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Energy Sector Management Assistance Programme

Kazakhstan

Natural Gas Investment Strategy Study

Volume 1

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ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

PURPOSE

The Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) is a special global technical assistance program run by the World Bank's Industry and Energy Department. ESMAP provides advice to governments on sustainable energy development. Established with the support of UNDP and 15 bilateral official donors in 1983, it focuses on policy and institutional reforms designed to promote increased private investment in energy and supply and end-use energy efficiency; natural gas development; and renewable, rural, and household energy.

GOVERNANCE AND OPERATIONS

ESMAP is governed by a Consultative Group (ESMAP CG), composed of representatives of the UNDP and World Bank, the governments and other institutions providing financial support, and the recipients of ESMAP's assistance. The ESMAP CG is chaired by the World Bank's Vice President, Finance and Private Sector Development, and advised by a Technical Advisory Group (TAG) of independent energy experts that reviews the Programme's strategic agenda, its work program, and other issues. ESMAP is staffed by a cadre of engineers, energy planners, and economists from the Industry and Energy Department of the World Bank. The Director of this Department is also the Manager of ESMAP, responsible for administering the Programme.

FUNDING

ESMAP is a cooperative effort supported by the World Bank, UNDP and other United Nations agencies, the European Community, Organization of American States (OAS), Latin American Energy Organization (OLADE), and public and private donors from countries including Australia, Belgium, Canada, Denmark, Germany, Finland, France, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Sweden, Switzerland, the United Kingdom, and the United States.

FURTHER INFORMATION

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Kazakhstan

Natural Gas Investment Strategy Study

Volume 1

Executive Summary and Main Text

December 1997

Energy Sector Management Assistance Programme
(ESMAP)

Oil and Gas Division
Industry and Energy Department
The World Bank

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Abbreviations and Acronyms

BCF	Billion Cubic Feet (10^9 CF)
BCM	Billion Cubic Meters (10^9 CM)
BOD	Barrels of Oil Equivalent per Day
BOE	Barrels of Oil Equivalent
BOO	Build-Operate-Own
BOT	Build-Operate-Transfer
BOTAS	Turkish State Oil and Gas Company
BTU	British Thermal Units
CA	Central Asia
CAC	Central Asia Center
CAPEX	Capital Expenditure
CCGT	Combined-Cycle Gas Turbine
CIF	Cost, Insurance, and Freight (included)
CIS	Commonwealth of Independent States
CHP	Combined Heat and Power Plant
CM	Cubic Meter
CO_2	Carbon Dioxide
DFO	Distillate Fuel Oil (gas-oil)
EPC	Engineering, Procurement, and Construction
ESMAP	Energy Sector Management Assistance Programme
ESR	Energy Sector Report
EU	European Union
FE	Far East
FGD	Flue Gas Desulphurization plant
FO	Fuel Oil
FSU	Former Soviet Union
G-7	United States, Japan, Germany, United Kingdom, France, Italy, and Canada
GDP	Gross Domestic Product
GEF	Global Environmental Facility
Gwh	Gigawatt Hours (10^9 Wh)
HSE	Health, Safety, and Environment

IBRD	International Bank for Reconstruction and Development
IEA	International Energy Agency
IFC	International Finance Corporation
IOCs	International Oil Companies
IPP	Independent Power Plant
Kwh	Kilowatt Hours (10^3 wh)
LDC	Local Distribution Company
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LRMC	Long-Run Marginal Cost
LSTK	Lump-Sum Turnkey
MCF	Thousand Cubic Feet
MCM	Thousand Cubic Meters
MMCM	Million Cubic Meters
ME	Middle East
MENR	Ministry of Energy and Natural Resources
MG	Ministry of Geology
MIGA	Multilateral Investment Guarantee Agency
MMBTU	Million British Thermal Units
MMSCFD	Million Standard Cubic Feet per Day
MMTCE	Million Tonnes of Coal Equivalent
MMTOE	Million Tonnes of Oil Equivalent
MOG	Ministry of Oil and Gas
MW	Megawatt
NG	Natural Gas
OECD	Organization for Economic Cooperation and Development
Opex	Operating Expenditure
p.a.	Per Annum
PSC	Production Sharing Contract
RFO	Residual Fuel Oil
R/P ratio	Reserves-to-Production Ratio
SA	South Asia
SAR	Staff Appraisal Report
SCF	Standard Cubic Feet measured at 60°F and 30 inch Hg
SEA	Southeast Asia

TCM	Trillion Cubic Meters (10^{12} CM)
TCE	Tons of Coal Equivalent
TOE	Tons of Oil Equivalent
UAE	United Arab Emirates
UGSS	Unified Gas Supply System—the transmission network of the former Soviet Union
WB	World Bank

Definitions

OECD Europe: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

Eastern Europe: Poland, Czech Republic, Slovakia, Hungary, Rumania, Bulgaria, Slovenia, Croatia, Bosnia and Herzegovina, and Yugoslavia (Serbia).

Former Soviet Union (FSU): Central Asian States—Kazakhstan, Uzbekistan, Turkmenistan, Kirgizistan, and Tadjikistan. Caucauses—Georgia, Armenia, and Azerbaijan. European part—Russian Federation, Ukraine, Belarus, Moldova, Lithuania, Estonia, and Latvia.

Units of Measure

Natural Gas:

1 MCF (1,000 CF) = 28.32 cubic meter = about 1 MM BTU = 252,000 Kcal

1 CM = about 9,000 Kcal

1 BCM = 35.3 BCF = about 0.9 MM TOE = about 1.35 MMTCE = (about 2.7 million tonnes of lignite)

LNG 1 ton = LNG 2.35 m^3 = about 1,400 m^3 of natural gas

Energy & Power:

1kwh = 3,412 BTU = 860 Kcal

1,000 Kwh = 3.412 mm BTU

1 MW = 1,000 KW

1 GWh of electricity consumes approximately:

250 tons of oil in an oil-fired conventional steam-power plant

390 tons of coal in a coal-fired power plant

8,000,000 CF of natural gas in a combined-cycle power plant.

Currency Unit

75 Tenge = US$1 as of April 1997.

Note

All dollar figures in the report refer to U.S. dollars ($).

Executive Summary

Overview

1 With proven gas reserves of about 2 trillion cubic meters and the potential to produce in excess of 35 billion cubic meters (BCM) annually, Kazakhstan possesses a significant energy asset. To date, however, only limited development of this gas resource base has occurred. Gross production, which has largely been limited to associated gas, peaked at about 8 BCM in 1992, and then declined. In 1996, gross production is estimated at 6.6 BCM, including 2.2 BCM consumed in the oil fields. In order to exploit this asset fully, however, a number of challenges must be overcome.

a. Kazakhstan has considerable hydrocarbon liquid (oil and condensate) resources, which have attracted extensive international investment interest. Much of Kazakhstan's gas will be produced in association with these liquid resources. Consequently, exploitation of the country's hydrocarbon liquid resources will become constrained if new market outlets are not developed to accommodate the gas produced in association with the oil and condensate. This would have major ramifications for the revenues expected from the oil and condensate production. These gas markets must be developed despite the following constraints:

- The pipeline infrastructure in the country was designed as part of the overall transmission system of the former Soviet Union. As a result, the existing system does not permit Kazakhstan to operate in a self-sufficient fashion (nor would it make economic sense to attempt to do so—energy independence is not an economically viable option). The country is dependent on gas imports from Turkmenistan, Uzbekistan, and Russia to meet its domestic requirements; in 1996, about 5 BCM were imported.
- Domestic gas consumption, which totaled 11.2 BCM in 1991, has been declining since then; 1996 consumption is estimated at 7.8 BCM. The decline in domestic demand is a reflection of the economic difficulties the country has faced in the years since independence. Potential demand, however, has been further constrained by limitations on the availability of imports in the south brought about by pricing issues and associated payment terms for imported gas. (Turkmenistan has indicated that it is both willing and able to increase sales to Kazakhstan, provided that it receives timely payments.) Growth in domestic demand will also be constrained by the scope of the existing transmission and

distribution facilities and by the need to ensure that the substitution of gas for other fuels is economical. While domestic consumption levels are expected to recover, it appears unlikely that the country can return to 1991 consumption levels much before 2005, when domestic gas consumption is projected to total about 12.1 BCM. In 2010, domestic consumption is projected to total about 13.3 BCM.

- Kazakhstan lacks an export marketing capability. In seeking to establish an export market position, it will encounter competition from Turkmenistan, possibly Uzbekistan, and, most significantly, Russia, which effectively controls access to the European markets.

b. While some expansion in the domestic use of gas is both economically and environmentally attractive, the gas companies lack adequate commercial focus and are experiencing significant financial difficulties (unless prompt action is taken, their financial position, which borders on insolvency, will become untenable). A turnaround in the financial and operating performance of the domestic gas companies is essential if the sector is to develop. Indeed, without such a turnaround, there is a significant risk that the entire domestic gas sector will collapse. (The foreign exchange issue will be a particular concern in seeking financing for domestic projects, which will not generate foreign exchange revenues.)

c. Development of the gas sector will require significant levels of investment, largely in the form of hard currency. The availability of financing for these investments will be based on the economic viability of the projects, the likelihood of the gas being paid for, and the assurance that foreign exchange will be made available to repay the loans.

d. The existing legislative and regulatory framework does little to support the constructive development of the gas sector. In addition, pricing procedures need to be modified if an environment is to be established that will foster development of the sector.

e. Geographical factors will adversely affect the cost of developing Kazakhstan's gas resources. The bulk of the country's gas resources are located in the northwest, while the major population centers are in the south (some 2,000 kilometers away). The country is surrounded by the largest gas reserves in the world (in Russia, Turkmenistan, and Iran), and all of these are more developed than the gas resources in Kazakhstan. Access to the international markets is controlled by Russia. While alternative export outlets may eventually be developed, the required capital commitment for such development will be significant (as will be some of the political issues). This all underscores the need for Kazakhstan to pursue a cooperative approach with its neighbors in the development of its gas resources.

In addressing these challenges, however, Kazakhstan will have the opportunity to deploy oil revenues to support its gas industry. The ability to build a gas industry on the back of oil revenue (for example, through the use of collateral financing) is a tremendous asset,

provided the country takes the time and effort to organize such an undertaking in a thorough and systematic manner.

2 The purpose of this study is to address the challenges that Kazakhstan faces in building its gas industry and to recommend the path that Kazakhstan should follow. The study clarifies existing issues and explores potential solutions, as well as suggesting immediate priorities.

3 In the gas sector, Kazakhstan's overriding objective should be to ensure that its gas resources deliver the maximum potential benefit to the country's economy. Within this context, three specific objectives will have to be met:

- OBJECTIVE NUMBER 1: To ensure (i) that gas sector development supports efforts to maximize the economic benefit of liquids production; (ii) that viable gas markets are developed so that liquids production is not constrained by limitations on the disposal of associated gas production; and (iii) that gas resources are not wasted.
- OBJECTIVE NUMBER 2: To restore the commercial viability of Kazakh gas operations and to develop the domestic gas markets so that gas is used wherever such use benefits the overall economy.
- OBJECTIVE NUMBER 3: To establish a position as a supplier of gas to the international market to ensure that the country can take advantage of profitable marketing opportunities.

The Strategic Path to Achieve Kazakhstan's Gas Sector Objectives

4 **OBJECTIVE NUMBER 1:**

> To ensure (i) that gas sector development supports efforts to maximize the economic benefit of liquids production; (ii) that viable gas markets are developed so that liquids production is not constrained by limitations on the disposal of associated gas production; and (iii) that gas resources are not wasted.

Background

a. The foreign private sector has demonstrated considerable interest in investing in petroleum projects in Kazakhstan. This has led to agreements for foreign participation in the development of Kazakhstan's two super-giant petroleum fields, Tengiz and Karachaganak, which could generate annual gross revenues in excess of $3 billion within ten years. The introduction of foreign investment to the upstream petroleum sector will not only result in a significant increase in liquids production (oil and gas condensate), but will also substantially increase Kazakhstan's gas production capability. Table 1 summarizes the country's natural gas production potential.

Table 1. Natural Gas Production Potential
(billions of cubic meters)

Area	*1997*	*2000*	*2005*	*2010*
Tengiz	1.0	3.0	5.0	5.0
Karachaganak	5.0	8.0	15.0	22.0
Other fields	2.5	4.4	8.0	9.1
Total	8.5	15.4	28.0	36.1

Source: "Analysis of the Condition of the Oil-Gas Complex and its Raw Material Basis in the Republic of Kazakhstan" by the former Ministry of Geology.

In order to avoid flaring gas or, in the case of Karachaganak, potentially constraining condensate production, however, it is essential that market outlets be found for the projected gas production. As a signatory to the 1992 Rio Convention on climate change, Kazakhstan is committed to the ultimate elimination of gas flaring. The country, therefore, needs to promote measures that will minimize the future flaring of gas.

b. Gas resources are being wasted at all points in the supply and distribution chain. In production, gas flaring needs to be controlled, monitored, and reduced. In transmission, there is considerable waste through "transportation losses." In addition, the volumes of gas recorded as consumed by the domestic companies appear excessive by international standards. Finally, in consumption, the lack of tangible economic incentives to utilize gas efficiently, coupled with the nonpayment problem, undoubtedly results in waste.

c. In a number of areas of the country, there are pollution problems related to the use of low-grade coal for power generation and other industrial activities. The substitution of gas for such coal usage offers significant environmental benefits, and their value should be included in assessments of the economic viability of future gas utilization projects.

d. Opportunities exist to increase gas deliveries and optimize costs through the negotiation of exchange arrangements with Turkmenistan and Uzbekistan, and possibly Russia as well. An exchange arrangement involving gas deliveries by Turkmenistan and/or Uzbekistan to the oblasts in the south (South Kazakhstan, Zhambyl, and Almaty) in exchange for gas supplies into the UGSS (Unified Gas Supply System) from Karachaganak offers the most economical means of meeting a substantial portion of the country's current and potential demand.

Recommended Path

a. Kazakhstan should pay particular and prompt attention to the development of a viable market for the gas that is associated with liquids production. In this regard, efforts to develop an export capability should proceed at the earliest opportunity, as should efforts to negotiate exchange arrangements with Turkmenistan and Uzbekistan.

b. There is a significant opportunity to extract liquids from Kazakhstan's gas. Kazakhstan needs to take full advantage of this opportunity by investing in extraction facilities. As a general guideline, however, such efforts should initially be directed only toward gas fields with liquids composition of at least 3 percent.

c. While legislative and regulatory measures can be introduced to address gas flaring and other losses throughout the gas supply and distribution chain, investments will be required to ensure compliance. These investments include the extraction of LPG, specific measures to capture and utilize flared gas, rehabilitation of the existing pipeline network, and the introduction of metering throughout the supply and distribution chain.

d. Measures to minimize gas wastage—particularly to minimize the flaring of associated gas—will be of little value if markets cannot be found for the gas produced. Table 2 indicates that new market outlets will be required by 2000 and demonstrates that an exchange arrangement will significantly reduce the amount of gas that would have to be delivered to new export markets.

Table 2. Preliminary Gas Supply and Demand Projections
(billion cubic meters)

Projection	*1997*	*2000*	*2005*	*2010*
Domestic production	8.5	15.4	28.0	36.1
Imports[a]	5.0	4.8	6.0	6.6
Total supply	13.5	20.2	34.0	42.7
Domestic demand	8.0	9.8	12.1	13.3
Oil field consumption	2.2	3.0	3.5	4.0
Exports to Russia[b]	3.3	6.0	6.0	6.0
Total demand	13.5	18.8	21.6	23.3
Surplus	0	1.4	12.4	19.4
Exchange potential[c]	3.0	3.5	4.5	5.0
Net surplus	0	0	8.9	15.8

a. Imports are required to meet demand in the southern region and in the Kostanai oblast.
b. In 1997, exports to Russia are assumed to increase to balance supply and demand. In 2000, 2005, and 2010, exports to Orenburg (in Russia) are assumed at maximum levels.
c. The exchange potential equals the import demand requirements in the southern region.

5 **OBJECTIVE NUMBER 2:**

To restore the commercial viability of Kazakh gas operations and to develop the domestic gas markets so that gas is used wherever such use benefits the overall economy.

Background

a. A significant turnaround is required in the financial and operating performance of the domestic gas companies. These companies lack an adequate commercial focus and, unless prompt action is taken, their financial position, which borders on insolvency, will become untenable. The most pressing problem is pervasive nonpayment throughout the domestic supply chain. It is essential that the domestic gas industry implement the principle that failure to pay for gas will result in curtailment of supplies. Legislative support may be needed to facilitate implementation of these policies. Other problems include operating inefficiencies, excessive staffing levels, and the need to progressively increase prices to free market levels. Such a turnaround, however, will be constrained by the lack of an adequate institutional capability, including an acceptable legislative and regulatory framework to deal with the domestic gas sector.

b. Increased domestic gas usage will be both economically and environmentally attractive. The substitution of gas for coal will deliver significant environmental benefits and will prove economically attractive in many instances. Such benefits will only be realized, however, if the domestic gas companies are able to demonstrate the ability to manage the associated growth in demand.

c. The foreign private sector has both the investment capability and the know-how to effect the required turnaround in the domestic gas transmission and distribution sector. Recognizing this, Kazakhstan has already initiated plans to privatize the sector.

Recommended Path

a. Kazakhstan's priorities in allocating gas supplies need to change. In the past, Kazakhstan has focused on providing gas preferentially to industries that have been deemed "strategic." The country should now implement an effective pricing system designed to ensure that gas will be used in the sectors of the economy where it can deliver the greatest benefit. This means ensuring that consumers who create the maximum market value for the gas (for example, power generation) have the incentive to use it. From a social standpoint, it is important to assure deliveries to institutions that may require the protection of a social safety net (for example, hospitals and schools) and to compensate the gas companies for making the deliveries.

b. A measured transition to privatization of the gas sector will support the creation of a market environment that encourages investment in the gas sector. In approaching privatization, Kazakhstan needs to address several issues:

- Priority must be assigned to the timing of the privatization of each of the individual components of the gas sector. It is recommended that LPG business should be the first to be privatized, to be followed, in order, by production, transit transmission, other transmission, and, finally, distribution.

- The major objectives associated with private sector participation should be clearly articulated: (a) to attract capital for rehabilitation of the existing facilities and for new facilities and (b) to facilitate the introduction of modern approaches to managing gas transmission and distribution and to garner the associated benefits.
- In proceeding with the privatization process, several factors need to be considered, including how to enhance competition; how to enhance efficiency; how to attract strong players to the sector; and which potential partners are most capable of making sizable investments quickly.
- Entering into the privatization process at this time carries risks. Potential investors will likely assume a "worst case" scenario in which the present nonpayment practices continue; in which unfair price controls may exist; and in which they may face both environmental problems and major liabilities for asset rehabilitation. This will translate into a reduction in the amount that investors will be willing to pay for the privatized assets and may lead to a complete absence of suitable investors. A turnaround in the financial and operating performance of the gas companies prior to privatization is essential if these assets are to realize their true value.
- A distinction should be made between facilities that can be offered to the private sector on a lease or concession basis (this would include certain of the transit pipelines) and those that should initially be put under private sector management through the mechanism of a management contract (this would include the LCD's, local distribution companies). As part of this turnaround effort, prices should be progressively increased to free market levels. As was noted above, LPG operations separated from natural gas operations and should be offered to the private sector ahead of the other gas operations, in a manner that promotes competition.
- A significant risk to be kept in mind is that private sector import and/or transmission companies will have to have the right to curtail supplies to local gas companies in the event of nonpayment. It must be anticipated that every investor will expect this right. Such shock therapy may be essential, but the government will need an action plan to deal with potential repercussions should such an event occur.
- In offering strategic facilities such as the export pipelines to the private sector, it is important that the government keep in mind the potential for the disruption of the supply chain if a framework for transit tariffs and gas imports has not already been agreed upon with neighboring countries. As an example, were the privatized pipeline to insist on hard currency payments for transit revenues, Turkmenistan and Uzbekistan would likely insist on hard currency payments for their gas sales to Kazakhstan. In a more extreme case, if the private tariff were imposed unilaterally, Turkmenistan and Uzbekistan could curtail all deliveries to the southern region of Kazakhstan, with potentially severe economic consequences.

- Performance measurement parameters should be established to allow the government to determine when operations under management contracts can be offered for full privatization.

c. It is important that the privatization effort be handled in a measured fashion in order to ensure that results meet expectations. It is also essential that the process to establish the appropriate legislative and regulatory framework, together with the supporting institutional capability, be well under way before any arrangements are concluded with the private sector. (Ideally, this framework should be in place. As a practical matter, however, the time required to complete establishment of the framework may conflict with some of Kazakhstan's privatization plans.)

d. The legislative and regulatory framework should include the following components:

- Comprehensive gas legislation—that is, a gas law. This legislation should establish a Regulatory Authority and provide legislative force to its actions. The law should allocate responsibility for oversight functions among the government itself, ministerial agencies, and the Regulatory Authority; establish the basic principles for participation by private interests in the domestic gas sector; and ensure that appropriate sanctions are available to deal with the current problems the sector, such as pervasive nonpayment.
- The law should also establish the parameters for the future structure of the industry. This structure should include separation of the LPG and natural gas components of the sector. Within the natural gas sector itself, production, transmission, and distribution activities should be separated and provisions introduced to ensure that no conflicts of interest arise among the segments of the industry.
- The Regulatory Authority should put in place regulations concerning open pipeline access, nondiscriminatory tariffs, and a nondiscriminatory pricing structure. It should also gradually assume responsibility for approval of pricing. It is recommended that the pricing structure initially employ a cost plus approach, but with a ceiling price dictated by the value of alternative fuels. Prices to large consumers should be subject to negotiation. The Regulatory Authority will also be responsible for instituting a variety of other regulations, including those related to environmental and safety issues.

e. Kazakhstan must demonstrate a clear commitment to resolving the nonpayment problem that affects the entire supply chain. Assured availability of supplies to the domestic sector will be predicated on Kazakhstan staying current on payments owed to regional suppliers. A firm contractual framework for setting the import purchase price is also required.

f. The legislative and regulatory framework should also provide the capability to deal with the significant nonpayment problem in the sector. In addition, a program of

investments will be required to solve a number of the problems facing the domestic sector. Investment requirements include a fully functioning metering capability throughout the supply chain. This will involve the installation of metering at all import and export locations; at the transfer points between transmission and distribution companies at all major customer locations; and, progressively, for mid-size and smaller customers. Without an effective metering capability, it will be difficult to deal with nonpayment. Within this context, it should be noted that the use of prepayment meters has proved to be a very effective tool in a number of countries. Investments will also be required to rehabilitate the existing transmission and distribution system and to support projects to expand or modify the system (these would include additional storage capacity and, possibly, additional pipeline facilities to connect new supplies to the existing distribution system).

g. New field development should be encouraged around the existing transportation facilities. For example, development of the gas fields in the Zhambyl oblast could be tied economically to the transmission and distribution system in southern Kazakhstan.

6 **OBJECTIVE NUMBER 3:**

> To establish a position as a supplier of gas to the international market to ensure that the country can take advantage of profitable marketing opportunities.

Background

a. Kazakhstan currently lacks an export marketing capability. In seeking to establish an export market position, it will encounter competition from Turkmenistan, possibly Uzbekistan, and, most significantly, Russia, which effectively controls access to European markets. All four countries will, in effect, be pursuing the same portion of the European market. It should be noted, however, that Kazakhstan is competitively positioned to supply these markets.

b. In the near term (over the next five years), the export market outlook is not particularly encouraging. The Western European market is currently fully supplied. The Eastern European and FSU markets are also being supplied by Turkmenistan and Russia, which both have surplus producing capability. While Kazakhstan could likely develop an outlet for some gas in the FSU countries, it should be noted that suppliers have had considerable difficulty in obtaining payments for all the gas delivered to these countries.

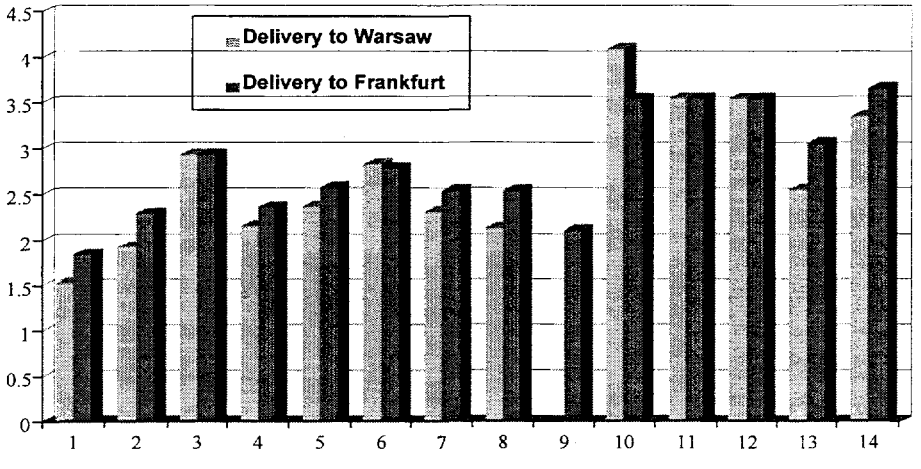
c. The longer-term outlook for export markets is somewhat more encouraging. Demand projections for Western Europe indicate that new supply sources will be required by about 2005. New supply requirements for Western Europe are projected to grow to a level of about 60 BCM by 2010. Demand in Eastern Europe is also forecast to increase, with new demand estimated at between 35 and 40 BCM by 2010. While both Russia and, to a limited extent, Turkmenistan have historically supplied Europe, the level of projected

demand requirements is such that Europe would be interested in expanding the range of its potential supply sources. Furthermore, Turkey is interested in importing gas from Central Asian producers. BOTAS (Turkish State Oil and Gas Company) predicts that its gas demand will increase to about 38 BCM by the year 2010 from its current consumption of 8.6 BCM (in 1996).

d. The average price of gas delivered to the European markets is in the range of $2.50–$3.00/MMBTU (figure 1). Gas that can be delivered to the European markets at a total cost at or below this level will be competitively positioned to meet future demand. It is estimated that Kazakhstan could deliver gas to Warsaw through UGSS at a cost of $1.52/MMBTU and to Frankfurt at a cost of $1.84/MMBTU. If a new pipeline through Russia were to be constructed, these costs would increase to $1.92/MMBTU for delivery to Warsaw and $2.29/MMBTU for delivery to Frankfurt. If Kazakhstan were forced to rely on the fallback case of a pipeline across the Caspian,[1] delivery costs would amount to about $2.93/MMBTU to both destinations. Consequently, Kazakhstan is well positioned competitively to supply future European and Turkish demand.

Figure 1. Estimated Delivered Costs for Additional Gas Supplies to Europe

($/MMBTU)



Note: (1) Kazakhstan gas via UGSS pipeline; (2) Kazakhstan gas via Russian pipeline; (3) Kazakhstan gas via Caspian pipeline; (4) Turkmen gas via UGSS pipeline; (5) Turkmen gas via Russian pipeline; (6) Turkmen gas via Turkey pipeline; (7) Russia-Yamburg gas; (8) Russia-Yamal gas; (9) Algeria via pipeline; (10) Norway (North Sea) via pipeline; (11) North Africa-LNG; (12) West Africa-LNG; (13) Iran via pipeline; (14) Qatar-LNG.

Source: ESMAP/World Bank studies.

[1] Include the onshore route through Iran. In this case, the delivery cost could be much lower.

e. Table 3 provides an indication of the netback prices that could be achieved by selling gas to the European market. The specific example in the table is based on deliveries to Warsaw in Poland. The netback estimates show indicative international parity prices both at the northern border (which is applicable to future Karachaganak exports) and at the southern border (which provides a benchmark comparison for purchases of imported gas).

Table 3. Indicative Gas Netback Prices to Kazakhstan

	At the north Kazakhstan border		*At the south Kazakhstan border*	
	Via UGSS	*Via new pipeline*	*Via UGSS*	*Via new pipeline*
Price in Warsaw ($/mmbtu)	2.80	2.80	2.80	2.80
Transportation cost ($/mmbtu)	1.02	1.42	1.36	1.76
Netback price ($/mmbtu)	1.78	1.38	1.44	1.04
Netback price ($/1,000 CM)	62.83	48.71	50.83	36.71

Recommended Path

a. Negotiations should be initiated with the regional players in the gas industry to establish a clear understanding of their relative rights and responsibilities.

b. Regardless of the results of negotiations with the neighboring countries, it is essential that all gas moving in and out of the country be monitored and metered. This is the only way to ensure that the terms and conditions associated with the transport and purchase of gas are fulfilled.

c. An agreed, enduring framework is required as a basis for setting pipeline tariffs for gas transiting the country and for gas being imported for delivery to the domestic market. This framework should address methods of payment (in gas or in currency, associated credit terms, and so forth) and provide a transparent methodology for calculating tariff levels. This framework is needed before the implementation of any final plans to privatize the transmission and distribution segments of the gas sector.

d. Gas exchange arrangements should be negotiated to permit the delivery of gas to Almaty and other areas that cannot be supplied directly from the gas fields in the northwest. Gas would be delivered from Karachaganak in repayment for the supplies in the south. In order to support this arrangement, investment will be required in gas processing facilities at Karachaganak. Exchange arrangements with Russia should also be extended to include the potential for gas deliveries to the Petrpavlovsk area in North Kazakhstan oblast, provided that the market is large enough and consumers are prepared to pay.

e. In order to develop a position as a supplier to the international markets, Kazakhstan should be prepared to engage both the foreign private sector and Gazprom as partners in its marketing efforts. As noted earlier, Russia effectively controls access to the European markets (it also controls access to certain of the FSU markets), and the cooperation of Gazprom is thus probably required if Kazakhstan is to export gas to these markets. At the same time, the European Union is anxious to ensure that supplies can be obtained to cover its projected growth in demand and to diversify its sources of supply. As a result, European gas companies can be expected to act constructively to facilitate the introduction of new, economical sources of gas supply to the European market.

f. Kazakhstan should also proceed with a thorough evaluation of the possibility of constructing an export pipeline (most likely in conjunction with Turkmenistan) across the Caspian[2] and through the countries of the Caucasus and Turkey. While this is unlikely to be as economically attractive as either use of UGSS or the construction of a new pipeline through Russia, it does represent an alternative if appropriate terms cannot be negotiated with Russia. This evaluation should include discussions with the European Union of the availability of low-cost, nonrecourse financing for such a project and possible offtake assurances to improve the economic viability of the undertaking. Private sector participation in such a venture will also be required. Consequently, discussions should be initiated with the international oil and gas companies with the objective of encouraging the development of a consortium to pursue the development and implementation of the project.

Immediate Priorities

7 Full implementation of the items outlined in the recommended paths will take considerable time. In the interim, there are a number of steps that can—and should—be taken as a matter of urgency:

- Immediate measures should be implemented to resolve the nonpayment problem. These will include legislation and associated enforcement powers to permit and mandate curtailment of supplies in the event of nonpayment (except in defined hardship and social protection cases) and the introduction of metering throughout the supply chain.
- A Regulatory Authority for creation of modern gas legislation should be established.
- Reform of the pricing structure should be initiated to accommodate the realistic costs of production, transmission, and distribution and the market values of the gas.

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[2] Include the onshore route through Iran. Preliminary discussions are ongoing between IOCs, Turkmenistan, and Turkey to transport Turkmen gas to Turkish and European markets through Iran.

- The gas companies should be required to switch to fully transparent accounting procedures that conform to international norms. At the same time, tax provisions must be modified to ensure that the companies are only taxed on their real earnings.
- Discussions are needed with international gas companies concerning the transfer of management responsibility for Kazakhstan's gas companies under the terms of management contracts.
- A program for capturing and utilizing flared gas should be designed.
- A program for rehabilitation of the existing pipeline network is needed.
- A program for appropriate gas conditioning must be developed at the Karachganak field to mitigate environmental issues and reduce pipeline deterioration.
- A dialogue should be initiated with Turkmenistan and Uzbekistan concerning the potential for regional cooperation. This dialogue would include the negotiation of gas exchange arrangements and collaboration in gas exports to European and Turkish markets.
- Efforts should be initiated to evaluate alternative pipeline options to deliver gas from the Central Asian states to Europe and to Turkey.

8 Among the numerous investment needs of the gas sector, the following are most immediate and should be accorded a high priority:

- Projects required to support exchange arrangements with neighboring gas producing countries
- Field processing of sour gas
- Capturing and utilizing flared gas
- Rehabilitating and modernizing existing gas transmission pipelines
- Installing gas meters
- Appraisal work for gas fields located close to existing pipelines.

Kazakh Gas Sector—Recommended Action Plan

No.	*Main linkage with sector objective*			*Area/issue*	*Action*	*Priority in timing for initiation of action*		
	1	2	3			A	B	C
1.0				**Sector Programs**		<1–2 yr	2–5	> 5
1.1		X		Legal basis is unclear.	Establish *modern gas legislation.*	X		
1.2		X		Detailed legal framework and legal enforcement are needed.	Establish *a Regulatory Authority.*	X		
1.3		X		Gas companies are effectively insolvent. Financial position is extremely weak.	*Corporatize gas companies* through management contracts with international gas companies and other TA including introduction of international accounting system.	X		
1.4			X	No direct access to international gas markets. Need to negotiate Russia jointly with other CA gas producers. The present gas supply infrastructure does not allow Kazakh's gas energy independence.	Promote Central Asia (CA) *regional cooperation* for gas export markets and swap arrangements.	X		
1.5	X			There is a large volume of flared gas. Safety practices are inadequate.	Strengthen environmental/safety regulations and enforcement. Simultaneously, exploit markets for the captured gas.		X	
1.6		X		Lack of competition in gas/LPG business.	*Separate gas and LPG business.*		X	
1.7		X		The current gas pricing is regulated and does not reflect market economy.	*Institute pricing reform* reflecting costs of transport (distance-based), market values of gas as a ceiling. Allow large consumers to negotiate the gas price.		X	
1.8		X		Efficiency of gas business is very low.	Shift to full privatization of gas companies when possible.			X
2.0				**Projects**				
2.1	X			Gas supply to Almaty is physically constrained.	*Rehabilitate the Gazli-Symkent-Almaty pipeline.*	X		
2.2		X		Payment collection is retarded, and nonpayment is widespread. As a result, consumers do not pay attention to rational use of gas.	*Install meters* for most consumers and enforce payment collection.	X		

(continued . . .)

Kazakh Gas Sector—Recommended Action Plan

No.	*Main linkage with sector objective*			*Area/issue*	*Action*	*Priority in timing for initiation of action*		
	1	2	3			A	B	C
(continued . . .)								
2.3	X			Existing fields are flaring gas at a total of 2–3 BCM annually, yet there are energy-constrained oblasts near those oil fields.	*Capture flared gas and utilize for power generation, and so on* (such as Aktyubinsk, Kumkol, and the like).	X		
2.4	X			Valuable hydrocarbon liquids in gas are wasted.	*Install gas processing plants* at oil fields and extract LPG/condensate (for example, Karachganak, Zhanazol, Uritau, Kumkol, and the like).		X	
2.5	X			Several domestic oil/gas reserves await appraisal.	Conduct *reserve assessment* for fields that are located near local markets and/or the existing transmission pipelines (such as medium and small fields in Zhambyl oblast, etc.).		X	
2.6			X	Operating capacity of the CAC transit pipeline is declining.	*Rehabilitate and modernize the Central Asia Center pipeline* to meet the required transit capacity.		X	
2.7	X			A few economically attractive domestic gas fields await full development.	*Develop gas reserves* close to the current consumption centers (for example, Amangueldy).		X	
2.8	X	X		Coal-fired power plants have serious environmental issues. Most of existing power plants need replacement.	*Implement fuel switch to gas and installation of gas fired power plants.*			X
2.9	X			Kazakh's gasification is limited to only 8 oblasts out of the total 19 oblasts.	*Establish infrastructure of new gas supply* to new markets.			X
2.10	X			Energy efficiency is very low and losses are high.	*Promote energy conservation projects.*			X

Note:Priority A: top, urgent, to be implemented less than 1–2 years; Priority B: to be implemented after basic requirements, within 2–5 years; and Priority C: to be implemented after economic stabilization, probably beyond 5 years when possible.

Sector objective No. 1: refer to Para. 4; No. 2, Para. 5; and No.3, Para. 6.

1

Introduction

1.1 Kazakhstan possesses a significant hydrocarbon resource base. Prior to independence, however, development of this resource base reflected the integrated requirements of the Soviet Union, not the needs of Kazakhstan. With a focus on oil production, only limited development of Kazakhstan's gas resource base has occurred, and the structure of the domestic gas markets has been based on the utilization of gas resources from Turkmenistan, Uzbekistan, and Russia.

1.2 Kazakhstan is one of the world's largest countries (in area). Its population of approximately 17 million, which is small relative to the country's size, is concentrated in just a few, widely dispersed, areas. The gas pipeline infrastructure was designed as part of the overall transmission system of the former Soviet Union and is capable of delivering gas to eight of the country's nineteen oblasts.

1.3 Kazakhstan is surrounded by the largest gas reserves in the world (in Russia, Turkmenistan, and Iran); all are more developed than the gas resources in Kazakhstan.

1.4 The challenge facing Kazakhstan is how best to exploit its gas resource base and achieve the overriding objective of ensuring that its gas resources deliver the maximum potential benefit to the country's economy. In pursuing this objective, a number of considerations must be kept in mind:

(a) Exploitation of the country's hydrocarbon liquid (oil and condensate) resources will become constrained if new market outlets are not developed to accommodate the gas produced in association with the oil and condensate.

(b) In the domestic sector, the substitution of gas for coal in the oblasts currently receiving gas will be environmentally attractive (particular attention should be paid to these environmental benefits). In many instances, such substitution will also be economically attractive. This will lead to an increase in domestic demand and will enable gas to increase its share of the domestic energy matrix.

(c) Growth in gas demand in the oblasts that currently receive gas is a realistic expectation. Given the distances involved, however, expansion of the domestic

distribution system to increase the number of oblasts supplied with gas will require considerable capital and, in most instances, will not be economically viable.

(d) In the domestic sector, it is also important that the government recognize that the goal of energy independence is not economically feasible. The cost of transporting gas through a new pipeline system from the northwest of the country to the south would result in a delivered cost that would, at best, be about even with the cost of alternative fuels. Given that gas can already be imported to the area at a significantly lower cost, there can be no economic justification for the construction of such a pipeline. Rather, efforts should be initiated to negotiate a long-term exchange arrangement. At the same time, the options of delivering gas by reversing the flow of a portion of the CAC line and/or the Bukhara-Ural line should be fully evaluated. Even if an exchange arrangement cannot be negotiated and the option of reversing the flow of the existing lines proves impractical, the alternative of purchasing imported gas would likely be preferable to a new pipeline.

(e) Kazakhstan receives transit fees in the form of gas for volumes transiting the country. These are delivered, along with any volumes purchased from Uzbekistan and Turkmenistan, to the southern part of the country. Current and projected demand levels in the south create the potential to negotiate exchange arrangements with Turkmenistan and Uzbekistan to receive gas in the south and to deliver an equivalent volume of gas from Karachaganak to the Unified Gas Supply System (UGSS) for delivery to FSU countries and/or Europe.

(f) Access to international markets is currently controlled by Russia. While the use of alternative export outlets would bring both political and economic challenges, construction of a pipeline across the Caspian and through the countries of the Caucasus (or Iran) and Turkey may represent a feasible option.

(g) In seeking international market access, Kazakhstan will encounter competition from Turkmenistan, and possibly Uzbekistan. Within the gas sector, however, the interests of Kazakhstan, Turkemenistan, and Uzbekistan appear to complement each other a great deal more than they conflict. It is likely, therefore, that there would be considerable benefits associated with pursuing a coordinated regional approach to the development of gas market outlets (particularly those in Europe, Turkey, and the FSU countries).

(h) A number of geopolitical considerations will impact the development of Kazakhstan's gas sector. These could include:

- Russia's desire to maintain a significant degree of influence over development of the oil and gas sectors in the Central Asian States
- The interest of European countries in ensuring future energy security

- Constraints on international investments in several neighboring countries, such as Iran and Afghanistan.

(i) In order to realize the benefits that the gas sector has to offer, significant investments will ultimately be required. These investments will include a substantial foreign currency component. In order to obtain financing for these projects, Kazakhstan will be required to demonstrate that the projects are economically viable, that a realistic plan can be devised to ensure payment, that hard currency will be available to repay the loans, and that investors will be able to repatriate earnings associated with the projects. Multilateral agencies have the potential to provide support to this effort in the form of technical assistance, loans, and guarantees.

1.5 Kazakhstan does have the opportunity to use its oil revenues (which will include a sizable foreign exchange component) to support the development of its gas industry. To do so effectively, however, the country needs to implement a program to develop a modern gas industry.

1.6 This study discusses these issues and explores a strategic path that will enable Kazakhstan to meet the following specific objectives:

- OBJECTIVE NUMBER 1: To ensure (i) that gas sector development supports efforts to maximize the economic benefit of liquids production; (ii) that viable gas markets are developed so that liquids production is not constrained by limitations on the disposal of associated gas production; and (iii) that gas resources are not wasted.
- OBJECTIVE NUMBER 2: To restore the commercial viability of Kazakh gas operations and to develop the domestic gas markets so that gas is used when such use benefits the overall economy.
- OBJECTIVE NUMBER 3: To establish a position as a supplier of gas to the international market to ensure that the country can take advantage of profitable marketing opportunities.

1.7 The original terms of reference for this study were outlined in a letter from Prime Minister Kajegeldin dated January 25, 1996. To summarize, this letter focused on the need to create a national gas program and referenced "three basic priorities" in the gas sector:

- Utilization of Karachaganak gas reserves and some other deposits for gasification in the northern provinces of Kazakhstan
- Stabilization of gas supply to the southern part of the Republic, first to the city of Almaty
- Commercialization of sector management. That is, introduction of market principles to the gas organizations belonging to the Ministry of Oil and Gas.

The letter also noted the need for large-scale private investments in the sector.

1.8 In meeting the three objectives cited above, Kazakhstan will also resolve the three "basic priorities" identified in January 1996. It is recommended that these priorities be addressed as follows:

PRIORITY NUMBER 1:

Utilization of Karachaganak gas reserves and other deposits for gasification in the northern provinces of Kazakhstan.

The government is currently finalizing the terms of a production-sharing agreement for Karachaganak with a consortium of foreign investors. The economic viability of Karachaganak development, however, is predicated on ensuring that condensate production from the field can be maximized. In order to maximize condensate production, market outlets will have to be developed for the associated gas. Karachaganak gas production levels could well exceed the country's entire demand for gas. In addition, the existing infrastructure does not support direct delivery of Karachaganak gas to domestic markets. Consequently, the following actions are recommended:

- Long-term exchange arrangements be negotiated with Turkmenistan, Uzbekistan, and Russia that will allow (a) Turkmenistan and/or Uzbekistan to supply gas to the oblasts in the south and receive gas from Karachaganak into the Unified Gas Supply System (UGSS) and (b) Russia to deliver gas to Kostanai and other locations in the north (such as Petropavlovsk) in exchange for gas delivered from Karachaganak to either Orenberg or into the UGSS.
- A gas processing plant be constructed at Karachaganak to ensure that the gas meets international specifications.
- The development of export market outlets be pursued to handle the surplus gas. The only current export outlets are the Caucasus countries and through Russia.

Producing fields in Aktyubinsk are currently flaring associated gas. It is recommended that a program be implemented to capture and utilize this gas. In the event that these fields are transferred to the private sector, it is recommended that a condition of the transfer be the development and implementation of a plan to capture and utilize the gas that is being flared.

PRIORITY NUMBER 2:

> Stabilization of gas supply to the southern part of the Republic, first to the city of Almaty.

It would not be economical for Kazakhstan to construct the infrastructure to operate its gas sector in a self-sufficient fashion. The southern part of the republic should thus continue to receive its gas supplies from Turkmenistan and Uzbekistan. Supply availability from Turkmenistan and Uzbekistan is not an issue, but interruptions in supply have resulted from disputes concerning the price and payment terms associated with these deliveries. In order to stabilize supply, therefore, the following actions are required:

- Negotiations should be initiated to establish an enduring framework as a basis for setting pipeline tariffs and gas import prices and associated payment terms among Kazakhstan and its neighbors.
- Gas exchange arrangements should be negotiated to permit the delivery of gas to Almaty and other areas in the south, with repayment to be provided from Karachaganak.
- All gas moving in and out of the country should be monitored and metered.
- The development of Amangeldi and other fields near Zhambyl should be pursued.
- Kazakhstan should take particular care to ensure compliance with all agreed price and payment terms for gas deliveries to the southern region once the appropriate terms have been negotiated.

PRIORITY NUMBER 3:

> Commercialization of the sector management. That is, introduction of market principles to the gas organizations belonging to the Ministry of Oil and Gas.

Kazakhstan is moving forward with the privatization of its gas sector. If correctly managed, privatization will result in the introduction of market principles to the gas sector. There is a danger, however, that if privatization is not correctly managed, the results could be counterproductive. The following steps are needed to assure the desired results:

- The government should seek to avoid the creation of monopoly situations in the private sector.
- The government needs to ensure that sectors offered for privatization are strong enough financially and operationally to attract the interest of competitive bidders. In

this regard, problems such as nonpayment need to be resolved before individual sectors are offered for privatization.

- The government needs to take particular care to screen potential bidders to ensure that they are both technically and financially capable. In this regard, it is recommended that the government seek the assistance of consultants with particular knowledge and expertise in the gas sector.

If the overall privatization effort is to be successful, it is essential that an acceptable legislative and regulatory framework be introduced for the gas sector. Ideally, this will be implemented before privatization efforts are concluded. As a practical matter, however, it would be acceptable to have the process well under way.

The actions required include the following:

- Initiate the process of introducing a modern legislative and regulatory framework for the gas sector.
- Reexamine the privatization efforts now under way to ensure that the sectors offered for privatization are sufficiently sound, both operationally and financially, to attract competitive bids. If insufficient bids are received, the government should consider delaying the privatization effort for a particular sector. The government should also reconsider any privatization efforts that would result in the creation of private sector monopolies.
- Initiate a process to turn around sectors that are not yet ready for privatization. In some instances, the turnaround may best be effected by international companies operating under management contracts. It is important to note that privatization in and of itself will not ensure that the operating and financial performance of these businesses are placed on a sound footing.

2

Energy Resources and Supply

2.1 Kazakhstan is endowed with substantial and diverse energy resources. The country's total recoverable reserves of oil, gas, and coal are estimated at 19.5 billion tons of coal equivalent (TCE). This equates to about 1180 TCE per capita, which ranks Kazakhstan among the top ten countries in the world in per capita energy resources. In addition, the country possesses substantial hydroelectric resources, with an estimated hydropower potential of 160 trillion Kwh (kilowatt hours).

2.2 Table 2.1 summarizes both current and projected primary energy consumption in Kazakhstan.

Table 2.1. Primary Energy Consumption in Kazakhstan
(MMTCE)

Source	*1995*		*2010*	
Coal	38.3	71%	48.2	60%
Gas	9.9	19%	20.4	26%
Hydro/nuclear/imported electricity	0.5	1%	2.5	3%
Oil	5.0	9%	8.9	11%
Total	53.7	100%	80.0	100%

Note: Coal: 1 Kg = 7,000 Kcal. Oil excludes transportation fuels—gasoline, diesel oil, and jet kerosene.
Source: Ministry of Economy and EC Energy Center, December 1996.

As this table indicates, coal dominates the energy matrix. Natural gas, however, is expected to increase its share in the country's energy usage.

Coal

2.3 Kazakhstan has two major coal mining complexes. Ekibastuz, near Pavlodar, is an open-pit mine producing hard coal with a low heating value and high ash content.

This coal is primarily used for power generation. Karaganda Basin is mainly an underground mining operation with 8 billion tons of hard coal reserves. These two mining complexes account for 99 percent of the country's coal production. In 1995, Ekibastuz produced 69 million tons and Karaganda produced 33 million tons. At these production rates, the country has over 100 years of coal reserves.

2.4 The Ekibastuz mine is considered to be highly competitive. Capacity at Karaganda (which has been in operation since the nineteenth century), however, is likely to be reduced because of uneconomical and/or unsafe operating conditions in some of the underground pits.

2.5 About 40 percent of coal production is exported to other CIS (Commonwealth of Independent States) countries. The high ash content of Kazakh coal, however, limits the size of the potential export market. The main market for Kazakh coal will continue to be Russian power plants, which were designed to burn high-ash coal. Consequently, coal demand will likely be limited to the existing demand base. While some new potential sources of demand for coal may materialize, the environmental impact should be carefully examined before any such arrangements are implemented.

Oil

2.6 Kazakhstan's recoverable reserves of oil and gas condensates are estimated at about 18.5 billion barrels (2.6 billion tons). Production in 1995 totaled about 500,000 barrels daily (26 million tons for the year), resulting in a reserves to production (R/P) ratio of over 100. The size of this resource base and the very high R/P ratio has attracted considerable foreign private sector investor interest. Chevron and Mobil are involved in the development of the super-giant Tengiz oil field, where production is expected to increase from the current daily level of 200,000 barrels (10.4 million tons/year) to 400,000 barrels (20.9 million tons/year) shortly after 2000, and ultimately to 700,000 barrels (36.5 million tons per year).

2.7 A consortium, including British Gas, Agip, Lukoil, and Texaco, has a provisional agreement to develop the Karachaganak gas and gas condensate field. Initial efforts in Karachaganak will be directed at increasing gas condensate production. Once an export pipeline is in place, condensate production will increase from the current annual level of about 3.4 million tons to about 9.4 million tons. (Three million tons are now sold to Russia annually and delivered to Orenburg, and 0.4 million tons are consumed in Kazakhstan.)

2.8 Kazakhstan is a net exporter of petroleum liquids (crude oil and gas condensate). Domestic demand for petroleum products totaled about 12 million tons in 1995. The anticipated growth in oil production will thus translate directly into a significant increase in the country's ability to generate hard currency revenues.

2.9 The country's three refineries are located at Atyrau in the west, Symkent in the south, and Pavlodar in the east. Crude oil has traditionally been imported from Russia to supply Symkent and Pavlodar under an exchange arrangement involving repayment from Kazakhstan's production in the west of the country. The exchange arrangement, however, has not operated particularly smoothly, and a number of issues need to be resolved, including price and transportation tariffs, if the exchange is to function efficiently.

Table 2.2. Kazakhstan's Refineries
(million tons/year)

Refinery	*Capacity*	*1993 throughput*
Atyrau	5.0	4.5
Symkent	7.5	5.7
Pavlodar	7.5	4.6
Total	20.0	14.8

Source: EC TACIS Project Report, September 1995.

2.10 All three refineries are hydroskimming facilities (that is,. they do not have upgrading capabilities), and they are unable to meet the middle-distillate requirements of the domestic market. Consequently, Kazakhstan has been forced to balance its requirements through a combination of product imports and exports. Modernization of the refining sector through the addition of upgrading facilities is a priority concern. In addition, new refineries are planned at Karachaganak and at Mangyshlak. Investment is also required in distribution facilities for petroleum products.

2.11 Table 2.3 provides estimates of the 1996 consumption of petroleum products.

Table 2.3. 1996 Consumption of Petroleum Products in Kazakhstan

Petroleum product	*Millions of tons*	*Percentage*
LPG	0.3	3.1
Gasoline	1.4	14.3
Kerosene	0.6	6.1
Diesel	3.0	30.6
Residual fuel oil	3.6	36.7
Other	0.6	6.1
Lubes/asphalt	0.3	3.1
Total	9.8	100

Source: Price Waterhouse, "Economic Assessment for the West Kazakhstan-Kumkol Pipeline Project," 1996; EC-TACIS Study, "Energy Strategy for Kazakhstan," December 1995.

Natural Gas

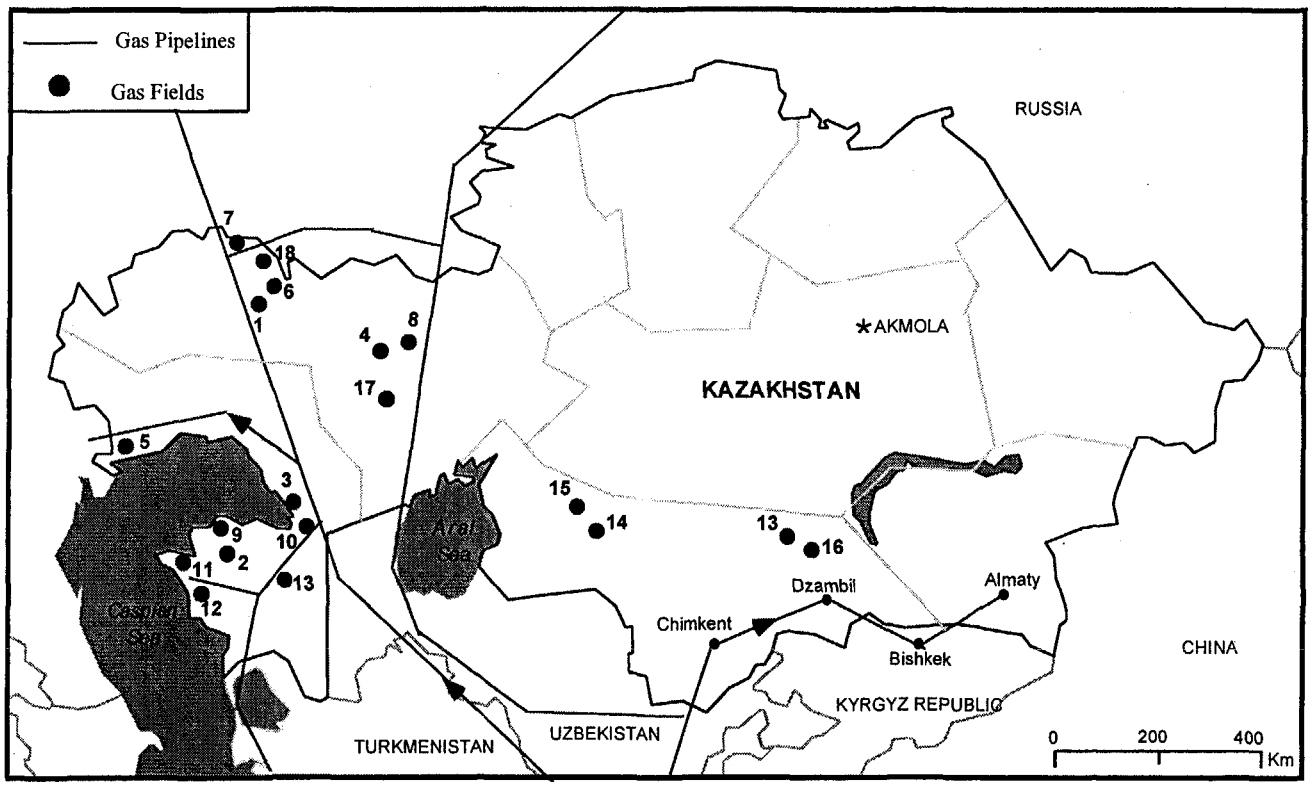
2.12 Proven recoverable natural gas reserves are estimated at 2 trillion cubic meters. In 1996, gross gas production totaled 6.6 BCM, resulting in a reserves to production ratio in excess of 300. The estimated proven recoverable natural gas reserves in Kazakhstan for 1995 is shown in figure 2.1.

2.13 The bulk of Kazakhstan's gas reserves are located in the northwestern part of the country, and over 45 percent of proved and probable reserves are located in Karachaganak. As already noted, the production focus in Karachaganak is gas condensate, and most of the gas associated with the produced condensate is currently being reinjected into the reservoir. About 4 BCM, however, was produced and delivered by pipeline to Orenburg in Russia in 1996. (Orenburg currently processes both the sour gas and the condensate produced from Karachaganak.) As condensate production increases, however, gas production will also increase and could exceed 19 BCM in 2000 and 25 BCM in 2005. With allowable reinjection limited to 10 BCM/year, and the capacity to deliver gas to Orenburg limited to 6 BCM/year, new market outlets will have to be found for Karachaganak gas if curtailment of liquids production is to be avoided.

2.14 Associated gas production from the Tengiz field, which is also in the northwest of the country, will represent the second-largest single source of gas production. The former Ministry of Geology estimates indicate that net associated gas production from Tengiz could total 3 BCM in 1999 and could reach 5 BCM in 2005.

Figure 2.1. Kazakhstan, Estimated Proven Recoverable Natural Gas Reserves, 1995

Field Name	(BCM)	Field Name	(BCM)	Field Name	(BCM)
1. Karachaganak	1,322	7. Kamen	40	13. Amangueldi	8
2. Kalamkas	520	8. Urihtau	40	14. Bektus	3
3. Tengizskoe	355	9. Jetibay	32	15. Nuraly	2
4. Janajol	130	10. Neanovskoe	24	16. Airaty	2
5. Imashevskoe	79	11. Tenge	23	17. Kzilskoe	2
6. Chinarevskoe	40	12. Kissimbaj	21	18. Tokarev	2



This map is for reference only and has not been approved by the Map Design Unit of the World Bank Group.

2.15 Table 2.4 summarizes the former Ministry of Geology's projections of natural gas production potential, while figure 2.2 shows the natural gas production potential by each region.

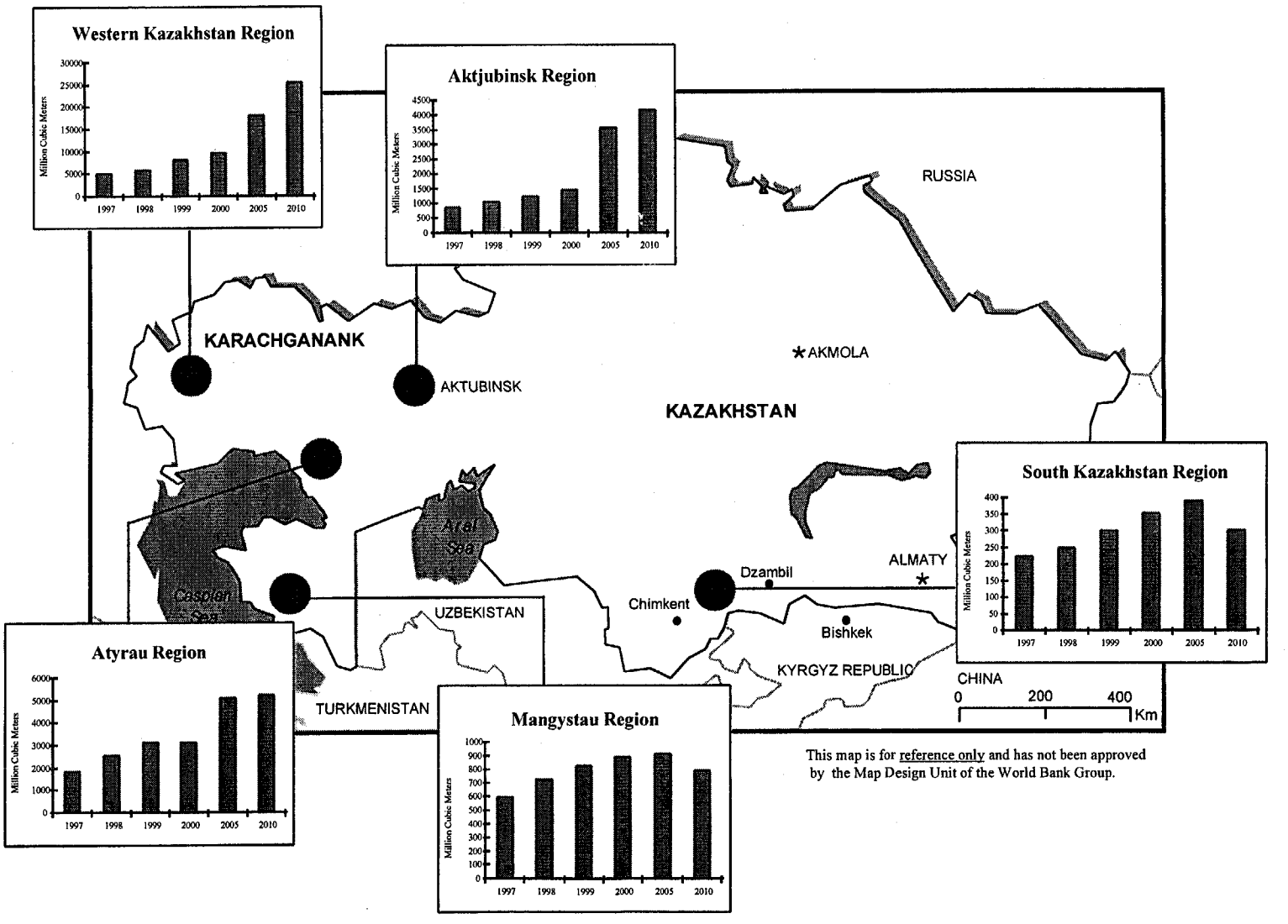
Table 2.4. Natural Gas Production Potential, 1997–2010
(million cubic meters)

Area	*1997*	*1998*	*1999*	*2000*	*2005*	*2010*
I. Aktyubinsk region	868	1,057	1,246	1,435	3,554	4,156
1. Zhanazol	868	977	1,086	1,185	1,085	947
2. Kenkijak-Bozoba	-	30	60	94	229	205
3. Alibeckmola	-	50	100	156	240	204
4. Urihtau	-	-	-	-	2,000	2,800
II. Atyrau region	1,850	2,534	3,124	3,117	5,116	5,234
1. Tengiz SHO	1,700	2,400	3,000	3,000	5,000	5,000
III West Kazakhstan region	5,000	5,830	8,095	9,587	18,060	25,600
1. Karachaganak	5,000	5,100	7,000	8,000	15,000	22,000
2. Kamenskoe and Teplovsko-Tokarevskaja	-	730	1,095	1,460	2,260	2,800
3. Chinarevskoe	-	-	-	127	800	800
IV. Mangystau region	597	730	829	894	912	792
1. Uzen	237	250	265	279	300	293
2. Zhetybay	107	132	138	128	80	62
3. Kalamkas	100	107	106	99	70	51
4. Ojmasha	65	133	190	226	191	117
V. Kizyl-Orda + Zhambyl + Jezkaz + South Kazakhstan	222	248	299	354	389	303
1. Kumkol	201	208	205	201	185	167
TOTAL	8,537	10,399	13,593	15,387	28,031	36,085

Source: "Analysis of the Condition of the Oil-Gas Complex and its Raw Material Basis in the Republic of Kazakhstan" by the former Ministry of Geology.

2.16 While Karachaganak and Tengiz represent most of the current and potential production, the production from other fields is not insignificant.

Figure 2.2. Kazahkstan, Natural Gas Production Potential



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The Aktyubinsk region (also in the northwest of the country) offers a few small, but promising, sources of gas. The Zhanazol field, for example, produces about 0.6 BCM of associated gas. In addition, a nonassociated gas field, Urihtau, is scheduled for development, with production commencing in 2001 at a level of 1,000 BCM and increasing to 2,800 BCM by 2010.

- In the Mangystau region, just to the east of the Caspian Sea, associated gas production from the Uzen and Zhetybay fields totals about 0.3 BCM.
- The Atyrau region, which contains the Tengiz field, also has a sizable volume of nonassociated gas in the Imashev field.
- The gas production sources in Aktyubinsk, Mangystau, and Atyrau are all relatively close to the export pipeline system. They are, however, some considerable distance from the population centers in the south of the country.
- In the south there is an opportunity to capture flared gas from the Kumkol field.

2.17 While Karachaganak gas has access to an export pipeline, much of the other associated gas in the western part of the country does not have access to a market. As a result, flaring of associated gas is at a fairly high level. (In 1996, it is estimated that over 1 BCM of associated gas was flared). Much of Kazakhstan's gas is sour, and processing at the field level will be mandatory.

2.18 There are some gas reserves in the southeast of the country, relatively close to the pipeline facilities servicing the population centers in the area. The MENR's (Ministry of Energy and Natural Resources) projections, however, anticipate only limited production levels in the southeast. Nevertheless, there are indications that Amangeldi and other fields near Zhambyl could produce as much as 3 BCM annually, and priority should be given to appraising the production potential from Amangeldi and other fields in the area.

2.19 The key issues associated with the natural gas resource base may be summarized as follows:

a. Market outlets must be developed for the gas that will be produced at Karachaganak in association with the gas condensate. This gas cannot be directly delivered economically (by a new pipeline) to the population centers in the south and the east. Consequently, the gas will have to be exported to FSU countries, Eastern and Central Europe, and/or Western Europe, either directly or through an exchange arrangement involving the delivery of supplies to the southeast (this is discussed in more detail in sections 3 and 4). By 2005 the requirement for new outlets could total 8 BCM, assuming that 6 BCM can be delivered to Orenburg. The Karachaganak gas is extremely sour, which will require investment in gas processing facilities to ensure that the gas can meet the quality requirements of the export market.

b. If flaring of associated gas is to be eliminated, market outlets must also be provided for this gas. For example:

- Associated gas that is located close to the CAC pipeline can be exported, supplementing the supplies from Karachaganak.
- Associated gas located in close proximity to the existing domestic transmission and distribution system can be delivered to the domestic market, displacing imports.
- The development of new domestic outlets—for example, by investing in power facilities to utilize associated gas—will be economical in some instances.

More detailed studies, however, need to be undertaken, on a case by case basis, to determine the option that will deliver the greatest benefit to the Kazakhstan economy.

c. Appraisals should be undertaken of the production potential from fields in close proximity to the existing pipeline network (both the import and the export pipelines). The investment in pipeline capacity is the largest single component in the buildup of gas costs, which will make development of gas reserves close to existing pipeline facilities very attractive economically, even in the case of relatively small reserve levels.

Electric Power

2.20 Kazakhstan's power generating and transmission system consists of three regional power grids: the north (including Altai, Ekibas, Pavlodar, Chelin, Karaganda, and Kostanai); the south (including Almaty and South Kazakhstan), and the west (consisting of Atyrau and West Kazakhstan.) The combined installed generating capacity totals about 17,200 MW in sixty-four stations. The relative shares of the country's power consumption are approximately 60 percent in the north, 25 percent in the south, and 15 percent in the west.

2.21 Kazakhstan has historically been a power importer. The south used to import 40 percent of its requirements (about 10 billion KWh) from Kyrgyzstan. These imports, however, are currently subject to frequent interruption, leaving the region with an annual power deficit of about 4 billion KWh. The southern region also imports power, from Uzbekistan, Turkmenistan, and Tajikistan. The west imports about 90 percent of its requirements from Russia. Taken overall, the country's import requirements currently amount to about 29 percent of its total consumption.

2.22 Table 2.5 briefly summarizes the basis of the existing and planned power generating capacity.

Table 2.5. Kazakhstan's Power Generating Capacity
(MW)

Source	*Existing*	*Under construction*	*Planned*
Thermal stations			
a) Coal	10,804	640	1,000
b) Oil/gas/coal	1,130		
c) Oil/gas	1,919		
d) Gas	-		1,117
Total thermal	13,853	640	2,117
Hydro	2,081		382
Nuclear	150		
Other	1,100		
TOTAL	17,184	640	2,499

Source: EC Energy Center.

As the Table 2.5 indicates, over 60 percent of the existing stations are coal fired. Coal is the lowest-cost primary fuel in the north (where the Ekibastuz and Karaganda mines are located), and much of the generating capacity in the area is based on mine-mouth stations. Emission from coal-fired thermal plants, however, has become a major environmental issue in the country.

2.23 Much of the country's capacity is over twenty years old. Within the next five years, it appears likely that at least 4,000 MW of capacity will need to be replaced. This may provide an opportunity to substitute gas for coal in the power sector. Up to this point, uncertainty regarding the availability of long-term gas supplies has acted as a constraint to the use of gas in the power sector. The government should examine the full range of power generating options, taking into account both economic and environmental considerations, and consider the introduction of foreign private sector independent power production (IPP) investment.

District Heating

2.24 Kazakhstan's large cities are all provided with heat and hot water through a centralized district heating system. The base load supply is provided by combined heat and power plants (CHPs). While the CHPs enjoy increased fuel efficiency as a result of cogeneration, many of the distribution networks are experiencing major leakage as a result of heavy corrosion in the distribution pipes. As a result, effective energy utilization is significantly below the levels expected for modern cogeneration plants.

3

Domestic Gas Demand and Distribution

Historical Gas Demand

3.1 Domestic gas consumption levels peaked in 1991 but have been declining since then. Table 3.1 summarizes the historical gas balance.

Table 3.1. Kazakhstan Gas Supply and Demand
(billion cubic meters/year)

Item	*1991*	*1993*	*1995*	*1996*
Production	7.9	4.5	5.8	6.6
Imports	9.6	11.9	5.7	5.0
Total supply	17.5	16.4	11.5	11.6
Domestic consumption	11.2	9.5	8.3	7.8
Transportation/loss	3.0	2.5	1.1	1.5
Oil field consumption	2.0	3.3	1.4	2.2
Total consumption	16.2	15.3	10.8	11.5
Exports	1.3	1.1	0.7	0.1

Source: The former Ministry of Oil and Gas and EC Energy Center.

3.2 The decline in domestic demand is a reflection of the economic difficulties the country has faced in the years since independence. Potential demand, however, has been further constrained by limitations on the availability of imports in the south, brought about by issues of price and associated payment terms. Turkmenistan, for example, has indicated that it is both willing and able to increase sales to Kazakhstan, provided it receives timely payments.

3.3 Despite the decline in domestic consumption levels, the country has remained a net gas importer throughout the period. The pipeline transmission system (which is

discussed in greater detail later in this section of the report) was designed as part of the overall system of the former Soviet Union. As a result, the system does not permit Kazakhstan to operate in a self-sufficient fashion. Kazakhstan has negotiated a number of agreements to import gas to meet its domestic needs:

a. Under the terms of a May 1993 agreement with Turkmenistan, up to 4 BCM/year of gas is to be delivered into the Bukhara-Ural pipeline to supply Kazakhgaz customers in the Kostanai and Aktyubinsk regions. Up to a further 3 BCM/year is to be supplied directly to western Kazakhstan through the CAC pipeline.

b. A December 1994, agreement among Kazakhstan, Uzbekistan, and Kyrgyzstan (as a transit country) calls for Uzbekistan to deliver 2 BCM/year to the southern region. The southern part of the country is entirely dependent on imports from Uzbekistan and Turkmenistan delivered through Gazli in Uzbekistan to Symkent, Zhambyl, and Almaty for its gas supplies.

c. Gas from Orenburg in Russia (where Karachaganak gas is processed) can be supplied to Kazakhstan through the Orenburg-Novopskov pipeline and from the Bukhara-Ural pipeline.

3.4 While price and payment issues have led to a curtailment of supplies, Kazakhstan has also encountered problems reconciling the volumes invoiced with the volumes delivered. Gas moving in and out of the country is not metered at the border. Because both transit revenues and import sales costs are dictated by the volumes of gas being transported, accurate measurement at all cross-border locations is essential. Duplication of gas meter stations, however, should be avoided at this stage, and the measurement of cross-border gas flows should be addressed as a regional issue. This is a matter that must be given a high priority in Kazakhstan.

3.5 While an increase in import availability will lead to some increase in domestic consumption levels, future demand growth will be dictated primarily by the overall state of the country's economy and by the competitiveness of gas when compared with alternative fuel sources.

3.6 Table 3.2 summarizes the use of gas by different sectors of the economy. It illustrates that the decline in consumption has been confined to the general industry and power sectors. It is thus these two sectors that offer the greatest potential for demand recovery.

Table 3.2. Domestic Gas Consumption
(billion cubic meters)

Sector	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*
Industry	5.2	4.7	4.1	2.5	3.2	2.9
Power	4.2	4.2	3.2	2.2	2.9	2.7
Domestic/municipal	1.4	1.5	1.5	1.5	1.5	1.5
Rural	0.4	0.7	0.7	0.7	0.7	0.7
Total	11.2	11.1	9.5	6.9	8.3	7.8

Source: EC Energy Center.

3.7 In order to assess the outlook for future demand, however, it is also important to understand the geographic distribution of demand and the associated constraints. Eight oblasts are connected to the country's gas transmission system. They fall into three distinct regions for gas delivery purposes:

a. The south includes the oblasts of Almaty, Zhambyl, and South Kazakhstan and is entirely dependent for its gas supplies on imports from Turkmenistan and Uzbekistan.

b. The west, which includes the oblasts of Mangystau, Atyrau, and West Kazakhstan, obtains its gas supplies from local fields and from Turkmenistan through the CAC trunk line.

c. The oblasts of Aktyubinsk and Kostanai are supplied from the Bukhara-Ural pipeline and can receive gas from both Russia and Turkmenistan.

3.8 Table 3.3 provide comparisons between the population levels and the numbers of apartments utilizing gas in these three regions.

Table 3.3. Population and Number of Apartments with Gas, 1994

Region	*Total population*	*Urban population*	*Apartments with gas*
The south	5,153,000	2,614,000	573,000
The west	1,459,000	808,000	60,000
Aktyubinsk/Kostanai	1,775,000	947,000	206,000
Total	8,387,000	4,369,000	839,000

Source: EC Energy Center.

3.9 Table 3.4 provides comparisons of the gas consumption by sector and region.

Table 3.4. Gas Consumption by Sector and Region
(billion cubic meters)

Sector/region	*1992*	*1993*	*1995*	*1996*
The south				
Industry	2.1	1.4	1.4	0.9
Power	1.9	1.4	0.8	0.6
Residential/municipal	0.9	0.9	1.0	1.0
Rural	0.3	0.4	0.4	0.4
Total	5.2	4.1	3.6	2.9
The west				
Industry	1.2	1.4	0.8	0.8
Power	1.7	1.2	1.7	1.7
Residential/municipal	0.2	0.2	0.1	0.2
Rural	0.1	0.1	0.1	0.1
Total	3.2	2.9	2.7	2.8
Aktyubinsk/Kostanai				
Industry	1.4	1.3	1.0	1.1
Power	0.6	0.6	0.4	0.4
Residential/municipal	0.5	0.4	0.4	0.4
Rural	0.2	0.2	0.2	0.2
Total	2.7	2.5	2.0	2.1

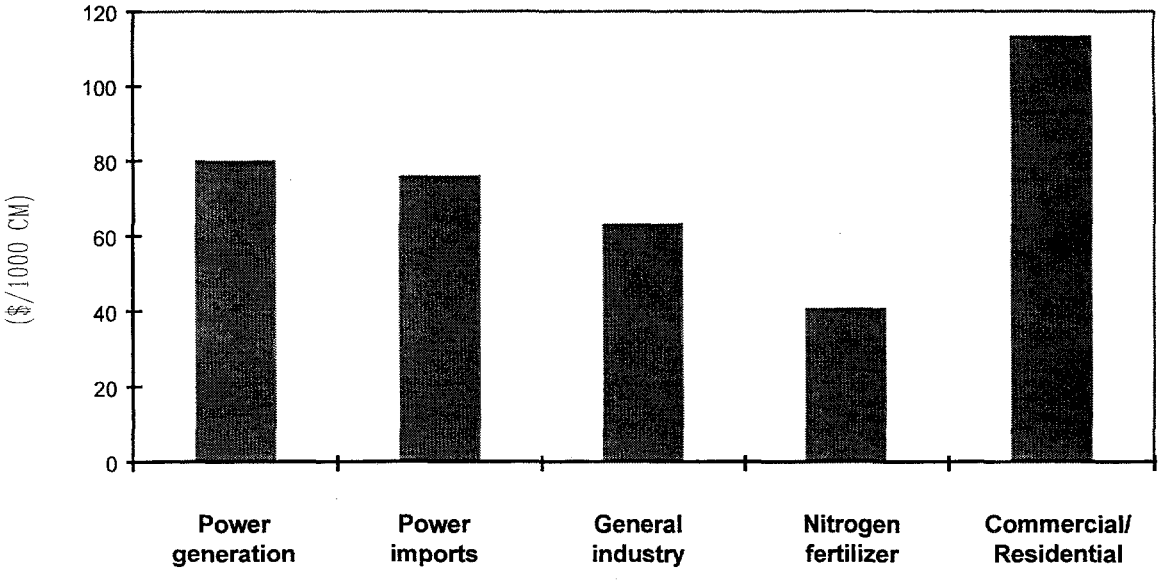
Source: The former Ministry of Oil and Gas, EC Energy Center.

3.10 With its sizable population base and well- distribution system, the south consumes substantially more gas than the other two regions in the residential/municipal and rural sectors. The decline in gas demand for industry and power, however, has disproportionately impacted the southern region. Indeed, the reduction in gas demand for power is almost entirely attributable to changes in consumption in the south and was brought about by factors such as a decline in electricity consumption and nonpayment problems. For gas demand levels in the country to recover, it is essential that this region be assured of access to imported supplies, and the gas delivered to the region must be competitively priced relative to alternative fuels, particularly coal from the Ekibastuz mine and mazout (residual fuel oil) from the oil refinery in Symkent.

Gas Values

3.11 The market value of gas in a given sector and in a given region is dictated by the price of competing fuels. For gas to economically displace competing fuels, its total delivered cost must be equal to or below its market value. (Market values of gas at the burner tip for various uses are briefly summarized in figure 3.1.)

Figure 3.1. Gas Market Values (at Almaty)



Note: Based on the regulated mine-mouth price of Ekibastuz coal of $4.18 per ton; US¢ 4.0 per Kwh. The above shows that the gas is competitive with existing fuel sources in a number of areas (the exception being the nitrogen fertilizer industry—ammonia and urea).

a. In the power sector, gas will generally be forced to compete against coal. The regulated mine-mouth price of Ekibastuz coal is approximately $4.18 per ton, and coal transportation costs are estimated at $2.05 per ton per 1,000 kilometers of distance. On this basis, the market value of gas for power generation at Almaty (see figure 3.1) and at Akmola is estimated as follows:

- Gas delivered to Almaty: $80 per 1,000 CM.
- Gas delivered to Akmola: $71 per 1,000 CM.

The only pricing data available are for regulated prices. The market value calculations are based on the regulated prices for both coal and transportation. The real production cost of Ekibastuz coal, however, is expected to be higher than the regulated prices, and these market values are thus probably understated.

b. In the power sector, gas may also have to compete against imported power. For example, hydro power from Kyrgyzstan is potentially available. According to the EC Energy Center, the cost of this power could be as low as US¢4.0 per KWh. At this price level, the market value of gas would be as follows:

- Gas used for power generation: $76 per 1,000 CM.

c. In the general industry sector, gas will likely be in competition with mazout (fuel oil). The current price for mazout at the Symkent refinery gate is equivalent to $60.42/ton. The current transportation cost for mazout is approximately $6.16 per ton per 1,000 kilometers. On this basis, the market value for gas competing with mazout at Almaty would be as follows:

- Gas delivered to Almaty: $63 per 1,000 CM.

It should be noted, however, that mazout has an export market value. To the extent that its export value at the Symkent refinery gate is higher than the price quoted above, the market value of gas will be increased correspondingly.

d. Gas can also be used in the manufacture of nitrogen fertilizer. There is currently no manufacturing capacity for nitrogen fertilizer in Kazakhstan, and the country imports its requirements (mainly urea) from Russia and Uzbekistan. Imported urea is currently priced at $200 per ton. On this basis the market value for gas used in the production of nitrogen fertilizer would be as follows:

- Gas used to manufacture nitrogen fertilizer: $41 per 1,000 CM.

e. In the commercial and residential sectors, the competing fuel is LPG. At a current average LPG price of $200 per ton (LPG prices fall within a range of $134–$290 per ton), the market value of gas would be as follows:

- Gas for commercial and residential use: $169 per 1,000 CM.

3.12 The current selling price of gas for all categories of consumers in the domestic market ranges between the equivalent of $30 and $42 per 1,000 CM. This, however, should not be used as the basis for comparing gas with alternative fuels. Rather, the assessment of the economics of domestic gas utilization should be based on the opportunity cost and the market value of the gas. For example, the current price of gas imported from Turkmenistan and Uzbekistan is about $35 per 1,000 CM. This represents its opportunity cost at Symkent, just inside the Kazakhstan border.

a. The marginal production cost of gas at Karachaganak is roughly estimated at about $0.50/mmbtu, or about $17.65 per 1,000 CM. To the extent that alternative outlets cannot be found for this gas, the cost of $17.65 per 1,000 CM represents its opportunity cost. Karachaganak gas could be transported to the south in two ways: (i) through a new pipeline from Chelkar to Symkent or, (ii) subject to agreement with Turkmenistan and Uzbekistan, by reversing the flow of a portion of the CAC line and/or the Bukhara-Ural line. The cost of transporting Karachaganak gas by a new pipeline from Chelkar to

Symkent is estimated at $55 per 1000 CM. The opportunity cost of Karachaganak gas transported in this fashion to Symkent would thus be about $73 per 1,000 CM[3]. The preliminary estimate of the cost of delivering gas by reversing the flow of a portion of the existing lines is $20 per 1,000 CM, assuming a transit fee of $1.50 per 1,000 CM and some cost to effect the reverse flow. Gas delivered to Symkent in this fashion would, therefore, have an opportunity cost of about $38 per 1,000 CM[4], which would make it highly attractive for most applications. This transportation option, however, requires more detailed review and evaluation. The comparative values of supply cost of Karachaganak gas is shown in figure 3.2.

b. Once Kazakhstan is able to establish an international marketing capability, this gas should realize a market price at the wellhead on the order of $50 per 1,000 CM. At that time, the opportunity cost for Karachaganak gas at Symkent would be increased to $70[5] (in the case of reversing the CAC and/or Ural-Bukhara pipeline) and $105[6] per 1,000 CM (in the case of a new pipeline).

c. The cost of developing nonassociated gas fields (including an appropriate return on investment) together with the cost of delivering this gas to the pipeline grid represents its opportunity cost. For example, it is estimated that the cost of producing gas from Amangeldi and other fields in the Zhambyl region would be about $25 per 1,000 CM. The cost of transportation to Symkent is estimated at $3.50 per 1,000 CM, which would result in an opportunity cost at Symkent of $28.50 per 1,000 CM, which is below both import price levels and the opportunity cost of Karachaganak gas at Symkent.

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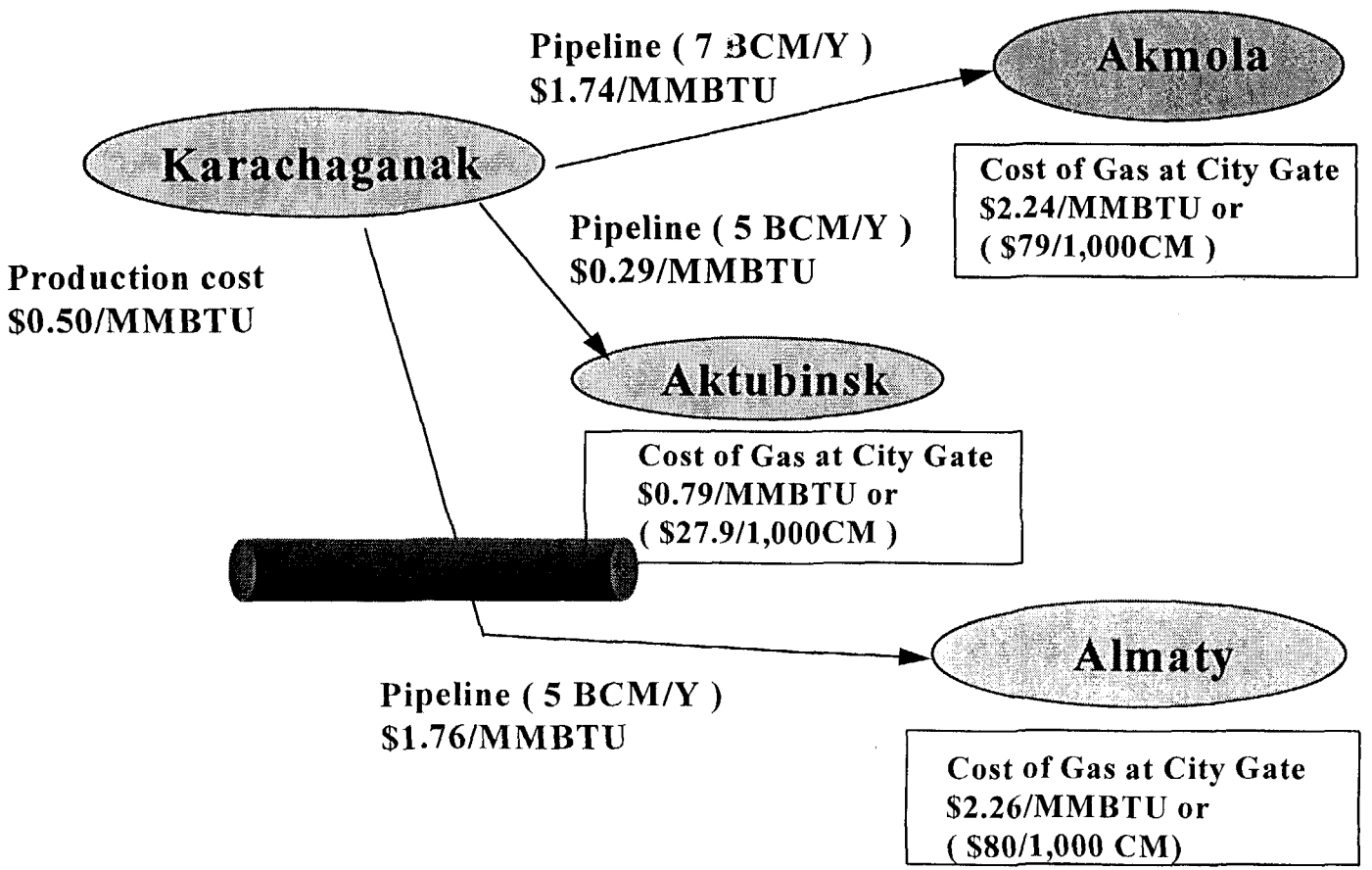
[3] $ 18 + $55 = $73.

[4] $ 18 + $20 = $38.

[5] $38 + $32 ($50–$17.65).

[6] $73 + $32 ($50–$17.65).

Figure 3.2. Comparative Values of Supply Cost of Karachaganak Gas



Note: All figures are based on new pipelines, except Shymkent-Almaty.

3.13 In order to put this all in perspective, tables 3.5 and 3.6 summarize the opportunity costs of gas that could be delivered to Almaty and provide the market values obtainable at Almaty for gas usage in the various sectors of the economy. The market values of gas for power generation at Almaty are shown in figure 3.3.

Figure 3.3. Gas Supply Economics: Market Values of Gas for Power Generation at Almaty

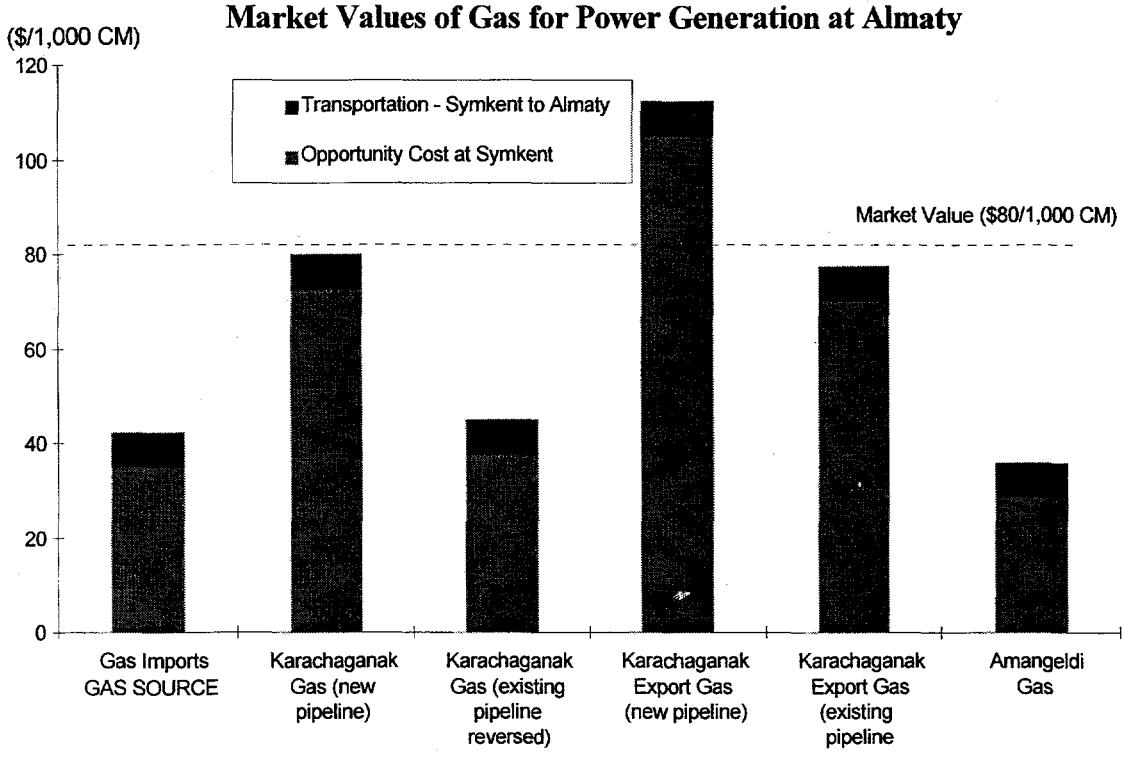


Table 3.5. Indicative Gas Supply Cost to Almaty
($ per 1,000 CM)

Gas source	*Opportunity cost at Symkent*	*Transportation Symkent to Almaty*	*Opportunity cost at Almaty*
Gas imports	35.00	7.40	42.40
Karachaganak gas via a new pipeline[a]	72.65	7.40	80.05
Karachaganak gas via existing lines (reversed)[a]	37.65	7.40	45.05
Karachaganak Export Gas via a new pipeline	105.00	7.40	112.40
Karachaganak export gas via existing lines (reversed)[b]	70.00	7.40	77.40
Amangeldi gas	28.50	7.40	35.90

a. The opportunity cost of Karachaganak gas is defined in paragraph 3-12 b above.

b. Karachaganak export gas is valued at the wellhead at an estimated export price of $50/1,000 CM (see table 1.4).

It should be noted that, until Kazakhstan's export marketing capabilities are well established, it is unlikely that all available gas will be exportable. Consequently, the opportunity cost based on local usage rather than export usage will be the more relevant number to use at this time.

Table 3.6. Market Values for Gas at Almaty

Consumer	*Competing fuel*	*$/mmbtu*	*$ per 1,000 CM*
Power generation	Coal	2.27	80.2
Power imports	Hydro	2.16	76.2
General industry	Mazout	1.79	63.3
Nitrogen fertilizer	Imported urea	1.16	41.0
Commercial/residential	LPG	3.22	113.5

3.14 As tables 3.5 and 3.6 indicate, development of Amangeldi and associated gas fields will produce gas that is very attractively priced against all alternative supply sources and will be competitive for all identified uses at Almaty. Amangeldi, however, will only be able to deliver a maximum of 3 BCM yearly, which means that other gas sources will be required to meet the demand in the southern region. While the alternative value of gas imports is significantly higher than the Amangeldi gas, it is still lower than the opportunity cost of Karachaganak gas, even when valued at the wellhead at a marginal production cost of $0.50/mmbtu. Imported gas will be competitive for all applications except nitrogen fertilizer manufacture; it would thus be in Kazakhstan's interest to import all nitrogen fertilizer needs.

The Environmental Benefits of Natural Gas

3.15 The market values identified above do not include economic values for the environmental benefits of gas, particularly when replacing coal. A switch from low-grade coal to natural gas has the potential to reduce emissions of CO_2 acid gas and particulate. A typical example of the benefit is summarized in table 3.7.

Table 3.7. Emission Rates of Pulverized Coal-Firing Power Stations and CGT Stations
(grams/Kwh)

Emission	*Coal-firing power stations*	*Gas-firing stations (CCGT)*
Particulate	0.122	0
SO_2	5.0–12.0[a]	0
NOx	3.12	1.0
CO_2	850	400

a. This depends on the sulfur content of the coal

Kazakh coal contains a large percentage of ash, which implies that a considerable environmental benefit will be realized by switching from coal to natural gas. Future plans for thermal power stations should, therefore, include a quantitative assessment of the potential environmental benefits. A rigorous assessment will require a detailed analysis of (i) the quality of the coal (taking into account both the calorific value and the impurities in the coal) and (ii) the abatement cost to decrease emissions. An indication of typical abatement costs is shown in table 3.8. This example addresses costs in the United States.

Table 3.8. Typical Abatement Costs

Emission	*US$ per ton*
Particulate	3,000–5,000
SO_2	4,060
Nox	1,640
CO_2	10–20

Source: Pace University.

If these abatement costs were to apply in Kazakhstan, the market value of gas for power generation would increase about $0.50/mmbtu ($17.65/1,000 CM) without taking account of CO_2 abatement and about $1.10/mmbtu ($38.83/1000 CM) when CO_2 abatement is included. While U.S. abatement costs could well be higher than those in Kazakhstan, they do provide an indication of the environmental value that can be gained by switching from coal to gas.

Future Demand Projections

3.16 Provided import supplies can be made consistently available in the south (which is primarily a matter of ensuring that timely payments are made), there is every reason to

expect that gas consumption levels will rebound as the economy starts to recover. Table 3.9 summarizes a very preliminary projection of gas demand by oblast.

Table 3.9. Preliminary Projection of Gas Demand
(billion cubic meters)

Area	*1996*	*2000*	*2005*	*2010*
Almaty	0.8	0.95	1.03	1.06
Zhambyl	1.1	1.6	1.65	1.75
South Kazakhstan	1.0	1.0	1.07	1.10
Total southern region	2.9	3.55	3.75	3.91
Atyrau	0.5	1.01	1.24	1.24
Mangystau	1.8	1.47	1.76	1.86
West Kazakhstan	0.5	0.55	0.83	1.03
Total western region	2.8	3.03	3.83	4.13
Aktyubinsk	1.0	1.64	1.77	1.77
Kostanai	1.1	1.34	1.47	1.59
Total region	2.1	2.98	3.24	3.36
Akmola			0.40	0.68
Kokshetau			0.25	0.30
Kizyl-Orda		0.30	0.60	0.90
Total region		0.30	1.25	1.88
TOTAL	7.8	9.86	12.07	13.28

Source: ESMAP Task Force/EC Energy Survey.

Domestic Gas Infrastructure

3.17 As already noted, the pipeline system in Kazakhstan was designed to meet the requirements of the former Soviet Union, not to meet the specific energy requirements of Kazakhstan. The pipeline network includes the following components:

a. The Central Asia to Central Europe gas export corridor extends from Turkmenistan through Uzbekistan and Kazakhstan to connect with the southern link of the Siberian pipeline system, which transits the Ukraine to the Slovakian border. CAC consists of five lines (1,000 to 1,400 millimeters in diameter) and transits 820 kilometers through Kazakhstan. It has a total design capacity of 185 MCM/day (67 BCM/year[7]). The line is currently used almost exclusively by Turkmenistan.

[7] Nominal capacity is 80 BCM/year.

b. The Bukhara to Ural corridor, which extends over 630 kilometers, consists of two 1,000-millimeter-diameter lines with a design capacity of 40 MCM/day (14 BCM/year).

c. The "Soyuz" and "Novopokov" lines (the southern section of the Siberian pipeline system) are 1,200 millimeters and 1,400 millimeters in diameter and run in parallel for 380 kilometers through northwestern Kazakhstan. Their design capacity is 170 MCM/day (62 BCM/year). The CAC line connects with these lines at Alexandrov. They then continue through Ukraine to the Slovakian border. The Soyuz line is well positioned to transport Karachaganak gas, provided the gas has been processed.

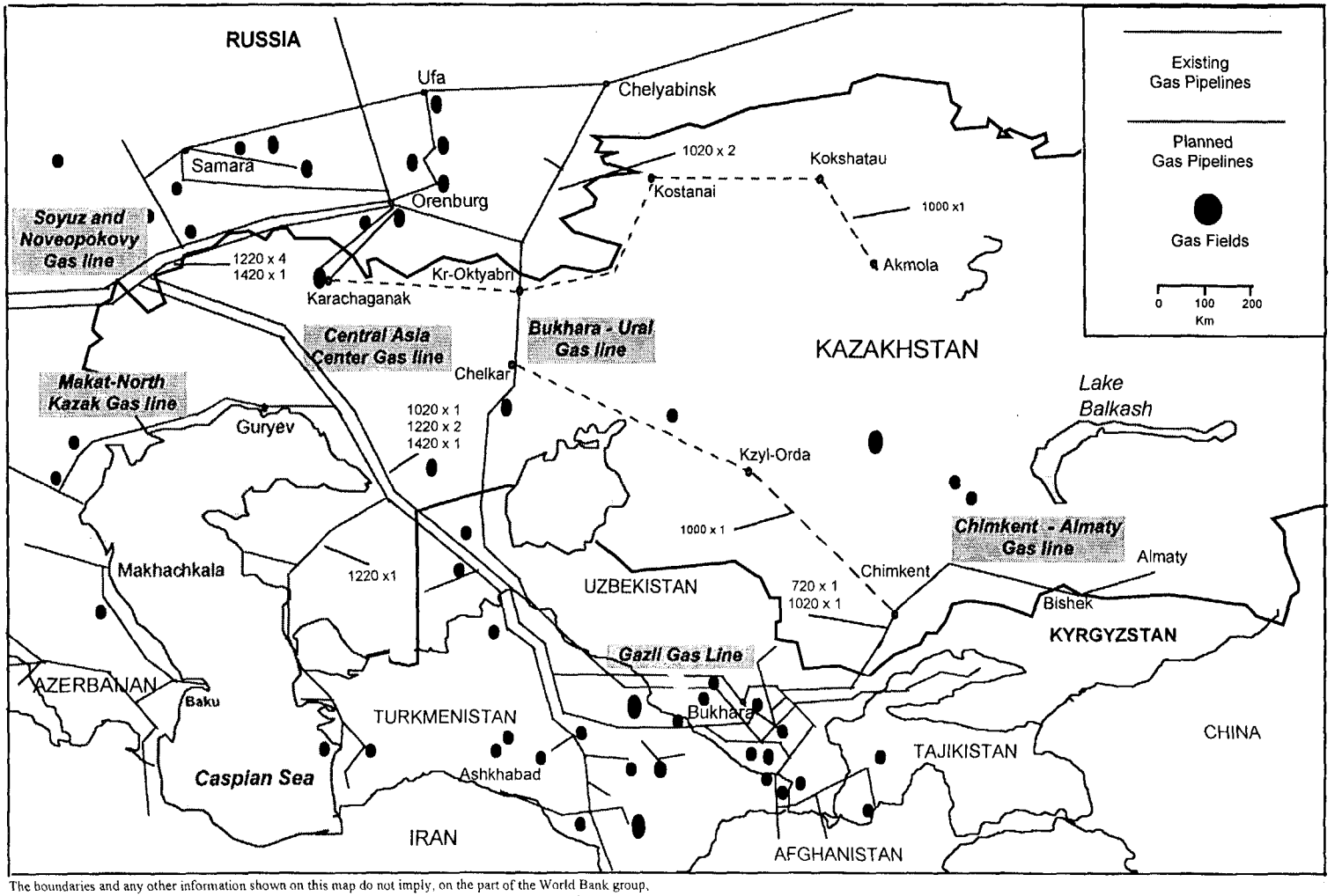
d. The Bukhara-Tashkent-Symkent-Zhambyl-Bishkek-Almaty line extends over 700 kilometers from Uzbekistan to Almaty, transiting Kyrgyzstan en route. It consists of 700 mm to 1,020 mm lines and has a design capacity of 36 MCM/day (13 BCM/year).

e. The Makat-North Kafkaz line extends from the CAC line at Makat over 370 kilometers to deliver gas into Georgia and connect with the delivery system to Azerbaijan and Armenia. It is a 1,400-millimeter-diameter line with a design capacity of 70 MCM/day (26 BCM/year.)

f. A dedicated line carries sour gas from Karachaganak to Orenburg, where it is processed. The capacity of this line is 6 BCM/year.

3.18. The existing pipeline system configuration does not permit Kazakhstan to deliver gas directly from Karachaganak and other gas producing fields in the western part of the country to the population centers in the south of the country. The option does exist to reverse the flow of a portion of the CAC line and/or the Bukhara-Ural line. This would enable the delivery of gas to the south, provided agreement is reached for this gas to transit Turkmenistan, Uzbekistan, and Kyrgyzstan. Gas cannot be delivered to the south without transiting Uzbekistan and Kyrgystan. Without the construction of additional pipeline facilities, therefore, Kazakhstan cannot become energy-independent. In addition, the existing system can only deliver gas to eight of the country's nineteen oblasts; it reaches about half the country's population. The gas pipelines in Kazakhstan are shown in figure 3-4.

Figure 3.4. Gas Pipelines in Kazakhstan



The boundaries and any other information shown on this map do not imply, on the part of the World Bank group, any judgement on the legal status of any territory or any endorsement or acceptance of such boundaries.

3.19 Consideration has been given to investment in an extended pipeline network that would comprehend the delivery of gas from Karachaganak to both the southern region (through a new pipeline from Chelkar to Symkent), displacing existing imports, and to Akmola in the northeast of the country, which would open up a potential new domestic market for gas. Consideration is also being given to the construction of a pipeline that would bypass Kyrgyzstan. The economic justification for the bypass is based on Kazakhstan's experience of gas "losses" during the transit through Kyrgyzstan. The need for such a bypass could be avoided if Kazakhstan could be assured that Kyrgyzstan would pay for any gas obtained during the transit. Without such assurances, however, Kazakhastan may have no alternative than to construct the bypass.

3.20 As already noted, the option of delivering Karachaganak gas directly to the southern region through a new pipeline link between Chelkar and Symkent is unattractive when compared with the alternative of purchased imports, even when Karachaganak gas is only valued at its marginal cost of production. (When valued at export parity it cannot compete with alternative fuels in the southern region.)

3.21 The pipeline economics associated with delivering gas from Karachaganak to Akmola are also questionable. The transportation cost to deliver gas to Akmola through a new pipeline system from Karachaganak is estimated as $1.74/mmbtu ($61.4 per 1,000 CM)[8] based on a design delivery rate of 7 BCM/year. With Karachaganak gas valued at its marginal production cost, this would result in an alternative value for delivered gas of $2.24/mmbtu ($79.1 per 1,000 CM).[9] As noted earlier, the market value for gas at Akmola is $2.00/mmbtu, ($70.6 per 1,000 CM), based on the regulated costs of coal and transportation, but without allocating any economic credit for environmental improvements. If the regulated costs for coal and transportation are valid, such deliveries would likely result in a net loss. Were Karachaganak gas to be valued at export parity, the option of delivering gas to Akmola by this route would be even less attractive. The addition of environmental credits could increase the market value of gas to about $2.50/mmbtu ($88.25 per 1,000 CM) without taking account of CO_2 abatement; the value would rise to $3.10/mmbtu ($109.4 per 1,000 CM) if CO_2 abatement is included. With the incorporation of environmental externalities, therefore, gas deliveries to Akmola could become economically viable once demand reaches a level of about 5 BCM/year. The small gas requirements projected for Kostanai and Akmola in both 2005 and 2010, however, could not justify the required level of investment. As a result, it would likely be difficult to demonstrate sufficient economic viability to be able to obtain financing for such a project at this time. Nevertheless, further studies should be undertaken to evaluate the Akmola option in more detail. These studies should address not only transportation costs and the environmental savings, but also the real (unregulated) cost of the coal that

[8] For more details, see Appendix 3.8.

[9] $17.7 + $61.4 = $79.1.

would be displaced by natural gas. The economics of gas supply to Akmola is summarized in table 3.10.

Table 3.10. The Economics of Gas Supply to Akmola

Item	*Market value ($/1,000 CM)*	*Estimated supply cost ($/1,000 CM)*
Karachaganak gas[a]	-	79.1
Market value[b] (w/o environment credit)	70.6	-
Market value (with environmental credit excluding CO_2 abatement cost)	88.25	-
Market value (with environmental credit including CO_2 abatement cost)	109.4	-

a. Valued at marginal production cost, based on 7 BCM/Y.

b. Based on regulated cost of coal.

3.22 While major new pipeline investments do not appear particularly attractive economically, selected smaller pipeline investments will expand the market for natural gas and warrant more detailed evaluation. Among these are connections from the producing fields in the Aktyubinsk area to the population center in the area and a connection from the Russian gas pipeline system to Petropavlovsk.

3.23 In the overall scheme, any investment in new pipeline facilities will have to compete with other capital requirements. Kazakhstan's existing transmission network is in need of major rehabilitation and upgrading. Identified requirements include the following:

- Rehabilitation of the CAC line, including putting the CAC-1 and CAC-2 lines back into operation, making operational the KC-Oporny workshops 4 and 5, and extensive scraper operations
- Repair of corrosion problems associated with the Soyuz line and other lines in Kazakh territory
- Rehabilitation of the Bukhara-Ural line to enable it to operate at its design pressure of 55 bar (it is operating at a reduced pressure of around 40 bar)
- Rehabilitation and optimization of the Gazli/Bukhara-Symkent line in order to increase the transport capacity, including improvement of operating pressure to the

original design pressure of 75 bar, minimizing liquids inclusion by installation of filters, and optimizing gas compression by installing a few compressors

- Rehabilitation and optimization of the Symkent-Almaty line in order to increase the transport capacity by adding a 22 kilometers of pipe with a diameter of 1,020 millimeters at the suction side of KC-4A compressor station, doubling the pipeline for the last section of 47 kilometers up to Almaty, and increasing the operating pressure to the original design pressure of 55 bar
- An increase in storage capacity in southern Kazakhstan from its current working level of 845 million cubic meters to a required level of 3.4 billion cubic meters and, in conjunction with this, an improvement in the pump in–pump out capacities. (According to information provided by Alaugaz, the seasonal load variation is about 50 percent. Given the constraints on gas supply related to payment issues, the capacity of existing underground storage has not been a critical issue. When demand recovers, however, the expansion of gas storage and the introduction of operational links between storage facilities and major gas users such as power stations will be necessary.)
- Renewal of cathodic protection, coating, and gas leakage detection throughout the system
- An extensive improvement in metering capabilities (this is discussed further below)
- The establishment of an integrated operating center in each gas consumption center
- The introduction in each LDC of a hydraulic model covering its gas supply pipelines to major consumers and the introduction of an unsophisticated monitoring system to minimize technical and nontechnical losses.

3.24 Projected capital requirements also include the need to install gas processing facilities at Karachaganak and other gas producing fields if export quality specifications are to be met. An eventual processing capacity of 15 BCM/year is envisaged.

Domestic Gas Operations

3.25 Kazakhstan's petroleum industry is functionally organized under the administrative oversight of the Ministry of Energy and Natural Resources (MENR). Under the terms of the presidential decree dated March 4, 1997, MENR took over, among other matters, the functions of the former Ministry of Oil and Gas (MOG) and the former Ministry of Geology (MG), which had previously shared oversight responsibility for the petroleum industry. A national oil company has also been created that is responsible for the overall operation of the gas sector.

3.26 The gas sector is undergoing a restructuring from the basis stipulated in Cabinet of Ministers decree No. 1237, issued on October 6, 1995. The decree required the following measures:

a. Two joint-stock companies, Kazakhgaz and Alaugaz, would be created, under MOG supervision, to handle gas transmission.

b. Ownership of local gas distribution companies should be completely separated from that of the gas transmission companies.

c. A joint-stock company, "Karachaganakgas," would be created. It would have the right to produce, process, and sell hydrocarbon condensates and associated gas from the Karachaganak field.

3.27 Following implementation of this decree, a structure was set in place for the sector that would operate until the changes initiated by the decree of March 1997. Kazakhgaz, which was once the sole national gas company, had owned gas reserves in Karachaganak and other domestic fields; had operated a major local pipeline network, primarily located in western Kazakhstan; and had operated the gas transit pipelines from Turkmenistan/Uzbekistan to Russia. Kazakhgaz had been responsible for gas transmission to five oblasts: Atyrau, Mangystau, West Kazakhstan (the western region), Aktyubinsk, and Kostanai. Its operating responsibilities ended at the gas distribution station in each oblast, where the local gas distribution companies took over. A Kazakhgaz joint-stock company subsidiary, "Batystransgas," had specific responsibility for the operation of the CAC pipeline. Karachaganakgas had also been treated as a subsidiary of Kazakhgaz. Karachaganakgas, however, has now been transferred to Kazakhoil. Kazakhgaz has handled most of the arrangements to purchase gas from Turkmenistan, Uzbekistan, and Russia.

3.28 Alaugaz has been operating the country's southern gas transmission system from Gazli in Uzbekistan to Almaty since 1994. It has been responsible for gas transmission to the local gas distribution companies in the three southern oblasts and has also been responsible for LPG transportation.

3.29 As part of its restructuring effort, the government has transferred the Karachaganak and the other producing assets that were under Kazakhgaz control to Kazakhoil. It also announced the selection of Tractebel of Belgium as the partner selected to enter into a fifteen-year concession agreement for the overall gas transmission and transit system in the country. There is now a possibility that the gas infrastructure assets of Kazakhgaz and Alaugaz may soon be transferred to a new gas transmission company, and other responsibilities may be reallocated.

3.30 Local gas distribution companies (LDCs) or "Oblagas" companies have operated under the supervision of the eight individual oblast governments and have been responsible for gas distribution within their respective oblasts.

The Gas Companies' Financial Problems

3.31 The domestic gas companies all face a significant financial challenge. Nonpayment is a problem that pervades the entire gas supply chain and has created severe financial difficulties for the companies. This, in turn, has resulted in a shortfall in the investments required for operations and maintenance. A long-term resolution of the payment problem must be regarded as a top priority. It is likely that a solution will require legislation that permits the gas companies to curtail supplies and strengthens their ability to collect outstanding accounts receivable. Other measures, however, are also required if these companies are to return to good health. These measures include improving operating efficiency, particularly a substantial reduction in the companies "gas cost for own needs and losses"; the elimination of surplus staffing in the workforce; reform of the tax system to eliminate tax levies on phantom profits; and reform of the pricing system to ensure that full cost recovery is achieved and all categories of consumers are treated in an equitable fashion.

3.32 To achieve the goal of business efficiency, privatization will ultimately be required. The government, recognizing that the foreign private sector could assist in turning around the performance of the domestic gas companies, has therefore embarked on a privatization process. While the foreign private sector has both the investment capability and the technical know-how to assist the domestic industry, the privatization process should be staged.

3.33 The activities managed by the two transmission companies, Kazakhgaz and Alaugaz, should deliver acceptable financial results as soon as the nonpayment problem is brought under control. Table 3.11 is a proforma summary representation of an income statement for Kazakhgaz based on its 1995 performance.[10]

Kazakhgaz also has the potential to generate hard currency earnings, which increases its potential appeal to foreign investors. A similar proforma analysis of the performance of Alaugaz suggests that it could have generated positive earnings of about $2 to $3 million in 1995.

Table 3.11. Proforma 1995 Income Statement for Kazakhgaz
(million US$)

Item	*CAC transit*	*Distribution*	*Production*	*Total*
Revenue	300	13	92	405
Operating expenses	(223)	(10)	(69)	(302)
Operating income	77	3	23	103

[10] For details, refer to Appendix 3.12.

3.34 As previously mentioned, the government has announced the selection of Tractebel of Belgium to establish a concession arrangement covering the gas transmission and transit systems in the country.

3.35 It is unlikely that the government could obtain full value at this time if it were to offer the LDCs to the private sector. Instead, it would be preferable to pursue a turnaround effort. Such an effort would perhaps be most effectively managed by engaging foreign private sector companies under management contract arrangements. Performance targets could then be established that would set the stage for subsequent privatization. A management contract arrangement would not provide direct access to the investment funds needed to support a turnaround in the local distribution operations, but it would greatly facilitate access to funding or to guarantees from bodies such as the World Bank.

3.36 As the privatization effort proceeds, three other factors should be kept in mind:

a. The institutional capability to deal with foreign private sector involvement in the gas transmission and distribution sectors is currently inadequate. An acceptable legislative and regulatory framework for the gas sector needs to be introduced (this will be discussed in more detail later in the report), and this introduction needs to take place before any arrangements with the private sector are concluded.

b. Kazakhstan should have a clear understanding of the needs and expectations of its neighbors regarding the use of Kazakhstan's transmission facilities. There is a considerable commonality of interest among the various regional gas players, and it would be very much in Kazakhstan's interest to participate in a cooperative dialogue with its neighbors on the subject of gas supply and demand. Precipitous action with regard to the transit pipelines and the associated arrangements for access and throughput could have a detrimental effect on such a dialogue.

c. LPG operations should be separated from natural gas operations and offered separately to the private sector, in a manner that promotes competition.

Gas Metering

3.37 One of the factors that could adversely affect resolution of the nonpayment issue is the lack of adequate metering throughout the gas sector. The introduction of metering for all customers will ultimately be required, although the immediate introduction of meters to customers who use gas only for cooking may not be financially justifiable and could be deferred. Within this context, it should be noted that in May 1997, the Government of Kazakhstan issued a new decree entitled "Resolution of the Government on Regulation of the Norms of Consumption of Heat, Hot and Cold Water," which mandated the installation of gas meters.

3.38 One option that warrants consideration is the widespread introduction of electronically controlled prepayment meters. Prepayment meters are relatively expensive, but they offer a considerable number of benefits:

- Consumer behavior is dramatically changed. Consumers are forced to rapidly come to grips with the reality that energy is not free.
- They tend to enhance energy savings (tests suggest that these should amount to at least 10 percent).
- They can help resolve the uncomfortable issue of forced curtailment of supplies: the decision to maintain or curtail supplies will clearly reside with the customer.
- Gas companies typically enjoy a reduction in operating costs through such benefits as a reduction in accounts receivable, a reduction in billing overhead, and the elimination of the need for meter readers.

3.39 While further investigation is needed to determine whether prepayment meters would generate appropriate benefits in Kazakhstan, should a rigorous cost/benefit analysis suggest that their introduction is economically feasible, consideration should be given to implementation of a pilot project.

Summary of Key Issues

3.40 The key issues related to the domestic gas sector may be briefly summarized as follows.

In looking to supply the southern region in the future, Kazakhstan has four options:

- Imported gas could be purchased from Turkmenistan and Uzbekistan (this would be a continuation of existing practice).
- Pipeline links could be constructed from the Karachaganak field to the CAC and/or Bukhara-Ural pipelines, and then a portion of the flow on these lines could be reversed.
- Pipeline links could be constructed from the Karachaganak field to the Bukhara-Ural pipeline and from Chelkar (further south on the Bukhara-Ural line) to Symkent in the southern region. This option, which would require a significant capital commitment, is the only one that would permit the country to become energy independent.
- A long-term exchange arrangement could be put in place whereby Turkmenistan and/or Uzbekistan would deliver gas to the southern region through the Bukhara-Almaty line and would receive gas from Karachaganak delivered into the UGS system at Alexandrov for subsequent export to the FSU and European markets.

3.40 Energy independence, at least in the gas sector, is not an economically viable proposition. Kazakhstan, however, can maximize the potential value of its gas resource base by negotiating long-term exchange agreements with its suppliers: Turkmenistan, Uzbekistan, and Russia. Under the terms of these agreements, Kazakhstan would obtain gas in the south of the country and in the Aktyubinsk and Kostanai regions from Turkmenistan, and/or Uzbekistan, and/or Russia and would deliver Karachaganak gas into the UGS system on behalf of its exchange partners for delivery to FSU countries and/or Europe.

3.41 There are two key components to the economics of an arrangement to exchange gas supplies rather than to purchase the gas outright. The first component is the simple comparison between purchasing the gas outright and producing gas at Karachaganak and delivering it into the UGS system. Table 3.12 summarizes the potential savings that such an exchange could offer.

Table 3.12. The Economics of Exchange versus Purchase
(US$/1,000 CM)

Item	*Purchase cost*		*Exchange cost*
Purchase price	35.00	50.00	n.a.
Production cost	n.a.	n.a.	17.65
Transportation to UGSS	-	-	3.53
Loss of transit fees	-	-	12.00
Total cost	35.00	50.00	33.18
Exchange savings	n.a.	n.a.	1.82/16.82[a]

n.a. Not applicable.

a. The maximum exchange volume is estimated as 5 BCM for the near future.

This table requires some explanation:

- Two purchase prices are shown, a price of $35/1,000 CM and an assumed future price level of $50/1,000 CM. (The price is currently $47/1,000 CM.)
- The production cost is based on the assumed $0.50/mmbtu production cost level at Karachaganak.
- The transportation cost to UGSS is based on an estimated tariff of $0.10/mmbtu to cover the cost of a new pipeline connection to UGSS.
- The transit fees are lost because under an exchange arrangement, Turkmenistan/Uzbekistan would no longer be transporting the exchange volume of

gas across Kazakhstan. This loss is based on an assumed transit fee of $1.50/1000 CM per 100 kilometers; that is, $1.50 x 8.

When compared with the option of purchasing imported gas, such an exchange arrangement offers Kazakhstan savings on the order of $2 per 1,000 CM at the current import price of $35/1,000 CM. As the price of imported gas increases, however, so will the savings—at an import price of $50/1,000 CM, the savings would amount to about $17 per 1,000 CM. Of potentially more significance, however, is that such an exchange would provide an assured outlet for a volume of gas equivalent to the amount being purchased. To the extent that Kazakhstan is able to generate sufficient market outlets to avoid flaring gas or cutting back condensate production, the economics of the exchange arrangement are those outlined above. In the event that Kazakhstan either does not have sufficient outlets to avoid flaring and/or curtailing condensate production, or if Kazakhstan is forced to sell gas at distress prices, the financial benefits of the exchange will be significantly higher (more details are provided in Appendix 3.14).

3.43 The second component of an arrangement to exchange gas supplies is the transportation saving that can be realized. Table 3.13 addresses the potential saving versus the option of constructing new pipeline links to the southern region.

Table 3.13. The Economics of Exchange versus Transportation Through a New Pipeline
(US$/1,000 CM)

Item	*Transportation cost*	*Exchange cost*
Production cost	17.65	17.65
Transportation to Symkent[a]	54.72	-
Transportation to UGSS[b]	-	3.53
Loss of transit fees[c]	-	12.00
Total cost	72.37	33.18
Exchange saving	n.a.	39.19

a. See Appendix 3-8 for details of the transportation cost calculation.

b. Based on an estimated tariff of $0.10/mmbtu to cover the cost of a new pipeline connection to UGSS.

c. Based on an assumed transit fee of $1.50/1,000 CM per 100 kilometers; that is, $1.50 x 8.

When compared with the alternative of transporting gas from Karachaganak through a new pipeline, the exchange offers savings on the order of $39/1,000 CM.

3.44 Table 3.14 outlines the savings available when comparing an exchange arrangement with the option of reversing the flow on a portion of the CAC and/or Bukhara-Ural pipelines.

Table 3.14. The Economics of Exchange versus Reversing the Flow of a Portion of the Existing Pipeline
(US$/1,000 CM)

Item	*Transportation cost*	*Exchange cost*
Production cost	17.65	17.65
Transportation to Symkent[a]	20.00	-
Transportation to UGSS[b]	-	3.53
Loss of transit fees[c]	-	12.00
Total cost	37.65	33.18
Exchange saving	n.a.	4.47

a. Based on an assumed transit fee level of $50/1,000 CM per 100 kilometers plus the cost of reversing the pipeline flows.

b. Based on an estimated tariff of $0.10/mmbtu to cover the cost of a new pipeline connection to UGSS.

c. Based on an assumed transit fee of $1.50/1,000 CM per 100 kilometers; that is, $1.50 x 8.

Although the savings in this instance are relatively limited, the opportunity does exist to negotiate a sharing of the combined savings to ensure an equitable arrangement. This would enhance the potential value of this exchange. It is worth noting that in all three cases, the exchange also offers Turkmenistan/Uzbekistan transportation savings on the order of $12 per 1,000 CM for gas delivered into the UGSS. One additional benefit of such an exchange is that it would significantly reduce the potential for future disputes concerning the price of imported gas.

3.45 While the exchange option is preferable to reversing a portion of the flow in the CAC and/or Bukhara-Ural lines, a reversal of the flow could represent a realistic alternative to an exchange arrangement. This is particularly true given the uncertainty regarding Turkmenistan/Uzbekistan's future interest in obtaining gas delivered into the UGSS at Alexandrov. Consequently, the government should initiate an effort to evaluate how this alternative might be implemented. Since an understanding of this alternative could be of value in the exchange negotiation discussions, this assessment should be undertaken as soon as possible.

3.46 A significant turnaround is required in the financial and operating performance of the domestic gas companies. Participation of the foreign private sector will certainly facilitate such a turnaround. Care must be taken, however, with the timing of the planned privatization effort. While the gas transmission and associated facilities could be offered on a lease/concession basis as soon as the appropriate legislative and regulatory framework is in place, it would be preferable to effect the required turnaround of the LDCs before offering them for full privatization. Such a turnaround effort would be

greatly facilitated if foreign private sector companies were to be brought in to handle the effort under management contracts.

3.47 The turnaround of the domestic gas sector will require significant investments to rehabilitate and upgrade the existing system. Within this context, it is worth highlighting the need to establish an objective of metering all gas deliveries, which is essential if the pervasive nonpayment problem is to be resolved. The establishment of metering stations at all cross-border locations is also required.

4

The Outlook for Gas Exports

Potential Export Markets

4.1 Kazakhstan has the potential to access export markets in the FSU[11] countries, Turkey, Eastern Europe, and Western Europe, provided it is accorded access to the export pipeline links of the FSU that are now controlled by Russia. The Soyuz pipeline, which transits northwestern Kazakhstan, provides potential access, either directly or indirectly, to Russia, Ukraine, Azerbaijan, and Armenia. The Soyuz line transits Ukraine to the Slovakian border. Gas from Karachaganak could easily be delivered to the Soyuz line. Russia, however, controls the mechanism for delivering gas to Europe, and access to European markets would be predicated on an agreement with Russia to permit gas to be delivered to Europe on Kazakhstan's behalf.

4.2 Turkmenistan is established as the main gas exporter among the Central Asian states. As such, Turkmenistan's activities provide a key indication of what Kazakhstan can expect as it pursues export marketing opportunities. Immediately after independence, Turkmenistan was accorded access to the markets of Western Europe by means of an exchange with Russia. This agreement, however, was subsequently terminated, limiting Turkmenistan's export outlets to a number of FSU countries that could be supplied directly. In 1996, Turkmenrosgas (TRAO), a joint venture between Turkmenistan and Gazprom, was established to handle Turkmenistan's gas exports. During 1997, TRAO, with specific Gazprom assistance, planned to deliver 20 BCM of Turkmen gas to countries in Eastern Europe. The TRAO arrangement has since encountered problems, however, and these deliveries have not materialized, and deliveries of Turkmen gas to Western Europe have not been resumed. Turkmenistan's experience demonstrates the importance of Kazakhstan cooperating with Russia (most likely in the form of Gazprom) if Kazakhstan is to gain access to export markets.

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[11] The FSU markets that can realistically be accessed are Russia, Ukraine, and Georgia. Azerbaijan and Armenia are also connected to UGSS. For the foreseeable future, however, the Azerbaijan and Armenian markets are unlikely to offer an assured outlet for gas.

4.3 Consideration has been given to the development of a number of other export outlets for gas produced in Central Asia (in Kazakhstan, Turkmenistan, and Uzbekistan). Projects planned or under consideration include:

- To Turkey (through Iran or across or around the Caspian Sea and through either (i) Azerbaijan and Georgia or (ii) Russia (Chechen and Georgia)
- To Europe through Turkey
- To Pakistan and India (through Afghanistan or Iran)
- To China and Japan.

A combination of economic and political constraints, however, suggest that it will not be easy to implement any of these projects for a number of years. Consequently, Kazakhstan should focus its immediate energies on obtaining access to export markets, first through Russia, and as a fallback, through the Caspian Sea or Iran.

4.4 Both Turkmenistan and Uzbekistan have a similar interest in developing export outlets. A coordinated approach to negotiating with Russia for access to European markets would likely benefit all three Central Asian States.

4.5 In the event negotiations with Russia prove unsuccessful, the most realistic option is to pursue construction of a line across the Caspian (or through Turkmenistan and Iran), through the Caucasus countries and Turkey, to Europe. Ideally, such a line should be constructed jointly by Kazakhstan, Turkmenistan, and, possibly, Uzbekistan. Preliminary analysis suggests that the economics of such a line are marginal at this time. The European Union, however, would welcome an alternative transportation route for gas originating in Central Asia, because this would increase the European comfort factor with regard to the security of future gas supplies. European Union support in the form of low-cost, nonrecourse financing and an assured market outlet for the gas for some period of time would substantially improve the economic viability of such a project.

The Western European Markets

4.6 While Western Europe is currently fully supplied with gas, future growth in demand, coupled with a decline in gas availability from traditional supply sources, will result in a supply gap that could materialize shortly after 2000. Table 4.1 summarizes the projected demand outlook for OECD Europe and compares it with the projected availability of supplies from established sources. Two supply cases are shown—a "base" case and a "low" case, which assumes a 10 percent shortfall in projected supplies when compared with the "base" case. These examples indicate the potential supply gap range.

Table 4.1 The Projected Supply Gap in OECD Europe
(billion cubic meters)

Demand/supply	*1995*	*2000*	*2005*	*2010*
Demand				
France	37.7	42.0	44.4	46.3
Germany	84.6	109.3	119.3	125.3
Italy	53.4	67.0	72.4	77.9
Other	112.3	171.7	188.9	220.5
Total	288.0	390.0	425.0	470.0
Supply potential, base case		420.0	425.0	410.0
Supply gap		n.a.	0	60.0
Supply potential, low case[a]		n.a.	382.5	369.0
Supply gap		n.a.	42.5	101.0

a. 10 percent less than the base case.

Source: Cedigaz (1994); International Energy Agency (1994); Statoil: Gas U&M Gassinfo (1996).

The issue in Western Europe is not whether new supply sources will be required, but when they will be required. With this in mind, European governments have started to explore possible gas supply alternatives and have demonstrated a specific interest in the potential for gas deliveries from Central Asia.

4.7 Three established suppliers will certainly seek to cover a portion of future demand:

- Algeria will likely expand its capability to deliver gas to Europe through Italy.
- Norway is the only country within Europe with the capability to increase both production and exports.
- Russia has very significant additional production potential, particularly from the Yamal field. Russia has had no difficulty obtaining financing for a project to deliver Yamal gas to Europe and this is evidently proceeding.

LNG from North Africa, West Africa, and the Middle East will also likely seek to penetrate the European market.

4.8 Russian gas supplies represent by far the largest threat to Kazakhstan's ability to establish a presence in the European gas market. Without Yamal, the Russian gas bubble could well diminish to the point that it would not be in Russia's interest to keep Central Asian gas away from the European markets. With Yamal, however, Russia will have a considerable incentive to attempt to limit Central Asian gas deliveries to Europe. This may ultimately force Kazakhstan to pursue the option of a pipeline across the Caspian,

but only after every effort has been made to come to a reasonable agreement for pipeline access with Russia.

4.9 In the face of this potential competition, the Central Asian States need to initiate joint efforts to establish a marketing presence in Europe at the earliest opportunity. In undertaking such an effort, Kazakhstan and its Central Asian neighbors will be assisted by the very competitive cost at which they can deliver gas to Western Europe, provided their gas can transit Russia, either through the existing UGS system of through a new pipeline system. Table 4.2 summarizes the cost of delivering gas from a number of potential supply sources to the Frankfurt city gate. These costs are based on the assumptions that either terms can be negotiated for use of the UGS system, or a new pipeline would be constructed through Russia. In the case of Russian gas, the options of delivery from Yamburg through UGSS and from Yamal through the proposed new pipeline are both shown. (More details are shown in Appendix 4.2.)

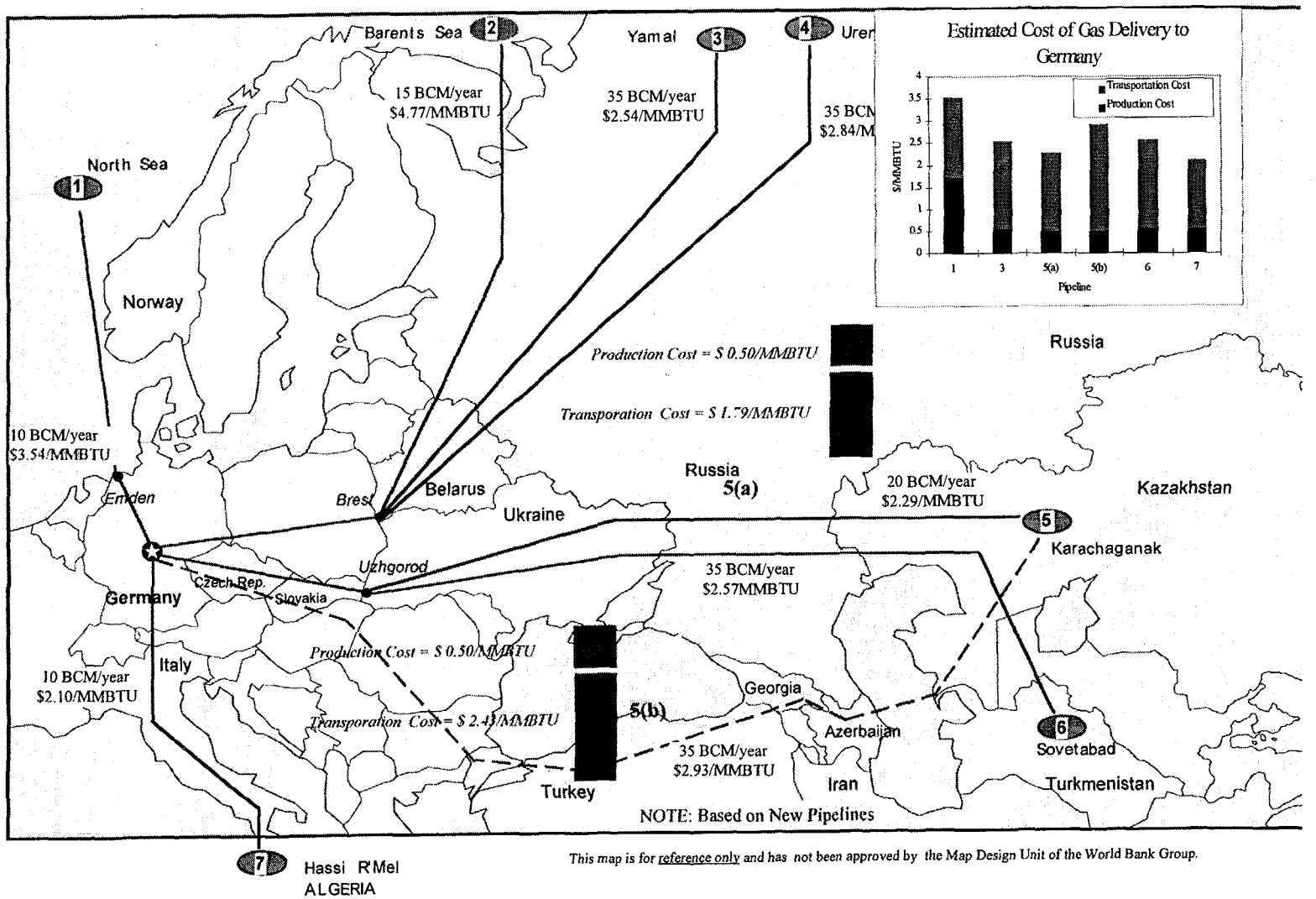
Table 4.2. Estimated Costs for Delivering Additional Gas to Frankfurt, Germany
($/mmbtu)

Gas supply source	*Transportation means*	*Production cost*	*Transportation to Frankfurt*	*Delivered cost*
Kazakhstan	UGSS Pipeline	0.50	1.34	1.84
Kazakhstan	Pipeline via Russia	0.50	1.79	2.29
Kazakhstan	Caspian Pipeline	0.50	2.43	2.93
Turkmenistan	UGSS Pipeline	0.55	1.81	2.36
Turkmenistan	Pipeline via Russia	0.55	2.02	2.57
Turkmenistan	Pipeline via Turkey	0.55	2.23	2.78
Russia (Yamburg)	UGSS Pipeline	0.44	2.10	2.54
Russia (Yamal)	Pipeline	0.55	1.99	2.54
Algeria	Pipeline	0.55	1.55	2.10
Norway	Pipeline	1.73	1.81	3.54
North and West Africa	LNG	0.55	3.00	3.55
Iran	Pipeline	0.46	2.60	3.06
Qatar	LNG	0.46	3.20	3.66

Source: World Bank/ESMAP studies.

4.10 As table 4.2 and figure 4.1 indicate, Kazakhstan could be extremely well positioned competitively to deliver gas to Western Europe, provided the gas can transit Russia. The same is true for Turkmenistan, but Turkmenistan is pursuing the alternative of constructing a pipeline to Turkey (through Iran) that could ultimately be extended in to Europe, even though such a link does not appear particularly competitive. A pipeline from either Kazakhstan or Turkmenistan across the Caspian and the Caucasus

Figure 4.1. Gas Import Options for Germany



countries to Turkey and to Europe, which would include a significant offshore component, would be more costly than a pipeline from Turkmenistan through Iran and Turkey.[12] Consequently, that alternative is likely to be only marginally competitive. As previously noted, however, European Union support in the form of low-cost, nonrecourse financing and assurances of market outlets for a given time period would improve the competitiveness of this option. If the existing pipeline from Turkmenistan to Iran is extended to Turkey, however, the gas supply costs to Turkish markets could be competitive. Some international oil and gas companies are seriously considering this option. The outlook for Uzbekistan would be similar to that of Turkmenistan. It would appear, therefore, that Kazakhstan, Turkmenistan, and Uzbekistan all have a common interest in entering into an agreement with Russia to utilize the UGS system (or even a new pipeline system through Russia) and potentially pursuing the construction of an additional link into Europe. The parties also have a common interest in ensuring that the required rehabilitation of the line occurs.

The Eastern European Markets

4.11 Demand in Eastern Europe is also expected to increase, creating an additional requirement for gas supplies. Table 4.3 summarizes the projected demand outlook for several markets in Eastern Europe.

Table 4.3. Projected Gas Demand in Key Eastern European Markets
(billion cubic meters per year)

Market	*1995*	*2000*	*2005*	*2010*
Bulgaria	5.5	6.1	6.7	7.3
Czech Republic	7.7	10.0	12.8	17.1
Slovakia	5.1	6.4	7.6	8.9
Hungary	10.7	12.3	12.3	12.3
Poland	9.1	13.0	19.5	26.2
Romania	n.a.	19.2	19.7	22.6
Total		67.0	78.6	94.4

Source: ESMAP/World Bank studies (Bulgaria, Poland, Romania) and International Energy Agency.

4.12 Russia has been—and will continue to be—the main supplier of gas to Eastern Europe. Other potential suppliers, however, are emerging:

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[12] In 1993, the World Bank's study, "Turkmenistan—Energy Sector Review," estimated the capital costs for pipelines to transport 28 BCM/Y of gas from Turkmenistan to Turkey as follows:

Turkmenistan-Iran-Turkey	$4.4 billion
Turkmenistan-Caspian Sea-Iran-Turkey	$5.3 billion
Turkmenistan-Caspian Sea-Azerbaijan-Georgia-Turkey	$5.0 billion.

- Norway is currently seeking market outlets in Eastern Europe, focusing specifically on Poland, the Czech Republic, Slovakia, and Hungary.
- Turkmenistan established a joint venture (TRAO) with Gazprom. While this venture had run into problems, discussions with Gazprom have resumed, creating the prospect that Turkmen gas could be supplied to Eastern Europe.
- LNG producers are eyeing the potential that the Eastern European gas market may offer.

4.13 Kazakhstan is also competitively positioned to supply the Eastern European market, provided it can route its gas through Russia (see figure 4-2). Table 4.4 summarizes the cost of delivering gas from a number of different supply sources to the Warsaw city gate. (The underlying assumptions are consistent with those used in table 4.2.)

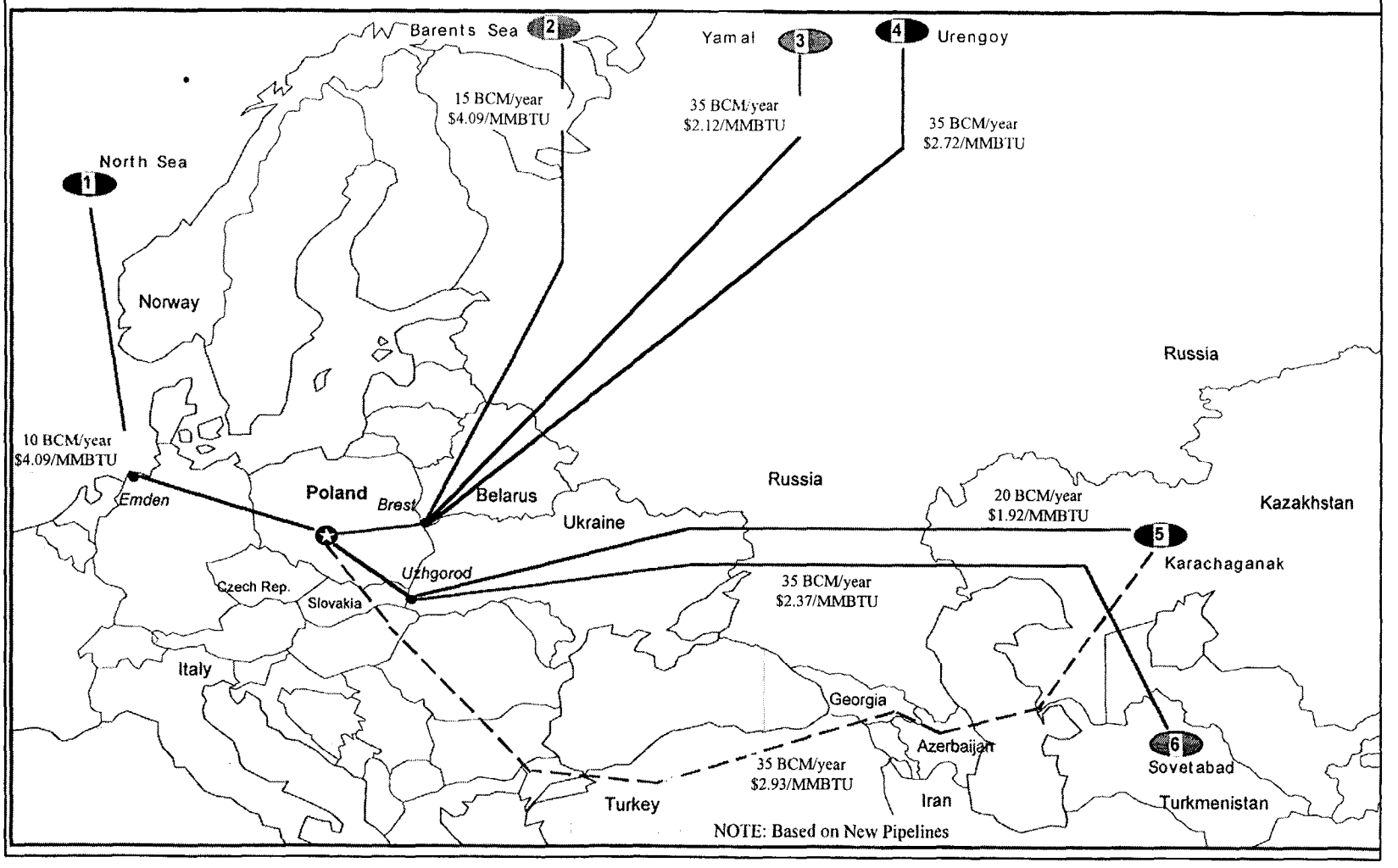
Table 4.4. Estimated Costs for Delivering Gas to Warsaw, Poland
(US$/mmbtu)

Gas supply source	*Transportation means*	*Production cost*	*Transportation to Warsaw*	*Delivered cost*
Kazakhstan	UGSS Pipeline	0.50	1.02	1.52
Kazakhstan	Pipeline via Russia	0.50	1.42	1.92
Kazakhstan	Caspian Pipeline	0.50	2.43	2.93
Turkmenistan	UGSS Pipeline	0.55	1.60	2.15
Turkmenistan	Pipeline via Russia	0.55	1.82	2.37
Turkmenistan	Pipeline via Turkey	0.55	2.28	2.83
Russia (Yamburg)	UGSS Pipeline	0.44	1.87	2.31
Russia (Yamal)	Pipeline	0.55	1.57	2.12
Norway	Pipeline	1.73	2.36	4.09
North and West Africa	LNG	0.55	3.00	3.55
Iran	Pipeline	0.55	2.00	2.55
Qatar	LNG	0.55	2.80	3.35

Note: For additional details see Appendix 4-2.

4.14 One consideration to be kept in mind concerning the Eastern European markets is that, at least in the near term, a portion of the gas sales price will likely have to be taken in the form of counter trade. This year, for example, it appears that, on average, 50 percent of the value of gas deliveries will be handled as barter transactions.

Figure 4.2. Gas Import Options for Poland



This map is for reference only and has not been approved by the Map Design Unit of the World Bank Group.

FSU Country Markets

4.15 Georgia and Ukraine are markets that are potentially accessible to Kazakhstan. (While Azerbaijan and Armenia are also linked to the UGSS, these two countries are unlikely to be market outlets for the foreseeable future.) Karachaganak gas is particularly well positioned competitively for delivery to Ukraine, but it should be noted that current suppliers (Russia and Turkmenistan) have encountered difficulty obtaining payment for gas deliveries there.

The Asian Markets

4.16 Potential markets exist in Turkey, Pakistan, India, and China that could be supplied by the Central Asian States. Project proposals have been developed for each of these markets. A combination of economic and political constraints, however, will likely delay implementation for a number of years.

4.17 **TURKEY.** Table 4.5 summarizes the projected gas balance for Turkey.

Table 4.5. Projected Gas Balance for Turkey
(billion cubic meters)

Item	*2000*	*2005*	*2010*
Demand	23.7	31.4	37.9
Established supply	8.0	8.0	8.0
Supply gap	15.7	23.4	29.9

Source: BOTAS, Turkey 1996.

Turkey is currently being supplied by Russia (6 BCM/Y) and Algeria (2 BCM/Y), which could potentially increase its deliveries.[13] The Russian gas is delivered by a pipeline that accesses Turkey at its western border and extends to Istanbul and Ankara. There have also been discussions about extending a line from Georgia into Turkey, thereby connecting Turkey to the UGSS. This could enable Kazakhstan to deliver gas to Turkey through Russia and Georgia.

Turkmenistan is in the process of constructing a pipeline into Iran which could be extended to Turkey's eastern border;, from there, it could reach the population centers of the country. Egypt is also evaluating the option of delivering gas to Turkey by pipeline or in the form of LNG. In addition, Iran has a potential interest in supplying Turkey. The only ways Kazakh gas could compete effectively with any of these options to deliver gas to Turkey is if it could be transported through the Russian pipeline system or if

[13] With Russia, an agreement was initiated in 1993 to import 6 BCM/Y of gas over twenty-five years. An additional gas supply of 4.5 BCM/Y is under negotiation. With Algeria, an additional supply of 2 BCM/Y is under negotiation. Furthermore, Turkey is discussing possible gas imports with Iran, Qatar, Nigeria, and Turkmenistan.

Kazakhstan could cooperate with Turkmenistan and access a Turkmen line to Turkey, most likely through an exchange arrangement. Table 4.6 summarizes indicative supply costs to Turkey from these locations.

Table 4.6. Indicative Gas Supply Costs to Turkey
(US$/mmbtu)

Gas supply source	*Transportation means*	*Production cost*	*Transportation cost*	*Delivered cost*
Kazakhstan	Pipeline	0.50	1.86	2.36
Turkmenistan	Pipeline	0.55	1.16	1.71
Iran	Pipeline	0.55	0.40	0.95
Egypt	Pipeline	1.70	1.36	3.06

4.19 **PAKISTAN AND INDIA.** Table 4.7 summarizes the projected gas balances for Pakistan and India.

Table 4.7. Gas Balances for Pakistan and India
(billion cubic meters)

Item	*2000*	*2005*	*2010*
Pakistan			
Demand	27.47	36.26	47.84
Established supply	27.00	28.80	28.50
Supply gap	0.47	7.46	19.34
India			
Demand	27.87	47.03	70.48
Production	19.50	26.20	35.00
Supply gap	8.37	20.83	35.48

4.20 Unocal is the proponent of a gas pipeline project from east Turkmenistan to Pakistan through Afghanistan, with an extension to India. (Unocal is also the proponent of an oil pipeline from Kazakhstan to the Arabian Sea through Turkmenistan, Afghanistan, and Pakistan.) The gas pipeline would offer Turkmenistan an extremely competitive transportation cost to deliver gas to the Pakistani and Indian markets. As Table 4.8 indicates, if Kazakhstan were to construct a link to this pipeline, it would also enjoy a relatively competitive cost of transportation and a very competitive overall delivery cost.

Table 4.8 Cost of Delivering Gas to Pakistan and India
(US$/mmbtu)

		Delivery to Pakistan		*Delivery to India*	
Gas supply source	*Production cost*	*Transportation cost*	*Delivered cost*	*Transportation cost*	*Delivered cost*
Kazakhstan	0.50	1.20	1.70	1.60	2.10
Turkmenistan	0.55	0.80	1.35	1.20	1.75
Middle-East Pipeline	0.55	1.80	2.35	1.80	2.35
Middle-East LNG	0.55	3.00	3.55	3.00	3.55
Southeast Asia LNG	0.55	3.00	3.55	2.90	3.45

4.21 While this pipeline clearly appears attractive, it is unlikely that the project will be able to acquire financing until there is evidence of considerably greater political stability in Afghanistan. In the meantime, however, it would be in Kazakhstan's interest to be recognized as a potential participant in the project when it does proceed. (It is worth noting that Gazprom intends to participate in this project.) This topic should be raised within the context of an overall regional dialogue concerning the development of market outlets for Central Asian gas and associated gas issues.

4.22 **CHINA.** Demand for gas is increasing rapidly in China; a supply gap of almost 24 BCM is projected by 2010. In addition, demand in Korea, Taiwan (Province of China), and Japan continues to increase. There is currently no regional pipeline network. Consequently, consideration has been given to the construction of a pipeline from Central Asia across China, which could potentially also serve as a delivery point for gas supplies to Korea, Taiwan, and Japan. (China's demand requirements are concentrated in the east of the country.) At full capacity of 28 BCM (the optimum size for a single line), the transportation cost across China would be approximately $3.20/mmbtu. This would be about $0.20/mmbtu more costly than LNG supplies from Southeast Asia and about $0.90/mmbtu more costly than Russian supplies from east Siberia. (A consortium consisting of the China National Petroleum Corporation, the Japan National Oil Corporation (JNOC), Korean Gas, and the Russian firm SIDANCO is pursuing a project to bring east Siberian gas to Chinese and Korean markets.) Such a line will not be able to achieve full capacity until sometime after 2010. At this stage, therefore, a pipeline from Central Asia to eastern China does not seem economically attractive, and there appears to be insufficient demand in western China to support the investment in pipeline facilities from Central Asia (which would have a logistical advantage in meeting any such requirements). A more rigorous assessment of potential demand (including identification of the specific locations of China's demand requirements) and the supply options could modify this conclusion. This should not, however, be viewed as a high-priority option. Table 4.9 summarizes indicative costs to supply gas to the major markets in China.

Table 4.9. Indicative Supply Costs to China's East Coast
(US$/mmbtu)

Gas supply source	*Transportation means*	*Production cost*	*Transportation cost*	*Delivered cost*
Kazakhstan	Pipeline	0.50	4.43	4.93
Turkmenistan	Pipeline	0.55	3.94	4.49
Qatar	LNG	0.55	3.80	4.35
Southeast Asia	LNG	1.00	3.00	4.00
East Siberia	Pipeline	1.00	2.30	3.30

Key Conclusions

4.23 Key conclusions related to the outlook for export gas markets may be summarized as follows:

a. The Central and Eastern European markets and the Western European markets offer the greatest long-term potential for Kazakh gas. Potential outlets also exist in the FSU, but these will not deliver the same return as the European markets, at least until the FSU countries are financially capable of purchasing gas, priced at its true market value, in hard currency.

b. In the near future, Kazakhstan's ability to access the international gas market will depend on agreements with Russia. Turkmenistan is also dependent upon agreements with Russia for a substantial portion of its export volumes. (This situation will also apply to Uzbekistan as it starts to address the export market.) In addition, Turkmenistan (and in the future, Uzbekistan) depends on Kazakhstan for transportation of its gas to its FSU and European export markets. At the same time, Kazakhstan is dependent upon Turkmenistan and Uzbekistan for deliveries of gas to the south of the country. This creates an overall commonality of interest among the three countries.

c. Kazakhstan should strengthen the dialogue with Turkmenistan and Uzbekistan. This should initially address issues involving the three countries: the establishment of a framework for setting transit fees and gas purchase prices, for providing access to the transit pipelines, and for measuring and monitoring the gas flows. This discussion should also address the potential to enter into gas supply exchange arrangements. In addition, this dialogue should set the stage for a collective negotiation among the three countries and Russia regarding access to FSU and European markets through Russia.

d. Pipeline access is the key to reaching the European markets. The existing transit pipeline systems are all in need of rehabilitation, and there will likely be a requirement to construct additional capacity from Ukraine into Europe if the Central Asian States are to be able to take advantage of the growth in European import requirements. Joint ownership of the entire transit system from Turkmenistan through to the Ukraine and on to Europe, coupled with a long-term right-of-way agreement, would be a mechanism (i) to secure the required pipeline access and (ii) to ensure a coordinated approach to rehabilitation of the existing facilities. Within this context, it is recommended that Kazakhstan be willing to exchange a minority share in the CAC line for a minority share in other portions of the transit system. The international private sector should then be invited to take on a role (in the form of a joint venture, or possibly a lease/concession arrangement) in the management of the portion of the UGSS system that can be used to export Central Asian gas, with the stipulation that there would be a requirement to undertake the necessary rehabilitation and expansion investments.

e. A pipeline across the Caspian (constructed in conjunction with Turkemenistan) *does* represent an alternative to transportation through Russia. Some form of concessionary assistance from the European countries that would receive the gas would likely be necessary, however, if this option is to prove economically viable.

f. The construction of a pipeline from Georgia into Turkey could allow Kazakhstan to deliver gas to Turkey through the Makut-North Kafkaz line and the connection into Georgia.

g. Kazakhstan should stay abreast of proposals to develop other market outlets for Central Asian gas. Kazakhstan should express an interest in the proposed project to deliver gas to Pakistan and India, now and when it is able to go forward, as well as the Turkmen pipeline through Iran.

5

Institutional Requirements

Commercialization of Domestic Operations

5.1 In order to develop a modern gas industry, a series of reforms will be required. This section addresses the key reforms. It should be recognized, however, that practical constraints may prevent implementation of the reforms as proposed. The recommendations detailed below should be regarded as guidelines, not as a specific blueprint.

5.2 A significant turnaround is required in the financial and operating performance of the domestic gas companies. If the country's gas resources are to deliver the maximum potential benefit to the economy, it is imperative that the domestic gas companies establish and maintain a strong commercial focus consistent with international standards. Actions that must be taken include the following:

a. The pervasive nonpayment problem must be resolved. While legislative action may be required to facilitate a solution, a resolution of this issue should be regarded as a top priority. First and foremost, the gas companies must have—and must exercise—the right to curtail deliveries in the event of nonpayment. The government may need to institute "lifeline" programs to support the poor, but the underlying principle that continued gas deliveries are predicated on payments being made should be established, with maximum government support.

b. All links in the gas supply chain must be held to the same payment standards. The LDCs must pay the transmission companies, who, in turn, must pay the producing companies and/or the importing (trading) companies.

c. Accurate measurement is an essential adjunct to a program designed to deal with nonpayment. Metering will ultimately be required of all customers, although in the initial phases of the turnaround it may not be necessary to meter "cooking only" customers. The introduction of prepayment meters, initially under a pilot program, should be undertaken. While the gas companies may be tempted to recoup the investment cost associated with installing meters, they must resist the temptation to

sell the meters to customers in order to eliminate any questions regarding the companies' rights with respect to maintenance and meter proving.

d. The companies should be required to abide by international accounting standards and to implement accounting procedures that are completely transparent. The government of Kazakhstan has indicated its intention to introduce international accounting standards by the end of 1997. Effective implementation of international accounting standards, however, will likely require a considerable amount of external assistance. Taxation policies should be consistent with these accounting procedures. In other words, companies should not be permitted to establish what are, in effect, hypothetical profits and then be taxed on those profits.

e. Targets should be established and companies should be held accountable for bringing their cost structures in line with international norms. Expenses identified in the companies' income statements related to "gas cost for own needs and losses" appear excessive and must be reduced. Excessive staffing in the workforce must also be eliminated.

f. The workforce must be managed in a fashion consistent with international practice. The payment of wages in full, and on time, is one of the companies' obligations.

g. The concept of customer focus must be introduced and developed.

h. Companies must be required to abide by international environmental and safety standards.

i. Performance measurement targets must be established in accordance with international norms to cover the full range of financial and operating performance. These would include the measurement of such items as earnings, cash flow, return on capital employed, management of receivables and payables, service reliability, customer satisfaction, and the like.

5.3 In order to instill the appropriate commercial focus and achieve the goal of business efficiency, the domestic gas industry should ultimately be transferred to the private sector. Established, quality companies within the international private sector have both the investment capability and the operating know-how to be able to turn around the financial and operating performance of the domestic gas sector. The government must also act with great care in managing the privatization process:

a. The transfer of assets at the wrong time could result in a significant loss of value to the government. Selected transmission assets could reasonably be transferred to the foreign private sector at this time on a lease/concession basis (indeed, the government has been involved in discussions on this subject with foreign companies). The LDCs, in contrast, should not be offered for full privatization until a financial and operating turnaround has been effected. In the meantime, however, the foreign private sector should be brought in to assist with the efforts to turn around the LDCs, acting under the terms of a management contract.

b. A flexible approach to the transfer of assets to the private sector will likely yield the best results for the government. For example, some assets offered for privatization may not be attractive to certain potential investors. Insisting on an all or nothing approach runs the risk of turning away highly qualified investors who may be willing to accommodate a compromise approach.

c. The process of turning around the domestic gas industry will not be easy. In evaluating companies for participation in the privatization process, the government needs to be completely confident that those selected have not only the operational capability to manage the business, but also the financial capability to weather problems that may arise, particularly during the period it takes to bring the nonpayment problem under control.

d. The government must take care to ensure that actual and potential conflict of interest issues are avoided. For example, if a producer or importer were to take on a transmission role, there would be a risk of according preferential treatment to its own supplies.

e. The government must have a full appreciation of the needs and expectations of the foreign private sector investors. For example the ability to handle capital flows efficiently and to repatriate profits are critical concerns. It is also essential that agreements with the foreign private sector have, and are perceived to have, full legislative force.

5.4 As privatization proceeds, it is essential that an acceptable institutional capability be put in place to handle the gas sector. Kazakhstan does not yet have the required legislative and regulatory framework, or the administrative capability, to deal with foreign private sector ownership and management of the domestic gas industry. It is essential that these institutional capabilities be initiated before arrangements with foreign private sector interests are finalized.

The Required Legislative and Regulatory Framework

5.5 The establishment of a modern regulatory framework is necessary to promote efficient, environmentally sound, and safe operation of the gas industry. This will take two forms:

- Economic regulation will provide the framework and incentives for efficient transmission, distribution and consumption of gas.
- Technical regulation will set standards in relation to health and safety matters and environmental issues.

5.6 The purpose of economic regulation is to control the monopoly power of the transmission, distribution, and trading companies in an open and transparent way. This regulation needs to strike a balance among the following requirements:

- Avoid the abuse of monopoly power that arises from a natural (and artificial) monopoly in the gas industry.
- Preserve incentives for regulated companies and ensure that gas transmission, distribution, and marketing companies recover the full economic cost of supply and a reasonable, but not excessive, profit.
- Allow participants in the gas industry to behave in a commercial way without unwarranted interference in management decisions.

5.7 Technical regulation seeks to:

- Ensure that gas consumers receive a reliable quality of service in return for paying prices that fully reflect economic costs.
- Avoid adverse impacts on health and the environment resulting from the transmission, distribution, and usage of gas.
- Minimize risks to public safety and property damage from unwanted gas escapes.

5.8 It is also necessary to achieve an effective balance between the Regulatory Authority and the regulated companies. Too much regulatory power or intervention can weaken incentives for companies to behave efficiently or to continue to invest. Too little could cause a loss of wealth for the country in the long term. The guiding principles are to achieve clarity, transparency, autonomy, stability, and certainty for participants in the industry and for consumers.

5.9 Conceptually, there are four different levels of regulation, although in practice the distinctions are often blurred :

a. Comprehensive gas legislation (gas law)

b. Rules and regulations promulgated under such legislation

c. Specific conditions in the licenses for companies operating in the downstream gas industry (such as transmission and distribution operations).

d. Gas sales contracts, tariff systems, technical regulations, codes, standards, and the like.

New Primary Legislation (The Gas Law)

5.10 The new gas law should establish a Regulatory Authority (see figure 5.1), whose duty would be to channel market forces most efficiently by promoting competition where competitive markets do not exist and to regulate areas that are natural or artificial monopolies.

5.11 To suit the particular needs of Kazakhstan, it is suggested that the Regulatory Authority be a totally separate and independent body reporting to the central government. Its responsibilities would include the following:

a. The Regulatory Authority should gradually take over the primary responsibility for competition policy matters and for pricing issues within the gas industry from the Ministry of Economy and Trade. (This was formerly the responsibility of the State Pricing and Anti-Monopoly Policy Committee.) The development and policing of general fair trade and competition policy should remain within a Ministry of Economy and Trade committee, which would continue to have a much wider role to play in other industrial and commercial sectors.

b. While the government and ministerial agencies should retain responsibility for certain key policy functions, the Regulatory Authority should have exclusive powers over day-to-day and detailed matters. This will enable the authority to set and control the procedures governing competition and performance of commercial and operational functions of the gas companies.

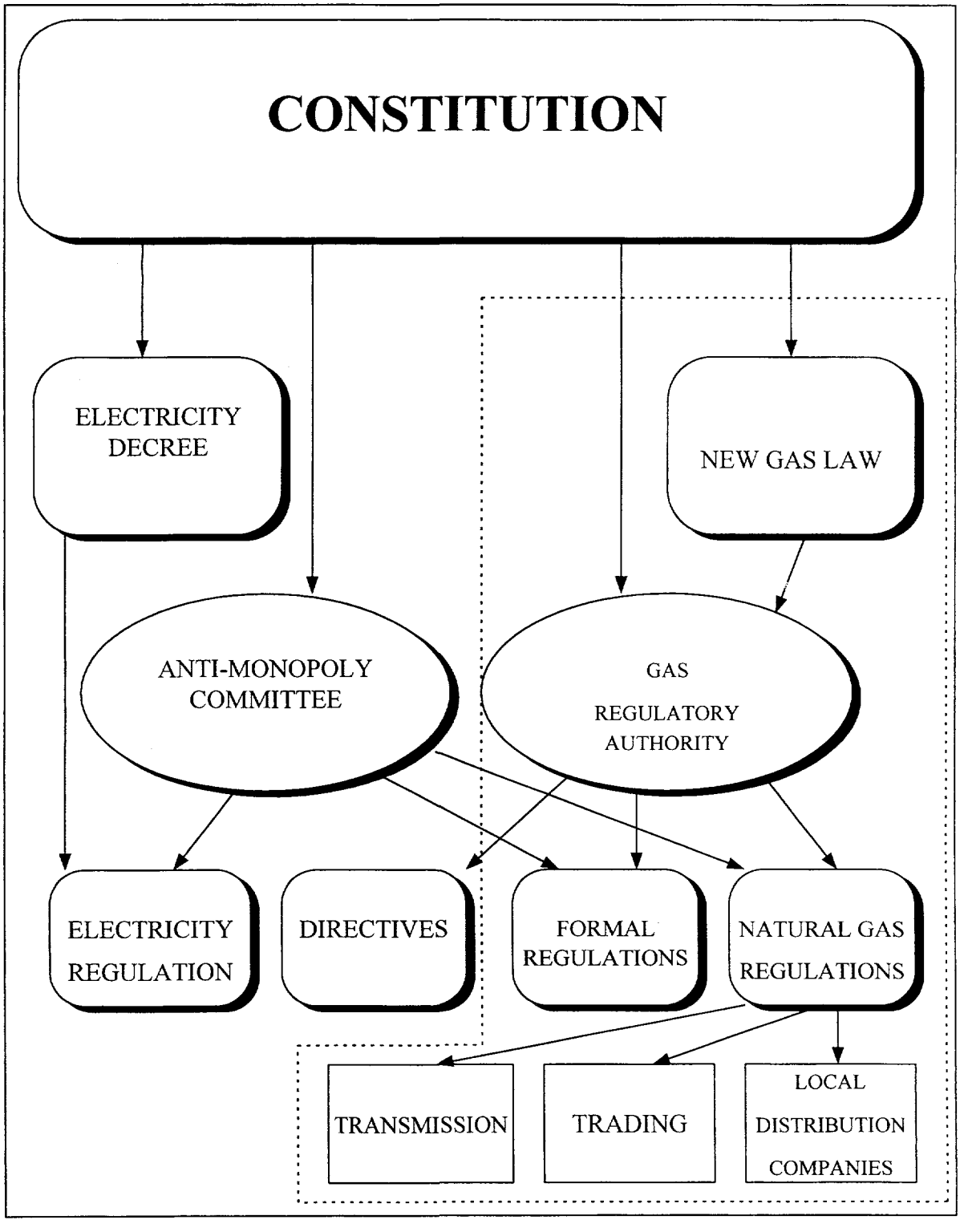
c. It is proposed that the government have the sole responsibility for decisions on the following matters:

- Planning of gas utilization in the overall energy sector in the country
- Development of gas industry policy—for example, in respect of commercialization, privatization, and the development of industry structure
- All policy matters relating to exploration and production
- Taxation and any government-funded subsidy payments for gas.
- General technical, safety, and environmental policy issues.

d. The Regulatory Authority should have exclusive powers in the following areas:

- Issuing authorizations or licenses to gas industry enterprises within the policy framework established by the government, including decisions on conditions to be included in authorizations and how the process of applying for licenses is run; issuing permits authorizing construction and operation of pipelines and conducting inspections of their facilities
- The design of mechanisms for the control and development of prices

Figure 5.1. How the Regulatory Authority Could be Established by a Gas Law



- Regulating tariffs and other conditions of service for pipeline franchises, including access to open-access pipelines
- Setting other supply conditions and quality standards
- Specific technical, environmental, and safety regulation for gas supply based on safety and environmental standards established in the legislation
- Action on matters relating to billings, interruption, and reconnection of gas supply
- Monitoring and enforcement of the regulations including determination and application of penalties
- Preventing anti-competitive and discriminatory behavior.

5.12 Table 5.1 briefly summarizes the recommended allocation of functions in the Kazakhstan gas industry among the various ministerial agencies and the Regulatory Authority.

Table 5.1. Recommended Allocation of Functions

Responsible party	*Function*
Upstream	
Ministry of Energy and Natural Resources/ Kazakh National Oil & Gas Company	Award of blocks
	PSC terms and conditions
	Evaluation and approval of development proposals
	Overall safety/technical policy
	Depletion/flaring policy
Ministry of Finance	Fiscal terms in PSCs/state finance
Ministry of Ecology and Bio-resources; Ministry of Energy and Natural Resources and others (Public Health/Labor Bureaus, etc.)	Safety/technical/environmental regulation
Downstream (including transmission)	
Gas Regulatory Authority	Pipeline authorization/terms of access
	Authorization of gas supply/licensing
	Pricing
Ministry of Energy and Natural Resources/ Kazakh National Oil & Gas Company	General policy direction/oversight
Ministry of Finance	Taxation regime
Ministry of Labor, Health	Safety, occupational health, and the like
Ministry of Ecology and Bio-resources	Environmental standards

5.13 The gas law should also establish, in detail, the composition of the Regulatory Authority. It is recommended that the authority be established as a small commission of three or five individuals (an uneven number is preferable for voting procedures). In addition a permanent support staff is needed, which should be built up gradually as the role of the Regulatory Authority develops. Appointments to the Regulatory Authority must be based on a prespecified, transparent, impartial procedures and should be for quite lengthy periods (such as five years). Early termination should only be possible in very limited and clearly defined circumstances, such as in the case of gross misconduct.

5.14 The law should also provide for appeal procedures to enable the regulated parties to appeal to a higher authority if they feel they have been unfairly treated. The appeals process must be open and transparent, and strict limits on the extent to which the appeals process can be used as a means of frustrating the objectives of the regulatory system are also necessary.

The Regulatory Regime

5.15 The design of the regulatory regime must take full account of the current condition of the gas industry and act as a catalyst to move the industry along the desired development path toward the optimum competitive structure. The following regulatory principles should therefore be included in the gas law.

5.16 TRANSMISSION, DISTRIBUTION, AND TRADING

a. In principle, there should be complete separation of transmission from local distribution. The government should seek to ensure separation of supply, trade, transmission, and distribution wherever possible.

b. The Regulatory Authority should have the power to require transmission and distribution companies to divest their trading functions at the point when it judges to be most appropriate. The progressive "unbundling" of trading and transmission is a key recommendation. If this is not carried out, for whatever reason, then it will almost certainly lead to inefficiency, hidden cross-subsidy, and inhibition of competition, which will damage the country's economy and ability to compete in the long run.

c. All companies engaged in several subsectors should be obliged to report their activities in a disaggregated form in their books of accounts.

d. If a transmission company is allowed to trade gas as well as transport gas on an open-access pipeline, the following should be required:

- The trading and transport functions of the pipeline company must be run at arm's length in separate subsidiaries.
- The same regulated transmission tariff must apply to the trading business and to third-party users.

- Transporters and buyers of gas from the trading function take custody of the gas in the pipeline at the inlet, so that the pipeline company does not own any of the transported gas.

e. There should be immediate, nondiscriminatory access for potential field developers and others to excess capacity in the pipeline system. Among other things, this means that third-parties' gas should be subject to the same costs as gas being transported by the transmission (or distribution) companies for their own use. In the event of any dispute, the onus should be placed firmly on the transmission (or distribution) companies to establish why they could not agree to transport the gas in question.

f. The users of pipelines should face the full economic consequences and not be subsidized in any way.

g. Permits, in general, should not grant exclusive transmission rights in the existing transmission system, including rights to capacity, rights of ownership, and long-term monopolies.

h. The local distribution companies (LDCs) should be able to purchase gas from any source. The authorizations for LDCs should include a provision for limited exclusivity (possibly five to ten years). This would leave open the opportunity to move to full gas-to-gas competition.

i. The Regulatory Authority should have the power to require that all participants (except consumers) in the natural gas and LPG industries participate only by means of licenses issued by the Regulatory Authority and that licenses must not be transferable or assignable without the authority's written consent. The procedures for applying for licenses and evaluating the applications should be an open process. The basic law governing the licensing of activities in Kazakhstan is the Law on Licenses adopted on April 17, 1995, and the two amendments dated July 20, 1995, and December 23, 1995. The gas law will need to clarify that the Regulatory Authority has full delegated authority to issue licenses as a "competent body," and the gas law needs to be compatible in other respects with the Law on Licensing.

5.17 LPG

a. The Regulatory Authority should have full powers and the obligation to see that the LPG business is run with an adequate degree of competition at each point in the supply chain—for example, each of the future market players must be able freely to purchase and/or import LPG. The LPG business should not be dominated by monopoly players, whether state-controlled or private.

b. Natural gas and LPG activities should be disaggregated (with separate accounts, management and locations, with no cross-subsidy between businesses).

c. The Regulatory Authority should have the power to order the divestment of the liquids activities at a point when it sees that this is in the country's best interest.

5.18 Miscellaneous

a. In general, the Regulatory Authority should operate by setting goals rather than through prescriptive regulation (except for some technical regulations, such as emission limits). This means a switch to consideration of techniques, procedures, and practices that generate the desired results, rather than restrictive numerical approaches.

b. Any moves to introduce a new regulatory system must avoid weakening the bargaining power of the Kazakh gas companies in relation to the monopolistic sellers.

c. The Regulatory Authority should have the power to decide the pricing methodology for tariff charges on the main transmission pipelines (for example, how the ratio between commodity and capacity charges is set, whether there should be a straight fixed/variable tariff design, and the like). It is essential that individual components of costs be fully understood by those who set the mechanisms.

d. As has already been noted, the Regulatory Authority should have the power to regulate gas prices in the various sectors of the gas market, as well as transmission tariffs. There are, however, differences in the way specific sections of the market should be regulated. For example, the Regulatory Authority should try to adopt a "hands-off" policy with respect to the larger, freely negotiated gas contracts. Specific recommendations covering the approach to establishing pricing and transmission tariffs are discussed later in this section of the report.

5.19 Transitional Arrangements

a. The responsibility to monitor and regulate gas prices and pipeline tolls, which presently vests in the Ministry of Economy and Trade, should progressively shift to the new Regulatory Authority on an agreed timetable. This will doubtless involve the secondment or transfer of skilled support staff.

b. Potential investors should be informed up-front of the planned regulatory changes, possibly through a gas policy paper issued by the government.

5.20 Safety, Technical, and Environmental Regulations

a. *Management of Safety, Health, and Environment.* The gas industry should adopt a policy and system of self-control based on the principle of quality assurance. It should exercise full responsibility for the initial and ongoing integrity of its operations and facilities and compliance with ongoing (evolving) health, safety, and environment (HSE) standards. This oversight power should replace the existing system of fragmented responsibilities. This does not deny the responsibility of the individual parties for approvals and inspections in their areas, but it would be the responsibility of the owner/operator to run the overall management system that assures the quality of its own

activities and those of third parties. The operating practice should incorporate systematic monitoring and audits of technical HSE conditions relative to targeted goals.

b. *Technical Regulation.* The Ministry of Energy and Natural Resources needs to clarify immediately which former Soviet standards apply to the Kazakh gas industry and which do not. The government should then move without delay to an international system of technical regulation, codes of practice, and standards for new facilities.

c. There is a pressing need for the draft safety regulations presently under consideration for oil and gas operations to be issued. With regard to the downstream sector, pipeline safety regulations need to be prepared.

d. Specific safety approaches need to be adopted to ensure that pipelines and facilities, including burners, are fit for the purpose. Pending a detailed review of the Kazakh Safety Code, it is suggested that a system be introduced in which the gas industry is largely self-policing. Proposals for all major construction should include a conceptual safety review that predicts the level of risk associated with the installation and operation of the facilities, confirming that the risks are in line with local and national guidelines.

e. Kazakhstan has made considerable progress in recent years regarding environmental legislation. Nevertheless, many of the implementing regulations, guidelines, procedures, and instructions are not yet in place to provide clear direction. What is needed is top-level, coordinated support for the introduction of systems and resources to carry out environmental assessment, monitoring, contingency planning, environmental audits and the introduction of the concept of "Best Practice Environmental Option"—that is, cost-effective enforcement. Regulations to achieve this end should be developed without delay, with international assistance as necessary.

f. Safety, technical, and environmental regulations are also needed for the LPG sector. It is apparent that present standards are well below an acceptable level.

Pricing

5.21 Under current pricing procedures, the Ministry of Economy and Trade sets prices for transmission and distribution of gas based on "cost-plus profit" tables submitted by the gas companies. (This was formerly the responsibility of the State Anti-Monopoly Committee.) Profit margins of 20 and 30 percent for transmission and distribution, respectively, are included in the tables. (Such cost tables are shown in Appendix 5.8.) There appears, however, to be considerable inconsistency in the approach the companies take to calculating their costs, and it is not possible to establish whether the cost tables reflect real or hypothetical costs. In addition, in the case of Kazakhgaz and Alaugaz, the cost components associated with the separate activities are not adequately identified. This underscores the need to move to international accounting standards and to maintain complete transparency in the books of accounts.

5.22 General principles and issues associated with tariff and non-tariff pricing are detailed in Appendix 5.9. Based on these principles (which, inter alia, form the basis for gas pricing in Western countries), it is recommended that the tariffs for gas be revised in stages, as follows:

a. The present "cost plus" concept should be further developed based on better costing, which will also distinguish between costs for different consumer groups and locations. Tariffs can then be established on the basis of realistic costs for production, transmission, and distribution. Within this context, the Ministry of Economy and Trade plans to introduce distance-based tariffs for gas transmission companies. Such an approach is to be encouraged, because distance-based tariffs should be employed to reflect true economic costs. Indeed, given the size of Kazakhstan, a failure to employ distance-based tariffs would undoubtedly result in a misrepresentation of the economics associated with transportation and could result in economic inefficiencies.

b. Simultaneously, calculations should be carried out to establish the market value of gas. This value will be based on what can be charged, while remaining competitive with the cheapest alternative fuel in each market and for each consumer group.

c. The market value acts as a ceiling price. If the cost-based tariff exceeds market value, then the supply is no longer attractive to customers.

5.23 It should be stressed that the market value concept only indicates the maximum that can be charged. Normally, the tariff will be between this maximum and the cost of supply. (Initially, it will also reflect the social implications of price increases.) The market value concept will be used at the policy and planning level to try to encourage use of gas where it has the highest value.

5.24 It is recommended that the tariffs for small consumers be simple, public, and reflect the amount of gas consumed. A relatively high fixed charge plus a charge for actual consumption would be the norm. The fixed charge would cover the "per customer" costs, including most system costs. The consumption charge would cover the cost of gas from the producer, the use of compressors and storage, and other costs that vary by volume. The tariff for larger customers would have a proportionately smaller fixed charge. It is further recommended that proper metering of consumption be introduced as the basis for charges, focusing particularly on those who use large volumes and who might modify usage to respond to cost and price.

5.25 The following important aspects should be included in the retail tariff design:

a. The tariff should be based on an analysis of costs by consumer group, location and other factors. It should be structured to reflect these costs and be set at a level that permits financial viability.

b. The tariff should be open and public, and the rationale for pricing and differences in prices should be known to all participants. There should be no undue discrimination.

c. The tariff should be simple and understandable to all consumers.

d. The tariff level should make the supply of gas economically attractive to customers and should reflect a general tendency to decrease the per-unit cost of service as consumption increases.

e. The tariff should induce consumers to use gas in an efficient way.

f. The overall package for consumers should contain incentives to encourage rapid gas market penetration. Such incentives could include initial selected rate rebates and measures to mitigate the customer's costs for conversion to gas.

5.26 Gas transit rates should be designed to ensure a reasonable return on investment. There are several calculation methodologies (see Appendix 5.9.) The rate can be unbundled and include:

- A demand rate to reserve capacity
- A commodity rate for the actual amount of gas transported
- A rate for gas storage.

Depending on location, this tariff design may be simplified by only having one demand and one commodity rate, or having one commodity rate for capacity, transport and storage.

5.27 In a country as large as Kazakhstan, gas prices and transmission tariffs are likely to differ significantly between regions. No attempt should be made to artificially "postalize" tariffs across the country.

5.28 Table 5.2 provides an indication of how tariffs can be established based on costs for the pipeline from Bukhara to Almaty and an assumed import price of 2,625 Tenge per 1,000 CM ($35/1,000 CM). Transmission costs are based on annualized unit costs per 1,000 CM over 100 kilometers. These prices are compared with the actual current tariffs. It should be noted, however, that since the cost numbers have not been confirmed, the tariff calculation is shown for illustrative purposes only.

Table 5.2. Cost-Based Pricing of Gas at Almaty and Symkent
(Tenge/1,000 CM)

	Almaty		*Symkent*	
Activity	*Cost-based*	*Present tariff*	*Cost-based*	*Present tariff*
Import	2,625	2,260	2,625	2,260
Transmission	580	440	260	440
Distribution	420	420	395	395
Total	3,625	3,120	3,280	3,095
Market value	5,300		5,300	

Comments on the Table

- Both the import price and the transmission costs to the two locations are significantly higher than the present tariff. The "purchasing" price used by the ministry and the transmission tariff set by the ministry should be changed accordingly.
- Because cost figures for distribution in the south are lacking, the data in table 5.2 assume that the distribution tariff equals the cost. This may not be true. The distribution tariff in the south is much higher than for the rest of the country, primarily because of the much higher costs of distribution to a large number of small consumers compared with a limited number of large consumers in the north.
- The discrepancy between the total "cost-based" tariffs and the actual tariffs is much greater in Almaty (16 percent higher) than in Symkent (6 percent higher).
- The market value is 45 percent to 60 percent higher than the "cost-based" prices in the two locations. Thus, there is still room to achieve financial viability through substantial real price increases, which should be gradually implemented with due consideration for the social implications.

5.29 The price of gas for the largest customers would be negotiated and would recognize the cost implications for the supplier (for example, interruptability, special load profile) and the market value of the alternative fuel. The manner in which differences between the cost and value are shared between suppliers and customers will be a matter of government policy and the extent of competition. As already noted, the Regulatory Authority should try to adopt a generally hands-off policy with respect to the larger, freely negotiated gas contracts.

Key Conclusions and Recommendations

5.30 Kazakhstan must develop and implement the institutional capability to manage its domestic gas industry. This is a matter of some urgency. Without this capability, the task

of turning around the financial and operating performance of the domestic gas companies will be difficult, if not impossible, and there is a risk that the value to be realized from the evolving privatization process will be significantly reduced.

5.31 To help promote investor confidence, the Government of Kazakhstan should announce, as soon as possible, that it intends to introduce an effective regulatory system for the gas industry. This should include notifying the bidders for concessions or equity interest in Kazakhstan gas companies and the potential sellers of gas of this intention. The time-scale for implementation should also be made clear. The following steps are required:

- Control the present and future monopoly power of the transmission, distribution, and trading companies in an open an transparent way
- Preserve incentives for regulated companies
- Assure that gas consumers are given a reliable quality of service in return for paying prices that fully reflect economic costs
- Minimize risks for public safety and property damage that might result from accidental gas leakage.

5.32 While the pace and depth of regulation to achieve these objectives are a matter for the Government of Kazakhstan to decide, it is suggested that the following principal elements be pursued:

- A Regulatory Authority operating independently of the Government of Kazakhstan should be established to oversee the downstream gas industry, to introduce competition where this is possible, and to regulate where it is not (for example, because of a natural or artificial monopoly). In the event of disputes, there will be an effective mechanism for appeal to a higher authority.
- The Regulatory Authority should have the responsibility for developing and enforcing a licensing system for all enterprises operating in the downstream gas industry, including conditions of service and, in the case of local distribution companies, the right to curtail gas supply to nonpayers under specified conditions.
- There should be open access for transmission pipelines and pipeline tariffs will be subject to regulatory oversight. All users of an identical pipeline service should face the same tariffs.
- There should be a requirement to run any gas trading and transmission functions at arm's length.
- Permit holders for transmission pipelines should be required to expand capacity or geographical coverage where it is economical to do so. This will either be written

into the licenses, or the licenses will be made nonexclusive or of limited duration of exclusivity, to put competitive pressure on the operator(s).

- The aim is that gas prices will eventually be determined by free market conditions, subject to regulatory oversight in the case of certain classes of consumers.
- Local distribution companies should not have exclusive rights to sell gas to the largest customers in their area. The Government of Kazakhstan will specify the threshold level of gas sales above which there is no local monopoly.
- The Government of Kazakhstan and the Regulatory Authority should have the right to determine whether it is in the national interest for companies to take an equity stake or exercise control over portions of the same gas supply chain.

5.33 Without a clear-cut regulatory framework, the ongoing privatization may not be effective. At least the following actions should take place before finalization of the contractual agreements of the successful bidder(s):

- Authorization of gas companies' right to curtail gas supply to nonpayers, except those who are protected under a social safety net or who are included in certain protected categories
- Promotion of international safety and environmental standards and their enforcement
- Promotion of business competition by separation of the LPG and the natural gas businesses
- Promotion of distance-based and cost-reflective tariffs
- Provision of access for third parties to pipeline
- Installation of gas meters with gas company ownership
- Enforcement of consistent payment standards throughout the gas supply chain.

Terms for third-party access to pipelines would include such key clauses as terms for access; firm or interruptible capacity; and available and minimum service conditions. These terms would create the flexibility to allow other transit activities to occur in the future, when sources of supply may change. It should specify who can have access to the pipeline and for what purposes (for example, transport of own gas), what proportion of the capacity may be available for third parties (the remainder being firmly committed to the concessionaire), and the tariff basis. The tariffs will need to be independently regulated.

5.34 The most practical approach to achieve the regulatory program is by the issuance of a presidential decree requesting that a particular government body, such as the Ministry of Energy, manage the development of the appropriate measures in consultation with other interested groups in the Government of Kazakhstan, such the Ministry of

Economy, the State Anti-Monopoly Committee, and other government agencies. This will involve a number of tasks, including a review of overall sector management options and constraints. This review will determine the priority and sequencing of actions for introducing a modern regulatory system. Further work needs to be done on the powers, responsibility, structure, legal and taxation status, and funding mechanisms for the Regulatory Authority. The government's proposals for providing initial funding for the regulatory authority should be clarified, and should be replaced in a short time by a levy on the gas industry; details of this program need to be negotiated.

5.35 Work has to be carried out on the identification of all existing legislation in the gas sector, including agreement on elements that should be included in a new gas law, especially where major institutional change is needed and there is political sensitivity. The pros and cons of all current proposals for both the institutional structure and the regulatory regime—such as open access to pipelines, which would eventually lead to a more liberalized gas market—need to be evaluated, and fallback positions established where the steps carry risk. Urgent attention needs to be given to staffing, recruitment, and training for the future regulatory commissioners and support staff. A needs analysis should be undertaken as soon as possible. A human resources plan is required to ensure that local personnel absorb and utilize the technology, support is generated for institutional strengthening, and a basis for ongoing development of manpower skills is provided.

5.36 The most crucial step is for the government to agree to the agenda for a new gas law (or set of decrees if it is decided to implement regulatory change in that way). This will provide the basic framework for economic, technical, safety, and environmental regulation of the gas industry for the benefit of the people and provide a template for redefining the government functions and the industry structure.

5.37 In the pricing area, the priority need in Kazakhstan is to ensure that the transmission and distribution companies have sufficient cash flow to maintain the system, reduce physical losses and leakages, and improve the quality of service. While the nonpayment issue is the most pressing concern, it will also be necessary to adjust the transmission and distribution tariffs upward and to couple the increased cash flow with a suitable program of investment targets. Until the accounting systems are upgraded to international standards, it would be best to calculate the tariff based on the cash operating and maintenance costs (including gas purchase costs) and cash needs for investment, predicated on the volume for which payment is expected. The upper economic limit on such tariffs is the market value of the gas, calculated by reference to competing fuels. Proper calculations of market values need to be carried out based on economic costs of alternative fuels. There will also have to be practical intermediate limits based on hardship and affordability.

5.38 In manpower planning, urgent consideration needs to be given to staffing numbers, recruitment policies, and training for the future Regulatory Authority commissioners and permanent staff.

6

Investment Requirements

6.1 Kazakhstan's gas sector will require significant investments. Much of the financing for these investments will have to be sought from the international business community in the form of equity, debt, or a combination of the two. In pursuing such financing, Kazakhstan will be in competition with other borrowers throughout the world and should make every effort to present itself in the best manner possible. To do so, a number of considerations must be kept in mind:

a. Each of the agencies active in the gas sector (such as the gas producers, the transmission companies, and the distribution companies) will need to prepare and maintain a comprehensive business plan incorporating a multiyear investment program. Investments within the program need to be prioritized and associated financing requirements need to be identified.

b. A distinction should be made between projects that will generate a significant portion of their revenues in foreign currency and those that will generate predominantly local currency. Provided other business criteria can be met (solid economic fundamentals, a track record of operational capability, and the like), projects that generate a significant portion of their revenues in foreign currency will be easier to finance on a limited recourse basis than the local currency projects. Local currency projects should be assessed for their potential to attract export credits (which will facilitate commercial financing). In addition, an assessment of the potential need for support for these projects from multilateral and bilateral sources should be made.

c. As Kazakhstan has discovered, it is not difficult to obtain international investment in the petroleum sector for projects, such as oil and condensate production, that are capable of generating significant foreign currency revenues. It will, however, be more difficult to obtain the required investment funding for activities in the petroleum sector that have a significant domestic component. With this in mind, it is important that Kazakh institutions present themselves to the international investment community in a manner that maximizes the potential to attract funding. An open attitude and an associated willingness to make reliable financial information

available will be essential. It is also important, as already noted, that the major financial and operating problems of the gas sector be solved if funding is to be obtained for future investments. Among the top priorities in this regard is the need for a prompt and full resolution of the nonpayment issue.

d. Additional steps that Kazakhstan can take to present itself in an optimal fashion include cooperation with the World Bank's guarantee arrangements, use of MIGA insurance programs, and the provision of payment guarantees through such mechanisms as funding an escrow account. Support from multilateral agencies, whether in the form of technical assistance, "seed" loans, or guarantees can be particularly helpful in providing leverage for other financing.

e. As was noted above, Kazakhstan will be in competition for funding with projects from other countries. While major producing and exporting projects such as Tengiz and Karachaganak should not face funding constraints, financing for other activities in the gas sector will likely be limited, even when the projects are optimally presented. Consequently, it will be necessary to set priorities within the investment program. Such priorities should place particular emphasis on generating cash flow, because this will best facilitate obtaining further funding in the future.

f. In seeking project financing for the gas sector, Kazakhstan's oil revenues, which will include a significant foreign currency component, will provide valuable leverage. Nevertheless, investors will still want assurances that the institutional capabilities and business plans are in place to support the viability of the gas sector.

Financing Gas Projects

6.2 In order for a project to be "bankable" (that is, able to secure financing) two preconditions are essential:

- The project must be economically viable.
- The financing entity must have confidence that proceeds will be sufficient and can be remitted to retire the loan: if hard currency funds are advanced, hard currency funds must be, or must become, available for repayment.

6.3 The economic viability of the project reflects not just its economic viability in the macro sense, but the specific returns that the investor can expect. The following factors all impact investor assessments concerning the potential economic and financial viability of a gas project:

- The "upside" potential for a major increase in profits
- The size of the market and the health of the macroeconomy
- The ability to convert and repatriate profits

- The extent of the natural resource base
- The availability of a suitable investment vehicle
- Taxes and financial incentives
- The existence of sound regulations and laws
- The track record of the host government in dealing with investors
- The host government's commitment to the project and the quality of securities and assurances provided to the investor.

6.4 Success in obtaining financing largely relates to risk perception. It is essential that the risk be brought within tolerable bounds. More generous fiscal and other measures simply will not compensate when a project is viewed as excessively risky. A key factor in mitigating the perception of risk is for a government to create a stable and credible business framework. The availability of third-party support (from a bilateral government lender, for example) will further serve to reduce the perception of risk. (Appendix 6.1 provides examples of project risks and risk mitigation measures.)

6.5 A gas project requires a combination of equity provided by the sponsors and debt provided by commercial banks, international financial institutions and bilateral government lenders. Equity will likely be in the range of 25 to 50 percent and debt on the order of 75 to 50 percent.

6.6 Basic financing structures include:

- Sovereign loans: this is an unsecured loan made to a central government.
- Project finance loans: this term is applied if the security for the investment takes the form of project assets and/or future project streams.
- Collateralized financing: these loans are secured by other cash flows or assets, including revenues from exports of oil and gas, gas transit services, and oil and gas reserves.

6.7 In most countries, a primary factor that will influence the financing structure is the ability of the project to generate hard currency. When a project creates only domestic currency but requires hard currency investment, collateralized financing will likely be required. In some cases, IBRD guarantees may also be required to provide the necessary assurances of convertibility. In Kazakhstan, the key factor is the payment risk—the risk that the borrower will not have sufficient Tenge to make debt service payments. This risk should be addressed squarely, because the government should establish as a priority objective the need to restore the practice that consumers must pay for purchases. Supplementary assurance can be given in the form of a mortgageable security on assets, the provision of an escrow account, and securing contingent loans that can make the necessary payments.

6.8 Guarantee schemes essentially enhance borrowing capacities by providing substantial comfort to the lenders. Typical examples are IBRD's Partial Risk Guarantees and Partial Credit Guarantees. These are described in more detail in Appendix 6.1. The Multilateral Investment Guarantee Agency (MIGA) also provides guarantees against the political risks associated with investments in project finance and other operations. Although the maximum coverage ($50 million per project) is insignificant relative to the size of the projects contemplated in Kazakhstan, its involvement would provide significant comfort to investors and lenders. IFC also provides guarantees to lenders.

6.9 The pervasive nonpayment problem associated with gas deliveries in Kazakhstan will make it difficult to obtain commercial financing for projects in the domestic sector. Financing from multilateral development banks may be possible for certain projects if a credible and speedy action plan is implemented to resolve this problem.

6.10 In some cases, grant funds can be made available when a gas project is linked with environmental mitigation. A typical example is the Global Environmental Facility (GEF), which assists developing countries in protecting the environment.

6.11 In the final analysis, however, financing for a project will only be made available if the host government is perceived as having a strong commitment to support the commercial viability of the project. A critical component of such support is ensuring that the legislative and regulatory framework to sustain a stable and supportive business environment is in place.

7

Recommended Implementation Steps

Key Conclusions

7.1 Kazakhstan's overriding objective is to ensure that its gas resources deliver the maximum potential benefit to the country's economy. To achieve this end, three specific objectives will have to be met; these, in turn, require that several goals be reached. The specific objectives and the associated goals are as follows:

a. To ensure (i) that gas sector development supports efforts to maximize the economic benefit of liquids production, (ii) that viable gas markets are developed so that liquids production is not constrained by limitations on the disposal of associated gas production, and (iii) that gas resources are not wasted. The following goals must be reached:

- Market outlets must be developed to ensure that all gas associated with the production of liquids can be utilized in an economic and environmentally acceptable fashion. Should insufficient outlets be available, Kazakhstan risks constraining the production of liquids or squandering its gas resources.
- The wastage of gas resources must be eliminated at all points in the supply and distribution chain. This wastage includes flaring of gas during the production phase, "transportation losses" during the transmission phase, and levels of deemed consumption during the distribution phase that appear to be excessive by international standards. In addition, the lack of tangible economic incentives to utilize gas efficiently at the consuming end, coupled with the pervasive nonpayment problem, undoubtedly results in wastage.
- Kazakhstan must pursue opportunities to develop gas resources that are located in close proximity to the existing pipeline network. Opportunities to benefit from gas liquids recovery should be pursued The country must also ensure that gas that is now flared is captured and put to constructive use.

b. To restore the commercial viability of Kazakh gas operations and to develop the domestic gas markets so that gas is used wherever such use benefits the overall economy. The following goals must be reached:

- Kazakhstan's priorities in allocating available gas supplies must change. In the past, Kazakhstan has focused on providing gas preferentially to "strategic" industries. The country should now implement an effective pricing system designed to ensure that gas will be used in those sectors of the economy where it can deliver the greatest benefit. This means ensuring that consumers who create the maximum market value for the gas (for example, power generation) have the incentive to use it. From a social standpoint, it is important to ensure deliveries to institutions that may require the protection of a social safety net (for example, hospitals and schools.)
- The domestic gas sector must become much more commercially focused. The sector is in need of a critical financial and operating turnaround, which can be effected only if the domestic gas companies start to function as true commercial operations. The pervasive nonpayment problem must be resolved (the solution will require that the gas companies both have and use the right to curtail supplies in the event of nonpayment.) In addition, pricing procedures must be brought in line with key "cost plus" (based on LRMC, long-run marginal cost) and market value pricing principles (to be used as a ceiling.) Investments to rehabilitate the transmission and distribution network are badly needed but cannot be implemented until the financial viability of the gas companies improves.
- Expertise from the international private sector must be engaged to assist with the turnaround of the domestic gas sector. Established qualified companies within the private sector have both the investment capability and the know-how to effect the required turnaround. Recognizing this, Kazakhstan has already initiated plans to privatize the sector. Such an effort, however, must be handled in a measured fashion in order to ensure that results meet expectations.
- The process of putting in place the appropriate legislative and regulatory framework, together with the supporting institutional capability, must be under way before any arrangements are concluded with the private sector. The legislative and regulatory framework should provide an acceptable mechanism for establishing prices, tariffs, and terms for access to the gas transmission and distribution facilities. It should also provide the capability to deal with the nonpayment problem in the sector.
- Arrangements must be negotiated with neighboring countries (Turkmenistan, Uzbekistan, Kyrgyzstan, and Russia) to ensure that Kazakhstan can optimize the benefits obtainable from its gas resource base, given the constraints of the existing distribution system. This means that Kazakhstan should negotiate exchange arrangements involving the delivery of gas by its neighbors to the South region in exchange for deliveries supplied from Karachaganak.

- The establishment of a strong, viable domestic sector will lay the groundwork for development of the domestic gas market over the longer term. There are strong economic and environmental reasons for encouraging an increase in the share of the energy matrix that gas enjoys.

c. To establish a position as a supplier of gas to the international market so that the country can take advantage of profitable marketing opportunities. The following goals must be reached:

- Kazakhstan must develop a presence in the international gas market. This, however, will require the negotiation of an agreement with Russia. Kazakhstan is well positioned from a cost standpoint to supply the markets in central and eastern Europe and in western Europe, provided that it can obtain agreement to transit Russia either through the UGSS, or, if agreement cannot be reached on the use of UGSS, through new pipeline facilities that transit Russia. Within this context, Kazakhstan should be prepared to engage both the foreign sector and Gazprom as partners in its marketing efforts.
- There is a considerable commonality of interest among Kazakhstan, Turkmenistan, and Uzbekistan. Kazakhstan should, therefore, pursue the development of a regional dialogue about the development of gas marketing opportunities. The objective of all three countries should be to secure long-term assured access to European markets through Russia.
- Kazakhstan and its neighbors should also pursue the option of a pipeline across the Caspian and through the Caucasus countries and Turkey to Europe.

Specific Implementation Steps

7.2 Achievement of these goals will require a series of specific implementation steps. To support these steps, key milestones should be identified and monitored. There is, however, a priority to these steps that should be followed.

7.3 To develop a modern gas industry, the most critical requirement is that the government introduce an acceptable legislative and regulatory framework for the gas sector. Details of the actions necessary are given in Section 5 of this report. As has been noted, it is critical that the establishment of this framework be under way before any arrangements to transfer portions of the domestic gas transmission and distribution sector to private interests are finalized.

7.4 Negotiations should be initiated with the regional players in the gas industry to establish a clear understanding of their relative rights and responsibilities:

- As part of this process, agreement should be reached to monitor and meter all gas moving in and out of Kazakhstan, since this is the only way to ensure that the terms and conditions associated with the transport and purchase of gas can be fulfilled.

- An agreed, enduring framework is required as a basis for setting pipeline tariffs for gas transiting the country and for gas being imported for delivery to the domestic market. This framework should address methods of payment and should provide a transparent methodology for calculating tariff levels.
- These negotiations should specifically address the introduction of supply exchange arrangements.
- The negotiations will also provide a basis for discussions between the Central Asian states (Kazakhstan, Turkmenistan, and Uzbekistan) and Russia regarding long-term access to European markets.

7.5 To ensure that the objective of full commercialization of the domestic gas sector is achieved in an expeditious and effective manner, the foreign private sector should be engaged both to provide investments and to provide know-how for the country's gas sector. Discussions have already been initiated with certain foreign companies. This process, however, should be staged and should be carefully managed:

- As noted, the conclusion of arrangements with the private sector should not occur until the process of introducing the required legislative and regulatory structure is under way (ideally it should be in place, but timing considerations may prelude this).
- Although it may be appropriate, at this time, to transfer certain of the transmission assets to the foreign private sector under lease or concession arrangements, full privatization of the LDCs should be deferred until the required financial and operating turnaround has been effected. Foreign private sector assistance should, however, be sought in the form of contracts to manage the turnaround of the LDCs.
- Performance measurement parameters should be established to allow the government to determine when operations under management contract can be offered for full privatization.
- Private sector participation should be sought in the evaluation and implementation of new transmission and distribution projects.

7.6 As noted, the domestic gas companies must become much more commercially focused. Required measures include:

- A move to international accounting standards, coupled with complete transparency in the books of accounts
- Bringing cost structures in line with international norms.
- Managing the workforce in a fashion consistent with international practice
- Increasing customer focus
- Abiding by international environmental and safety standards

- Establishing and holding the companies accountable for achieving a series of financial and operating performance targets.
- Amending the taxation system so that tax is levied only on genuine profits.

7.7 Investments will be required to resolve some of the problems that have plagued the domestic gas sector:

- Metering will ultimately be required for all customers if the nonpayment problem is to be resolved. A pilot project using prepayment meters should be introduced.
- Appropriate procedures should be introduced to enable the government to deal with hardship issues. The gas companies should not be forced (directly or indirectly) to subsidize government social programs.
- Investments will be required to rehabilitate and maintain the existing transmission and distribution network.

7.8 As noted, in seeking to become a player in the international gas market, Kazakhstan will need to enter into a dialogue with Russia and would be well served by engaging Turkmenistan and Uzbekistan:

- Such a dialogue could well result in the establishment of a marketing joint venture with Gazprom.
- The dialogue could also result in the establishment of a broader joint venture with the objective of ensuring the rehabilitation of portions of the existing transit pipeline network and the construction of additional facilities to access the European market.

High-Priority Projects

7.9 To achieve the country's gas sector objectives, significant investments will be required. In evaluating the priority of potential investments, consideration must be given to economic, financial, technical, and environmental aspects associated with each of the projects. Significant priority should be accorded to projects that offer improvements in the efficiency of natural gas usage and offer environmental mitigation.

7.10 The ESMAP task force together with its Kazakh counterpart has examined potential projects and has concluded that projects that fall within the following categories should be accorded high priority:

- Projects required to support the exchange arrangements with neighboring gas producing countries
- Field processing of sour gas
- Capturing and utilizing flared gas

- Rehabilitating and modernizing existing gas transmission lines
- Installing gas meters
- Appraisal work for gas fields located close to existing pipelines.

7.11 The government is in the process of transferring a number of its gas assets to the private sector. The private sector owners or concession holders will ultimately be responsible for implementing projects that fall under the identified "high priority" definition. Given this caveat, the following projects have been identified.

a. KARACHAGANAK FIELD GAS PROCESSING PLANT

- Capacity: 4 BCM/year.
- Approximate investment cost: $100 million (phase 1), $400 million (total cost).

A modern gas processing plant is an absolute requirement if any use is contemplated for this gas other than delivery to Orenburg, Russia. Currently up to 6 BCM a year of sour gas can be transferred to Orenburg. If net gas production is to increase above this level, processing facilities are required. Also, if an exchange is to be negotiated with Turkmenistan/Uzbekistan, Kazakhstan must be capable of delivering sweet gas from Karachaganak. The initial capacity of the plant is assumed to be 4 BCM a year. Expansion of the gas processing plant would be required as gas markets grow and gas production from the Karachaganak field increases.

b. CAPTURING FLARED GAS FROM THE ZHANAZOL OIL FIELD AND UTILIZING IT FOR POWER GENERATION

- Volume: 0.6 BCM of flared gas.
- Approximate investment cost: $140 million.

At present most of the 0.6 BCM a year of associated gas produced from the Zhanazol oil field is flared. Aktyubinsk, which is located about 200 kilometers north of Zhanazol, is short of electrical power—in 1995, the estimated deficit was 2,54 billion KWh. The proposed project contemplates completion of a pipeline link to Aktyubinsk and installation of a 100 MW CGT in Aktyubinsk. The power plant will consume 0.2 to 0.3 BCM a year of gas. The balance will be delivered to gas customers in the Aktyubinsk area.

c. CAPTURING FLARED GAS FROM THE SOUTH TURGAI FIELDS

- Volume: 0.15 BCM a year.
- Approximate investment cost: $100 million.

The oil fields in the South Turgai zone are flaring associated gas. The Kumkol field has been flaring an average of 0.15 BCM a year. The producing operations in the area have recently been transferred to the private sector. The operating agreements include a requirement that the operators develop plans for utilization of the associated gas. A grace period, however, is incorporated in these agreements to allow the operators adequate time to develop these plans. Preliminary indications suggest that much of the gas will be used for reinjection, the generation of power for the operators' own use, or both. The region is a net importer of power. Consequently, a potential market exists for any power that is generated in surplus to the operators' own requirements. (Construction of a transmission line from Kumkol to Kyzl-Orda would be required.) At this stage, however, no effort has been made to coordinate these plans. Without coordination, there is a risk that the overall utilization of the associated gas will be suboptimal. Consequently, it is recommended that a Steering Committee be established under the chairmanship of a designated government official with representation from the national and local governments, each of the operating companies, and LPG/electricity distribution companies. This Committee will be responsible for the development of a coordinated plan for the utilization of associated gas in the region.

d. DEVELOPMENT OF AMANGELDI AND OTHER GAS FIELDS IN THE ZHAMBYL REGION

- Production: 3 BCM a year (1.5 BCM in phase 1).
- Approximate investment cost: $276 million ($66 million for phase 1).

The gas fields in the Zhambyl region are located less than 170 kilometers from the existing southern gas transmission pipeline to Almaty. It is estimated that these fields could produce 3 BCM a year. This project is contemplated in two phases. Phase 1 will produce 1.5 BCM a year from the Amangeldi field and deliver it through a 130 kilometer pipeline to the existing transmission line. Phase 2 contemplates full development of the other gas fields and an increase in production capacity to 3 BCM a year.

e. REHABILITATION OF GAS TRANSMISSION PIPELINES

- Pipeline: Central-Asia-Center (CAC) pipeline.
- Approximate investment cost: $110 million.
- Pipeline: Gazli-Symkent-Almaty.
- Approximate investment cost:$150 million.

The main Turkmen gas export corridor, the CAC pipeline was built in the 1960s and 1970s. Its gas compressor stations now require substantial rehabilitation. The

southern transmission pipeline was also built in the 1960s and 1970s. Its gas compressor stations also require significant rehabilitation. In addition, portions of the line need to be replaced, and improvements in the gas takeoff capacity to underground storage are required.

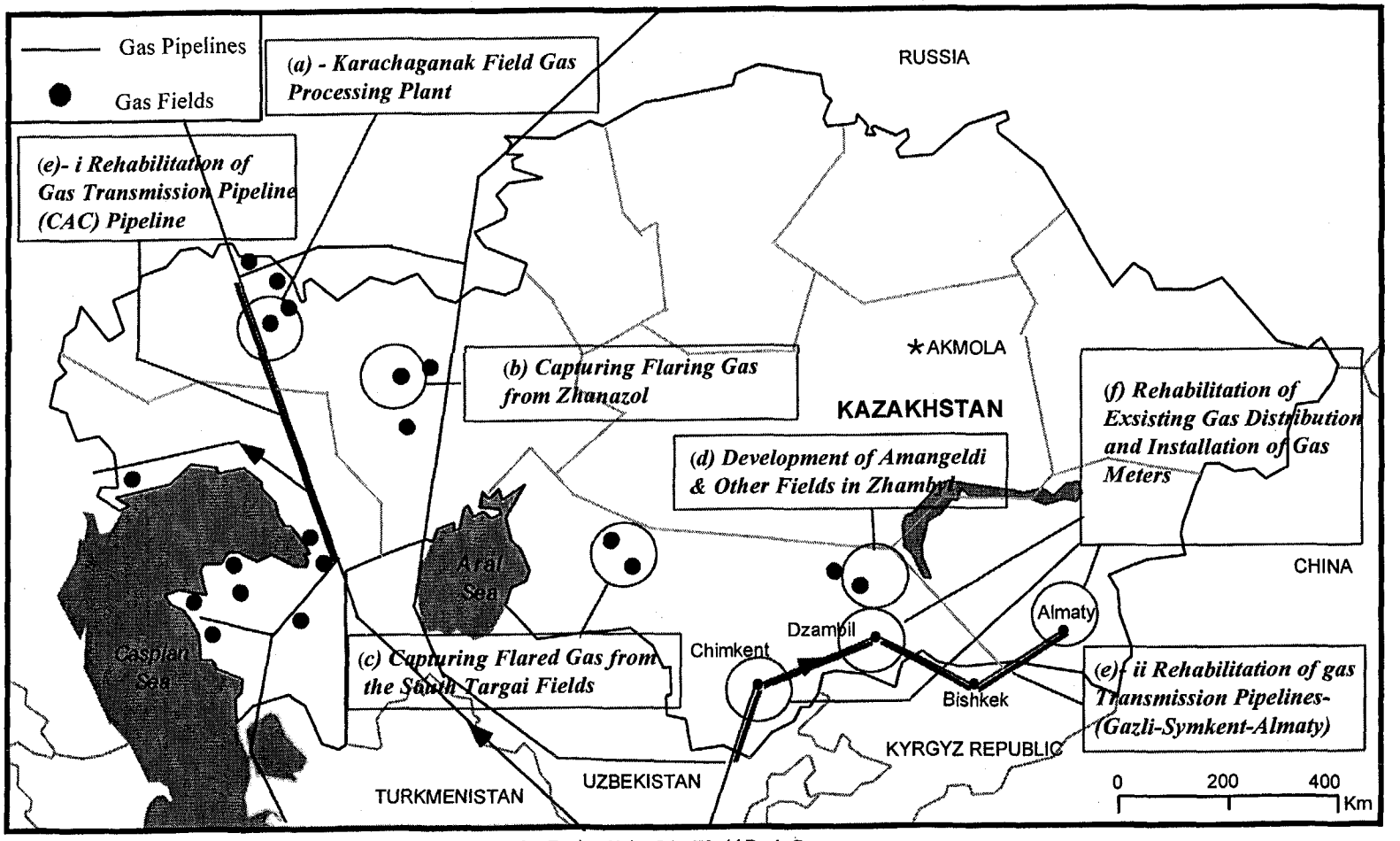
f. REHABILITATION OF EXISTING GAS DISTRIBUTION FACILITIES AND THE INSTALLATION OF METERS

- Project: meter installation.
- Approximate investment cost: $78 million.
- Project: rehabilitation of local distribution facilities.
- Approximate investment cost: $30 million.

The installation of metering (ultimately to all customers) is an essential component of the program to turn around the domestic gas companies and, in particular, to deal with the nonpayment problem. The $78 million covers the installation of meters at cross-border locations, throughout the transmission and distribution system, and at all customer locations (with the exception of cooking-only customers) and provides funding for a pilot program to use prepayment meters at 15,000 customer locations. The rehabilitation component is directed at the local distribution systems in Almaty and South Kazakhstan. The objective will be to stop gas leakage and establish a more reliable gas distribution service.

7.12 Before these projects can move toward implementation, more precise feasibility studies will be required to determine their financial viability. In addition, more rigorous environmental and safety assessments will be needed. Thereafter, discussions can be initiated with potential investors. The locations of the above projects are shown in figure 7.1.

Figure 7.1. Kazakhstan: High Priority Project Locations



This map is for reference only and has not been approved by the Map Design Unit of the World Bank Group.

Joint UNDP/World Bank

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

LIST OF REPORTS ON COMPLETED ACTIVITIES

Region/Country	*Activity/Report Title*	*Date*	*Number*
	SUB-SAHARAN AFRICA (AFR)		
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English)	05/89	--
	Francophone Household Energy Workshop (French)	08/89	--
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English)	03/90	--
	Symposium on Power Sector Reform and Efficiency Improvement in Sub-Saharan Africa (English)	06/96	182/96
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English)	02/88	--
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU
	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90
Central African Republic	Energy Assessement (French)	08/92	9898-CAR
Chad	Elements of Strategy for Urban Household Energy The Case of N'djamena (French)	12/93	160/94
Comoros	Energy Assessment (English and French)	01/88	7104-COM
Congo	Energy Assessment (English)	01/88	6420-COB
	Power Development Plan (English and French)	03/90	106/90
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (English)	12/87	--
	Power Sector Efficiency Study (French)	02/92	140/91
	Project of Energy Efficiency in Buildings (English)	09/95	175/95

Region/Country	*Activity/Report Title*	*Date*	*Number*
Ethiopia	Energy Assessment (English)	07/84	4741-ET
	Power System Efficiency Study (English)	10/85	045/85
	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	--
	Energy Assessment (English)	02/96	179/96
Gabon	Energy Assessment (English)	07/88	6915-GA
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
	Industrial Energy Efficiency (English)	11/92	148/92
Guinea	Energy Assessment (English)	11/86	6137-GUI
	Household Energy Strategy (English and French)	01/94	163/94
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English & Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84
	Coal Conversion Action Plan (English)	02/87	--
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English)	11/87	--
	Power Loss Reduction Study (English)	09/96	186/96
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87
	Environmental Impact of Woodfuels (French)	10/95	176/95
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83
	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Islamic Republic of Mauritania	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87

Region/Country	*Activity/Report Title*	*Date*	*Number*
Mauritius	Bagasse Power Potential (English)	10/87	077/87
	Energy Sector Review (English)	12/94	3643-MAS
Morocco	Energy Sector Institutional Development Study (English and French)	07/95	173/95
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
	Electricity Tariffs Study (English)	06/96	181/96
	Sample Survey of Low Voltage Electricity Customers	06/97	195/97
Namibia	Energy Assessment (English)	03/93	11320-NAM
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87
	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
	Energy Assessment (English)	07/93	11672-UNI
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Energy Assessment (English and French)	07/91	8017-RW
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADC	SADC Regional Power Interconnection Study, Vols. I-IV (English)	12/93	--
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	--
Sao Tome and Principe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE
	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
	Industrial Energy Conservation Program (English)	05/94	165/94
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
South Africa Republic of	Options for the Structure and Regulation of Natural Gas Industry (English)	05/95	172/95
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84
	Wood Energy/Forestry Feasibility (English)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
	Household Energy Strategy Study	10/97	198/97
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	--
	Industrial Energy Efficiency Technical Assistance (English)	08/90	122/90

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Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86
	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English)	03/89	UNDP Terminal Report
	Energy Assessment (English)	12/96	193/96
Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
Zimbabwe	Energy Assessment (English)	06/82	3765-ZIM
	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84
	Power Sector Management Assistance Project (English)	04/85	034/85
	Power Sector Management Institution Building (English)	09/89	--
	Petroleum Management Assistance (English)	12/89	109/89
	Charcoal Utilization Prefeasibility Study (English)	06/90	119/90
	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM
	Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program (English)	04/94	--
	Capacity Building for the National Energy Efficiency Improvement Programme (NEEIP) (English)	12/94	--
	EAST ASIA AND PACIFIC (EAP)		
Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	--
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
	Strategic Options for Power Sector Reform in China (English)	07/93	156/93
	Energy Efficiency and Pollution Control in Township and Village Enterprises (TVE) Industry (English)	11/94	168/94
	Energy for Rural Development in China: An Assessment Based on a Joint Chinese/ESMAP Study in Six Counties (English)	06/96	183/96
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86

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Indonesia	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II (English)	12/90	124/90
	Prospects for Biomass Power Generation with Emphasis on Palm Oil, Sugar, Rubberwood and Plywood Residues (English)	11/94	167/94
Lao PDR	Urban Electricity Demand Assessment Study (English)	03/93	154/93
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Energy Strategy Paper (English)	--	--
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84
Philippines	Commercial Potential for Power Production from Agricultural Residues (English)	12/93	157/93
	Energy Conservation Study (English)	08/94	--
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979-SOL
South Pacific	Petroleum Transport in the South Pacific (English)	05/86	--
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rural Energy Issues and Options (English)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English)	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88
	Impact of Lower Oil Prices (English)	08/88	--
	Coal Development and Utilization Study (English)	10/89	--
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Vietnam	Rural and Household Energy-Issues and Options (English)	01/94	161/94
	Power Sector Reform and Restructuring in Vietnam: Final Report to the Steering Committee (English and Vietnamese)	09/95	174/95
	Household Energy Technical Assistance: Improved Coal Briquetting and Commercialized Dissemination of Higher Efficiency Biomass and Coal Stoves (English)	01/96	178/96
Western Samoa	Energy Assessment (English)	06/85	5497-WSO
	SOUTH ASIA (SAS)		
Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program (English)	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study (English)	12/88	--
India	Opportunities for Commercialization of Nonconventional Energy Systems (English)	11/88	091/88

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India	Maharashtra Bagasse Energy Efficiency Project (English)	07/90	120/90
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III (English)	07/91	139/91
	WindFarm Pre-Investment Study (English)	12/92	150/92
	Power Sector Reform Seminar (English)	04/94	166/94
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
	Energy Efficiency & Fuel Substitution in Industries (English)	06/93	158/93
Pakistan	Household Energy Assessment (English)	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
	National Household Energy Survey and Strategy Formulation Study: Project Terminal Report (English)	03/94	--
	Managing the Energy Transition (English)	10/94	--
	Lighting Efficiency Improvement Program Phase 1: Commercial Buildings Five Year Plan (English)	10/94	--
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86
EUROPE AND CENTRAL ASIA (ECA)			
Bulgaria	Natural Gas Policies and Issues (English)	10/96	188/96
Central and Eastern Europe	Power Sector Reform in Selected Countries	07/97	196/97
Eastern Europe	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Kazakhstan and Kyrgyzstan	Opportunities for Renewable Energy Development	11/97	16855-KAZ
Kazakhstan	Natural Gas Investment Strategy Study, Volumes 1 and 2	12/97	199/97
Poland	Energy Sector Restructuring Program Vols. I-V (English)	01/93	153/93
Portugal	Energy Assessment (English)	04/84	4824-PO
Romania	Natural Gas Development Strategy (English)	12/96	192/96
Turkey	Energy Assessment (English)	03/83	3877-TU
MIDDLE EAST AND NORTH AFRICA (MNA)			
Arab Republic of Egypt	Energy Assessment (English)	10/96	189/96
Morocco	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
	Energy Sector Institutional Development Study (English and French)	05/95	173/95
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector (English)	06/90	115/90

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Tunisia	Fuel Substitution (English and French)	03/90	--
	Power Efficiency Study (English and French)	02/92	136/91
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
	Renewable Energy Strategy Study, Volume I (French)	11/96	190A/96
	Renewable Energy Strategy Study, Volume II (French)	11/96	190B/96
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91

LATIN AMERICA AND THE CARIBBEAN (LAC)

LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	--
	Elimination of Lead in Gasoline in Latin America and the Caribbean (English and Spanish)	04/97	194/97
Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	--
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Prefeasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	National Energy Plan (Spanish)	08/91	131/91
	Private Power Generation and Transmission (English)	01/92	137/91
	Natural Gas Distribution: Economics and Regulation (English)	03/92	125/92
	Natural Gas Sector Policies and Issues (English and Spanish)	12/93	164/93
	Household Rural Energy Strategy (English and Spanish)	01/94	162/94
	Preparation of Capitalization of the Hydrocarbon Sector	12/96	191/96
Brazil	Energy Efficiency & Conservation: Strategic Partnership for Energy Efficiency in Brazil (English)	01/95	170/95
	Hydro and Thermal Power Sector Study	09/97	197/97
Chile	Energy Sector Review (English)	08/88	7129-CH
Colombia	Energy Strategy Paper (English)	12/86	--
	Power Sector Restructuring (English)	11/94	169/94
	Energy Efficiency Report for the Commercial and Public Sector (English)	06/96	184/96
Costa Rica	Energy Assessment (English and Spanish)	01/84	4655-CR
	Recommended Technical Assistance Projects (English)	11/84	027/84
	Forest Residues Utilization Study (English and Spanish)	02/90	108/90
Dominican Republic	Energy Assessment (English)	05/91	8234-DO
Ecuador	Energy Assessment (Spanish)	12/85	5865-EC
	Energy Strategy Phase I (Spanish)	07/88	--
	Energy Strategy (English)	04/91	--
	Private Minihydropower Development Study (English)	11/92	--
	Energy Pricing Subsidies and Interfuel Substitution (English)	08/94	11798-EC
	Energy Pricing, Poverty and Social Mitigation (English)	08/94	12831-EC
Guatemala	Issues and Options in the Energy Sector (English)	09/93	12160-GU
Haiti	Energy Assessment (English and French)	06/82	3672-HA
	Status Report (English and French)	08/85	041/85
	Household Energy Strategy (English and French)	12/91	143/91

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Honduras	Energy Assessment (English)	08/87	6476-HO
	Petroleum Supply Management (English)	03/91	128/91
Jamaica	Energy Assessment (English)	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
	Energy Efficiency Building Code Phase I (English)	03/88	--
	Energy Efficiency Standards and Labels Phase I (English)	03/88	--
	Management Information System Phase I (English)	03/88	--
	Charcoal Production Project (English)	09/88	090/88
	FIDCO Sawmill Residues Utilization Study (English)	09/88	088/88
	Energy Sector Strategy and Investment Planning Study (English)	07/92	135/92
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz (English and Spanish)	08/91	138/91
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