

**Politics, Markets and the Shift to Gas:  
Insights from the Seven Historical Case Studies**

By Mark H. Hayes and David G. Victor<sup>1,2</sup>

(Chapter 10 in *Geopolitics and the Gas Industry from 1970 to 2030*)

*Draft 28 October 2004*

---

*Note to readers for the CDDRL seminar (November 3): This draft is drawn from a forthcoming book on the history and future of natural gas infrastructures. The book includes an introduction to the issues (part I), results from seven historical case studies (part II), results from economic modeling that looks out to the year 2030 (part III), and main findings from the study (part IV). This chapter offers conclusions from the historical case studies, and it focuses on issues that we thought would be of greatest interest to the CDDRL audience: the role of the state, and the special problems that arise in creating long-term international contracts for gas trade. For more on the study, including copies of the historical case studies, results from the economic modeling, and a summary of the main findings visit <http://pesd.stanford.edu/gas>*

---

Most energy forecasts envision a shift to gas in the world energy system over the coming decades. To realize that vision will require tapping increasingly remote gas resources and shipping them to distant gas markets in other countries. Few analysts have explored the robustness of such projections in the real world where political and institutional factors exert strong influences on whether governments and private investors will be able to muster the capital for long-distance pipelines and other infrastructure projects that are essential to a gas vision. Although gas has strong economic, technological and environmental advantages over alternative energy sources, will the difficulty of securing contracts where legal institutions are weak—an attribute of nearly all the nations that are richest in gas resources—impede the outlook for global gas?

---

<sup>1</sup> The authors are Research Fellow and Director, respectively, at the Program on Energy and Sustainable Development, Stanford University.

<sup>2</sup> Not for quotation or citation without permission. We are grateful to Thomas Heller, Steven Krasner, Amy Jaffe, Joe Barnes and Joshua House for comments on drafts, insightful discussions and editorial assistance. We are particularly grateful to the authors of the case studies whose work this chapter attempts to synthesize; notably, we thank James Ball, Steven Lewis, Fred von der Mehden and David Mares for a constructive critique of earlier drafts. Mistakes reside with us.

Which gas resources and transportation infrastructures are likely to be developed? As gas infrastructures interconnect the world, what political consequences may follow? To help answer these questions, this study on the geopolitics of gas combines two tracks of research—one that employs seven historical case studies and another that rests on a quantitative model for projecting alternative futures for gas to 2030. Section II of this book has focused on the former—lessons from history—and this chapter examines the conclusions from the seven historical case studies presented in chapters 3-9.

Our quarry is “geopolitics,” which is a concept that bears explanation. For many analysts, geopolitics is the competitive zero-sum game played by nation-states in their pursuit of power and security on the cartographic landscape. In this view of international politics, prevalent especially during the Cold War, countries are primarily concerned about gains from trade, investment, and military action *relative* to other national competitors. Greater territory and resources for one party necessarily create a loss for others.

“Geopolitics,” though, encompasses a less dismal view. It is the influence of geographic, demographic, economic and technological factors on political outcomes and vice-versa. In this broader definition, relative gains matter, but so do the substantial gains from possible cooperation. Indeed, the economic model presented in part III of this book illustrates the enormous opportunity for joint gains from international gas trade. Yet, as that model shows, many of the economic opportunities remain untapped even today—Russia and the gas-rich nations of the Persian Gulf, for example, both supply gas to markets at levels far below their simple economic potential. As geography, technology and political choices direct gas trade along one route at the expense of another, investment and revenues are diverted as well, with considerable political implications. Countries that commit to importing large volumes of gas place the security of their energy systems partly in the hands of others, which in turn give both suppliers and users of gas a stake in the internal political stability of one another. This is what we mean by “geopolitics of gas”—not simply the zero-sum jockeying for global position, but also the

immensely political actions of governments, investors and other key actors who decide which gas trade projects will be built and how the gains will be allocated.

We selected this sample of seven historical case studies with an eye to diversity in the factors that, we hypothesized in chapter 2, would explain why some international gas trade projects are built while others languish. These historical examples include ventures that transport gas in liquid form (“LNG”) as well as pipeline; they include projects that governments pursued when they controlled access to capital and set the rules in highly regulated markets, and they include cases where private investors were left to take risks in a more market-oriented context. We have probed projects that were first of a kind and served largely virgin gas markets and projects that supplied markets that were already mature. The sample includes projects that span transit countries—and thus required cooperation of governments beyond simply the suppliers and users of the gas—as well as projects that exported gas directly from source country to a final market. Also presented are cases where international institutions such as multilateral trade agreements and development banks were omnipresent and those where they were scarce, as such institutions we thought might affect the prospects for inter-state cooperation. Each case study includes not just a probing of a built project but also an assessment of key alternatives that were contemplated seriously but not pursued at the same time. This pairing of built and not built projects, as we discuss in further detail in chapter 2 where we introduce our case study methods, reflects efforts to avoid bias in the sample of studies—to ensure that our findings are not distorted by looking only at gas ventures that actually came into operation.

We focus this summary of our main findings on three topics. First, we examine the role of the state in orchestrating the construction of gas infrastructures. The international trade in gas arose during a period of state domination of most economies, and the provisions for state financing and programs to “create” demand for gas reflect that historical context. We explore the implications of the shift to a greater role for market forces. Second, we examine the fundamental challenge to governments and investors in cross-border gas trade: providing importing countries with the confidence

that vital energy supplies won't be cut off and investors the surety needed to commit large sums of capital to projects that are profitable only after many years of predictable operation. Third, we explore what could go wrong with the now commonplace vision for a shift to gas. In the conclusion to this chapter we summarize our main arguments by revisiting the four main factors that we introduced in chapter 2 and which served to guide our selection of cases.

### **I. The Role of the State in Gas Trade**

The international gas trade arose in the period since the late 1960s when states controlled most energy services. In the prevailing wisdom of the post-war era, infrastructures for energy supply, such as gas, were too important to be left to the whims of the market. Through the 1980s European gas production, trade and distribution were entrusted to national champion gas companies such as British Gas, Statoil in Norway, and Gaz de France. As consumption in European countries quickly outstripped local supplies, neighbors to the east (the Soviet Union) and across the Mediterranean (Algeria) soon became the two largest external suppliers of gas to Europe. A Soviet state ministry (GazExport) controlled gas exports. Algerian gas production was firmly in the grip of state-owned Sonatrach, the result of the wave of nationalization that would sweep other Arab energy exporters in the 1970s. North American gas markets, too, were state dominated—with regulators in control of essentially all aspects of pricing, and contestable markets for gas largely nonexistent. Elsewhere in the world, local monopolies and state firms were the main agents of gas production and supply.

The trend toward competitive gas markets began as part of the broader movement toward economic liberalization in the United States and the United Kingdom in the 1980s. In the U.S., government controls on wellhead prices were removed and gas producers began to compete to win buyers for their output—a competitive gas market was born. In the U.K., state-owned British Gas was privatized and the sector was opened

to competition. By the 1990s, gas markets in continental Europe, Latin America, and Asia began to follow, if tentatively, a path toward liberalization.

The seven case studies in the preceding chapters span the past 30 years of gas trade and thus chronicle the shift from state control toward liberalized gas markets with an increasing role for private players. Today, nearly all major consuming markets have adopted plans to allow a greater role for the ‘invisible hand’ of the market. However, this trend has been far from linear and homogenous across the globe. Some governments retain strict control of the gas market, such as Russia where gas delivery remains the exclusive purview of a single state-controlled firm (Gazprom). Other countries, such as Bolivia and Argentina, have returned to state controls after brief experiments with more open markets.

We find it useful to imagine two archetypical worlds relating to the role of the state in gas markets. We define an “old world” of gas trade, where the state dominates the economy, including the provision of gas, and international trade in gas is backed by state-to-state agreements. In contrast we define the “new world” of gas trade as one where the role for the state shifts to provider of market institutions that create the context for private firms to take risks and reap rewards from investment in costly gas infrastructure projects. These are ideal types; no project operates solely in one of these “worlds,” and most of the projects we studied combined elements of each. The “old world” often included substantial roles for private firms; the “new world” is often laden with state guarantees, subsidies and other measures that dampen the pure expressions of market forces. Nonetheless, we will show that these two ideal types are useful in exposing the underlying forces at work, especially as more societies place increasing emphasis on markets as means of industrial organization. Here we focus on this shifting role for state and market—focusing, first, on the supply and then on the demand for gas.

### **The Role of the State in Gas Supply**

The International Energy Agency's World Energy Investment Outlook 2003—the most recent comprehensive projection of its kind—envisions that about US\$3 trillion will be needed over the next three decades for the infrastructures to produce and move gas from fields upstream to final users (IEA 2003). Around two-thirds of that US\$3 trillion will be required “upstream” for exploration, drilling and the infrastructure of supply. Who will be most able to mobilize these resources, and what are the attributes of projects that are most likely to attract such large commitments of capital?

The seven case studies show that while there is a shift to a greater role for private investment in new gas export projects, geography and politics have slowed the exit of the state. Much of this pattern simply reflects the desire of governments to preserve control over the rents that accrue from gas projects. Russia and Algeria maintain powerful state-owned companies (Gazprom and Sonatrach) that dominate gas production and concentrate revenues in the state and its favored partners. Nevertheless, there is relentless pressure for greater private participation in the upstream business. State-owned gas companies usually lack the access to capital and technology that are essential to the development of the most remote gas resources. Almost all of the untapped huge gas resources in the world are located in countries that, today, confront this dilemma of industrial organization. On the one hand, state ownership and domination facilitate control over rents; on the other hand, state control and rent extraction are a powerful deterrent to private investors, especially when state terms are volatile and unpredictable.

This dilemma of industrial organization is especially evident in the LNG business, which is the most capital- and technology-intensive of gas infrastructures. The case studies on Qatar and Trinidad demonstrate different successful models for attracting private players and building new gas export facilities (see chapters 8 and 9, respectively). Qatar, though the government has maintained a majority stake in Qatargas and subsequent LNG projects through Qatar Petroleum, has invited foreign investment on favorable terms. In contrast, neighboring Iran has struggled to engage private players and develop a successful LNG export project because the government has been unable to

create a similarly predictable investment environment. (U.S. sanctions have also hurt Iran's prospects.)

Trinidad provides the starkest example of a new world model for gas export project development. The government of Trinidad has long preserved stable rules that are favorable to private investment. When opportunities arose for private companies that were seeking to supply the U.S. market with gas, Trinidad offered the easiest location to sink billions of dollars in capital with a reliable return for the investor. Despite the fact that Trinidad's known gas reserves were smaller than many competing alternatives (e.g. neighboring Venezuela, Algeria, or Nigeria), the authors of the Trinidad case study show that the government offered the most credible promises for an investor-friendly environment. Since the investment was large and lumpy, the attractiveness of that environment drew capital to Trinidad and temporarily foreclosed other possible projects in the Atlantic basin.

This finding is hardly remarkable in the era of "globalization," but it has immensely practical implications for how analysts assess the availability of gas resources. It appears that gas is enormously abundant in the world (USGS, 2001); our findings suggest, however, that politics and institutions are as important as potential gas volumes in creating a viable resource.

A cursory examination of the list of the top holders of the world's gas resources (table 1) suggests that the most of the potentially attractive gas resources are in countries where risks to investors are aplenty—rule of law is weak and governments unstable. The coincidence of major gas resources and poor institutions poses a particular challenge in the "new world" of the global gas trade where private companies are expected to provide the bulk of capital and technology. Even as the direct role of host country governments in gas export projects diminishes, states still play a critical role in providing security and stability and in setting the institutional context within which these multi-billion dollar investments operate. The search for credible environments to invest explains, in part, why many of the largest gas resource holders have failed to become major gas producers

and exporters. Whereas in oil there is a close relationship between the ranking of reserves and exports, in gas the correlation is weaker. In part, this divergence reflects geography. The cheapest way to move gas is by pipeline, and thus proximity to large markets is a valuable asset. (Notably, the proximity to the U.S. has pushed Canada to become the world's #2 gas exporter yet does not appear on the ranking of top reserves in Table 1.) In part, however, we maintain that this looser relationship between resource potential and actual exports reflects variation in the contexts that explain where investors will actually risk capital to tap a resource.

**Table 1. Top Holders of Gas Reserves, Production, Exports and Their**

**Attractiveness to Investors.** “Reserves and Resources” is the broadest measure of likely natural gas available in the country, which we obtain from the most recent comprehensive assessment by the United States Geological Survey’s World Energy Assessment (USGS 2000). The USGS Assessment did not report resources for the U.S. itself, which we draw from U.S. Energy Information Agency (reserves) and other USGS reports (reserve growth and resources). GIRI is computed from the scores from the November 2002 edition of the *International Country Risk Guide (ICRG)*, a well-known source of investment risk information for foreign investors (ICRG 2002). GIRI is a linear compilation of indices measuring government stability, investment profile, internal conflict, corruption, law and order, ethnic tensions, and bureaucratic quality. A high score of 10 denotes the best context for investment. Further detail on the GIRI calculation can be found in (Hayes and Victor 2004). Total exports are for calendar year 2003 (BP 2004). Note: The USGS assessment merits updating, as evident especially in areas such as Qatar which have been the locus of intensive recent exploration.

	Country	Gas Reserves and Resources (Tcm)	Share of World Total	General Investment Risk Index (GIRI)	Gas Production (Bcm)	Total Exports (Bcm)	Export Rank
<b>1</b>	Russia	83.0	24.0%	5.5	578.6	131.8	<b>1</b>
<b>2</b>	Iran	33.6	9.7%	5.8	79.0	3.52	<b>23</b>
<b>3</b>	Saudi Arabia	32.4	9.4%	7.2	61.0	--	<b>NA</b>
<b>4</b>	United States	30.0	8.7%	8.7	549.9	18.46	<b>9</b>
<b>5</b>	UAE	15.5	4.5%	7.5	44.4	7.11	<b>17</b>
<b>6</b>	Turkmenistan	9.4	2.7%	NA	55.1	4.92	<b>20</b>
<b>7</b>	Norway	8.9	2.6%	9.2	73.4	68.4	<b>3</b>
<b>8</b>	Iraq	8.7	2.5%	NA	2.4	--	<b>NA</b>
<b>9</b>	Algeria	8.1	2.3%	4.7	82.8	61.1	<b>4</b>
<b>10</b>	Venezuela	8.1	2.3%	4.3	29.4	--	<b>NA</b>
<b>11</b>	Indonesia	8.1	2.3%	4.3	72.6	39.4	<b>6</b>
<b>12</b>	Australia	7.9	2.3%	8.8	33.2	10.52	<b>13</b>
<b>13</b>	Qatar	6.4	1.8%	7.5	30.8	19.2	<b>8</b>
<b>14</b>	Nigeria	6.3	1.8%	2.8	19.2	11.8	<b>12</b>
<b>15</b>	Brazil	5.9	1.7%	5.5	10.1	--	<b>NA</b>
	Rest of World	73.9	21%				
	World Total	346.2	100%				

Rather than look simply at potential volumes for gas supply, cost curves for gas production should be developed that combine the simple economic costs of recovery with factors that reflect the widely varying environment for hosting investments. In Section III of this book our colleagues do this by showing the effect on the optimal investment in

gas infrastructures when the hurdle rates are adjusted to reflect the varying risks for long-term capital projects in different countries.

### **The Role of the State in “Creating” Gas Demand**

All of the projects considered in this study involve large volumes of gas—typically 5 to 30 billion cubic meters (bcm) per year. For comparison, the energy content in 20 bcm of gas is roughly equal to about 10% of all the energy consumed in Brazil, California or Italy; it is about half the energy consumed in Singapore and roughly equal to Hong Kong’s total energy consumption.

To ensure that such large volumes could be absorbed, the creators of these large projects have paid considerable attention to ensuring that demand for gas would rise in tandem with the surge in supply that occurs when a project begins operation. In all the cases where gas was to be delivered to a market that previously had little or no demand for gas—what we call a “virgin market”—government itself played a central role in creating the necessary demand for new volumes of gas. Absent this role by the state, none of these projects would have gone ahead at the same speed or with the same volumes of deliveries. Even in cases where governments were liberalizing markets and adopting elements of the “new” gas world they nonetheless often viewed one of their central functions in orchestrating the creation of demand. Table 2 summarizes the status of the target market, the role of the governments in orchestrating demand, and outcomes for each of the seven case studies.

The cases on Arun and the Qatar LNG projects show that the robust commitment of Japanese buyers to increase gas imports was essential to these projects moving forward (see chapters 3 and 8, respectively). In the first of these projects—Arun—the Japanese government (through METI<sup>3</sup> and Japan’s Export-Import Bank) sent strong and credible signals to project investors by supporting the project with financial guarantees. Japanese trading companies, while taking significant financial risks in launching these projects,

---

<sup>3</sup> For simplicity, we use just the most recent acronym for this Ministry, whose name and position has changed with time. The case studies on the Arun and Qatar projects offer additional detail on METI’s role.

acted under this umbrella of support from the government. Japan's energy system in the early 1970s was dominated by oil and coal; natural gas played a tiny role, but these investors knew that the Arun gas project would not founder for lack of demand because the central government would orchestrate the construction of receiving terminals, distribution pipelines and power plants.<sup>4</sup> Twenty years later, when the Qatargas project was coming to fruition, METI was much weaker and its ability to orchestrate industrial investment had waned considerably; by then, however, a credible government commitment to create the needed demand for gas in Japan was less essential because a robust gas-using infrastructure already existed in Japan's key urban areas. (That infrastructure was not a gas transmission grid as in Europe or the United States 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, which in turn made it easier for the monopolists to commit with confidence in infrastructure projects that would yield a return only over long time horizons.)

Similarly, much of the variation in the outcomes of the two proposed projects to pipe gas across the Mediterranean in the late 1970s is also due to the starkly different roles that the Italian and Spanish governments took when confronted with the possibility of importing large volumes of gas (see chapter 4). Like Japan, in the 1970s the Italian government was actively seeking to diversify its oil-dominated energy system by importing gas and was willing to mobilize significant state resources to secure new energy supplies. Through its own export credit agencies, the Italian government provided support and guarantees for the bulk of financing that would be needed for the Trans-Mediterranean ("Transmed") underwater pipeline project. ENI, a powerful and

---

<sup>4</sup> The Japanese market was not completely virgin; like many industrial countries, Japan's major cities already had pipeline distribution systems in place to distribute "town gas"—a brew of aromatics, hydrogen and carbon monoxide produced by heating coal. In some European cities that network was used as the backbone for natural gas distribution systems, with technical changes (e.g., changes in the size of holes in burner nozzles, as the heat content and burning properties of natural gas are somewhat different from town gas). In Japan, the specifications of the old system were kept and the imported gas is blended with other fuels and ingredients to adjust its heat content to the specifications of the older town gas system. Nonetheless, town gas was a bit player in Japan's energy system and the vast majority of the infrastructure needed to get useful gas from tankers to final users was not in place when Japan began its shift to LNG.

financially sound enterprise, used this credible state guarantee to orchestrate both the Transmed pipeline as well as the development of Italy's internal gas transmission grid (particularly in the southern part of the country). The state's commitment to guarantee ENI's returns allowed the firm to invest with confidence and to raise capital from international lenders. In contrast, Spain's government did not have a policy to expand gas consumption or imports in the late 1970s and early 1980s, and thus no state-owned or private player was able or willing to take the risks inherent in constructing a major gas import pipeline that would be economically viable only if it could deliver huge volumes of gas to final users in Spain.<sup>5</sup>

Gasification has not always followed even in cases where large volumes of gas have been readily available but governments have not orchestrated investment in infrastructures and other essential elements for assuring demand. Russian and German investors built a large pipeline across Belarus in the 1990s mainly to supply additional volumes of gas to the German market where the investors thought that the risks were relatively low since the German market was already mature and a complex array of distribution pipelines was already in the ground (see chapter 5). To reach Germany the pipeline would also cross Poland, where the project backers also hoped to sell gas. Unlike most of the former Soviet client states that had shifted to gas when the Soviet Union built pipelines in the Cold War, gas played almost no role in Poland's coal-dominated energy system. The virgin market offered huge potential. In practice, however, the Polish gas market has not flourished mainly because gas would compete with politically well-connected coal suppliers who were keen to scuttle any advantage that might be given to gas. The Polish government, beholden to coal interests, was not a champion for gas; no entity in Poland was prepared to build the infrastructure and advance new politics that would be needed to confer an advantage for gas.

---

<sup>5</sup> Italy had other advantages as well. The discovery of gas in the Po Valley in the North during the 1940s had spawned the creation of gas distribution networks around some of Italy's most lucrative northern markets; those networks were thus available for distribution of Algerian gas. Spain, by contrast, had virtually no gas infrastructure when it contemplated investment in Algerian export. Italy also received significant financial backing from the European Investment Bank for the project, discussed below. In 1990, the situation changed and Spain became a hot gas market. New Spanish politics encouraged private investment in power generation, and the favored technology for those plants was all gas-fired. Similar forces are at work in Chile, evinced in the Southern Cone case study.

Thus these studies sound caution about visions for rapid gasification in markets where gas delivery infrastructure does not already exist and where the state is not prepared to back the creation of the gas delivery infrastructure. Indeed, across all the case studies in this book the country that reveals the most rapid gasification is the one where the state played the most central role in determining energy choices: the Soviet Union. A decision from the center to favor gas in the 1950s, orchestrated through Soviet central planning, catapulted gas from just 1% of total primary energy supply in 1955 to 30% in 1980 (chapter 5). We do not claim that this role for the state is economically efficient or the only way to create a market, but we do note that in history this role for the state accounts for a large amount of the observed variation in the timing and completion of first-of-a-kind gas projects.

The case study of the Southern Cone (chapter 6) provides two contrasting examples of the potential role of the state in the context of liberalizing gas markets. The GasBol pipeline, connecting Bolivia to Brazil, was a favorite of both governments and the development banks. The Brazilian government, the World Bank and the Inter-American Development Bank all sought to use the pipeline to encourage economic development and political stability in gas-rich Bolivia—gas, it was hoped, would offer an alternative to drugs as Bolivia’s top cash export. The development banks funded about half the project, and the Brazilian government forced state-owned Petrobras to contract for the bulk of gas purchases from the pipeline and also encouraged the company to support investment in developing Bolivia’s gas fields to help move the project forward. To ensure that the gas would be used—and to diversify Brazil’s hydro-dominated electricity system that failed in years when rains were scarce—the Brazilian government introduced special subsidies and regulatory rules that, it hoped, would encourage potential gas users to build power plants, factories and other investments in gas-using equipment. However, after catalyzing the development of the project, the Brazilian government did not continue to supply the incentives that favored gas, leaving Petrobras with binding contracts for volumes of Bolivian gas it could not sell. The Brazilian government used state guarantees to advance its foreign policy goals (i.e., encouraging

economic development in Bolivia) and found it convenient to externalize the cost of this policy to Petrobras (and thus to Brazilian consumers via higher prices for other services provided by Petrobras). In this first example, the government sought to orchestrate demand as it would in the “old” era of state-dominated energy markets; ultimately, however, it was unwilling to sustain a change in market rules and subsidies that would be needed to counter-act the strong bias against using gas for power generation.

The second example from the Southern Cone case study, the GasAndes pipeline from Argentina to Chile, illustrates the types of projects that seem most likely to proceed with the shift to the “new” world in which governments do not determine directly the prices and quantities of gas supplied and consumed. In this new world, gas projects are most likely to emerge where distribution networks already exist or where private users are able to organize themselves to offer a credible demand for gas. The GasAndes project beat out its competitor, Transgas, because it connected rich gas fields in Argentina to a small number of major buyers in Chile (power generators near Santiago). The liberalizing electric power market in Chile, along with the tighter air pollution regulations in badly polluted Santiago created favorable conditions for importing gas. Rather than simply serving large power plant consumers, the Transgas project sought a significant expansion of the gas distribution network around Santiago and in neighboring cities; it sought to spawn new gas distribution companies that would serve industrial and residential gas consumers, in addition to gas-fired power generators. Thus, the Transgas project would have been more costly, requiring a much longer period to recoup their investment; the backers of this vision sought a concession from the government to guarantee a return on its investment in the gas distribution grid. Favoring competitive markets, the Chilean government refused to provide such a concession and the Transgas project foundered, while the GasAndes project moved quickly ahead because it required coordinating only a small number of large gas users with shorter time horizons.

**Table 2. The Role of the State in “Creating Gas Demand”**

<b>Chapter and Case Study</b>	<b>Target Market and Size<sup>6</sup></b>	<b>Role of the State</b>
3. Liquefied Natural Gas from Indonesia: The Arun project	<u>Japan</u> : virgin	<u>Japan</u> : METI orchestrates purchasing by gas distributors and supports trading company investment.
4. Gas for Europe from North Africa: The Transmed and Maghreb projects	<u>Italy</u> : virgin (South) and mature (North)	<u>Italy</u> : Government provides financial support via export credits; EBRD supports expansion of gas grid to Southern Italy; Alternative project to Spain fails because government does not support gas grid expansion.
5. Russian gas exports to Europe: the Yamal project through Belarus and Poland	<u>Poland</u> : virgin <u>Germany</u> : mature	<u>Poland</u> : Government favors coal and gas market fails to take off. <u>Germany</u> : Government plays schizophrenic role, but gas distributors find users for new supplies anyway.
6. Gas Trade in the Southern Cone	<u>Argentina</u> (YABOG): mature <u>Brazil</u> (GasBol): virgin <u>Chile</u> (GasAndes or Transgas) virgin	<u>Argentina</u> : Government-owned gas company assures use of gas purchased from Bolivia <u>Brazil</u> : Brazilian government (with development banks) assures Bolivian gas contracts but fails to create demand. <u>Chile</u> : Environmental regulations create market in favor of gas over alternative sources (coal, hydropower)

---

<sup>6</sup> “Virgin” markets depend on natural gas for less than ten percent of primary energy supply.

<p>7. International Gas in Central Asia: Turkmenistan, Iran, Russia and Afghanistan</p>	<p><u>Russia</u>: mature  <u>Iran</u>: mature  <u>Pakistan</u>: mature  <u>India</u>: largely virgin</p>	<p><u>Russia</u>: Russian government and Gazprom use their dominant positions as the only large gas users to purchase gas at favorable prices;  <u>Iran</u>: Iranian government provides financing for project via national oil and gas company;  <u>Pakistan and India</u>: Neither government provides sufficient financial or political support for project</p>
<p>8. Liquefied Natural Gas from Qatar: The Qatargas project</p>	<p><u>Japan</u>: mature</p>	<p><u>Japan</u>: Government plays small role (relative to Arun case) but project delivers gas through existing networks</p>
<p>9. Liquefied Natural Gas from Trinidad and Tobago: The Atlantic LNG project</p>	<p><u>U.S.</u>: mature  <u>Spain</u>: largely virgin</p>	<p><u>U.S.</u>: Government plays no role, but project arranges innovative financing into a liberalized market  <u>Spain</u>: Diversification policy provides indirect assistance.</p>

## **II. Contracting and Security of Supply in the Changing Gas World**

The global trade in gas arose during the oil crises of the 1970s. Oil importers, especially in Europe and Japan, sought to supplant the suddenly expensive and unreliable supplies of oil with imports of natural gas. This shift, animated mainly by concerns about energy security, introduced severe challenges. First, importing governments needed to ensure that they did not replace oil with another insecure and volatile import. Second, a shift to gas would require building infrastructures (pipelines and LNG systems) that were much more costly than their oil equivalents. A long time horizon would be needed to justify the investment. The response to these two challenges was found in long-term contracts. For governments, these contracts promised to assure energy security; for investors in gas projects, such contracts created a context in which capital could be risked when returns were distant.

In this section we look at whether these two ambitions for long-term contracts have been realized. First, we examine the most simple and politically salient question of contracting for gas: Were the promised volumes delivered, or have states deployed the “gas weapon” in a manner similar to the Arab embargo on oil? Second, we look at the role of long-term contracts as devices for managing financial risks, with attention to how the parties that invested in these projects mitigated their exposure. We probe whether such contracts were themselves credible, and the devices that parties have used when they feared that enforcement of long-term commitments would be imperfect.

### **The Gas Weapon?**

The over-riding concern in the “old world” of gas trade centered around assuring firm delivers of contracted volumes. The long-term contract for guaranteed deliveries was specifically designed to mitigate these concerns. A take-or-pay sales clause was the keystone of the contractual relationship, committing the buyer to pay for a specified volume of gas (regardless of whether he actually takes delivery), usually over a period of 20-30 years. Pricing formulas included provisions for renegotiation (typically every three

years) and were linked to prices for the oil products it replaced in the end-user market, net of transportation costs; the amount left over was allocated among project developers and the host country. This so-called “netback” pricing scheme was the status quo for long-distance gas trade—not only LNG but also the Russian and Algerian deliveries.<sup>7</sup> Japan has long indexed the price for its LNG imports to the Japanese “Crude Cocktail” (JCC), a weighted average of Japanese oil imports. Such oil-linked schemes created substantial fluctuations in gas prices, but governments and bankers were already familiar with these risks, and gas was usually priced at a discount to the oil that it supplanted. (Of the seven cases in this book, only Trinidad uses a contractual structure with flexible deliveries dictated partly by the price of gas in the U.S.) Prices might vary, but consistent volumes would be delivered.

Table 3 summarizes all instances from the seven case studies where gas deliveries have deviated substantially from the contracted terms; they include outright interruptions and provide a first snapshot of the situations where fears of insecure supplies have been realized.

---

<sup>7</sup> In only one example mentioned in these studies—Algeria’s early LNG exports to Britain and to the U.S., contracts that dated to back to the in the late 1960’s—was the gas delivered on a rate-of-return contract. Algerian shipments to the U.S. and Europe in the 1970s adopted full oil-linked pricing, similar to the netback scheme before pursuing a radical oil-export parity pricing scheme in the early 1980s. The Algerians returned to a more standard netback pricing formula when oil prices collapsed in 1986.

**Table 3. Contract Interruptions from the Seven Case Studies**

Initiating Party	Example
<b>Supplier</b>	<ol style="list-style-type: none"> <li>1. Algeria (Sonatrach) from 1981 to 1983: “Gas Battle” with Italy, Belgium, France, Spain and the United States leads to refusal to ship gas via Transmed pipeline (Italy) and reduced volumes for LNG buyers (Belgium, France, Spain, and the U.S.). Outcome: Formula price increases for most buyers, U.S. shipments nearly stopped.</li> <li>2. Indonesia (Aceh province) stops shipments from Arun LNG project in 2001. Outcome: Aceh rebellion suppressed and shipments resume.</li> <li>3. GasAndes 2004, Argentine administrative policy forces a reduction in pipeline supply to Chile. Outcome: Argentina interprets its reduction in exports as allowable under the <i>force majeure</i> clause; Chile shifts to other fuels.</li> </ol>
<b>Transit Country</b>	<ol style="list-style-type: none"> <li>1. Russia (Gazprom) refuses to transport Turkmen gas to Europe (1997-1998). Outcome: Gazprom and its Russian partners get favorable terms and Turkmen gas is exported via Russia.</li> <li>2. Ukraine disputes with Gazprom over volume and payments for gas shipments (mid-1990s). Outcome: Ukraine secures extended transit contract with improved terms.</li> <li>3. Gazprom cuts supplies to Belarus (and to Europe via Belarus Connector) in pricing dispute with Belarus (2004). Outcome: contract renegotiated and shipments resume.</li> </ol>
<b>User</b>	<ol style="list-style-type: none"> <li>1. In 1981 U.S. Government refuses to allow LNG importers to accept shipments from Sonatrach to punish Algeria for its attempt to drive up prices. Outcome: Algeria loses most of its U.S. market over the next decade.</li> <li>2. Argentina forces renegotiation of contracted deliveries from the YABOG pipeline, reducing volumes and prices taken from Bolivia (1987). Outcome: contract is renegotiated and later pipeline is left empty.</li> <li>3. Brazil refuses to accept the full volume of gas it contracted from Bolivia via the Gasbol pipeline (2001). Outcome: Petrobras absorbs penalties because the pipeline is part of Brazil’s larger foreign policy strategy.</li> <li>4. Japan refuses to accept volumes and prices from Qatargas that are in line with historical LNG projects much more costly than contracts being signed by other LNG importers (1998). Outcome: contracts renegotiated in Japan’s favor.</li> <li>5. Turkey refuses to accept the large volumes of gas contracted through the Bluestream pipeline from Russia due to macroeconomic troubles and a glut in the Turkish gas market (2002). Outcome: Russia accepts reduced contractual volumes and prices.</li> </ol>

*Security of Supply*

Across all seven case studies we find just three instances where suppliers have reduced output below the contracted terms. The most dramatic example concerns Algeria, which stopped gas deliveries in the early 1980s in an effort to drive up prices for Italy, France and other gas buyers. (These events are described in further detail in chapter 4 of this volume.) This is the only example that is fully analogous with the “oil weapon” used during and after the Arab oil embargo—where an exporter unilaterally rejected existing contracts and expectations in an effort to tighten supply and drive up prices.

All the other cases of supply interruption are more complicated and, mainly, do not simply reflect strategic efforts to drive up prices. Rather, they are the byproduct of other factors, such as internal conflicts that spill over to disrupt exports. In 2001 uprisings in Aceh briefly stopped shipments from the Arun project; the original deal with Japanese buyers that created the Arun project had been predicated on the assumption that the Indonesian government would quell local uprisings in the Aceh region, but that deal was difficult to sustain in the face of Indonesia’s severe internal strife. In 2004 Argentina unilaterally lowered the volume of gas it allowed for shipment to Chile; in the wake of an unexpected financial crisis, Argentina’s government had frozen internal gas prices and found it politically expedient to cut exports rather than suffer the political consequences of widespread domestic shortages that would have occurred if Argentina’s producers had been free to send scarce local supplies to Chile where they would have fetched a premium export price.

Beyond these three examples—relatively few and short in duration when compared with the tens of decades of collective operations—the cases suggest that the gas weapon is rarely used because all major markets for gas are fundamentally contestable over the long term by alternative suppliers or alternative fuel sources. Curtailing gas shipments causes harm to reputation; because gas projects come in large tranches and create lock-in effects, a potential supplier that is passed over for its poor reputation can find itself locked out of lucrative markets for a generation or longer. The

studies suggest that governments are aware of this and that the gas weapon has come into play only when key decision makers fail to keep their attention on their government's long-term reputations. The new government that took power in Algeria in 1980 focused on short-term political objectives rather than commercial stability. It sought a clean break from the past by abrogating the contracts that earlier technocrats had painstakingly assembled, and it sought for gas export prices what Algeria had already achieved (with OPEC's help) in oil.<sup>8</sup> The long term costs to Algeria in reputation and in foregone gas revenues have been severe. Over the following decade Algeria lost the U.S. LNG market as U.S. buyers did not renew expiring contracts; previously the U.S. had been Algeria's largest buyer of LNG. European LNG customers also quickly looked elsewhere for gas supplies in the 1980s. The net cost of Algeria's 'Gas Battle' ran quickly into the billions, as over half of Algeria's costly LNG export facilities remained idle for nearly a decade. The damage to reputation has lingered longer, American and European gas buyers welcomed the opportunity to build LNG export projects in more stable Trinidad in the 1990s. Today, Trinidad has supplanted Algeria as the dominant supplier of LNG to the U.S. The Italian government and ENI did cave in to Algeria's demands and pay higher prices for Transmed pipeline gas in the early 1980s, as the Italians had already sunk its investment in the pipeline. However, future governments became much more wary of relying on Algerian gas supplies—building a diverse portfolio of supplies from Russia, Norway and the Netherlands. Anecdotal evidence suggests that European buyers will not soon forget the checkered history of Algerian gas supply.

Users of gas are primed to be sensitive to the risk of gas curtailment, and thus any indication that such curtailment might occur usually yields swift effects on suppliers' reputations. The Polish government was extremely worried about dependency on Russia for gas and thus negotiated an alternative supply project with Norway in parallel contracting for Russian gas from the cross-Belarus pipeline project. The Norway project fell apart due to unfavorable economics, but the Polish government rekindled the project

---

<sup>8</sup> The new government and new Sonatrach leadership also fundamentally misunderstood the commercial aspects of the gas market. They believed that lower shipments at higher prices was a sustainable model, as they had done via OPEC with oil. These new officials did not realize that gas required competitive pricing, otherwise there would be no demand at all.

when Russia's conflict with Belarus over gas pricing cut supplies to Poland for a brief period in early 2004. The Norwegian alternative—expensive but viable—was a threat designed to focus Russia and Belarus on the potential long-term costs from their lack of discipline.

The two case studies of LNG projects supplying the Japanese market could be viewed as the most physically insecure of the seven gas supply projects examined. LNG tankers bound for Japan crossed thousands of miles of open ocean and dangerous straights. LNG tankers could have been attacked by pirates or terrorists; states hostile to Japan might have attempted to disrupt the sea lanes. Suppliers could, in principle, withhold supplies to drive up prices or to punish Japan politically. Such scenarios were examined closely by the Japanese government, and two factors explain why these dangers never materialized. First, just as Japan had few alternative LNG suppliers so, too, the suppliers had few alternative outlets for disposing their gas. Japan dominated the LNG market with more than half the total global consumption and, until very recently, there was no well-developed secondary market for redirecting cargoes to other users. Just as geography and sunk capital prevent pipeline routes from being redirected—thus binding even unreliable sellers to a particular market—so, too, the thinness of the world LNG market had a similar effect that bound most suppliers to security-conscious Japan. Second, Japan ensured stable supply by simply guaranteeing that it would pay the highest price in the marketplace. The first of these projects—Arun—remains among the most profitable (for developers) in LNG history. Given its willingness to pay a hefty premium for stable supplies, Japan Inc. shifted the burden to potential gas suppliers to show that they would be credible, long-term sellers. (The one instance of supply interruption concerning a Japanese LNG project—Arun in 2001—occurred when the field was already in decline and Japan had ample alternatives. Still, the perception of Indonesia's instability has caused new buyers to choose Australia and Sakhalin (Russia) for new long-term contracts.)

The historical case studies provide some comfort to prospective gas importers who fear insecure supplies—especially those with diverse import infrastructures.

Nevertheless, the experience of importers dependent on Algerian gas in the early 1980s is still a cautionary tale. Previous to the change in government in 1979, Algiers was sending all the right signals to gas buyers by offering long-term commitments to deliver gas at competitive prices. Circumstances changed rapidly when the new government took power in 1980 seeking to distinguish itself from its predecessor and emboldened in its aim to boost gas prices by the success of the Arab oil embargo. While the long-term results were disastrous for Algeria, historical lessons are not always well studied or applied. Shifts in political regimes—and the limited time-horizons of leaders who aim to upset existing orders—may pose continued threats to stable gas exports.

### *Security of Supply and Transit Countries*

Analysts have given particular attention to the risks of insecure supply from pipeline projects that cross transit countries. The concern has been that while suppliers and users are bound together, transit countries could have disproportionate influence over outcomes and demand a disproportionate share of the revenue for themselves. Again, our studies suggest that interruptions due to behavior in transit countries are few and occur mainly as unintended byproducts of broader disputes. In 1995, Ukraine suffered chaotic internal rule that made it difficult to collect revenues from gas users as well as overriding hostility to Russia, and in 2004 the president of Belarus was locked in dispute with Russian President Putin and Gazprom over ownership of pipelines and pricing of gas. Neither of these cases involved simple disputes over transit fees as both countries had previously been part of the Soviet Union; both were large gas consumers built on the legacy of inexpensive Soviet gas.

As with suppliers, transit countries must contend with the fact that transit fees they earn are linked to a service that is fundamentally contestable. In the original Transmed contract negotiations, Tunisia sought to use its geographical position along the most favorable pipeline route to demand a high take; it backed down when Algeria and Italy credibly explored an LNG export option that would have bypassed Tunisia completely and left it with zero transit fees. Tunisia could attempt to force renegotiation of its fee now that the pipeline is built, but such a move would jeopardize possible

expansions.<sup>9</sup> (Almost all projects operate in the context of constant chatter about expansion, which partly reflects the real prospects for expansion and partly is a tactic that keeps operators focused on the long term.) Once operational, if Tunisia were to block the Transmed gas shipments it would gain nothing itself. It has little domestic use for the gas, limited storage, and gas supplies would stop shortly after the blockage or diversion was detected. It might be feasible for Tunisia to extract a larger share of rents over the short term, but faced with such demands Algeria and its importers certainly would respond by focusing on other routes for the next phase of expansion.

In the case of the Ukraine and Belarus crises, the interruptions in 1995 and 2004 created harmful consequences for reputation. Over the short term, both Ukraine and Belarus externalized their damage to Russia, which receives lower revenues for its exports and is seen as a less reliable supplier. Ukraine was able to demand higher transit fees because in the middle 1990s it controlled nearly all of Russia's gas export capacity, but that loss in rents has spurred Gazprom to search for alternative export routes. For the West European market, Belarus was the easiest alternative because Russian trunk pipelines already crossed the eastern part of the country. But the souring of relations with Belarus has rekindled Russia's interest in the "North Transgas" pipeline on the seabed of the Baltic, which would allow Russia to bypass all transit countries and allow shipments directly to the European Union. Barely four months after the Belarusian interruption Gazprom announced that it had lined up funding for the North Transgas project in partnership with the German firm E.ON. (E.ON bought Ruhrgas in 2002 and, with that purchase, acquired a 6.4% stake in Gazprom—the largest non-Russian holder of Gazprom shares.) For the potentially lucrative Turkish market, Russia built a pipeline directly across the Black Sea (The "Blue Stream" pipe) to avoid Ukraine and other transit countries. So far, it appears that Russia has not suffered much from the trouble of being upstream of unreliable transit countries because Europe's second-largest external supplier (Algeria) is perceived as even less reliable. Russia's real competitor is the rise of LNG imports into Europe, whose prospects have brightened considerably with the declining

---

<sup>9</sup> Two expansions of the Transmed pipeline have been completed since its startup in 1983. Today, alternative pipelines bypassing Tunisia are feasible and moving forward. This is in part to avoid paying transit fees to Tunisia, but also to bypass the monopoly that ENI (Snam) holds on the route.

cost of LNG technology, and the perennial interest by Germany and other Russia-dependent gas importers to diversify energy sources.

### *A Buyer's Weapon?*

For projects that ship large volumes of gas to markets, the “gas weapon” is equally available to users. Indeed, the case studies here involve more examples of interruptions and renegotiations of contracts instigated by users than suppliers or transit countries (table 3). In some cases, these interruptions have been a byproduct of misestimated demand, not as a part of a grand strategy to reallocate rents or political power. Turkey, for example, has forced renegotiation of the Blue Stream contracts when the expected bullish gas market in Turkey failed to meet expectations in the wake of macroeconomic troubles. Brazil, too, has failed to absorb the large volumes it contracted from Bolivia. Only the Brazilian government's broader foreign policy concerns have prevented Petrobras from forcing a reduced price on its gas purchases from Bolivia.

Nevertheless, if buyers have suitable energy supply alternatives they are in the position of power to renegotiate prices—as the operating costs of any project are a small fraction of the already sunk capital cost. The implications for operations will be discussed further below, however we note here three cases where gas buyers have used their power to shift the terms of the original contract bargain in their favor. First, in the early 1980's, the U.S. turned the gas weapon back on Algeria as it attempted to hold up supply. With adequate alternative supplies available in North America, the U.S. Department of Energy refused to approve new Algerian contracts rather than allow U.S. customers to pay the higher prices Algeria demanded. In the late 1980s, Argentina unilaterally forced new contract terms on the YABOG pipeline, as increasing domestic production made Bolivian imports less necessary. Japanese buyers also had access to alternative suppliers in the late 1990s and used that leverage to bring the prices for shipments from Qatargas in line with the declining cost of contracted deliveries from other suppliers in the Asian region.

### **Credibility of Long-Term Commitments and the Management of Financial Risk**

In both the “old” and “new” worlds, gas projects demand huge quantities of capital. Governments and private investors alike need assurance that their investments will yield a consistent return over the long life of the project. In the “old world” these projects were organized within state-to-state agreements with state-backed financing; governments, themselves, had a strong incentive to assure compliance because gas trade was usually interwoven with many other international issues that affected the state-to-state relationship.

In the “new world” the capital and reputations at risk are private. As with any large investment where the preponderance of cost is sunk before operation begins, investors in gas supply infrastructures are exposed to what Raymond Vernon termed the “obsolescing bargain” (Vernon 1971). Before the project is built, potential investors are in the position of power, holding scarce capital and technologies required for the project. After a deal is struck between investors, gas buyers and the host-country governments, capital is ‘sunk’ into developing gas fields and constructing export infrastructures. Once built, a gas pipeline or LNG facility has no alternative use and the leverage for setting rules on taxes and prices shifts to the host-country government and to the gas buyers. Generally, a manager will continue to operate a project so long as the price it earns for its shipments (net of taxes and royalties) covers the continuing costs of operation—not necessarily allowing for recovery of initial investment or a suitable return on that investment. In gas pipeline and LNG projects, this risk is particularly acute. Compared with coal and oil, gas production and export projects are more capital intensive,<sup>10</sup> requiring greater earnings over operating costs for a longer period to recover the initial investment.

---

<sup>10</sup> The IEA estimates that the average investment required to deliver gas from fields to end-users through 2030 will cost an average of \$28 per metric ton of oil equivalent. Compare this to \$22 required to build the capacity to deliver an incremental ton of oil, or \$5 for the capacity to deliver an energy equivalent amount of coal. From: IEA (2003). World Energy Investment Outlook 2003. Paris, IEA.

The risk that gas buyers will not adhere to the full conditions of a contract is one aspect of the obsolescing bargain problem faced by investors in gas infrastructure projects. Table 3, above, includes several instances where buyers sought reduced prices after full investment was sunk. As these examples suggest, the obsolescing bargain is a real risk for investors. The ability of buyers to unilaterally adjust prices depends in large part on the availability of alternative energy supplies. In the “old world” single partner relationships formed the bedrock of cross-border gas trade. In limited circumstances, such as those described above, buyers could unilaterally exercise power to reduce contract prices. Buyers could only exercise this “weapon” where suitable energy supply alternatives were available. Today, gas markets are evolving toward more flexible exchange, bringing with it a fundamental shift in the formation of prices and the ability and incentives for buyers to shirk on price commitments. We revisit the impacts for security briefly at the end of this section and it will be the subject of further discussion in chapters 11 and 12. We now turn to discuss the continuing challenges that investors will face in sinking capital in the countries that will supply the gas traded on world markets.

Most of the world’s gas resources are in countries where institutions for enforcing commitments are weak, politicized or nonexistent. Yet typical gas export projects require devoting more than half of the capital investment in the export country itself—in field development, pipelines and processing equipment, and (for LNG) costly liquefaction facilities. Such investments are intrinsically immobile. Because the investor with sunk capital in a project will be willing to operate at much lower earnings than those agreed to in the original contract, host governments may be tempted to raise effective tax rates or engage in other “squeezing” of the project knowing that the investor has few options but to continue to operate. As discussed above, the long-term contestability of investment sites can exert a discipline on such behavior, but only when time horizons are suitably long and governments are actually able to implement distant-looking strategies—the problems in Algeria and Ukraine, among others, are evidence that such squeezing does occur.

Investors in gas supply projects are keenly aware of the motivations and opportunities for host country governments to shirk contracts. All else equal, they prefer

to operate in states that can most credibly signal their commitment to uphold original bargains. The most obvious way a government signals its ability to sustain a commitment is through its own past actions, thereby establishing a reputation for being a stable and investment-friendly environment. Where these conditions do not exist investors demand higher rates of return and payback schedules that weight near-term payments over heavily discounted future streams.

Spiraling downward—the same countries deemed most risky by investors are arguably more likely to have governments that also heavily discount benefits that might accrue from future investments. Where domestic and external disturbances are common (e.g. areas of civil unrest or war) the government is likely to place much greater importance on current payoffs (staying in power) relative to the promise of future projects.

Domestic politics can also limit the ability of governments to uphold the terms of agreement over the life of the project. Radical changes in government can lead to abrupt shifts in policy—as in Algeria or Iran in the late 1970s, or Bolivia in 2003. Absent revolutions and coups, host governments and government officials also change tax rates and property rights for their own personal enrichment or to earn votes. Oil and gas resources are often viewed as a national heritage, and thus can be the focus of intense political rhetoric. The symbolism of “protecting the national interest” at the expense of “foreign profiteering” creates strong incentives for politicians and bureaucrats to shirk on earlier commitments to gas project investors.

What can be done to overcome these obstacles? Here we examine strategies that governments in supply countries can pursue themselves; later we examine options available to private investors and through international institutions.

A host country’s governance structure is perhaps the strongest determinant of its ability to signal credibility in its commitments. North and Weingast (1989) showed that the establishment of the Bank of England in the late 17<sup>th</sup> century was an attempt by the

British Crown to raise the credibility of its promises to repay loans from its wealthy citizens. The Crown needed new financing, particularly to prosecute a war against France. Wealthy capital holders, having suffered through a string of defaults, sought to ensure that they would be repaid this time. In part to address this issue the British Crown established a Parliament composed of capital-holders that assumed veto control over revenue collection and public spending. The Bank of England was created to coordinate state borrowing, using capital advanced by English citizens. Each loan was, in turn, backed by specific tax allocation. If the Crown shirked on any of its loan obligations, future lending from the Bank would be withheld. The Bank of England was an early step toward a government with division of powers and a constitution to protect private property that is the foundation of the Western democratic and economic systems. Under this system, the constitution and an independent judiciary are intended to protect the long-term interests of the country and guard against opportunistic behavior by any given political administration. Out of specific reciprocity, broader cooperation emerged (Axelrod, 1984; Seabright, 2004). There is no exact analogue to this structure for foreign investment in gas projects, but the Bank of England example suggests that governments might signal credibility by creating structures that limit their own freedom of action.

The ideal reforms to signal credibility to investors in new gas supply entail creation of institutions that provide for the rule of law and the protection of property rights. That is a difficult task, especially as governments may only have a few years to demonstrate their credibility and earn visible rewards for painful reforms. Among the interim steps is transparency—simply publishing the receipt of government revenues and their allocation can signal seriousness that corruption and rent-seeking will be spotted and kept at bay.

The list of LNG exporting countries shown in table 4, and the notable absentees from that list, provides insights into how governments signal the credibility demanded by investors. Whereas pipeline economics are highly sensitive to the geographical proximity to a particular user market, LNG export economics are less constrained and thus better illustrate the role of investor confidence. What matters for LNG is the availability of a

large gas resource near a coastline and the proximity to any market—close enough to make shipping feasible, yet far enough to make LNG the preferred option to a pipeline. Such conditions are satisfied in most of the gas-rich countries shown in table 1.

Although gas-rich countries are numerous, only a select few have managed to secure the billions in capital required for new export projects (table 4). The success of Qatar, Trinidad and Tobago, and Brunei in the competition for LNG investment suggests that countries that are physically and economically small may have an advantage in creating an attractive investment environment. Trinidad established credibility with investors as a stable constitutional democracy with gas investment-friendly policies that survived a swing in political winds. Yet, the examples of Qatar and Brunei suggest that the division of powers and democratic governance is not the only path to investor confidence. The leaders of these countries have few checks on their near absolute powers. Gas export revenues quickly became critical to the economies of all three countries—accounting for over ten percent of the total domestic economies in 2003 (table 4). The prospects of concentrated benefits from LNG project investment were enough to encourage these governments to implement a set of laws to attract gas investors. In contrast, for larger countries with broader political landscapes—such as Venezuela or Iran—the demands on such resources are more complex to manage, which may make it more difficult for such nations to make credible any promises to protect foreign investment. Geographically, both these countries juxtapose highly successful LNG exporters (Trinidad and Qatar); politically they are quite different.

**Table 4. LNG Exporters in 2003.** The value of LNG exports based on 2003 LNG exports (BP 2004) roughly approximated at \$3 per mmbtu and estimated GDPs (market exchange rates, from the U.S. Energy Information Agency).

Rank	Country	LNG Exports 2003		GDP (2002* billions USD)	LNG Exports as Share of GDP
		Volume (bcm)	Value (billions USD)		
1	Indonesia	35.7	\$4.1	\$172.9	2.4%
2	Algeria	28.0	\$3.2	\$55.9	5.8%
3	Malaysia	23.4	\$2.7	\$94.9	2.8%
4	Qatar	19.2	\$2.2	\$17.5	12.7%
5	Trinidad & Tobago	11.9	\$1.4	\$9.6	14.3%
6	Nigeria	11.8	\$1.4	\$43.5	3.1%
7	Australia	10.5	\$1.2	\$409.4	0.3%
8	Brunei	9.7	\$1.1	\$4.7	24.0%
9	Oman	9.2	\$1.1	\$20.3	5.2%
10	UAE	7.1	\$0.8	\$71.0	1.2%
11	USA	1.6	\$0.2	\$10,383.1	0.0%
12	Libya	0.8	\$0.1	\$19.1	0.5%

The nine other LNG exporting countries suggest that shrinking borders is not the only path to attracting investment. Algeria and Indonesia developed their gas export industries largely in the 1970s under regimes that, at the time, welcomed foreign investment. In both cases, major LNG projects went ahead during periods of relative stability and foundered in political turmoil. Host governments can also create (or allow) islands of investor-friendly stability in a sea that is otherwise opaque and daunting. Thus, the first LNG projects in Russia are proceeding on Sakhalin—physically far from Moscow and backed by commitments from regional Sakhalin government that enjoys some autonomy from Moscow and has a strong vested interest in the sustainability of projects in its own territory. Egypt and Nigeria have both created special zones for LNG investment.

Governments also have the option of structuring gas projects so that commitments are more readily self-enforcing and to lengthen the shadow of the future, just as the 17<sup>th</sup> Century British Crown did when it reorganized public finances to promote reciprocity. Self-enforcing commitments are theoretically possible, but we do not observe any in practice. One strategy might be employed as a solution to deliver Iranian gas to energy-hungry India. The most economically feasible pipeline would transit Pakistan and deliver gas to that country as well. Given the tense relations between the two countries, India is concerned that Pakistan could withhold gas shipments as a weapon against it. The roughly \$600 million USD in transit fees could help keep Pakistan in line through similar claims we have made with respect to Ukraine and Belarus. Restructuring the deal to include a power plant within Indian territory—to deliver electricity back across the border to an exclusively dependent segment of Pakistan—would magnify the potential benefits to Pakistan and raise the costs to Pakistan of shirking. An analogous arrangement, the Indus Waters Treaty, has facilitated the sharing of water between these two countries for over 40 years, surviving two wars and near continuous heated tensions over Kashmir (Sridharam 2000).

Ultimately, no constitutional or technical mechanism can eliminate the physical reality of sunk capital, and the dangers for investors are acute when a state is failing or collapses completely. Each of the state-based remedies to the commitment problem described above can be rendered impotent when governments are toppled or regional separatism supercedes federal powers. Where such risks exist the investor must search his own toolbox for remedies or perhaps turn to international institutions, options to which we now turn to discuss.

#### *Private Solutions to the Commitment Problem*

Oil and gas investors are no strangers to risk and are accustomed to operating where the state-provided safeguards against opportunism are few and even security protections are minimal. In these situations investors also employ their own private mechanisms to maintain returns over the life of the project.

First and foremost, foreign investors can seek partners that can help to enforce commitment. The most common strategy is to establish a joint venture or partnership with a domestic company whose connections to the host country government substitute for the weakness of national institutions and perhaps dampen the tendency for the “foreign” owners of a project to become a subject of political controversy. As the domestic player stands to benefit from the successful operation of the project, it will mobilize its political connections in times when the government may be otherwise inclined to change tax and royalty structures to squeeze equity and rents for itself. This strategy, however, is not without danger. Local partners can also be corrupt; their influence can be rendered impotent if political minds shift—just as ENI discovered when the Algerian coup swept out not just the technocratic government, but also the leadership of their local partner Sonatrach.<sup>11</sup>

Foreign investors may also choose to employ technologies in a project that require special expertise to operate rendering their investments unattractive for expropriation, just as retreating armies poison wells and burn depots to spoil the rents of territorial advance. European buyers of Soviet gas in the 1980s lent capital to the USSR for the construction of the massive inter-continental gas pipelines. However, the Europeans were quite sure that they would receive gas in repayment for the loans—as the bulk of capital they provided was in the form of the large steel pipelines that were only useful for shipping gas and Europe was the only viable export market at the time. (Some of the gas was also consumed internally within the Soviet Union, but Europe was the only proximate buyer who could pay in much-needed hard currency.) Such strategies provide some protection against outright expropriation by lowering the potential benefits to partner governments from shirking their commitments.

Where the central government is unable to assure local security and deter civil unrest the investor may seek to make the project self-enforcing by distributing benefits to local communities, giving them a stake in the continued operation of the project. Though

---

<sup>11</sup> Henisz (2002) shows the risk of a local partner “squeezing” the profits from a foreign investor is in many cases greater than the risk of host government opportunism; Henisz, W. J. (2002). Politics and International Investment: Measuring Risks and Protecting Profits. Northhampton, MA, Edward Elgar.

not included in the case studies presented in this book, the recent LNG project in Nigeria and proposed projects in similarly fractured countries like Venezuela and Egypt include fully developed plans to supply local communities with water, power and health care. This fact may suggest that gas projects may be less likely to create the ills of the “resource curse” that have plagued major exporters of oil (Karl 1997; Ross 1999). Because the capital commitments for gas projects are generally larger, investors time horizons for gas projects are commensurately longer, giving them a greater stake in the stability of the region in which they are operating. Investors are also better protected from direct theft by locals, as gas lines are not easily tapped for resale on black markets. Contestation over the rents from gas projects remains a problem, however, and where governments fail to provide protection and the investor himself is unable to provide an effective remedy, solace may be found in special external institutions.

#### *A Role for External Institutions?*

Where state-based and private mechanisms for enforcing contracts are inadequate, can governments and investors turn to outsiders, such as international institutions, to supply the function of enforcement? The case studies suggest three possible roles for external institutions to provide assurances to investors.

First, investors and governments alike are seeking to protect themselves from each other—the investor fears that the government will squeeze or expropriate his investment, and the government fears that investors will demand too much of the rent for himself. Both might engage an external institution that has a time horizon and a portfolio of engagement longer and broader than the individual project. Historically, the involvement of the World Bank or other multi-lateral lending agencies in a project in a resource-rich but institution-poor country provided some leverage to protect the project investment. These multi-lateral lending agencies often provided other loans or support to the host-country government, and the banks used the threat of curtailment of these other services to sustain the agreed framework for the oil and gas project. In the Gasbol project, for example, the World Bank chose to provide financing as part of its broader agenda focused on Bolivian development and regional integration. The strong position of

the World Bank in these two countries, particularly Bolivia, provides a strong incentive for the governments to hold to the terms of the Gasbol contract. Similarly, investors might engage private banks to supply capital—even those with deep pockets could be drawn to that option because the host country may be reluctant to stiff banks with which they want to sustain broader lending relationships.

Second, international institutions may offer the possibility for governments to create broader linkages on their own. The gas export projects from Argentina to Chile probably required first that these historical enemies bury their swords and secure a broader political and trading relationship—codified and catalyzed through the Mercosur trading system. Similarly, détente allowed the creation of common security institutions in Europe that, in turn probably aided the investment in gas export projects from the USSR.<sup>12</sup>

Third, an external institution can take a much more direct role in a gas export project by acting as a trustee for all of project revenues. Such offshore escrow accounts have been employed in several oil and gas projects, including the Arun project in Indonesia. Generally, a trustee bank offshore receives the revenues and distributes it according to a fixed set of rules, e.g. operating costs to the project first, then royalties to the government, next debt repayment, all before profits get paid. This has been an effective structure where host countries have been willing to accept the impingement on sovereignty that comes with it. In the 1970s, Algeria refused to accept such offshore escrow accounts, whereas the Indonesian government at the time embraced them as a very small price to pay for the very big prize of Arun and other LNG export projects.

---

<sup>12</sup> An early hypothesis of this research was that pipelines could be a mechanism to promote peace and political integration through shared economic interests. The results of the seven case studies we have examined, along with cursory analysis of nearly all other cross-border gas pipelines, show no evidence that gas pipelines are a means to peace. As in the case of Argentina and Chile, peace and institutions preceded pipelines, rather than the reverse. (Moreover, as in those two countries today, the pipelines can be a source of tension—Chile has responded to Argentina’s curtailments of gas in 2004 by exploring alternative energy strategies, which in turn have amplified animosities between the nations.)

An extension of the escrow account structure offers promise to deliver project benefits to broader populations in exporting countries than often occurs. The Chad-Cameroon oil export pipeline, completed in 2003, was the first test of a structure that sought to manage the internal distribution of project royalties and taxes. In 1999, under pressure from the World Bank, Chad adopted the “Petroleum Revenues Management Law” which required that the bulk of the tax and royalties from the project be dedicated to education, health and development purposes and created an external body charged with supervising these revenue allocations (Esty 2003). Again, the host country government is unlikely to accept such an arrangement except under external pressure and when other options are exhausted. In the Chad-Cameroon oil pipeline project, this trusteeship structure was imposed largely at the behest of the World Bank, in cooperation with project investors—even in those conditions that are most likely to yield an independently governed trust the actual outcome appears to offer much less independence from the hosts.

Some observers have speculated that structures similar to those employed in Chad could be codified with agreements among the major extractive resource investors, thereby requiring that all new projects in poorly governed states use trusteeship structures to control revenues coming from the project to the states—on the grounds that such external management would better deliver the benefits of the natural resource project to the people rather than the whims of the rulers. Such a code could mandate transparency on the use of revenues delivered to the state. However, any such approach would require cooperation from all the major international players in a particular resource field. That condition strikes us as difficult to satisfy since some investors are always likely to defect, which would cause the whole arrangement to unravel. We expect that such arrangements, although impinging on sovereignty, are most likely to occur where the hosts themselves are most keen to demonstrate credibility—either because outsiders such as the World Bank insist on such arrangements as a condition for financing or because the host government is pursuing a long-term resource development strategy and knows that gas investors will demand risk premia in the absence of such confidence-creating mechanisms.

**Implications for Gas Security**

In discussing “gas security” there are dangers in drawing too close a parallel with oil, where security is mainly a function of the volumes that can be delivered to a fungible world market. Because gas is very costly to transport and because new infrastructure connections take years for construction, gas supply security is only assured in the short-term by having diverse routes for supply to final users. The infrastructure for moving specific volumes of gas to specific users—complemented with the ability to switch fuels—determines security for gas users that depend on imports. For example, in the early 1980s, Italy was able to respond to the cut-off of Algerian supply by sustaining shipments via already built long-distance pipelines from the Netherlands and Russia and increasing domestic production. Since the Transmed pipeline had not yet begun operation, Italy was in the fortunate position of not yet depending on the Algerian supply. The markets to which Algeria curtailed LNG supply (Belgium, France, Spain, and the United States) responded over the coming decade by cutting Algerian gas imports dramatically; the U.S. government simply refused to allow U.S. buyers to sign new higher priced contracts with Algeria. All of these LNG importers had other gas and energy supply alternatives. In the wake of the Arab oil embargo the Japanese government encouraged LNG buyers to diversify their sources first away from the Middle East in the 1970s—LNG projects in Brunei and Arun were the products of this gas import policy. Later, Qatargas opened a new supply source for gas for Japan, providing more diversity of LNG supply infrastructure. To a much lesser degree than with oil, gas security until now has not been merely a function of the sheer availability of volumes on the world market, although a future global LNG market with fluid spot pricing could make the analogy more appropriate at some point in the distant future. In this scenario, where many flexible supply alternatives are available, security concerns center mainly on prices signaled through interconnected global markets—not the absolute availability of volumes.

In a regulated environment it was clear where the gas came from and where it was going. Thus it was relatively easy for governments and their bidders to tailor the terms

of long-term contracts for political ends. When these original agreements became inconvenient, governments would adjust the terms through tacit actions that signaled the new expectations—for example, when the French and Italian governments decided to offer subsidies that sustained Algeria’s shipments, and when a few governments caved in to Algeria’s demands others followed. (For the U.S., Algeria’s gas was less essential, and the U.S. government forbade any renegotiation of the Algerian contracts.)

As gas markets liberalize—especially in Europe, where countries are small and borders are plenty—directed gas trade is harder to sustain, especially as the forces of liberalization demand that gas traders abandon destination clauses and other schemes that create rigidity in gas markets. In this 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. In the old world the long-term contracts appeared to be keystones. In fact, those contracts were hard to enforce in courts as legal instruments. They were instruments for the coordinated sinking of capital—which, in turn, created partially reciprocal infrastructures that were largely self-enforcing—rather than strictly enforced legal instruments. In the new world where the length of contracts is shortening and the terms more modest, the importance of legal enforceability is rising. Private players operate across borders and assume responsibilities for maintaining secure supplies and also seek to protect their financial interests. Removed from the protective arms of the state, these private companies often lack the suite of tools available to governments to coerce partners (both governments and private partners) to uphold their end of the contractual bargain.

We suggest three implications for gas security as the gas business shifts to the “new” world. First, the new world marked by multiple suppliers and users and fungibility of gas can yield greater security for producers and users alike. However, realization of that security will require infrastructures that are “overbuilt” when compared with the point-to-point contracts that were typical of the “old” world. It is not clear that the market, itself, will deliver the incentives to attract such overbuilding, not least

because private incumbents will generally benefit from scarcity in transportation infrastructures.

Second, in the “old” world the price of gas and the premium for security were combined into one final price and delivered by enterprises that were owned (or tightly regulated) by the state. In the new world those two functions may separate, which will make the costs of security more transparent and possibly harder to muster. Some entity will be required to supply the difference between the purely economic cost of gas supply and the cost of security, and consumers themselves may be prone to under-invest in the security portion.<sup>13</sup>

Third, large gas projects are typically very time consuming to plan, license, construct and commission. The pricing mechanism, alone, can’t bring new supplies online when there are disruptions in the existing system, when demand is mis-estimated, or other factors create a spike in price. Even as the “new” world shifts to a greater role for market forces, parties that are particularly keen on security may nonetheless demand “old world” arrangements such as long-term contracts, dedicated pipelines, and point-to-point deliveries.

### **III. What Could Go Wrong?**

The larger study of which these case studies are a part is founded on the premise that the demand for gas is rising rapidly; realizing this gas vision will require infrastructures to move the gas from its abundant sources to distant burner tips. These seven case studies suggest some factors that could impede that vision. The shift from state-dominated energy systems to a growing role for markets could make it difficult to “create” the demand for new gas supplies, especially in relatively virgin markets. And

---

<sup>13</sup> For those familiar with electricity markets, the analogue may be comparable to maintaining reserve requirements (excess production capacity) and excess transmission capacity.

wary investors may find it difficult to obtain the right mix of gas resources and investor-friendly environments that appear to be essential for capital intensive gas export projects.

In this final section we focus on two other factors that, so far, have not figured prominently in our summary of findings from the case studies.

First, much of the potential future demand for gas is based on assumptions about the operation of electric power markets. A first wave of gasification occurred as early as the 1940s and 1950s in the United States and Europe as gas was supplied for use in industrial processes and for heating and cooking. The second wave of gasification evident since the late 1980s has been linked to electricity.

Electricity has been a powerful driving force. In many markets, gas-fired electric power generation is substantially less costly than other options and especially attractive to new entrants who are wary of the high capital cost of coal or nuclear power plants. In contrast with the first wave of gasification, gas for electricity also confronts smaller infrastructure hurdles as a few large power plants can be served by large trunk lines whereas supplying gas to residential and small industry users that were typical of the earlier gasification required much more extensive (and expensive) distribution networks.

The conventional wisdom that gas is favored for electricity has been shaped by the experiences in England and Wales, the United States, and several other markets. In these electricity markets, gas has gained because gas generators require a lower expenditure of capital (at market rates), operate at higher efficiencies and emit less pollution than gas's main competition in power generation: coal and oil. But these recent trends in some markets do not mean that they apply automatically to all markets. 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 use has made it hard for gas to enter the power generation market. In Brazil, the dominance of incumbent hydropower has impeded the entry of gas. In the Brazilian case, the lower capital cost of gas-fired power plants has not conferred an automatic advantage because

most power is dispatched on the merit of operating costs, which are nearly zero for a hydroelectric dam. Interwoven with the dispatch rules in Brazil is the system that governs how producers are paid, which socializes the risk of drought and thus prevents gas generators from being paid the true market-clearing price in time of hydropower shortages. The only gas-fired power plants built in Brazil are those that were constructed with special government incentives (which have since been withdrawn), and where Petrobras is a partner since Petrobras has been stuck with disposing the gas that Brazil has contracted from Bolivia (de Oliveira 2004).

It is hardly 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 gas has foundered). We sound a note of caution, especially when projections such as the IEA’s World Energy Outlook (IEA 2002) envision that two-thirds of the incremental demand for gas over the next three decades is to be used in electric power generation.

Second, it may prove politically difficult or impossible to build key parts of the infrastructure needed to achieve the global trade of low cost gas that is essential to realizing visions of a rapid shift to gas. Elsewhere in this book our collaborators have argued that the structure of the world’s gas market is set to tip away from a set of largely disconnected regional markets to a new arrangement where price formation is more global and reflective of gas-on-gas competition rather than mere indexing of gas to oil prices (see chapter 11). LNG is the key to that global shift, and the large U.S. market is the prize. Those who have sought to import higher volumes of LNG are facing a string of failures and political difficulties in siting LNG regasification facilities in nearly every part of the U.S. market.

Our case studies offer little insight into how these siting difficulties might be overcome. All the studies looked at factors that have affected the ability of offtakers to make use of the gas from these projects; none of the studies found siting difficulties to be a major factor. We examined three LNG projects. Two sent cargoes to Japan; in those

projects the key issues were arrangements to assure security of supply. On the demand side the central government and key trading companies orchestrated the needed arrangements within Japan; local opposition was not a significant factor. Of our cases, only the Trinidad LNG projects served the U.S. market; in those cases, the major issues in the U.S. did not relate to siting but, rather, to fear that other (pipeline) suppliers would get to the capacity-constrained northeast market before the first Trinidad train was online. The absence of siting difficulties in the case studies examined in this book reflects that this difficulty is just now arising as a systemic concern, not that this hurdle will necessarily be easy to clear.

#### **IV. CONCLUSIONS**

At the outset the case study research, we selected four key factors—investment climate, transit countries, offtake risks, and geopolitical relationships—that, we thought, would affect the development of cross-border gas trade projects. A survey of the academic and trade literatures suggested that these four factors would be particularly important, and thus we selected case studies that allowed us to observe these factors in variation. We revisit each of those four key factors here, before offering broader conclusions on future gas geopolitics.

As expected, we found that investment climate was extremely important—especially in the shift to a greater role for private investors and competitive gas markets. However, we found that generic measures of investment climate—such as broad country risk indexes—are crude and generally unhelpful guides to the locations where investors are likely to sink their capital.<sup>14</sup> Gas projects are of such scale that even in countries

---

<sup>14</sup>Trinidad, for example, was not an obvious winner for an investment in a new LNG project in the 1990s. Investment risk scores were not significantly better than those for Egypt, Nigeria or even neighboring Venezuela. (According to the General Investment Risk Index (GIRI) for the end of 1995 when Trinidad plans began to be solidified, Egypt scored 6.4, Nigeria 5.3, Venezuela 5.8 and Trinidad 5.8. Lower scores indicate a lesser investment climate.) Despite weaknesses in other areas, the government of Trinidad and Tobago was able to create a context for this particular project that suitably assuaged investors.

where broad risk measures are unattractive, special efforts are typically made to create investment zones and other unique arrangements that can provide the security that participants demand before putting billions in capital at stake.

Transit countries brought complexity, but we did not find broad evidence that states with pipelines crossing their borders were likely to act to “hold up” shipments for political or economic gain. Transit countries are constrained by the carrot of continuing revenues and the stick of encouraging buyers and sellers from bypassing them completely with an LNG tanker or an alternative pipeline route. The most successful example of a “hold up” is Ukraine’s siphoning of gas from Russia’s westbound pipelines in the middle 1990s, but even in that case—where nearly all of Russia’s exports crossed the country—Ukraine’s behavior was tempered by the knowledge that alternative routes could be built, with long-term erosion of Ukraine’s transit fees. Transit countries appear to negotiate, as would be expected, to seek fees that approach the cost of the alternative route.

Our initial hypothesis was that projects that served well-developed markets would entail lower financial risks and allow speedier construction because a robust offtake market would allow easy absorption of new volumes. Instead, we found that the risks in the offtake market were mainly a function of government energy policy, e.g. was the importing country government willing to expend the political or economic resources needed to advance gas use.

Interestingly, we did not find that international institutions—such as trade agreements—played much of a role in the development of these gas trade projects. Rather, the massive scale of these projects suggests that these projects often operate outside pre-existing treaties and the imperative for energy trade can operate on its own

---

The managers of the Trinidad project, in turn, were able to mobilize quickly on this government support. The authors of the Trinidad case noted that “more LNG projects have failed as a result of management failures or lack of informed government support than any other cause” (chapter 9, this volume). The author was arguing that the Atlantic LNG project in Trinidad developed precisely because these two critical factors—government support and competent management—overcame a myriad of other obstacles that would have impeded development under less attentive oversight.

logic (e.g. Soviet gas and oil exports to Western Europe). We did find that international financial institutions such as the World Bank have had an impact on projects in cases where they have been willing to supply substantial financial support for projects that, otherwise, would not be able to attract capital. The strongest example of that role, the Bolivia-Brazil gas pipeline, suggests that this is a costly way to interconnect countries since alternative capital avoided that project for sound reasons. In the early stages of this project we noted considerable enthusiasm for “peace pipe” hypotheses—projects that, once constructed, would create interdependencies that could promote cooperation between linked countries. We found little evidence for that hypothesis.

In all, we draw three main conclusions for the geopolitical contours of a world that is shifting to gas. First, the countries and firms that become major players in the gas world will be those that combine access to resources with the ability to apply sound management and the proper institutional context for investment. We have shown that there is little correlation between the hegemon in proved gas reserves and those that actually deliver gas in market competition. This observation suggests that the traditional metrics for assigning power over natural resources requires much closer attention to subtle contextual and internal factors, with less focus on raw volumes of untapped resources. It also suggests that traditional concerns about politically motivated curtailments of resource shipments may apply less in the gas world than with other globally traded commodities.

Second, the role of the state in this world has been shifting dramatically over the last two decades. In an earlier era, governments were at the center of all key commercial decisions—they assured contracts, and they “made” markets. Today, project developers increasingly expect that the role of the state is in setting the context but staying at arm’s length. We have raised questions about whether that expectation is consistent with the assumption that a worldwide shift to gas will include the rapid gasification of relatively virgin markets as well as gasification in countries where there is no robust system for enforcing contracts and supplying capital. Traditionally the state has supplied those roles, but if the state moves to the shadows it is not clear that private investors will

occupy that space—particularly the role of building gas grids. Conversely more recent trends in Latin America and in the former Soviet Union suggest that retreat of the state may not proceed evenly in all regions of the world.

Third, we have raised some cautionary notes about the vision of global gasification. None of our studies suggest that gasification will stop. But they do suggest that the management, institutional, legal and political contexts have been extremely important in determining where gas projects are built; for now, none of those factors is typically reflected in the energy system models that are used to project the rapid gasification of the world economy.

## **References**

- BP (2004). Statistical Review of World Energy.
- Esty, B. C. (2003). The Chad-Cameroon Petroleum Development and Pipeline Project. Boston, Harvard Business School.
- Hayes, M. H. and D. G. Victor (2004). Factors that Explain Investment in Cross-Border Natural Gas Transport Infrastructures: A Research Protocol for Historical Case Studies. Stanford, CA, Program on Energy and Sustainable Development.
- Henisz, W. J. (2002). Politics and International Investment: Measuring Risks and Protecting Profits. Northampton, MA, Edward Elgar.
- ICRG (2002). International country risk guide. Corp Author(s): Political Risk Services (IBC USA (Publications) Inc.). New York, N.Y., International Reports.
- IEA (2002). World Energy Outlook. Paris, International Energy Agency.
- IEA (2003). World Energy Investment Outlook 2003. Paris, IEA.
- Karl, T. L. (1997). The paradox of plenty : oil booms and petro-states. Berkeley, Calif. ; London, University of California Press.
- North, D. C. and B. R. Weingast (1989). "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." The Journal of Economic History **XLIX**(4): 803-832.
- Ross, M. (1999). "The Political Economy of the Resource Curse." World Politics **51**(Jan): 297-322.
- Sridharam, E. (2000). Economic Cooperation and Security Spill-Overs: The Case of India and Pakistan. Economic Confidence Building and Regional Security. M. Krepon, and C. Gagne. Washington D.C., The Henry L. Stimson Center.
- USGS (2000). World Petroleum Assessment, United States Geological Survey.
- Vernon, R. (1971). Sovereignty at bay: the multinational spread of U.S. enterprises. New York, Basic Books.