Europe is already in place and is able to carry additional gas at a small marginal cost.) As global gas demand rises, these new supplies from the Middle East will become an important hub for flexibility in global markets. In an attempt to dominate this future opportunity, Qatar (and to a lesser degree, Iran) is making massive investments in LNG. Interestingly, Qatar’s rise was contemplated and could have happened even a decade earlier if not for the distraction of political controversies with its neighbors and concern by major LNG users (notably Japan) about the risks of relying on gas tankers that had to traverse the dangerous waters of the Persian Gulf (see chapter 8). Prolific Turkmen gas may also be slow to come to market due to political and economic barriers in moving that gas across rival Russia (see chapter 7).

The international gas industry is already responding to this integration of supplies and major gas consuming regions. As liquidity in the market and the number of available supply alternatives have grown, so have the opportunities for price arbitrage. Traditionally, the risks

associated with multi-billion dollar LNG projects have been secured through bilateral contracts between suppliers and users of gas that, by design, provided security by not allowing flexibility in the source or destination of the gas. LNG tankers were like “floating pipelines.” This book includes a study of one of the first LNG projects to adopt that model—the export from Arun in Indonesia to Japan (see chapter 4). The book also documents the first project designed to “break the mold” and allow flexibility in destination: the LNG export project from Trinidad and Tobago, which allows the project operators to export gas to Europe or the United States, depending on where the prices are most attractive (see chapter 9). In this new model, multinational gas companies with access to vast amounts of capital are investing in major natural gas infrastructure projects without the security of fully finalized sales for total output volumes. Instead, companies are counting on their own ability to identify end-use markets at some future time, closer in line to the investment pattern that characterizes development of multi-billion dollar oil fields. Expectations of a premium, liquid market for gas in the United States are a key factor encouraging this change, as is liberalization of certain European markets which allowed gas sellers to bypass European state gas monopolies and sell directly to large gas customers and power generators (see chapter 9).

The modeling work suggests that the United States market will remain a premium region as North American production fails to keep pace with demand, and high prices pull gas supplies from around the world. New supplies from Alaska are also likely to play a role, but they will not eliminate the need for imported LNG (see chapter 11). LNG is also forcing a change in how U.S. policy makers and gas buyers think about the factors that govern the supply of gas in the U.S. market and prices. At present, only 4% of U.S. gas supplies come from LNG, although

some projections envision that fraction rising to one-fifth of all supplies in the next two decades. Much of the U.S. political debate on LNG has focused on safety and siting of regasification terminals, and much of the conventional wisdom assumes that once these terminals are built, they will be filled to capacity to quench the U.S. thirst for gas imports. In reality, despite record high gas prices in the U.S. at this writing (middle 2005), the existing five LNG terminals are running half empty because gas netbacks (net profits once transport costs are considered) are even higher in Europe and much of the available LNG in the Atlantic basin (where all current U.S. terminals are located) is being drawn to European markets. In the Atlantic basin, as the authors of the case study on Trinidad and Tobago's LNG projects demonstrate, an integrated interconnected gas market already has taken shape (see chapter 9).

### **NEW MARKET STRUCTURES AND THE CHANGING ROLES FOR GOVERNMENTS**

Throughout most of the historical development of the gas industry, governments have played the central role in creating markets for gas as well as in directing gas supply projects. Government-owned enterprises have built and operated the infrastructures that were essential to distributing the large volumes of gas. Government-to-government agreements, usually backed with government-controlled financing, have been the essential cement for the producer-consumer relationship. Historically, governments absorbed and managed nearly all the risks of major international gas supply arrangements.

However, as market liberalization takes hold in many key gas consuming countries and global trading of natural gas expands, the role of government is changing—away from builder, operator and financier of gas projects and toward regulator and creator of the context for private investment. The historical case studies in chapters 3-9 show how this shift to market-oriented structure—which itself is part of a broader trend in the organization of modern states and economies—will affect the incentives to create new gas transportation networks that are essential if the world is to continue its rapid shift to gas.

The case studies demonstrate that governments have played the central role in “creating” demand for new import volumes of gas. Absent the state, very few, if any, of these projects would have been able to move ahead at the same speed or with the same volumes of deliveries.

Studies of the first-of-a-kind LNG export projects from Arun in Indonesia (1970s) and Qatar (mid 1990s) to Japan show the importance of willing government to orchestrate the investment—in these cases, the government of Japan and a small coalition of Japanese buyers. The first of these projects—Arun—rested on the willingness of the Japanese government (through MITI and Japan’s Export-Import Bank) to orchestrate the purchase of the gas and the timely construction of an infrastructure for utilizing the gas. The Japanese government provided crucial financial support as Japanese trading companies launched the Arun venture. The government’s interest was rooted in its high priority on energy security and a desire to diversify energy supplies away from coal and oil. In the Japanese context, as an island nation, the government supported construction of an infrastructure that was not a gas pipeline transmission grid (as seen in Europe) but, rather, a network of LNG receiving terminals, serving a cluster of

relatively isolated local markets. Constraints on moving gas between those markets helped each local monopoly protect its position and thus invest with confidence in long-term returns. Lack of similar U.S. government backing for proposed sales of Arun gas to California meant contracts to that market languished in the face of Japanese insistence that it be given the right of first refusal on any increased gas exports from the Arun field (see chapter 4).

Similarly, the role of the Japanese government and its coalition of gas buyers was important to Mobil Corporation's ability to get the Qatargas project off the ground in 1987. Although the strength of MITI and other crucial arms of the Japanese government had weakened considerably as part of a broader effort to expand the role for market forces in the Japanese economy, the role of a Japanese buying consortium with access to existing import infrastructure was critical to Qatargas' success in gaining financial backing and sufficient sales contracts. The timing of the project coincided with a reduction in Japanese concerns about the political stability of energy supplies from the Persian Gulf, derived in no small part from rising U.S. military presence in that region (see chapter 8).

In the same vein, much of the variation in the outcomes of the two proposed projects to pipe gas across the Mediterranean in the late 1970's is also due to the starkly different roles that the Italian and Spanish governments took towards the prospects of starting to import large volumes of gas. Like Japan, Italy was actively seeking gas imports and was willing to mobilize significant state resources to secure new energy supplies. Through its own export credit agencies, the government provided the bulk of financing for the Transmed pipeline project. State-owned energy firm ENI was positioned at that time to orchestrate the Trans-Mediterranean

(“Transmed”) pipeline project as well as the development of Italy’s domestic gas transmission grid. State backing allowed ENI to invest with confidence and provided cover for international lending. Spain, on the other hand, did not have supporting policies in place, and thus could not lead successful development of a major gas import project in the 1970s and 1980s (see chapter 3).

Importantly, other case studies show that the ready availability of large volumes of gas is not enough to create demand for gas in end-user markets. In markets where the state has avoided a central role in supporting infrastructure expansion, rapid gasification has not taken place. In the 1990s in Poland, for example, a large pipeline from Russia was constructed mainly to supply additional volumes of gas to the German market. Because it crossed Polish territory, large volumes were also available to Poland—yet the Polish market has used very little of that available gas—despite take-or-pay contracts for Polish delivery. The Polish gas market stalled in large part because the Polish government did not support gas and thus no entity in Poland was prepared to build the infrastructure needed to distribute gas. Coal represented a plentiful—and politically entrenched—fuel source (see chapter 5).

The instance of most rapid gasification that is observed in any of the case studies is the one where the state played the most central role—the Soviet Union. A decision from the center to favor gas in the 1950s, orchestrated through central planning, catapulted gas from just 1% of total primary energy supply in 1955 to nearly one-third in 1980 (see chapter 5). Of course, state intervention is usually neither the most economically efficient nor the only way to create a market, but these case studies suggest that state intervention accounts for much of the observed

variation in first gas projects. Moreover, the importance of governments in creating demand historically should sound caution about visions for rapid gasification in markets where gas delivery and domestic market infrastructure do not already exist and where the state is not prepared to back the creation of the gas delivery infrastructure.

The historical case studies also show that intervention of the state and other supporters of gas projects can backfire in the absence of a strong commercial rationale. The GasBol pipeline, connecting Bolivia to Brazil, was a favorite of both governments and multinational development banks looking to support market reform, transparency, and intra-regional trade in the aftermath of a bilateral peace treaty. Under pressure from multinational organizations, market liberalizers and domestic trade groups, the Brazilian government forced state-owned Petrobras to contract for the bulk of gas purchases from the pipeline and also encouraged the company to provide financial support for the investments in field development in Bolivia to be sure that the project went forward. But the failure of demand for gas in Brazil to materialize—in part due to the inability of the Brazilian government to create a regulatory context that would allow gas-fired power plants to sell their electricity—meant that GasBol could not survive financially. Petrobras was left on the hook for volumes of gas it could not sell (see chapter 6).

The GasAndes pipeline from Argentina to Chile indicates the types of projects that seem likely to emerge when governments, themselves, do not absorb the risks associated with building a gas market. The GasAndes project, a relatively small pipeline to connect gas fields in Argentina to a small number of power generators near Santiago, Chile, beat out its competitor, Transgas, because it was able to find private sector buyers and environmentally driven

government support for a limited, strictly commercially-viable project. The liberalizing electric power market in Chile along with the tighter air pollution regulations in badly polluted Santiago created favorable conditions for the project.

In contrast, the Transgas project sought to build a much more elaborate gas distribution network around Santiago, seeking to supply gas to new distribution companies that would serve industrial and residential gas consumers in addition to new gas-fired power generators. The rival project, GasAndes, sought to supply just large electricity plants in Santiago directly. The Transgas project was more costly, and payback would have occurred over a longer period and with greater uncertainty. Transgas sought a concession from the government to allow it to recover investments in the gas distribution grid. When the government made clear that no such concessions were forthcoming, the GasAndes project moved quickly ahead (see chapter 6).

On the supply side, the role of government in managing and absorbing risk has been equally important. Even where private firms have actually made the investments in developing gas fields and in building the transmission infrastructure, governments have been essential guarantors of long-term contracts that, historically, have underpinned most large scale gas infrastructure investment. In the past, investor risk has been mitigated by “take-or-pay” contracts. But new, more flexible contracting is being pressed upon the industry as gas markets become more global and commoditized. Gas-on-gas competition, new gas resale contract clauses and joint investor/host country marketing strategies are creating a new market structure for gas.

As the role of the state weakens, the key anchoring role for gas projects is shifting toward the private sector. In the old world, governments had deep pockets and a strategic vision that was organized around serving national markets and developing national resources. The development and implementation of this vision was often inseparable from the state-owned and supported enterprises whose charge it was to supply energy to the national market. In that world, cross-border gas trade projects were national ventures (see, especially, chapters 3, 5, and 7).

In the new world, a handful of large energy companies with deep pockets and a similar strategic vision are taking over the role as creator and guarantor of the implementation process. These players are largely private, but they also include national energy companies that are now playing a larger role in the *international* marketplace—Gazprom, PetroChina, Petrobras, Petronas (Malaysia) and others. This shift to large energy companies, however, is likely to mean that infrastructure development will increasingly be driven by commercial interests rather than national energy security objectives (see chapter 9).

The advent of new, more commercially oriented players dominating the gas scene will also change the nature of how contracts are negotiated and enforced. In the regulated, state-controlled environment, it was relatively easy for governments and their bidders to tailor the terms of gas trade agreements for political ends. But as gas markets liberalize—especially in Europe, where countries are small and borders are plenty—directed gas trade is harder to sustain, especially as provisions such as destination clauses are undone. In the emerging commercially-driven environment, the role of courts as enforcers has grown—made possible, in part, by legal reforms that have accompanied the shift to markets and given courts and quasi-judicial bodies,

such as regulators, greater authority. Although the industry press is just now focusing on the implications of this trend, case study investigation on this issue suggested that this shift has been under way for more than a decade (see chapters 3 and 9, respectively).

Ironically, the importance of existing contracts may lie less in their enforceability but, rather, in their ability to tap a first mover advantage. By facilitating the creation of sunk infrastructure costs, existing relationships act as a deterrent to others and a binding agent for the project investors. Once Italy had partnered with Algeria and had begun to lay pipe, huge incentives were created to continue cooperation (see chapter 3). Russia's contract with Poland partly deterred alternative (more costly) suppliers to that market. The ultimate deterrent to Norwegian supplies to Poland was the fact "on the ground" of Russia's pipeline (see chapter 5).

With the exception of Russia, various case studies show that private commercial players have been better placed to position themselves as first movers than state gas concerns. Owners of Trinidad LNG were able to push Algeria's Sonatrach from lucrative U.S. east coast markets by producing at lower costs (see chapter 9). Nimble GasAndes beat out slow-paced Transgas, which had hoped to tap government support to create a market (see chapter 6). A topic that remains to be explored is whether government-owned entities will be able to act as strategic players in the more competitive gas world or whether private commercial players will be able to organize competitive supplies to get to market more effectively, thereby leaving state monopolies to wait for long term market growth to make space for them to enter without the pressure of innovation.

## GLOBAL GAS AND SECURITY OF SUPPLY

The shift from the highly structured world of government-backed bilateral contracts with oil-linked pricing formulas to a new world of private, market-related gas contracts raises questions about national security of supply. Private sector participants have different interests from countries; they cannot be expected to consider automatically the energy security concerns of client nations as they are driven mainly by commercial pressures. Moreover, some gas exporters—whether governments or firms—may explore the prospects for creating a gas exporting cartel similar to OPEC.

The studies presented in this book suggest that concern for maintaining a secure supply of reasonably priced natural gas, a topic that has been eclipsed by the same questions applied to oil, will increasingly be viewed as a vital national interest. In the past, gas consumers have feared interruption in vital gas supplies for a variety of reasons, such as contract disputes between Algeria and its customers (chapter 3), political unrest in Indonesia (chapter 4), and transit country risk such as those associated with transporting Russian gas to Europe through Ukraine and Belarus (chapter 5). In addition to fears of supply interruption, major gas consuming countries or regions worry that a key exporter, such as Russia (to Europe) or group of exporters, could exercise monopoly power to extract inflated rents for their product.

Key gas-exporting countries are already engaged in nascent efforts to create a gas cartel. In May 2001, the Gas Exporting Countries Forum (GECF) held its first ministerial meeting in

Tehran with the aim to enhance coordination among gas producers. Although the GECF ministers announced that they did not intend to manage production or set quotas, some members of the group are exploring their possible leverage over current and future gas markets. By its third session in Doha, Qatar, GECF had swelled to 14 members: Algeria, Brunei, Egypt, Indonesia, Iran, Libya, Malaysia, Nigeria, Oman, Qatar, Russia, Trinidad and Tobago, the United Arab Emirates and Venezuela (and one observer, Norway).

The GECF has already tried, unsuccessfully, to exercise some collective influence in the European market. GECF helped to catalyze formation of a working group headed by Russia and Algeria who sought to resist European Union (EU) attempts to outlaw destination clauses that prevent contracted gas buyers from reselling to third parties. (The option to resell gas is a pivotal mechanism for market arbitrage and efficiency as it helps to prevent segregation of markets that allows gas sellers to exert monopoly power.) In another example, Egypt has sought a change in gas pricing systems that would end the link to crude oil prices with the aim of easing the penetration of gas into European markets.

These efforts have generated little practical effect on gas markets, and an exporters' cartel remains still a theoretical prospect rather than a real present danger. Chapter 13 shows that the Gas Exporting Countries Forum has too many members with diverging interests to exert effective constraints on gas export capacity in the intermediate term. There are a large and growing number of suppliers in international gas markets, and the existence of this diverse, competitive fringe of alternative suppliers does not favor cartelization. Moreover, large LNG

and pipeline projects are marked by huge capital costs and relatively low operating costs, which put a premium on full operation once the equipment is in service.

Over the long term, gas exports may eventually concentrate in the hands of just a few major producers, which could make it more feasible for a group of gas producers to restrain capacity expansion to gain higher rents. The overall distribution of world natural gas reserves is more concentrated than the distribution of oil reserves. The two countries with the largest gas reserves, Russia and Iran, have roughly 45% of world natural gas reserves while the two countries with the largest oil reserves, Saudi Arabia and Iraq, have just 36% of world oil reserves. The five-country concentration ratio for the two fuels is roughly the same at 62%. However, the regional concentration of gas resources is more diverse. Middle East countries hold only 36% of natural gas reserves – as opposed to 65% of oil reserves. The former Soviet Union represents a second equally important region for gas production and exports (see chapter 13). However, we can already see evidence that gas export market share is less tightly correlated with reserve base than in the case of oil. Chapter 10 argues that the countries most likely to become exporters are those that are able to combine prodigious gas resources with a business environment that favors private investment; those same conditions could impede the successful implementation of an effective cartel.

Historically, some well-positioned gas suppliers have been able to extract short term rents in particular markets by manipulating supplies into markets where alternative supplies are not available. Algeria used this position to force higher prices on the Italian and French markets in the 1970s, but Algeria quickly suffered when circumstances changed. Over the long term,

Algeria has paid a high cost due to the reputation it gained as an unreliable supplier (see chapter 3). The same Algerian effort to lift prices also contributed to Algeria's loss of share in the U.S. market, which created an opening that new export projects from Trinidad eventually filled (see chapter 9).

As the case studies show, diversity of supply is an important protection from rent-seeking behavior both of both gas exporters and transit countries. When Ukraine first interrupted Russian gas exports in 1995, European buyers who redoubled their efforts to diversify found many alternative suppliers, confirming the importance of market reforms that encourage multiple supply sources and gas-on-gas price competition (see chapters 5 and 10).

We expect that the globalization of gas markets will increase the diversity of supplies and reduce the risk that any single supplier (or even a cartel) could exert influence over gas supplies and prices. The shift from administered to competitive gas markets introduces new uncertainties, but also provides some security benefits. Where the market reigns, shortages yield higher prices that in turn yield demand response (curtailment or fuel switching) or attract new supplies. In contrast, where prices are administered users do not see the signal of shortage. Privatization of resources in key supply areas like Russia may also make it more difficult for governments to coordinate rent seeking supply restraints, depending on the level of government control or levers over export networks.

## RISKS TO THE GREATER GAS VISION

For many analysts, the assumption that the world will shift to gas is rooted in current trend lines and models whose strength is their ability to represent fundamental economic potentials. By those reckonings, the future for gas is bright. But the real world depends on many political and social factors beyond trend lines and economic potentials, and some of those could turn sour for gas. We focus on three such factors that, by way of conclusion, help to illuminate the geopolitical forces that could stall the dash to gas.

First, the vision for gas depends enormously on investor confidence and the supply of vast sums of financial and intellectual capital. A plethora of studies has confirmed that world gas resources are abundant (see chapters 1 & 2). Gas projects are generally more capital-intensive than those for oil, and most of the capital needed for typical LNG and pipeline export projects is required in the country or region where the gas deposits are located. The richest gas deposits are generally located in countries that traditionally have not been attractive for private investors. The capital intensive nature of gas and the long payback periods typical of gas projects—15 to 20 years or longer for some of the most complex projects—means that the gas future probably hinges on whether the major gas players will be able to justify spending on gas projects in some less than hospitable investment contexts.

We argue in chapter 10 that the countries that are likely to become large exporters are not simply those with large amounts of gas but, rather, those that combine gas resources with an attractive investment environment. Thus, Trinidad has become the largest LNG supplier to the

U.S. while gas-rich and proximate Venezuela, where it is harder for private firms to commit capital with confidence, remains on the sidelines (see chapter 9). In the Persian Gulf, Qatar has attracted far more gas investment than all other nations because it has offered an attractive environment for investors (see chapter 8). For the moment, it appears enough countries are offering settings for large-scale gas extraction and export projects that this fear will not be realized. However, circumstances can change quickly. Whole regions, such as the volatile Middle East, can become embroiled in war and other deterrents to investors; key gas exporting countries, such as Russia, can become distracted by other political priorities; countries that are the darlings of investors can switch when new regimes take power, as happened in Algeria in 1981 (see chapter 3).

Second, developers of gas resources may run afoul of problems with the governance of host countries, often called the “resource curse,” that has historically afflicted countries that become largely dependent on revenues from natural resource exports. Historical experience shows that many countries that are rich in natural resources have nonetheless failed to sustain economic growth due to poor governance, including fiscal management. When the sale of natural resources accounts for a large fraction of a society’s economic activity, politics becomes focused on disputes about allocating and seizing the revenues from such exports; harms to indigenous communities often proliferate; good governance, focused on the society’s broader long-term interests, is difficult to sustain. Such problems are evident worldwide across many extractive industries around the world from Bolivia to Indonesia and Russia. The Arun case study concludes, for example, that non-governmental organizations (NGOs) and social discontent had less impact on Arun development in the 1970s because critics had yet to organize

themselves sufficiently on a political basis to provide significant impediments to the Arun operation. By 1998, however, agitation in Aceh where Arun is located became so severe that gas export operations were temporarily suspended and led finally to full-scale central government military action against local armed groups (see chapter 4).

The case of Arun may be a telling sign of an era coming to an end—an era where developers of these resources faced much less external scrutiny on their operations and where states, themselves, directed many resource development projects. It is plausible to argue that neither of those two conditions will hold in the future. With the advent of revenue management schemes for oil (and gas) export projects in Azerbaijan and on the Chad-Cameroon pipeline, it is plausible to expect that most gas projects could some day face similar intervention.

Democratization and the spread of information have put new powers in the hands of people and NGOs and have eroded the assumption that private investors can speak just directly to governments who will do their bidding.<sup>2</sup> In Bolivia, as in Arun, indigenous groups have developed their own independent influences on policies that have been strong enough to derail investors.

Third, visions for gasification may also run afoul of political difficulties in the countries that are the major users of gas. Questions have arisen, especially, around the siting of major gas infrastructures amid growing worries about terrorism. In the United States politicians have focused particular attention on LNG regasification terminals, which are essential if the vision for

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<sup>2</sup> Unocal's recent extra-judicial settlement with a group representing an indigenous population in Burma further supports this line of argument. The settlement avoided a final opinion in a case brought by the indigenous group alleging that Unocal was aware of the Burmese military's use of slave labor to aid construction of a gas export pipeline to Thailand in the 1990s.

a global gas market driven by rising U.S. imports is to be realized. Community resistance has stalled LNG regasification terminal siting in nearly every part of the U.S. market—except the Gulf coast where public acceptance of industrial facilities is generally much higher than in the rest of the country. Since regasification is the key manner in which LNG sellers can create markets for their gas, sustained difficulties in siting these import facilities will hamper the gas future.

However, singular attention to regasification terminals in the U.S. could leave the public and major gas users expecting that LNG will arrive in abundant supplies and prices will decline. As we discuss in the first section of this chapter, the emergence of an integrated, global gas market will mean that price in one locale will increasingly become a function of the machinations of markets in other locales. Historically, long term contracts were the keystone to financing LNG project development. Increasingly, however, these long term contracts are not determining the physical flows of LNG. As a larger number of liquefaction facilities are constructed, particularly terminals serving deeply liquid domestic gas markets in the U.S. and the U.K., the opportunities for arbitrage between markets continues to grow. Arbitrage itself drives price convergence across regions—and also determines the destinations of LNG cargoes. Thus, gas buyers and energy policy makers in importing countries will increasingly need to be aware of gas market conditions beyond their borders and their direct supply relationships. Gas prices and the destinations of LNG cargoes will be determined by the development of global gas supplies and the demand conditions in numerous end-user markets.

Fourth, and finally, the case studies also underscore that since around 1990 much of the “dash to gas” has depended on expectations about electric power markets. Conventional wisdom holds that gas is favored for electricity; from the middle 1980s through the late 1990s that has, indeed, been the experience in England and Wales, the United States, and several other markets. In many regions, gas has gained its advantage due to tighter environmental rules. It has also gained, however, because liberalization has created additional pressure to select the least cost options. Increasingly efficient gas-fired turbines are well adapted to competitive markets, due to their relatively low capital cost and the short-lead time required for construction. But close attention must be given to markets where gas-fired generation is not the current low marginal cost supplier or where electricity demand might be constrained by other factors.

In Brazil, a darling for potential investors in the 1990s, the recent collapse of economic growth, combined with dominance of incumbent hydropower and an unfavorable implementation of regulatory rules, has impeded the entry of gas (see chapter 4). In Poland, the dominance of incumbent coal-fired power plants, the vast over-supply of electric generating capacity and the lack of strong government incentives for gas have made it difficult for Russian gas to enter the market (see chapter 5).

It is not yet clear whether gasification in other emerging markets—such as China and India—will follow the examples set in the United States and England (where electrification and liberalization favored gas for electricity) or Poland and Brazil where governments failed to institute the incentives for a push to gas. We end, thus, with a note of caution on the crucial connections between markets for gas and the final suppliers of energy services. In the late 1990s

nearly every new power plant ordered in the United States was gas-fired; after 2002, with gas prices expected to sustain historically unprecedented levels for the remainder of the decade, the order books for new gas plants have become empty, and U.S. power generators are looking with fresh eyes at new coal and nuclear plants and are expanding investment in renewable energy. Oil products have secured a dominant position in energy systems because these energy-rich liquid fuels, with their high energy density and flexibility, presently have no viable competitor for providing transportation services. In electric power, however, gas confronts many viable alternatives.