

Chapter 1 - Introduction

South Africa is one of the few coal-based economies in the world. The extensive use of coal is due to its wide-scale availability and low cost, as well as past policies that stressed energy independence. While South Africa's coal supplies are prolific, it has virtually no oil and limited gas resources. Other than a coal gas pipeline system in the Johannesburg area and an antiquated system in Cape Town, there is no developed gas market.

Large deposits of natural gas have been discovered north of South Africa in Namibia and Mozambique. In addition, South Africa has deposits of coal bed methane and one offshore gas field at Mossel Bay. The World Bank and the Southern African Development Community are encouraging the development of natural gas transmission pipelines from the northern gas fields to South Africa's industrial and urban regions. A number of multinational energy companies (primarily Royal Dutch Shell and Enron) are likely sponsors of pipeline development, but they, as well as potential consumers, are concerned about the Republic of South Africa's regulatory climate.

The Republic of South Africa is developing a draft Natural Gas Policy Act, in response to suggestions made mainly by the World Bank. This Act will lay out the basic ground rules for the industry. At this juncture, the Republic of South Africa does not plan to establish a state-owned gas monopoly; the transmission pipelines are expected to be privately owned. This raises issues concerning access to the pipelines and the method(s) to be used for determining pipeline rates. Without a legal framework in South Africa that ensures that investment in the necessary pipeline infrastructure is forthcoming and that the benefits are passed onto the Southern African economy, either the pipelines will not be built or the economic rent from these pipelines will be captured by private interests. The law must ensure that the revenue generated by gas development in Mozambique and Namibia will not be siphoned off by those with political power, but will flow to those sectors of the economy where efficiency gains can be realized.

The World Bank and the Republic of South Africa want to ensure that the emerging gas industry develops along competitive lines. With only a single pipeline from either Mozambique or Namibia there is concern that the owners

would exercise market power and retard the industry's growth. The World Bank suggested a regulatory scheme modeled on that of the United States, while recognizing the significant differences between a mature gas market in North America and the emerging market in Southern Africa.

Although the World Bank believes the regulatory scheme it is suggesting would foster a competitive market, at the onset it is important to understand the nature of the regulatory programs being proposed. South Africa now has a free market for gas. Thus, the Bank's proposal is one that would impose regulation on the market. To be sure the Bank's scheme would be termed one of deregulation, within the economic and institutional framework that exists in the mature gas industry in America. But within the yet to be developed South African market copying policies of deregulation from the United States would lead to substantial government intervention.

The history of natural gas regulation in North America and Europe has been a sorry one. In general, the regulations have created undesirable concentrations of economic power such as monopoly, and preserved and protected high prices. Residential gas prices in the United States are still nearly four times higher than industrial prices, largely because the residential sector is still regulated.

The development of the natural gas industry in Southern Africa is a huge undertaking that will ultimately require billions of dollars in investment. Such large expenditures of resources have the potential to either lead or throttle the region's economic development.

If investment in Southern Africa's gas industry is made in tandem with opening markets and efficient pricing, natural gas could displace many uses of coal and some petroleum products providing the basis for strong and vibrant economic growth. Moreover, displacing coal with natural gas would have substantial side-benefits in better air quality and a reduction in greenhouse gases. In this scenario, growing demand for natural gas is market driven, with open competition between suppliers and customers for the best product at the best price. This scenario also suggests widening trade within the Southern Africa region, building a solid base for further economic growth.

In contrast, the demand for natural gas could be force fed — achieved by constraining the use of alternative fuels. (This seems to be the implied by the "Policy Creativity" scenario advocated by the Southern African Development Community [SADC] study of the natural gas market. See page A-14 of Appendix A). The impact on economic growth of such policies is very uncertain. The problems with this scenario would be compounded if there were little or no competition among natural gas suppliers. In this scenario, economic growth for South Africa's neighbors would only be achieved by higher cost and reduced growth in its own economy.

Before mimicking natural gas regulatory policies in North America it is advisable to take a close look at the potential competitiveness of each sector of the industry, the special circumstances of Southern Africa and the state of development of the industry in the region. That is the charter of this report.

Chapter 2 - The Natural Gas Chain in Southern Africa

A. The Natural Gas Chain

Natural gas accumulates in underground reservoirs and is brought to the surface through one or more wells. It then passes through a natural gas "chain," before final delivery to the consumer. Gas from neighboring wells is first gathered and then treated to remove sulfur and other impurities in order to standardize its heat content. Next, the purified gas is transmitted, under pressure, through large diameter pipelines to its markets. Generally, gas must be produced at relatively constant rates while demand fluctuates with the time of day and season. Thus provision must be made in the chain for storing gas. The final step in the chain is delivery to industrial, commercial and residential users through smaller diameter lines and distribution networks.¹

Unlike petroleum products or coal, natural gas producers and consumers are tied together by pipeline gathering, transmission and distribution systems. These activities are the most costly and also the most likely to tend towards monopoly. New buyers cannot be connected to the pipeline network overnight, and current buyers are usually committed to a single supplier. Moreover, unless transmission pipelines are interconnected, gas producers must deal with a single purchaser. In contrast, coal and oil purchasers can usually turn to another supplier, and producers of coal and oil generally have alternatives such as rail cars and lorries for bringing their products to market.

Historically the owners of natural gas transmission pipelines have played two roles — a transportation and merchant function. In contrast, oil pipelines tend to be common or contract carriers; their owners transport crude oil or petroleum products owned by others for a fee. Petroleum, as it is converted from crude oil to products, frequently passes through many types of transport systems and changes ownership many times. Gas pipelines, however, directly tie the producer and final consumer together. So, gas pipelines companies often act as merchants; they own the gas they ship. They buy the gas from producers and resell it to consumers. If a particular community or gas producer is served by a

¹ The economies of scale in natural gas systems and the implications for South Africa are described in Chapter 3.

single pipeline this gives its owner a particularly large amount of economic leverage, which is the heart of the regulatory problem.

B. Competition in each link of the chain in Southern Africa

Figure 1 illustrates the location of known gas deposits and pipelines in South Africa. As the chart shows, at present potential gas suppliers in Mozambique and Namibia are not connected to likely customers in urban centers and industrial areas of South Africa. The Johannesburg area (Gaunteng) and Richards Bay are served by coal gas supplied by Sasol through the Gascor pipeline system. Moreover, the bulk of the Gascor system transmits coal gas with a heat content of about one half that of natural gas with the result that most buyers cannot substitute natural gas for synthetic coal gas.

Proven natural gas reserves in the Pande field in Mozambique, the Kudu field in Namibia and Mossel Bay in the Republic of South Africa total 7.4 tcf, about 275 times the present annual consumption of coal gas. The Kudu field is the largest known deposit, with estimated reserves of 5 tcf. The Pande field has reserves of 1.7 tcf and Mossel Bay, 0.7 tcf. Coal bed methane (cbm) reserves are 1.3 tcf. In the aggregate, there is now ample supply of gas relative to consumption in South Africa.

Crucial, however, to the competitiveness of any market is the concentration of ownership. The current distribution of natural gas supplies in Southern Africa is interesting. For the foreseeable future, the South African gas market is likely to be divided into two markets for direct gas use and a single market for gas-fired electricity generation. Natural gas pipelines thrusting south from Mozambique or Namibia will serve very different areas of South Africa; Kudu gas will supply the Cape area, while Pande and coal bed methane gas will supply Gaunteng. In the near future, there is little chance of an interconnection between the gas pipeline systems, except indirectly through the electricity grid.

The Kudu field was discovered by Royal Dutch Shell, which will likely build the associated pipeline transmission systems. The only natural gas competition Shell faces is from Mossel Bay, where natural gas is now being converted to petroleum products. Counting Mossel Bay gas, Shell controls 88% of natural gas supplies in the Cape area.

Shell also owns the coal bed methane deposits which could serve Gauteng. The principal potential competition in that region is from the Pande gas field in Mozambique, which is controlled by Empresa Nacional de Hidrocarbonetos de Mocambique (ENH). Pande gas represent 57% of natural gas supplies in the region. Assuming coal bed methane will be costly to develop, it would appear that ENH controls 100% of the lower-cost gas supply slated for Gauteng, Transvaal and Natal.

At present, there are only two gas pipeline systems in South Africa: Gascor's low-therm gas distribution system and the converted Petronet pipeline from Secunda to Richard's Bay. The first pipeline delivers gas produced by Sasol (95% at Sasolburg) to its industrial customers in Gauteng. The second pipeline plans to deliver higher-therm gas produced at Secunda. The Petronet pipeline is open access, that is, anyone can purchase space on the line provided they are willing to pay the going transportation charge. In theory, companies producing gas from the Pande field or from CBM could use this pipeline to access Natal, if the gas can be delivered to Secunda.

Who will own or control a pipeline from the Pande field to Gauteng or from the Kudu field to the Cape is now unclear. Neither pipeline has been built. Furthermore, the nature of distribution systems has yet to be determined, and the RSA is just now addressing gas regulatory issues.

Chapter 3 - Natural Monopoly, Competition, and Regulation

A. Natural monopoly

A "natural monopoly" occurs in an industry when it is most economic to have a single firm produce a good or service. Such an industry is said to have strong "economies of scale," meaning that the marginal cost of producing additional units declines over all realistic levels of demand. Put another way, competition is impractical in such an industry because it would result in unnecessary duplication of facilities and overproduction.

Natural gas and electricity transmission and distribution systems exhibit strong economies of scale. It would be very costly (not to mention a traffic tangle) to have dozens of firms laying electrical lines or gas pipelines side-by-side down city streets.

Long-distance gas transmission pipelines also exhibit economies of scale. These economies of scale arise due to the fact that the right-of-way is usually a fixed expense. Also, the per-unit cost of transporting gas declines with the volume shipped; larger pipelines are more efficient.

Natural gas production does not have strong economies of scale. Instead, the cost of production is mostly dependent on the natural endowments of individual gas fields - some gas is cheap, some is not. Field development is modular and can usually be sized economically to meet expected demand. The development of offshore gas fields may be an exception to this rule.

B. The traditional theory of franchised and certificated monopoly combined with regulation

Protecting the consumer from price gouging is only one of the reasons for the regulation of natural monopolies. In addition, there are safety, environmental and other social concerns. In the United States electricity and gas are frequently considered public "necessities" and are given special status. For example, a common concern is their availability to the aged and poor at prices they can afford. The result has been the establishment of what are often called "life-line rates" to ensure that these groups receive adequate supplies. In

addition, electricity and gas distribution systems often depend on publicly owned streets and access corridors for their rights-of-way. Together these various concerns are often used to justify government intervention in what would otherwise be the simple production and distribution of an ordinary commodity in a private market.

Historically there has been another reason for government intervention in natural gas markets. When a country is in the early stages of development, the economic environment is often so risky that private investors are reluctant to undertake the enormous expenses required to develop a basic infrastructure. In response, governments of developing economies have often extended to those willing to invest in roads, bridges and other large capital infrastructure projects a monopoly in the form of an exclusive franchise. Such a franchise reduces the risk of the project and is often what induces new investment. Indeed, in the early days, the U.S. Congress and state legislatures awarded those prepared to build bridges, roads, and railroads exclusive franchises as an inducement to undertake the investment the United States needed if it was to grow.²

In most countries either a system of public ownership or franchised monopoly with price regulation dominates gas and power industries. Outside North America public ownership of gas and power companies has been most prevalent, but this is changing. In the last few years many countries have moved to privatize publicly owned gas and power utilities. Privatization leads directly to the issues of regulation, safety standards and fair pricing.

The theory and practice of regulating privately-owned utilities is straightforward. A company gives up its independence in pricing and the opportunity for substantial profit in return for an exclusive service territory and a regulated return on its investment. In essence, the highs and lows are eliminated and stockholders are expected to earn an average return.³

² Morton J. Horwitz, *The Transformation of American Law: 1780-1860*, Cambridge: 1977, Harvard University Press, pp. 63-109.

³ Alfred Kahn, *The Economics of Regulation*, 2 Volumes, for the classic exposition of this theory.

In practice, regulation has not been so smooth and has, over time, introduced serious biases in the regulated company's behavior. For example, allowable rates of return, based on the return to capital, provide an incentive for excessive investment and "gold plating" in the rate base. These are inefficiencies that a developing economy can ill afford.

C. The impact of regulation on a developing industry

1. Early investments may be "marginal"

As explained earlier, the motive for granting companies an exclusive franchise was often to stimulate development, not to control, "monopoly" profits. Frequently, the development of a major natural gas transmission pipeline is "marginal." It is easy to see why. Typically, natural gas transportation projects are enormously expensive. There are few profits during the period in which natural gas penetrates the market and displaces alternative fuels. It is expensive for consumers to switch from oil or coal and they only do so gradually. Thus, it takes time for the demand for natural gas to build. This all but guarantees that a pipeline system will be under-utilized in its early years.

Because pipeline systems are capital intensive, calculated rates of return are very sensitive to the distribution of revenue over time. If revenue is lumped toward the back end of the project, it must be very high to offset the impact of the debt service in the early years. Mature pipeline systems appear to be very profitable, but this is usually achieved only after many years of operation at a sub-marginal rate of return.

2. Profits from one part of the gas chain may be necessary to underwrite development of another part of the chain

Who benefits from the construction of a natural gas pipeline? There are at least three groups who do: gas producers who are given access to new markets, potential gas consumers who find it economic to switch to a cheaper and better fuel, and the investors who build the pipeline and expect revenues to exceed costs. If the pipeline investment is marginal, the expected rate of return may not be high enough to ensure the project's viability.

On the other hand, gas producers might be willing to build a pipeline with a lower rate of return than would normally be expected if it means improved profits from gas production. Likewise, gas consumers might be willing to underwrite such an investment, if it means greater profits downstreams. If public policy prevents either producers or consumers from having an ownership interest in the pipeline, it could condemn the project to the dustbin. For example, the Alaska Natural Gas Pipeline from the Alaska's North Slope to Canada and the lower forty-eight states was never built. The main reason for its cancellation was its high cost. In addition, Alaska's gas producers were prohibited from participating in pipeline ownership. This prohibition increased financing costs because it made the project riskier. Only companies like BP, Exxon and ARCO, with significant gas supplies on the North Slope, had the incentive and capital assets large enough to sponsor the project -- but by law they were prevented from doing so.

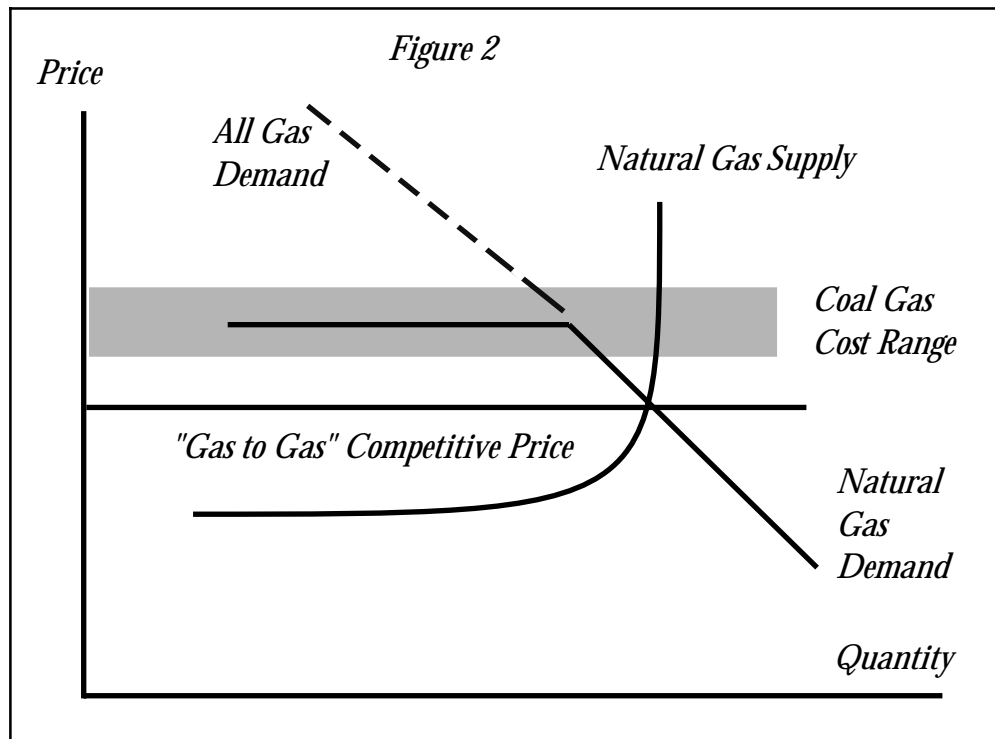
3. Interfuel competition

As is shown in Appendix A, inter-fuel competition in the Republic of South Africa is vigorous. If a supplier of one type of fuel raises or threatens to raise his prices too high, consumers can switch to a competing source of energy.

Natural gas will penetrate such a market slowly, but once it does, it will almost certainly lower all energy prices. In particular, the predictable cost of converting coal to gas (which is about \$3 per GJ) puts a far firmer cap on delivered natural gas prices than any regulatory body could imagine. Figure 2, illustrates this. Attempts to price gas for larger industrial users above the cost of converting coal to gas are doomed. In effect, the top half of the demand curve is lopped off.

4. Competition before construction

Once a pipeline is laid, competition from a second line is less likely. Since, economies of scale encourage oversizing, pipelines are frequently designed to have spare capacity. Even when existing lines are full, potential competitors have to reach an expected minimum threshold of demand in order to justify a second investment.



Before pipeline construction, however, there is usually intense competition among several companies to construct and manage the facility. If ownership rights (through grants of right-of-way or other transport certificates) are vested in public authorities, competition can be explicitly introduced through auctions or other methods of competitive bidding. Even if there is not an explicit auction, there may be serious competition. If the owner of the gas resource does not own the pipeline corridor or control the market to which the gas is bound, the cooperation of several individuals and institutions must be sought. The sorting out of investment plans and ownership rights is normally very competitive; the gas resource owner and potential gas buyers have every reason to make it so.

In the case of South Africa, there already exists serious competition for the rights to build a transmission pipeline from the Pande field to Gaunteng. Mozambique has sought to develop the Pande field for several decades but ENH has not had the expertise or capability to finance the project. Development was evaluated by the World Bank in 1991, which concluded that the project was economically viable. A partnership between ENH, Plustpetrol, and Sasol was

formed to develop the field and pipeline. Sasol was, however, outbid by Enron, who took over management of the project. It is yet to be determined whether Enron will be able to market the gas at a high enough price to cover the cost of the pipeline and provide adequate revenue to Mozambique.

Development of the Kudu field is less competitive because the field was discovered and is managed by Royal Dutch Shell. As a major multinational oil company, Shell has the expertise and means to finance field, pipeline and market development on its own.

5. Competition after construction

As discussed in Appendix C, regulation of the natural gas industry in North America has changed dramatically over the years. The combination of surplus capacity and a contractual quagmire led the interstate gas transmission industry to accept open access. This has made it possible for individual gas consumers and producers to contract for transport space on pipelines. As a result the market for gas has broadened rapidly.

In effect, open access has resolved the problem of the pipeline companies' natural monopoly. If a multitude of buyers and sellers can gain access to pipeline transportation at non-discriminatory rates and access terms, competition can replace regulation for much of the gas market.

D. The dangers of excessive regulation

Regulation is a tempting method for governments to achieve policy objectives. It has little impact on budgets, because most of the cost is borne by regulated industries or their customers. But, these efficiency costs can be very high, particularly in a developing economy. Thus, it is imperative that policy makers take a long-term view and be concerned with the impact of regulation on their economies.

In the centuries long experience with regulated industries in the industrialized world, regulation has seldom accomplished what its proponents hoped. Regulation usually begins with the best of intentions, usually to protect the health and safety of the population, ensure low and stable price for consumers etc. As often as not, the regulatory process has been "captured" by the firm or

industry it was intended to discipline. The result is regulations that preserve and protect the special status of a few well-organized firms; consumers are left out of the process, because their interests are too diffused. The alternative, which is to have the regulatory process become hostile to industry, can be equally pernicious. Ill conceived regulations can cause inadequate investment resulting in decaying infrastructure and deteriorating service.

Regulation introduces market rigidity which reduces consumer choice. Also, regulated industries frequently bundle products and services. Consumers, faced with a single seller, have no choice but to pay the all or nothing price for the bundle. Cost-based regulation gives regulated companies an incentive to over-capitalize, be investing more than is necessary to meet basic consumer needs.

Economic circumstances and technologies are constantly changing. But regulated industries are often slow to implement new ideas. For example, in the case of telecommunications, technological alternatives to landlines (satellite and microwave) and low cost fiber-optics have all but eliminated the economies of scale associated with long-distance telephone lines. It took several decades for the benefits of these innovations to reach consumers because regulators were slow to grasp the implications of the new technologies and to recognize that a competitive market was now viable.

E. Implications for South Africa

The Republic of South Africa is endowed with an unusual set of natural resources and is in a state of economic development quite different from North America, Asia, or Europe. As a consequence, an effort to transplant in South Africa procedures and programs developed elsewhere could do more harm than good.

As described elsewhere, the gas producing sector in most of the industrialized world is highly competitive. There are a variety of supply sources and a large number of private companies willing and able to produce gas, if the price is right. There have been, however, perceived problems of pipeline delivery caused by economies of scale and severely constrained right-of-ways. (Gas consumption in most of the industrialized world is in densely populated areas, making rights-of-way expensive.) At the same time, alternative fuels to gas are costly or their use is constrained.

Circumstances are almost the reverse in the Republic of South Africa, where there is an abundance of cheap coal, relatively inexpensive pipeline rights-of-way, and only a few sources of natural gas. The most important supplies of natural gas are in neighboring countries, controlled by single companies, and are expected to serve different parts of the republic.

In a market with interfuel competition, prices of gas at the burner tip (the final consumer) will be set by the cost of alternative fuels. There is an exception. In the event there is a surplus of natural gas "gas-to-gas" competition can drive prices below the cost of alternatives, as it has sometimes done in North America. The benefits of gas-to-gas competition could, in theory, be achieved through cost-based regulation, if anyone would build the facilities. Such regulation must, however, be implemented at every link in the gas chain. Regulating transmission and distribution rates simply makes it easier for a monopoly gas producer to extract maximum monopoly profits. It does so, in part, because the pipeline owner no longer has negotiating leverage with the producer. Bilateral monopoly is replaced by monopoly.

Chapter 4 - Regulatory Options for South Africa

A. No Special Regulation

Like other businesses in South Africa, firms in the natural gas industry are subject to a variety of laws governing the performance of contracts, liability to third parties for damages, and other issues that arise in the day-to-day conduct of a business. There are, however, no special laws that apply only to the natural gas industry. One option for the Republic of South Africa would be to continue matters as they are. The principal supplier of coal gas, Sasol, bases its tariff structure on the collective willingness of its customers to pay and its own cost structure. Pipeline right-of-ways are privately negotiated, and a combination of American and British safety standards has been adopted by the industry on its own.

There are several advantages to continuing to treat the gas industry like any other industry rather than singling it out for special regulation. The cost of any investment mistakes is likely to be borne by the investors, not consumers or taxpayers. The time and money that government officials would spend on researching and tracking the gas industry, were special regulations adopted, could be applied to education and other vital programs. Most importantly, the regulatory programs of most advanced economies have failed to meet their objectives and South Africa should not repeat their mistakes.

One reason given for special regulation of the gas industry is that transmission lines require turning to the government to obtain permission to cross the lands of so many different owners. But transmission pipelines from either the Kudu or Pande fields are not expected to cross areas of high population density. Consequently acquiring rights-of-way is not expected to be a major component of the cost or a major constraint on development. There is no compelling reason for government involvement based on right-of-way problems.

Another reason for special regulation is to prevent firms in the industry from taking advantage of their position to charge consumers abnormally high prices. But as detailed in Appendix A, there is already stiff inter-fuel competition in South Africa. If natural gas is going to penetrate the market, it can do so only by being price competitive. Inter-fuel competition will rob the gas industry of any opportunity to charge consumers anything but a competitive price, making

government price regulation an unnecessary hinderance. This is generally true for the residential and commercial sector and particularly true for the industrial sector.

B. Monopoly Franchise (The Merchant Function)

In a merchant pipeline, transportation and marketing functions are undertaken by the same company. The pipeline sponsor is responsible for purchasing gas from producers and selling gas to industrial customers and local distribution companies. The cost of transportation is covered by the margin between purchases and sales, rather than by "transportation rates." Gas shipped on the pipeline is wholly owned by the pipeline sponsor.

The merchant pipeline option is almost always accompanied by a government-granted monopoly franchise. An exclusive franchise is granted by dedicating government owned right-of-way and/or designation of service territories. There is one crucial advantage to granting a monopoly. It reduces uncertainty for potential investors and ensures a rate of return high enough to hasten the construction of transmission pipelines.

But granting exclusive franchises presents a dilemma for the Republic of South Africa. It may get transmission pipelines built, but once the market matures and customers are captive to the system it leads inevitably to regulating gas prices at the burner tip and, perhaps, the wellhead. Otherwise, there would be concerns about monopoly abuse by the pipeline owners. Yet price regulation brings its own set of problems. Numerous studies of regulation in the U.S. have shown that it is a poor substitute for competitive prices, resulting in many instances in prices higher than would have been the case under competition. In addition, regulators are often tempted to use price regulation to pursue goals at odds with economic efficiency. Many U.S. utilities, for example, are now saddled with uneconomic investments in experimental programs because regulatory authorities had required them to do so.

Furthermore, once a monopoly is granted it is almost impossible to take away, and it therefore becomes difficult to introduce price competition in lieu of price regulation. The monopoly pipelines of central Europe are a good example. And in the United States, had it not been for the extraordinary situation that pipeline companies found themselves in, burdened with

take-or-pay contracts, it is quite likely that monopoly in gas transmission would still prevail.

C. Open Access

Under an open access regime, pipeline transportation is treated as a separate and distinct activity. Gas customers can bid directly for gas supplies from producers and then arrange transportation on a transmission pipeline. This regulatory option assumes that there are sufficient numbers of customers receiving gas and enough producers of gas to spark active bidding, so that prices are determined competitively.

If there are a number of transmission pipelines (as is often the case in North America) there can be a market for transportation that is effectively competitive. The United States is now criss-crossed by a number of interconnected pipelines. But such circumstances are rare. Usually there is only one pipeline connecting producers with consumers. This means that access to the pipeline and transportation rates must be regulated if there is to be a competitive market among producers and consumers.

The advantages of the open access option are significant. Regulators do not have to be concerned about gas wellhead prices or the burner tip prices of large customers. They can focus on the single issue of gas transportation, which is relatively simple to regulate.

Open access provides many benefits to consumers in a mature natural gas industry, but it may also undermine the incentive to invest in long-distance pipelines. The return on investment in an open access pipeline is at the sole discretion of the regulators. Once built, the pipeline owner has little or no leverage over customers or regulators, since their cost is fixed. If regulators set the price for transportation services too low, investment in maintaining and expanding existing lines will be discouraged, and new lines are unlikely to be built. If rates are too high, the industry may be stillborn.

D. Hybrid

The World Bank has recognized that the open access policy option may not be viable in South Africa and has proposed a "hybrid" option instead. Under

this type of regulatory regime, companies willing to construct a long-distance transmission line can act as merchants for a sufficient number of sales contracts to guarantee the viability of the pipeline. Industrial gas customers that agree in advance to long-term sales contracts are given lower prices and/or special advantages. Once the pipeline is built other consumers are granted access at rates that would be determined by regulatory authorities in the Republic of South Africa.

The main advantage of this proposal is that it preserves the principle of competition and does not guarantee the pipeline sponsor a long-term monopoly.

But the hybrid option may not be practical. The proposed pricing and rate structure, with early customers getting a discount, is precisely the opposite of pipeline economics, where there is normally declining average costs for reasonable levels of demand. Once a pipeline is in place, it pays everyone to increase the volume for whatever amount of incremental revenue can be obtained. This is an irresistible fact of economic life, for the regulators, the pipeline sponsor, and sophisticated consumers. The hybrid option thus tries to swim upstream against a very powerful economic current. Whereas the economics point to selling additional space on the line at a price that just covers variable costs, under the hybrid option the owners of the pipeline must try to recoup not only variable costs but some portion of their fixed costs as well.

This puts the ability of the transmission company to recover costs at risk. The pipeline sponsor may not be able to control events if, for example, the gas producer grants discounts to new customers or new gas producers enter the market. The persistent threat of competition undermines the integrity of the long-term contracts which are intended to build the system. Will anyone take the risk?

If and when, pipeline capacity is reached the incentive structure reverses. In this case, the pipeline sponsor may exclude potential competitors or undermine them with below-market bids.

E. Limited Franchise

There is another option that the World Bank did not consider which might be termed the limited franchise option. The Republic of South Africa

could grant exclusive monopolies to companies proposing transmission pipelines but only for a limited time. At the end of the period, there would be open access and thus competition. The length of time the monopoly would last could be predetermined by the government or it could be made a part of a competitive tender. Some firms might be willing to build a line if guaranteed a monopoly for, say, seven years, while others might be willing to build one only if granted a monopoly for a longer period. Some cities in the U.S. have experimented with this approach when franchising cable television.

Chapter 5 - A Look to the Future

A. The benefits of developing natural gas markets in Southern Africa

There are many potential benefits from developing a natural gas industry in the Republic of South Africa. These benefits may, however, take decades to unfold and will require patience and restraint. Excessive promotion of a natural gas market through restricting other energy supplies would have a high economic cost. In contrast, the benefits from market-driven growth include improvements in the environment, growing regional cooperation, sustainable economic development, enhanced energy security and improved working conditions.

Substituting natural gas for coal used as a fuel in South Africa would have important environmental benefits.⁴ If natural gas can be developed and transported to the Republic of South Africa at a cost below that of converting coal to gas, it would both benefit the economy and improve air quality. This is because the process of converting coal to gas is energy intensive. Compared to natural gas, large amounts of energy are used to manufacture coal gas. This process results in the release of both air pollutants and greenhouse gases.

The World Bank is in the process of revising its environmental requirements to make them more stringent.⁵ The new standards are not yet finished, but it is certain that they will significantly reduce allowable levels of sulfur and other polluting air emissions. The Bank's standards are important, because new projects will have to meet them in order to obtain financing. In addition, the World Bank standards have been widely adopted by other institutions as well.

Opportunities to further regional trade and cooperation between the Republic of South African and neighboring countries have been missed in the past. The Southern Africa economy is dominated by the Republic of South Africa, but it cannot prosper in isolation. Economic development is not

⁴ As already pointed out, however, it will be less expensive to clean up coal emissions (particularly for electricity generation) than to develop high-cost natural gas supplies.

⁵ "World Bank Standards," *Independent Energy*, October, 1995, p. 62.

independent of political stability and the fortunes of Southern Africa's nations are interwoven.

Natural gas development is capital intensive and may squeeze out other types of investment. But, natural gas is frequently linked to the manufacture of internationally traded commodities. A series of successful gas projects, linked to the production of exportable commodities (or those that displace imports) could stimulate economic growth. In any case the development of either the Pande or Kudu field could have a substantial impact on the economies of Namibia and Mozambique, which should feed back to South Africa.

The Republic of South Africa is cushioned from oil shocks through its synthetic fuel program. However, particularly in the case of Moss gas, this has been an expensive alternative and it is unlikely that any new projects will be developed. All other things being equal, the Republic of South Africa's dependence on imported oil will increase.

The development of a Southern Africa natural gas industry over the next several decades is a logical way to improve energy diversity and enhance security. It would provide consumers with an alternative fuel choice and the region with secure supplies.

In the early twentieth century, John L. Lewis, the legendary head of the United Mine Workers (UMW), pursued a policy of higher and higher wage rates for deep-coal miners. He was once confronted with an elegant discourse in which it was explained that higher wages meant mines would be closed down and his union would lose jobs. Lewis agreed that this was true, but commented that the work was so dirty, risky, and hard that no one should have to do it.

The Republic of South Africa's coal deposits are closer to the surface and much richer than those in Appalachia or Europe. Moreover, technology has changed. There are far more options to substitute equipment for labor, which rising wage rates will surely prompt. As the Republic of South Africa's economy develops, higher wage rates in coal mining will go hand-in-hand with better quality jobs. Equipment handling and technological control requires an educated workforce. The end result will be a benefit to everyone.

John L. Lewis was both right and wrong. Higher wage rates did shut down inefficient mines and reduce the size and influence of the UMW. But, higher wage rates and federal safety regulations also goaded the industry into technological improvements that have made mines cleaner, safer, and a much better place to work.

B. Developing a vision

There is little or no case for government intervention in the gas industry in South Africa, particularly to regulate activities that do not yet exist. That does not mean, that the Republic of South Africa and its investing companies should not have a vision about how the natural gas industry might look in the coming decades. There are the following factors to consider. If the gas market is to be competitive, there must be a variety of supply sources and companies producing and transporting gas. At the very least, the government should avoid barriers to entry that will make the South African market for natural gas non-contestable. To do this, it should encourage the development of an integrated gas market avoiding, where possible, granting exclusive franchises or tying investment to constraining regulatory programs.

The limited number of gas fields and their distance from industrial centers makes delivered gas too expensive to be widely used in the Republic of South Africa at the present time. Gas development is, however, a classic "cart before the horse" problem. Once a pipeline is under construction there will be great incentive for additional exploration and development. There is no guarantee, but there is an excellent chance that additional gas reserves will be discovered in Mozambique, Namibia, and in the coal bed methane deposits of South Africa.

New exploration and new field discoveries by a variety of companies will eventually create the natural gas supply diversity necessary for a competitive market. The thrust of public policy in the meantime has to be to stimulate as much infrastructure development as possible and encourage widespread exploration.

To date, attention has focused on construction of international transmission pipelines which would connect potential consumers in South Africa with producers in Namibia and Mozambique. This is the obvious first step, but only a step in developing a natural gas pipeline system for Southern Africa.

Figure 3 demonstrates the likely first thrust of pipelines to the South. Ultimately, however, these pipelines can be extended to pick up additional gas consumers and producers. See Figure 4.

The South Africa gas market will not be fully competitive or contestable until the major transmission pipelines are interconnected. This is illustrated in Figure 5. Such a development may take decades to achieve. Once accomplished, however, the pipeline network would allow full-scale competition. Assuming open access to pipelines, gas consumers could buy gas from producers in a variety of locations. If gas exploration is a success, this type of inter-linking and integrated market could produce gas-to-gas competition and much lower prices for all consumers. Indeed this ought to be the principal objective of the Republic of South Africa.

C. Setting public policy goals

The construction of transmission pipelines from the Pande and Kudu fields ought to encourage new exploration by new players. The Republic of South Africa cannot, however, guarantee new producers access to these pipelines unless they were a part of broader agreements with the governments of Mozambique and Namibia. Put another way, open access is not a realistic option for any of the three governments on their own. If it is pursued by only one country, that country will disadvantage its own industry. For example, open access to customers in South Africa, effectively hands a monopoly to Mozambique which could deny access to producers other than its own production company.

A single pipeline to multiple gas producers has the same economic result as multiple pipelines to a single producer. There still is no real competition. The Republic of South Africa ought to avoid giving any pipeline company an exclusive franchise.

D. Tools to achieve public policy goals

Greater reliance than ever before is now being placed on markets to solve basic economic problems. The underlying engine of the marketplace is competition, to ensure quality products at fair prices. In the long run, the most effective tool to protect consumers and discipline the industry is competition.

Competition is far more effective than regulation or central planning by government. Competition, however, requires diversity; a multitude of consumers, pipeline companies and supply sources. As a general rule, regulation limits the number of players and stifles competition, whether it is intended to or not. Thus, the Republic of South Africa's policy should be aimed at encouraging diversity.

The crucial question for the government of the Republic of South Africa is not the desirability of competitive transportation through open access pipelines, but how and when to do it. It is a meaningless policy unless it is implemented by all affected countries in Southern Africa.

In the decades to come it is possible to imagine a natural gas market in South Africa looking something like the North American market — a multitude of producers, transport systems and consumers. Figure 5 outlines such a vision. But, such a market will develop only in the far distant future. First, the infrastructure must be built and private industry must be given adequate incentives to build it.

Chapter 6 - Conclusion

The development of a natural gas market for Southern Africa could have substantial benefits for the region and the Republic. The level of benefits as well as costs will, however, depend on how the market is developed. A structured market, in which exclusive franchises are granted to single parties, could hamper economic development by restricting supply and raising energy prices. By contrast, the Republic of South Africa has the option to pursue open competition in every sector of the gas chain. In such a market no company could control gas pricing or availability; the result would be gas-to-gas competition and much lower gas prices. As a consequence, South Africa's economic growth could be higher. Replacing coal and coal gas with natural gas would also provide significant benefits to the region's air quality and reduce greenhouse gas emissions.

A competitive natural gas industry for Southern Africa requires that its gas policy and regulatory framework be coordinated between at least three countries, the Republic of South Africa, Namibia, and Mozambique. Attempts by the Republic of South Africa to establish independently a competitive natural gas market are doomed to failure because there are no local supplies of low-cost natural gas. Unless competition between gas suppliers is assured, opening the Republic of South Africa's gas market will only solidify the potential monopoly of gas producers in Mozambique and Namibia.

Of the three most important sectors of the gas chain the Republic of South Africa has sole jurisdiction over one, distribution, and partial jurisdiction over another, transmission. The competitive circumstances of these sectors of activity have been examined at length in the body of this paper and are summarized briefly here.

The two retail gas distribution systems in Johannesburg and Cape Town are small, antiquated and costly. Other residential areas are spread out and expensive to serve. Without significant residential and commercial demand for space heating, these systems are unlikely to generate sufficient volume of demand to warrant a massive expansion which might lower costs and prices. Government intervention in this activity (fixing retail rates based on cost) would have little or no impact because there is probably no realistic way to get costs down.

In contrast, there is potential natural gas demand in the industrial sector, for ore processing, power generation, petro-chemical production and the like. Potential industrial users in South Africa are, however, sophisticated buyers with a variety of fuel choice options. In particular, most of them can manufacture or buy coal gas at around \$3 per Gj. This puts a lid on gas prices at a level roughly equivalent to delivered gas prices of the major industrial countries. The cost, and present price of coal gas, is about the level at which, for example, Pande natural gas can be delivered to the Johannesburg areas. At these price levels, however, there will be little or no benefit from the reduced cost to South Africa's industrial consumers and natural gas will penetrate the market very slowly, if at all.

The widespread availability of cheap coal and manufactured coal gas will cap delivered natural gas prices and eliminate the need for price regulation. Why, then, worry about open access on transmission pipelines? As long as there is a single gas producer, open access will not help South Africa's industrial gas consumers. Open access simply moves the monopoly upstream. In may, in fact makes things worse, since bilateral monopoly would be replaced by unilateral monopoly.

For a competitive solution, pipeline open access has to be accompanied by competition among both gas consumers and gas producers. All three sectors of the gas chain have to be open and competitive. By all accounts, the gas fields in Namibia and Mozambique are prolific and can be developed at reasonable cost. Once a transmission pipeline penetrates either of these regions there are likely to be additional discoveries. If these discoveries are made by different companies than those developing the Pande and Kudu fields, the producing sector is on its way to becoming a competitive market. But, these new market entrants must have the right to explore and develop new properties. They must also have the right to ship gas on existing trunk lines. In other words, "open access" must be applicable across the entire transmission pipeline system, not just in portion of the system within the jurisdiction of the Republic of South Africa.

The open competitive solution described above requires negotiation and agreement with Southern Africa's neighboring countries. No one country can unilaterally assure a competitive solution. In the absence of such an agreement, it would be unwise for South Africa to open its gas market to a preordained monopoly.