



THE JAMES A. BAKER III
INSTITUTE FOR PUBLIC POLICY
OF
RICE UNIVERSITY

*UNLOCKING THE ASSETS: ENERGY AND THE FUTURE OF CENTRAL
ASIA AND THE CAUCASUS*

**CASPIAN GAS EXPORTS: STRANDED RESERVES
IN A UNIQUE PREDICAMENT**

IRA B. JOSEPH
*FORMER EDITOR-IN-CHIEF
WORLD GAS INTELLIGENCE*

PREPARED IN CONJUNCTION WITH AN ENERGY STUDY BY THE CENTER FOR INTERNATIONAL POLITICAL ECONOMY AND
THE JAMES A. BAKER III INSTITUTE FOR PUBLIC POLICY
RICE UNIVERSITY – APRIL 1998

Introduction

Standard practice in the energy business correlates new areas of opportunity with old areas of success. The Caspian region marks the latest in this trend, with most people in the business describing it as "the next North Sea" or "next Alaska," alluding to key oil and gas development areas over the past 30 years that have marked the cutting edge of the business. But the Caspian region cannot be looked at as the "next anything" because its assets and liabilities provide very unique problems within the world of energy development. Landlocked and practically surrounded by countries that could be better served by having the Caspian remain dormant, the gas producing countries of Central Asia and the Caucasus have an uphill task confronting them in creating commercial export plans.

Several countries in the Caspian Basin have ample enough reserves to support export projects including Turkmenistan, Kazakhstan, Uzbekistan and Azerbaijan. The purpose of this paper is to investigate whether the natural gas supplies from these countries can be transported to a market economically. However, economics may not be the sole determining factor of whether the region will become a major gas exporter in the coming years. Other variables, including politics, will play a role as well.

Two basic routes are being discussed to export 2-billion cubic feet per day of gas from Turkmenistan to either Turkey or Pakistan/India. The Turkish route passes through 1,200 km of Iran, while the Pakistan route traverses 770-km of Afghanistan. The route to Turkey faces political obstacles, although the biggest problem in executing this project will be commercial. The route to Pakistan has few commercial problems, but is fraught with political instability and therefore will have an extremely difficult time garnering finance from commercial lending institutions.

While many analysts point to the political problems that might block Turkmenistan from exporting gas to Europe via Iran, Russia, Azerbaijan or Georgia, the core problem remains commercial viability. Serious questions linger about whether there is a market for the gas at all in an already crowded European market, where much of the buying is already tied up in long term take-or-pay contract structures that make barriers to new suppliers formidable. The key to

whether Turkmenistan can find a market in Europe will rest on the political decision among buyers to opt for supply diversity over price. Turkmenistan and Iran will also have to be willing to sell gas at bargain basement prices in order to monetize otherwise idle and stranded reserves. Otherwise, any country in Europe could buy as much gas as they want for the next 40 years from existing suppliers-Russia, Norway, Algeria, the Netherlands, and the UK-- that could increase sales more easily and at lower prices than any potential export route from the Caspian.

Iran's eagerness to establish an export link to Europe could greatly help Turkmenistan initially find markets, as Tehran is not just interested in profiting from Turkmen gas transit fees, but establishing a baseload market for itself in Turkey and Europe.

In terms of commercial viability, the best option for gas exports from the Caspian region appears to be sales directed at Pakistan and India. These markets provide almost unlimited demand growth for gas and an ability to pay prices that could finance the pipeline and reward producers in Turkmenistan with acceptable wellhead earnings. The major problem with this option is that the gas must travel through Afghanistan to connect with the Pakistani gas grid. Creating a stable environment in Afghanistan along any pipeline route remains problematic, but may still be feasible, as the Taliban-led Afghan government is believed to be in control of 80% of the country. Stability of the existing regime remains in question, however. A pipeline route would benefit most people and places along the stretch by providing jobs and a steady source of income for decades. However, the pipeline would not benefit all parties to the country's conflicts. This could mean the pipeline would be a lightning rod for regional conflict much the way oil pipelines have attracted guerilla attacks in Colombia.

The greatest barrier to the Pakistan project is financing. It will be extremely difficult to convince the banking world to loan over \$1.4-billion (70% of the project's estimated cost and a standard debt-equity ratio on lending in the energy sector) to build a line through Afghanistan because the risks are simply too great. Instead, the project is likely to need multilateral backing such as the World Bank or to find backers that can finance the project from equity. None of the companies presently looking at the Afghan route can afford to pay for it themselves, so the project is in danger of being slowed by a financial morass.

Also threatening a Turkmen-Afghan-Pakistan connection is a competing proposal for an Iranian export pipeline. Iran, which has even more reserves than Turkmenistan and a common border with Pakistan, is investigating whether to build a pipeline along its southern coast that would connect its South Pars offshore gas field to the Pakistan grid. This project has developed to the point where foreign partners like Royal Dutch/Shell and Russia's Gazprom have been brought in to assist. However, Pakistan's shortage of gas is so acute, both projects could prove viable.

The construction of a natural gas export route from Turkmenistan to Pakistan could foster regional cooperation in the Caspian as other regional producers like Russia, Kazakhstan, and Uzbekistan could eventually link in to the eastern gas line. The potential for demand growth in the Asian market is nearly unlimited at prices that both buyers can pay and suppliers can profit. This is in sharp contrast to routes to Europe where the regional producers would likely find intense competition among themselves for a limited market. Russia, Turkmenistan, Kazakhstan, and Uzbekistan have all publicly noted their interest in working jointly toward an eastern corridor. In the first stage of development, Turkmenistan is likely to provide most or all of the gas, with incremental supplies coming later from other countries. Since Pakistan and India's demand for gas has nearly no ceiling --at prices around of \$2 per mmBtu-- several suppliers could be considered once Turkmenistan gets the export ball rolling. However, there's no guarantee that Turkmenistan will not try to go it alone, leaving other suppliers with only small regional markets to tap.

Caspian Gas Export Options

Exporting gas from the Caspian region presents a difficult problem on several levels. If exporting were merely an exercise in creating profitable economics, at least three export routes would probably be in place by the turn of the century.

The first wave of problems facing Caspian gas exporters comes rushing in on the political front in areas that have little to do with gas and a lot to do with everything from superpower politics to the Arab-Israeli conflict. After the complicated political web created by the sordid relationships among the US, Iran, Afghanistan, Russia and the Caspian nations themselves are factored in, gas

exports become a political mine field. This minefield is traversable, but could take years to navigate.

Commercial Barriers To Europe

Commercial considerations do not seem to point to an easy road for Caspian gas in Europe. Competition in the European market is quite intense, and while buyers might welcome another supply source, there is more than enough gas available for quite some time from existing suppliers such as Russia, Norway, Algeria, the Netherlands and starting in October, the UK. Russia, for its part, has displayed an inclination to prevent Turkmen gas from reaching Europe, as it would constitute direct competition in eastern and southern Europe over a similar or even shorter distance.

Russia is also concerned that a Turkmen line through Iran would also open up the possibility of Iranian gas sales in Europe, thereby augmenting gas on gas competition in an already increasingly crowded market. Kazak exports from one of its two large field are likely to reach Tajikistan or Kyrzistan, but sales to Europe are unlikely without the direct involvement of Russia's Gazprom as a transiting agent. The great wildcard on exports to Europe is Azerbaijan, which has more than enough gas to export, but is more focussed on oil field development and domestic gas utilization.

Even without Caspian gas factored in, competition for gas markets in Europe is going through a revolutionary change. Traditionally, large producer and consumer groups controlled European gas markets. Countries like Norway or Russia made huge long-term deals with one or two large buyers such as Ruhrgas in Germany or Gaz de France, where these companies held virtual monopolies over imports because they owned the pipelines and would not allow others to access their infrastructure. These transmission companies would then resell the gas to local distribution companies or directly to endusers, building in an extremely comfortable margin for themselves. Gas would be priced in competition with fuel oil and coal. Prices do not move based on changes in the spot market, largely because there is almost no spot market and therefore no gas on gas competition.

Gas Prices

(\$ Per mmBtu)

Europe UK US

1993 2.50 -- 2.00

1994 2.20 -- 1.80

1995 2.40 -- 1.50

1996 2.40 1.80 2.10

1997 2.60 2.00 2.20

Source: BP, WGI

The rise of more liberalized markets in North America and the UK is ushering the forces of change towards Europe. Pipeline companies like Ruhrgas or Gaz de France may soon be asked to open up their assets to third party access. This change, now being discussed as part of the European Union's Gas Directive, could open up the market to direct gas on gas competition. This type of competition has lead to sharply lower gas prices in the US and UK relative average border prices in Europe.

The EU gas directive may bring some competition to markets for larger consumers such as heavy industry or power generation. Currently, most of these buyers are under long term take-or-pay contracts with suppliers like Ruhrgas or Gaz de France, who in turn have iron clad long term deals with suppliers like Russia, Norway, or Algeria. However, the opening of the UK-Belgium Interconnector pipeline could begin to create some gas on gas competition in Europe, even though half the pipeline's capacity is already sewn up in deals that are three years long or greater. Given that most European gas deals in the past were at least 10 years long, Interconnector sales are clearly a step towards a more competitive environment.

Competition or liberalization in Europe would be a double-edged sword for Turkmenistan and its Caspian brethren. On the one hand, gas on gas competition opens up the possibility of marketing

opportunities in Europe. However, competition is also likely to lower price, which means that it will be even harder to Caspian suppliers to beat existing baseload suppliers on price.

Despite the hurdles, Turkmenistan could make inroads into European markets several ways. One way would be to create strategic alliances with potential endusers such as Shell, Amoco, Mobil, or Enron. These firms are building power generation businesses in Europe that are intent on finding their own supplies of gas and not having to go through the traditional transmission companies. Turning gas into electricity provides companies several ways to protect their margins, making the possibility of buying gas at a higher price an option if the power sales can make up the difference. Enron has been a pioneer in this field in the US, although European markets, especially in the poorer south, introduce the problem of currency risk, as the gas must be bought in dollars and the power must be sold in local currency. Such a problem has recently ground gas-fired power generation projects to a halt in Asia, where currency devaluation has made gas imports too costly.

Shell, which has been hired to conduct the feasibility study on the Turkmen-to-Turkey pipeline, is already contemplating a marketing alliance with Turkmenistan as a supply source for its power generation business that it intends to build with Bechtel through their co-owned Intergen subsidiary. In addition, Shell also owns large stakes in several of the existing European gas majors such as Ruhrgas, Gasunie of the Netherlands, and Distrigaz of Belgium, leaving Shell in a position of creating competition with its own highly profitable assets. This strange and seemingly contradictory position could provide Turkmenistan with an opportunity to make inroads, although once again, competitive pricing from other suppliers could provide a major constraint.

This scenario is not true in Turkey, where state Botas will remain the monopoly importer, especially now that Turkey has been rejected for admission to the EU and therefore is unlikely to follow its Gas Directive. Botas have a preliminary agreement to import Turkmen gas but pricing details are far from resolved. Botas has so many supply suitors that is likely to squeeze every last cent out of potential suppliers, lessening the attractiveness of the Turkish market. Turkey's potential import options include pipeline gas from Russia, Norway, the UK, Algeria, Libya, and Egypt (Amoco and ENI want to build a direct line under the Mediterranean), while LNG imports

could come from almost any one of the world's nine current suppliers, not to mention new sources such as Trinidad, Oman, or Nigeria.

Turkmenistan: The Gas Export Anchor

Turkmenistan's gas reserves may be the greatest of the untapped oil and gas reserves in the Caspian region. What distinguishes Turkmenistan from all other gas producers in the region is that it has a significant track record as a proven exporter of gas prior to the break-up of the Soviet Union and in recent years to Ukraine. Granted this export route, Russia, has been closed off indefinitely, if not in perpetuity, by Gazprom, who has said on numerous occasions that the days of Turkmen gas transiting through the Russian system are over. But it does leave Turkmenistan with a significant amount of domestic infrastructure to take gas to its borders. Given the transportation difficulties encountered by many aspiring gas and oil exporters in this part of the world, this fact is not insignificant.

In 1991, BP's Review Of World Gas reported that Turkmen gas exports peaked at around 5-bcf/d, with over half of the volume going to Ukraine. Turkmenistan, whose economy depends heavily on revenues from gas exports, has been severely hit by cuts in exports through Russia, its main outlet for sales of gas abroad. Gas output halved in 1997 to only 1.7-bcf/d from 3.5-bcf/d in 1996, while gas export revenues shrank to just \$274 million from \$956.9 million in 1996. Plenty of countries have untapped oil and gas resources, but no country has this amount of untapped infrastructure, which makes it unique among the world's major energy producers. Re-establishing links to export markets in Ukraine are problematic, as it would require successful renegotiations with Gazprom over transit rights. Instead, Turkmenistan will likely have to create new export outlets to either Europe or Asia.

Turkmenistan still exports gas to many of its Central Asian neighbors on occasion, but these sales are small by comparison, and growth prospects are limited. Once again, Russia is a transit country and new links would have to be built, which is unlikely considering non-payment is already a serious problem. Debts owed to Turkmenistan for its gas exports continue to be an important problem and continue to hamper its economic recovery. Several former Soviet countries that receive natural gas from Turkmenistan via Russia owe significant amounts of

money to Turkmenistan. Ukraine, Georgia, Kazakhstan, Uzbekistan, and Azerbaijan combined owe Turkmenistan in excess of \$1 billion. In response, Turkmenistan has periodically threatened and at times actually terminated transport of gas supplies to several of these countries.

Europa Europa

Turkmenistan's gas exports are constrained because it is in the interest of so many others to keep them that way. To the north and west is Russia, which has more gas than it knows what to do with in nearby sedimentary basins that are vying for the same markets. These markets mainly focus on eastern and southern Europe, where gas demand is growing at over twice the rate of more established markets in northern and western Europe.

Russia has allowed Turkmenistan to sell its gas to Ukraine through the Gazprom system since the breakup of the Soviet Union. Exports have been erratic because payments among the Ukrainians, Russians, and Turkmen's have fallen behind at times, creating huge debt positions. Gazprom charges companies around 4.8c per mmBtu per 100 km to use its pipelines, up from 4.2c prior to 1997. This implies a price of around 75c per mmBtu of transit costs for the 1,500 km journey through the Russian system. The Turkmens have been selling gas at the Uzbek border for around \$1.16 per mmBtu. At the Ukraine border, the delivered price was around \$2.25 per mmBtu prior to the cut-off in sales, leaving a sizable profit (around 80c per mmBtu) for any company that could make the trade work. Quite a few trading companies have agreed to pay over the past five years, but few have delivered, as exacting anywhere near \$2.25 per mmBtu from Ukraine has proven to be difficult, if not impossible. Sizable debt of hundreds of millions of dollars has accrued due to failed trading schemes in recent years.

Keeping Turkmen gas out of Europe is also in the interests of any producer in Algeria, Norway, the UK, Libya, Egypt and any LNG producer that has designs on entering the European market. Allowing Turkmen gas to flow freely into the European market as an incremental source could end of slashing prices. Given its huge resource base, Turkmenistan's entry to the market could play havoc on the economics of gas pipeline and LNG project targeting Europe, which both incur high up front costs and are already notorious for a lower and long rate of return than oil. Former

Algerian oil minister Nordinne Aut Lassounie estimates that on average, the rate of return on new oil projects is still around 30% while gas projects are lucky to attain 20%.

Turkmenistan's primary target for a gas market in Europe is Turkey, a country where gas still accounts for less than 10% of primary energy demand, and no major cities are attached to a grid other than Istanbul. Turkmenistan's access to Europe runs straight through Turkey, but gaining access to the Turkish landscape is no easy prospect: either move the gas through Iran or through the Caspian Sea via Azerbaijan which has its own gas to sell and Georgia.

Turkmenistan is pursuing both of these options, which are backed by major adversaries, namely the governments of Iran and the US respectively. The US, but not strongly enough to prevent a recently opened link to be successfully built in less than six months, opposes the Iranian option. Adding to the complication is Turkmenistan's close relationship with Israel through the Israeli company Merhav. Israel is clearly at odds with Iran, but must place greater priority on furthering the evolution of political and economic relations with the more secular Muslim states of the Caspian region. Israel's credit agency has just signed on with Turkmenistan to help finance the modernization and expansion of the country's domestic gas grid. In essence, Israel has more to gain from developing Turkmenistan as an ally than to gain by protesting the Turkmen-Iranian gas connection.

As stated by Clinton administration official Bruce Riedel, Senior Director for Near East and South Asian Affairs at the National Security Council, at a recent Baker Institute meeting on Iran, the US prefers a subsea link to Turkey through Azerbaijan and Georgia, but this plan runs afoul of Russian intentions to link its grid to Turkey through Georgia or under the Black Sea. Any infrastructure built in Georgia will likely need the nod from Russia's Gazprom, which has tremendous influence in the region and whose powerful chairman, Rem Vyakhirev, is Georgian. Creating transit agreements across this route proves to be a difficult task, as drilling rites within the Caspian Sea are far from resolved and both upstream and downstream details are likely to be linked if any resolution were to come to fruition.

To compete, either of the Iranian route or the Azeri route will have to provide a delivered price of the gas within 10c-15c per mmBtu of the Russian price of gas at the German border, which is

the benchmark for the European market. European border prices are hovering between \$2.50 and \$3 per mmBtu at the moment and are likely to fall during the coming decade.

Landing gas in Turkey and Europe at current European prices is not impossible from Turkmenistan, but it would require a drop in what it costs to produce Turkmen gas. Currently, European gas prices are connected to European gas oil, fuel oil and coal quotes, but are likely to be decoupled over the next decade as pricing based on gas-on-gas competition replaces interfuel competition as the market maker. This shift only serves to hurt any incremental supplier with potentially high transportation costs.

The economics of shipping gas across Iran to Turkey and beyond depends on at least 5 variables, including size of the pipeline, number of gas compressors, volume of gas, terrain, and distance. Then there are the financial variables that include interest rates, payback period, present and future pipeline value, and risk insurance. Shell is in the process of spending millions of dollars to do so, but rough estimates can be made. To produce gas in Turkmenistan, government and private company estimates fall in the 30c-60c per mmBtu range. Turkey has said that it is willing to buy the gas at its border for \$2.60-\$2.70 per mmBtu. Turkmen government estimates put the cost of producing and shipping this gas to the Uzbek border at 90c per mmBtu, but given that the primary field in question is on the Iranian border, only production costs could be factored in.

While Russia charges only around 90c per mmBtu to ship across 1,500 km of pipeline to Ukraine--the pipeline is fully amortized, has extremely low operating costs and spare capacity--shipping the same amount of gas across Iran is likely to be up to twice as much in order to make the new pipeline financible, not to mention paying a tariff to the Iranians. The financial costs tied to transport for new pipelines are estimated to be around 70%-80% of the project. Therefore, gas flowing through the pipeline will have to generate enough cash flow to cover these costs. In this case, this pipeline would need to generate around \$1.50-\$1.75 per mmBtu based on an average throughput of 500-600-mmcf/d, assuming a 10 year financing schedule at a 20% interest or discount rate and a \$1.6 billion dollar present value. (Note: a market for the full 2-bcf/d is not seen until 2010 at the earliest). Creating a return on investment of even 50c per mmBtu will be difficult under these circumstances, given that the Iranians will want some income for moving the gas through their territory. So far, Turkmenistan have shown great reluctance in selling gas to

any party at their border for less than \$1.10 per mmBtu. There may be some margin to serve as a basis for negotiation, but it will be difficult to make the many financial and commercial pieces fall into place.

The first spur of the new link has already been built and sends gas to northeastern Iran for domestic consumption in Iran. The pipeline, running from Korpedzhe in Turkmenistan to Kord Kuy in Iran, can deliver a relatively modest 400-mmcf/d compared to the 2-bcf/d scheduled to go to Turkey. Iran paid some 80 % of the \$195 million in construction costs, and Turkmenistan will pay back its debt in natural gas supplies within three years. Turkmenistan sells its gas to Iran at a border price of \$1.11 per mmBtu or \$40 per 1,000 cubic meters. If the same price were applied to gas sales to Turkey, this would leave \$1.50 per mmBtu in cash flow to finance the construction of the pipeline, not including Iran's transit fees.

It is important to re-emphasize that the biggest problem facing Turkmenistan is that at least three other countries--Russia, Norway, and Algeria--can already land gas more cheaply from ample reserves through existing links or ones under construction such as the Yamal pipeline and the UK-Belgium 2-bcf/d Interconnector pipeline. This gas can cover all the projected demand of the next 30 years. What's more, they could do it more cheaply than Turkmenistan, with Russia able to offer the cheapest prices; as low as \$2.20 per mmBtu by some estimates. Therefore, building a link from Turkmenistan will have more to do with Turkmen desires than the pull of European customers. Even Turkey has already committed to more gas than it will probably need by 2010 from existing pipeline suppliers and new LNG sources and this assumes almost no potential for an economic slowdown the likes of which have been seen in Asia.

Elsewhere in Europe, other buyers such as Ruhrgas, Gaz de France, or Enagas could step in and become a baseload customer in the name of supply diversification, but this seems unlikely as most have found at least three supply sources to help spur competitive pricing over the next few decades. Turkmenistan could find welcome buyers among Europe's emerging independent power market, but the barriers to entry will be significant.

Of the two options, running the line through Iran is the most cost-effective route, as Iranian pipeline infrastructure laid out across the northern part of the country already paves the way for

building additional pipeline capacity. Also, Iran is willing to pick up some of the tab for the project because it wants to export its own gas to Turkey and southern Europe. Whether Tehran has the funds is an entirely different matter, as the country is stretched to finance its equity share of several major oil projects that it hopes will boost oil production capacity. Iran has already built a spur from Turkmenistan into northern Iran to supply industrial buyers. This project was completed in less than a year with little fanfare, demonstrating that if Iran sees a commercial interest in building a pipeline to the Turkish border, it will try to do so despite any protestations from the US.

Iran may also pick up more of the financial burden in order to jumpstart its own export plans for gas. With 740-tcf of reserves, only 3.5-bcf/d of production and only tiny exports to Armenia, helping Turkmenistan export through Iran would facilitate Iran's long-term goal of becoming an even greater gas exporter than oil. Eventually, Iranian gas could displace Turkmen gas along the route. If the Turkmen deal is not completed in the next five years and Iran continues its warming trend with the US, Tehran could be in a position to export gas on its own and cut Turkmenistan or any other Caspian supplier out of the equation.

However, the multi-billion price tag may be too much for Iran to finance alone. The route through the Caspian would have to be backed by at least two major oil companies with deep pockets to cover at least 30% of the \$1.6-billion price tag. Shell is eager to be one of those companies and if it found the risk worth taking, could finance the project itself, given its over \$9-billion in cash on its books.

Any project involving major oil companies would have to come packaged with a traditional long term take-or-pay contract, which are under threat of disappearing as Europe liberalizes its gas markets. Companies potentially to be involved in such a pipeline are likely to link it to power plants expected to be built in Turkey. Likely candidates to be involved are Royal Dutch/Shell, Enron, Amoco, and Mobil, all of whom are seeking deals to build Turkey's next generation of gas-fired power plants.

In May 1997, Iran agreed to transit 770-mmcf/d of Turkmen gas through its land to Turkey beginning in 2000 to go along with the 387-mmcf/d of Iran gas at some later point. The financing

and timing of this project is dubious at best, but Iran met its commitment to open up a 200-km link to Turkmenistan in the first quarter of 1998 that will serve industrial users in northern Iran. By comparison, the length of a full Turkmen-Turkey link stretches almost 1,500 km. With Iran and Turkmenistan sitting on a huge percentage of the world's proven gas reserves, it is realistic to assume the longer pipeline could be built. But, first gas is unlikely to flow into Turkey by 2000 given the limited financial or technical resources in both countries. For Iran, the opportunity cost of a Turkmenistan project is great given its long list of commitments to more potentially profitable projects.

In February, 1998, Turkmenistan and Shell signed a separate memorandum of understanding (MoU) on a \$ 4 billion gas pipeline project along the same route through Iran to Turkey and beyond. Authorities in Turkmenistan, Iran and Turkey gave Shell the go-ahead to carry out a feasibility study on the 3,800 km line, to run from the Shatlyk field in eastern Turkmenistan, with recoverable reserves of 16-tcf of gas. The link would carry 3-bcf/d a year through Dogubayazit in Turkey, to Bulgaria and onwards to other parts of Europe. Half the gas will be delivered to Turkey, with the rest going to the European market.

The Asian Advantage

With fierce competition facing Turkmenistan to the west, eastern routes to Asia present a viable economic alternative. Sitting to the east and southeast are Pakistan, India, and China, which among them contain over 40% of the world's population, desperately need cleaner sources of primary energy and have no existing import links by gas pipeline or LNG. Global warming might also help spur international support for creating a larger market for gas in these countries, which will need to replace energy requirements derived from coal and oil. In Pakistan, coal accounts for 6% of primary energy demand while oil accounts for 50%. In India, coal accounts for almost 50% of primary energy, with oil another 33%.

Plans to build a 1,300 km pipeline to carry up to 2-bcf/d of gas of Turkmen gas to Pakistan and India via Afghanistan have been moving forward despite skepticism on the part of outside observers. As planned, the pipeline will travel 175 km in Turkmenistan, 770 km in Afghanistan and 547 km in Pakistan, with the consortium also planning an oil pipeline along a similar route.

Lead by Unocal and Saudi Arabia's Delta, a consortium known as CentGas has been formed to execute the project, which was scheduled to begin last December, but has not been able to get off the ground. The Unocal consortium plans to tap the 25-tcf Dauletabad-Donmez field in the Amu-Darya basin but faces a legal challenge from Argentine Bridas, which is trying to develop the 27-tcf Yashlar field in the Murgab basin northeast of Dauletabad.

Comparing Returns To Europe and Asia

The notional price of the gas has been set at around \$1.60-\$2.05 per mmBtu delivered to Multan in Pakistan's Punjab province, although a definitive agreement has not yet been announced by Unocal. Unlike the pipeline options to Europe, the economics of this project are quite discernable less one large and imposing obstacle: Afghanistan. If one assumes production and transport costs of up to 60 per mmBtu to take the gas to the Turkmen-Afghan border, this leave up to \$1.45 per mmBtu to break even on transit costs. Since the pipeline is some 430 km shorter than the Turkmen-Turkey route, transportation costs are at least one third lower (\$1-\$1.15 per mmBtu using lending assumptions above and a \$2.7-billion price tag) if the same size pipeline is taken into consideration. The higher costs come from the terrain and the additional compression needed to move larger volumes from the time of commissioning. It can be assumed that volumes averaging 1.5-bcf/d could be absorbed by Pakistan's well established gas grid and pent up demand for gas from power generators, industrial buyers, and fertilizer plants.

The transit fees are also likely to be much lower, at least during the costly front end years of the operation, because Afghanistan would rather have a low transit fee than none at all. By contrast, Iran would be more likely to peg its transit fee closer to the opportunity cost of moving the gas through Russia or Azerbaijan. Since a notional price of up to \$2.05 per mmBtu has been agreed, financing the pipeline will have to be covered by the \$1.50 per mmBtu or so left over, which must also include a transit fee for the Afghans. If delivered costs to the Afghan border are around 25c-30c per mmBtu, which is entirely possible given the short distances involved, profits of up to 75c per mmBtu are possible to the gas producers.

Afghanistan's long history of regional strife and fractured political organization argues against the \$2.7-billion gas pipeline in security terms. The current Taliban-led government in

Afghanistan does not appear to be able to reverse this trend, which is inhibiting financing. With Unocal and Delta buying the gas at the Turkmen border, the risk is squarely on the shoulders of CentGas, leaving any guarantees by the Turkmen government out of the question. CentGas officials maintain that Afghan instability is not an issue and that they've secured the political right-of-way along the route. However, CentGas officials do concede that financing is still a major problem and could continue to be so for some time.

While Afghanistan is a major hurdle, at least it is a definable one and unlike Europe, a market for the gas is not at all in question. Pakistan could easily buy 2-bcf/d of Turkmen gas, if not twice that amount given its lack of success in discovering and developing large-scale domestic fields. The final price of the gas will be an issue, but since Pakistan does not have access to any competing supply and is desperately in need of incremental volumes, negotiations could progress more rapidly than those with oversaturated European buyers. Any definitive agreement with the Taliban is likely to be challenged on several fronts, as the fundamentalist government has been flagged for all types of human and civil rights violations. However, Unocal is facing similar pressure in Burma and has managed to keep momentum rolling on its project there.

The most ambitious project in the running for Turkmen gas exports is a plan to build an 8,000 km pipeline through China to Japan. The pipeline would run along an existing route through Kazakhstan and connect to a new line built in China's western Xinjiang Autonomous Region and Tarim basin on its way to the eastern port of Lianyungang. Plans include a leg that would tunnel under the Yellow Sea, over South Korea and under the Sea of Japan. Almost any observer can see that this project is extremely ambitious. Given the unstable economic situation in Asia, it will be years before such a project could move forward. A more scaled-down version of the pipeline is possible that would serve China only, although the Chinese are likely to develop domestic sources and possibly LNG import before undergoing this bold project. Exxon, China's state CNPC, and Mitsubishi have also looked at various long distance options.

Kazakhstan's Options

With its 80 tcf of gas reserves, Kazakhstan certainly has the reserves to be a major gas exporter. However, its geography and traditional links to Russian gas infrastructure will make it difficult

for the country to find markets in either Europe or Asia. More than 40% of the country's reserves are located in the giant Karachaganak field in the northwest. To date, Karachaganak's gas processing is done north of the border at Russia's Orenburg facility. The current operations of Karachaganak are unsustainable for the international consortium that has bought into the field. Karachaganak gas is currently exported to the Orenburg facility, where a fee is charged for processing. The consortium must then buy its gas back from Orenburg at a price higher than the one for which it could be sold to Russia. While an agreement was signed between Kazakhstan and Russia to continue the cross border flow, other options are being explored.

While consortium partners are certainly interested in producing up to 900-bcf per year of gas, it is Karachaganak's potential of producing 200,000 b/d of oil and condensate that has investors interested in the field. Finding a market for 2.5-bcf/d of gas will not be easy. Currently Kazakhstan produces around 600-mmcf/d and imports another 450-mmcf/d, with no exports in the formula. Imports come into Almaty via Tashkent from eastern Turkmenistan. Kazakhstan has two separate pipeline grids; one that exports Karachaganak gas to Russia and one that import Turkmen gas for use in Almaty. Joining these two distinct and distant systems will be difficult.

Demand peaked at over 1.3-bcf/d in 1992, but has been falling more or less steadily since that time. A turn around is expected in 1998, as Belgium's Tractabel begins its 15-year contract to operate the Kazakh system. Barring a major economic downturn, new customers are likely to be hooked into the system, as Tractabel plans to invest \$600-million in expanding and upgrading the 700-mmcf/d system. A key project is a link to bypass Kyrgyzstan, which cuts the eastern grid in two at present.

Fields other than Karachaganak do not have access to export pipelines at all. Kazakhstan's other significant producing areas are the Tengiz and Zhanazhol fields. The undeveloped offshore areas are also believed to hold large amounts of gas. While these fields are near the Russian gas pipeline system, they are not currently linked to it, and capacity in the Russian pipeline system may be insufficient over the long term. Lack of access to export infrastructure means Kazakhstan's ability to export gas out of the Caspian region is questionable. Turkmenistan may not want to share its pipeline system to carry Kazakh gas to Europe or Asia given its own vast reserves.

The Chevron-led Tengiz project could build a gas pipeline parallel to the Caspian Petroleum Consortium pipeline now being built to take crude oil to the Black Sea. There, the Tengiz gas-reserves are proven at 13-tcf-could be liquefied and shipped or sold into markets ringing the Black Sea. The Russians are highly unlikely to go for such a project if its own gas did not predominate in the system. Tengiz currently produces around 125-mmcf/d, which is either sold to Kazak Power or Gazprom. There is also the giant Astrakhan field in the northwestern Caspian that sits between both Karachaganak and Tengiz. Italy's Agip holds equity stakes in both Karachaganak and Astrakhan so some type of joint development and export plan remains an outside possibility.

Economics do not prevent Kazakhstan from exporting. But Kazakhstan is unlikely to get access to routes through Russia as Gazprom stands to gain much more value in exporting its own gas along the same route.

If Kazakhstan is likely to make any headway on the export front, it will be through regional sales to regions of Uzbekistan, Kyrgyzstan, and Tajikistan. The Kazaks would like to replace their Turkmen imports with domestic production at a cluster of fields 400-km west of Almaty and export the surplus to the east and south. Sales to China or connection into the Unocal-led pipeline to Pakistan remain a remote possibility.

Azerbaijan

Azerbaijan could play an important role in Caspian gas exports as a key transit point to Turkey. The US Department of State has been pushing the idea that a gas pipeline from Turkmenistan across the Caspian and through Azerbaijan and Armenia and/or Georgia is a viable alternative to the northern Iranian pipeline. Under the scheme, both Azerbaijan and Turkmenistan would sell their gas along the route. The question of political obstacles to such a route remains a serious problem.

Much of Azerbaijan's gas development over the next 10 years will focus on developing domestic reserves located around Baku for domestic use in the oil and power generation sectors. According to a US Department of Energy study, natural gas production declined by 5 percent in 1996 to 630-mmcf/d. To meet domestic demand in the past, Azerbaijan had imported natural gas

from Russia, Turkmenistan, and Iran. However, state Azerigaz announced in March 1996 that it did not intend to import any more gas and instead would develop new gas fields in the Caspian Sea to meet demand. Azerbaijan could be self-sufficient in gas within 5 years, following a complete overhaul of the gas supply system, including replacing worn-out compressors and upgrading gas pipelines. The European Bank for Reconstruction and Development is also studying a proposal for the Kalmas gas storage project.

Increased oil production in the Caspian is also expected to increase gas production because most of Azerbaijan's natural gas production comes from associated gas from offshore oil fields. Additional gas production could also come from the recently discovered offshore Nakchivevan field, with an estimated 900 billion cubic feet of reserves. Azerbaijan is also boosting natural gas production by reducing flaring. As a result, gas production could increase by as much as 2.7-bcf/d and therefore Azerbaijan could become a net exporter of natural gas to its neighbors.

Uzbekistan

While not widely known, Uzbekistan is one of the 10 largest gas producers in the world. Since the fall of the Soviet Union, the country has made considerable headway in building its gas production from 4.1-bcf/d in 1992 to almost 5-bcf/d in 1997. Taking short-term steps to increase production at existing fields, most gas production increases have come from fields in southeast Uzbekistan in older fields such as Shurtan and Kokdumalak.

As part of an effort to become self-sufficient in energy, Uzbekistan has been developing domestic uses for its plentiful gas. Programs include conversion of cars and trucks to run on compressed gas instead of gasoline, and utilization of gas for feedstock at a new \$1 billion gas chemicals plant at the Shurtan gas field.

Of all the Central Asian gas producers, Uzbekistan has been the most resourceful in developing export markets. Cut off from larger European markets by Russia, Uzbekistan has acted regionally to establish an export market for up to 250-mmcf/d of sales to its neighbors. However, rising domestic consumption and several large unpaid bills by Kazakhstan since 1996 has cut into export rates. Some of the country's exportable surplus has been sold to Ukraine via Russian pipelines, but Gazprom has exacted some very large fees, making this route an unlikely option

for the future on a sustainable basis. Of all the Central Asian countries, none has put more effort into coordinating some sort of transit agreement with Gazprom that would open up the Russian network. Several international companies such as Enron has been trying to broker such an agreement but none has come to pass.

Conclusion

Turkmenistan has emerged as the leader of potential natural gas exporters from the Caspian region. After several years of looking at every export option possible, developments are gravitating towards the most logical of the new possibilities, an export route through Iran to Turkey or through Afghanistan to Pakistan and India.

Of these two projects, Pakistan is the much better of the two commercial opportunities, given the shorter distance and the lower transit costs through Afghanistan. However, obtaining the necessary financing of nearly \$1-billion for the project will prove to be difficult from commercial sources, as Afghanistan is considered too great a political risk. International lenders such as the World Bank may be interested in such a project because it would provide a steady source of income for Turkmenistan and Afghanistan while promote international environmental and energy efficiency goals by cutting coal and oil use in Pakistan and India.

Delivering gas over 1,200 km to the Turkish border at prices competitive with alternate suppliers in Russia, Norway, Algeria and the UK will be difficult to achieve and may result in gas prices in Turkmenistan that are below the current cost of production. The economics of the project may change over time as prices in Europe are falling due to the emergence of competition. Iran has a long-term interest in seeing the pipeline built because it will provide an outlet for its own sizable gas reserves, so it is likely to be flexible in creating a transit fee structure. Iran would gladly offer lower transit fees in exchange for more financing from other sources such as major oil companies. Shell, which is engaged in the official transit study for the pipeline, is a likely source. Most parties support this route, except the US government, which is trying to keep Iran, isolated from regional energy infrastructure developments. However, the US position in this matter appears to be weakening, which means that Turkmen gas could find its way to Turkey via Iran as early as 2002 if the proper commercial conditions could be established. .

The US government has several options if it wishes to stop this project. The most obvious is applying pressure on the Russian government and Gazprom to open up its existing pipeline links to Turkmen, Kazak, and Uzbek gas to third party access. However, Gazprom Chairman Rem Vyakhirev has spoken out against such cooperation. Vyakhirev appears more interested in opening up Turkmen, Kazak, and Uzbek pipelines to Russian gas sales to Pakistan and India.

A coordinated effort by all potential Caspian exporters will not help facilitate an export route. Turkmenistan will remain the key player in the region and doesn't need other producers to attain adequate export volumes. Kazak and Uzbek gas development is likely to focus on domestic and regional export markets.

Azerbaijan is the regional wildcard. It is at the center of significant financial investment by the world's largest oil companies, which may quickly want to monetize gas assets once oil field developments have been completed. Azerbaijan's short route to Turkey-either via Georgia, Armenia, or Iran- and potential cost savings of producing associated gas may make it an important exporter if those producing oil companies decide to prioritize gas development. The economics of producing associated gas as part of an oil field development create substantial savings at the wellhead and therefore allow more flexibility in terms of transport costs.

Caspian gas exporters have to be concerned about time. The window of opportunity for creating a gas grid to exploit their resources will not be open forever. In general, whatever the Caspian region could potentially do with its gas, Mideast producers could do at lower prices, with higher margins and armed with deeper pockets. Both Iran and Iraq have considerable gas reserves that could be sold to either Asian or European buyers. Both countries are eager to develop gas reserves as a means of fending off domestic demand for crude oil that would cut into exports and as an alternative source of revenue that would be less politically sensitive than oil.

Iran is already opening up sizable gas fields to foreign investment and has its eye keenly fixed on Pakistan and India as markets. At some point, Iran's willingness to cooperate with Turkmenistan could quickly dry up if it thinks it can attract the market and capital on its own. Political situations make this unlikely at the moment, but five years from now, things could be considerably different.

Iraq also has huge gas reserves numbering 120-tcf and a common border with Turkey. Plans have already been drawn up by Iraqi State Oil and Gas concern, SOMO, to put certain gas fields out to international tender once US sanctions have been lifted. Even Saudi Arabia is a potential threat to Caspian exporters. While Saudi Arabia has shown no desire to export gas under the rule of oil minister Ali Naimi, this could change after the minister retires or is replaced in the future. Saudi Arabia consumes only 4-bcf/d of gas despite holding 250-tcf of gas reserves. If Caspian producers do not find a way to cooperate in the near future, potential Mideast partners could quickly become formidable competitors.

Gas Production Forecasts (in mmcf/d) Year 2000 2005 2010

Armenia 0.0 0.0 0.0

Azerbaijan 700 1,000 1,500

Georgia 50 100 200

Kazakhstan 900 1,500 2,300

Kyrgystan 10 15 20

Tajikistan 10 15 20

Turkmenistan 5,500 6,500 9,000

Uzbekistan 5,300 5,800 6,500

Source National authorities, gas companies

Note:

Mr. Ira Joseph recently finished a nine-year term at Petroleum Intelligence Weekly, where he was editor-in-chief of World Gas Intelligence, a leading BI-monthly publication on international gas. He now consults for gas companies looking to create an international portfolio.