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Republic of Armenia

Organization and Structure of the Natural Gas Sector:

Review and Recommendations

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NATURAL GAS SECTOR RESTRUCTURING

OBJECTIVE

The objective of this study was to review the current status of the natural gas sector in Armenia, and in particular to provide an overview, prior to a detailed analysis, of the legal status, organization, staffing, and general policies and priorities and recommended changes that are essential to the ability of its constituent companies to function as self-sufficient commercial entities. This analysis covers the entire operation of the natural gas sector, with emphasis on the distribution level where pilot models are being considered.

BACKGROUND

Among the Republics of the former Soviet Union, Armenia had one of the highest levels of gas consumption. In the residential sector, the market penetration was the highest of all former Soviet Union Republics, with 83.3% of all residents receiving gas in some form or other. Of these, 61.5% used natural gas delivered by distribution systems and 21.8% used bottled gas.

The importation of natural gas into Armenia originated in 1957, the date at which the Yerevan branch of the Trans-Caucasian Gas Main Department began operations. In 1970 that branch was renamed "Armtransgas Industrial Association" which involved in its structure three regional subsidiaries, the Abovian, Vanadzor and, from 1972, the Goris Gas Main Maintenance Departments. "Armtransgas" was responsible for the importation of natural gas into the Republic and for the operation of the gas main pipeline.

At the same time, the "Armgas State Committee on Gas Supply" was established, whose responsibility was chiefly the distribution of natural gas. A total of 10 urban and regional gas distribution departments were established within "Armgas". In 1974, a new gas sales activity was added when the "Liquefied Gas Industrial Enterprise" was established, whose task it was to import liquefied gas and to distribute it to regions without natural gas supply. In addition, Armgas was put in charge of the underground storage of natural gas then under construction in the Abovian Region. The operation of all of these enterprises was absorbed into the overall structure of the "Armtransgas Association". After several name changes, Armtransgas now operates under the name of "Haigasard State Concern".

Until 1972, Iran was the exclusive source of gas for Armenia. Iranian gas was transported through Azerbaijan. The subsequent discovery of giant natural gas fields in the former USSR led to the importation of natural gas into the Republic through an interconnected nationwide gas transportation system operating throughout the USSR. At that stage, the Armenian gas supply system permitted the importation of natural gas through three main pipelines from Azerbaijan, which are as follows:

1. Khazakh - Idjevan - Yerevan (1000 mm diameter, approximately 40"),
2. Kransny Most (Azerbaijan) - Alaverdi - Kirovakan - Leninakan (700 mm diameter, approximately 28"), and

3. Yevlakh - Stepanakert - Goris - Sisian - Nakhichevan - Ararat (500 mm diameter, approximately 20").

In 1983, the construction enterprises of "Haigasard" began the construction of the Northern Caucasus-Trans-Caucasus main gas pipeline. That line is the only non-Azeri link to Russian and Turkmenistan gas, through Georgia. The line diameter is 1000-1420 mm (40 - 56"), depending on location. The construction of that vital link to foreign gas was completed in 1993.

In 1988, the conflict between Azerbaijan and Kharabakh brought on the embargo of Armenia by Azerbaijan. Since all gas import lines ran through Azerbaijan at the time, the disruption of gas deliveries through Azerbaijan plunged Armenia into an economic crisis. In 1991, the disintegration of the USSR deepened the crisis as all economic relations were severed, the markets were redirected and the Republic had to search for a way out. This economic crisis resulted in the near-collapse of industry and in a substantial reduction of the incomes and paying ability of the general public. The resulting nonpayment for consumed gas forced further reductions in gas imports. By 1994, gas supplies to the residential sector had to be shut down altogether. The remaining natural gas consumers in the Republic can be grouped as follows:

- the power system;
- the industrial system;
- district heating;
- priority community needs (hospitals, schools, etc.).

Estimated historical gas consumption volumes in the Republic are listed in Table 1, by consuming subsector. As that Table shows, the natural gas industry continues to be in disarray. 1995 deliveries were up from 1994 but, at 1.46 billion cubic meters, they were still less than a quarter of 1989 deliveries.

Table 1
NATURAL GAS IMPORTS AND CONSUMPTION IN ARMENIA

	1987	1988	1989	1990	1991	1992	1993	1994	1995
	Millions of Cubic Meters								
Gas Imports to Armenia	5120	5754	6328	4712	4153	1879	801	868	1458
- Gas Exports	200.2	266.6	308.5	375.3	349.8	76.4	-	-	-
Sales to:	4776	5366	5756	4292	3713	1711	768	791.3	1372
- Armenergo	1104	1583	2089	974.6	1025	1073	692	682.4	1175
- Yerevan City District Heating	201.0	198.0	193.7	163.4	95.4	8.4	0.6	7.8	42.0
- Other District Heating	327.8	325.7	268.3	278.8	180.3	7.7	0.01	2.2	14.9
- Residential Consumers	1197	1251	1315	1355	1207	412.4	12.8	-	3.8
- Industry, including	1620	1668	1582	1221	993.2	188.4	59.5	98.9	136.8
Chemical	120.2	113.3	105.6	26.1	39.5	13.0	-	14.8	23.2
Light Industry	79.8	89.5	71.6	58.8	44.8	15.7	-	0.86	1.0
Electro-Technical	119.2	132.2	126.2	125.5	97.7	40.0	-	-	-
Agricultural	97.0	100.0	98.6	85.2	80.4	6.0	-	15.2	19.0
Transport	29.1	30.4	28.6	29.3	21.3	1.7	-	0.2	0.5
Construction	69.1	69.3	70.6	52.0	50.3	7.0	-	0.1	1.9
Construction Materials	206.3	203.2	217.8	114.3	159.6	26.0	-	31.0	50.0
- Hospitals, Schools, etc.	325.1	345.6	308.7	299.5	211.7	21.5	16.5	10.0	56.9
- Internal Consumption	29.3	27.0	94.4	20.0	17.1	15.0	-	5.6	7.2
- Losses	118.7	160.5	187.1	149.5	108.7	80.9	-	46.2	67.2

The natural gas delivery system as a whole has been, and continues to be, unable to account with precision for sector-by-sector gas consumption since gas meters are installed only at industrial and other significant enterprises. There is no gas metering in the residential sector. In the past, residential gas consumption was calculated according to norms established by experts of Armgas SE. These residential-sector norms include as consumption and billing parameters the number of persons in a household, the types of appliances used (with imputed tariffs for gas stoves approximately three times as high as those for water heaters), and the surface areas of dwellings, which are used to estimate the amount of gas used for space heating. Normative gas consumption calculations were performed at the beginning of each year and submitted to GosPlan (now the Ministry of Economy), where they were used to estimate individual and aggregate household gas consumption for the year. It is obvious that such a "metering" system could not meet the more rigorous standards of market-oriented consumption accounting. One of the most urgent prerequisites for the resumption of gas deliveries to the residential sector is the installation of gas meters for each household or, at a minimum, for each apartment building.

In 1994, the Republic of Armenia, in an attempt to secure reliable gas supplies from abroad, signed a Gas Purchase Agreement with Turkmenistan. That Agreement permits Armenia to pay for part of its gas imports through barter which, by now, accounts for 60-75% of the total value of gas imports. At first, all natural gas commodity bartering was performed by the "Armcontract Trade Agency" within the Ministry of Materials Resources. By 1995, a new Agency was created for that purpose, the "Armturtrade State Enterprise". Jurisdiction over the enterprise was assigned to the Ministry of Energy. A simplified schematic diagram depicting cash and commodity flows, in addition to gas and electric power flows, and the economic relations between Armturtrade, Haigasard., foreign suppliers, local producers of barter goods and users of gas and electricity is provided in Figure 1.

As shown in Figure 1, part of the cash payments made to Haigasard by industrial gas consumers and thermal power plants are forwarded to Armturtrade State Enterprise, where they are used to finance the purchase of locally produced barter goods. These barter goods are then shipped to a foreign trade subsidiary of Haigasard which forwards them to the foreign supplier in partial payment for delivered natural gas. As always, commodity bartering is extremely inefficient and essentially non-transparent. In Armenia, some of the fall-outs of barter trading include substantial non-payments, debt accumulations and a confusing array of cross-indebtedness among various enterprises throughout the Republic.

Haigasard Organizational Structure

Presently, the Haigasard State Concern consists of 35 organizations with a total staff of 6,550 employees. The functions of Haigasard State Concern are: the purchase of natural gas from importers; gas transmission by high-pressure gas pipelines and medium-pressure gas distribution to selected industrial consumers; natural gas storage; liquefied gas imports, storage and distribution through low-pressure delivery networks; sale of compressed gas for motor fuel; construction and operation of pipeline systems; gas equipment manufacturing; and others. The various enterprises within the Haigasard structure are shown in Figure 2, where the company names reflect changes proposed by the Ministry of Energy. These enterprises can be classified according to operating systems as follows:

FIGURE 1
 NATURAL GAS TRADE IN ARMENIA

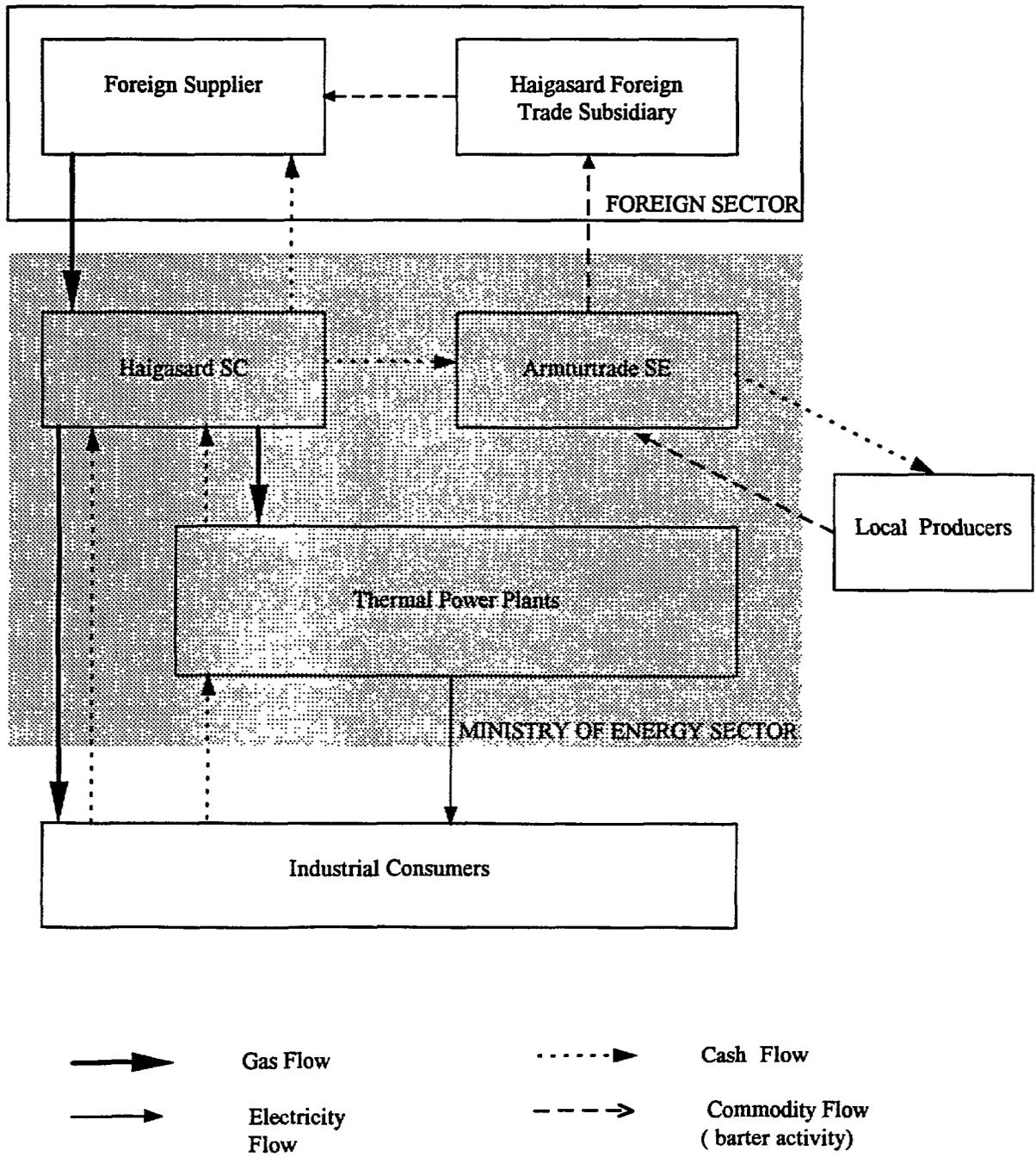
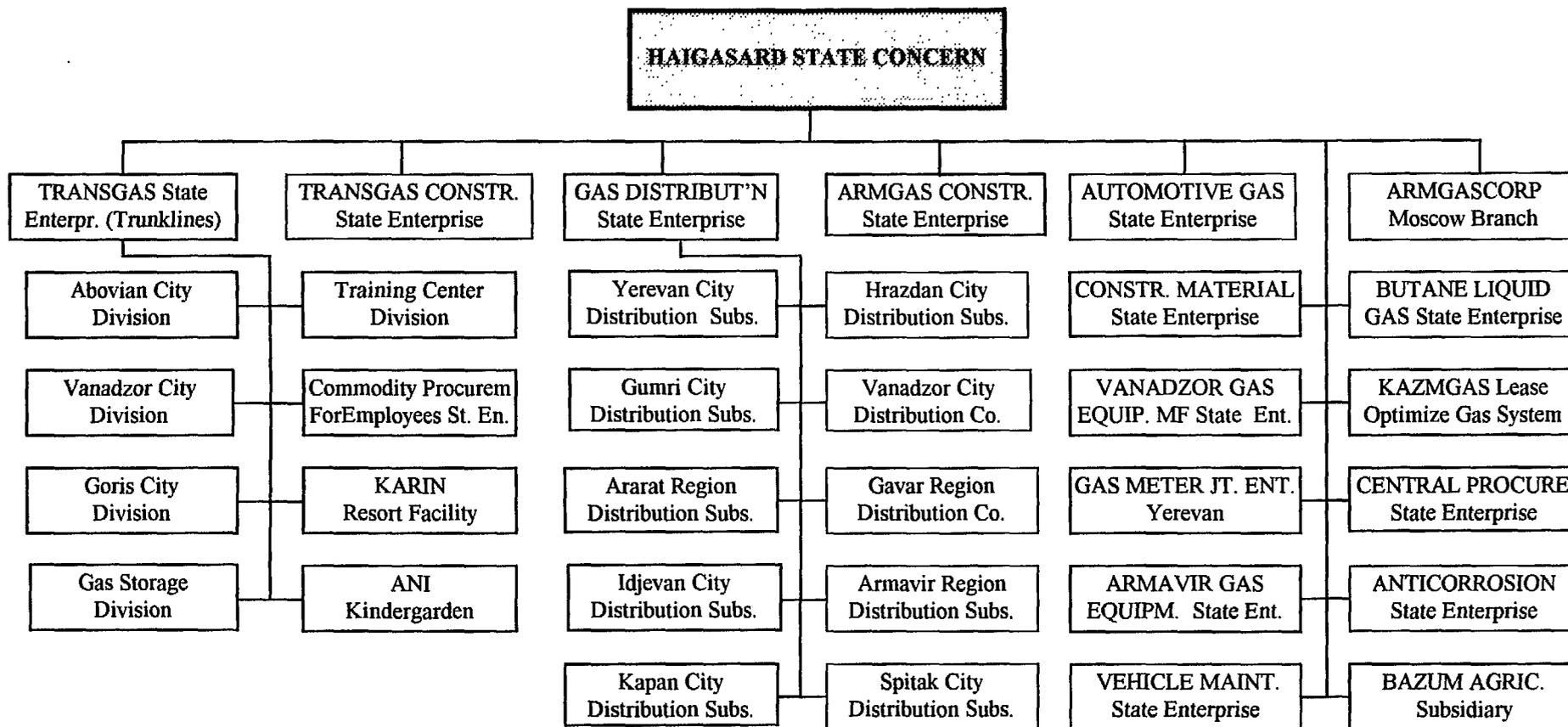


FIGURE 2



1. The Haigasard Gas Transport System

The high-pressure main pipeline system, the "Transgas State Enterprise", is a constituent part of the Trans-Caucasian gas main system which provides access to natural gas from Russia, Turkmenistan, Uzbekistan, Kazakstan, Azerbaijan, and Iran. At present, gas is supplied to the Republic almost exclusively from Turkmenistan and rarely from Russia, through Georgia. The operating capacity of the Northern Caucasus-Trans-Caucasus system is 50 million cubic meters per day, enough to meet the combined gas demand of Georgia and Armenia.

The gas main inside the Republic is 1918 km in length. There are 67 pressure reduction/gas distribution stations. The design pressure of the pipelines is 50 ATMs. As mentioned, the Haigasard transport system is subdivided into the following three regional systems:

1. The Abovian Division (Abovian city, 106 employees),
2. The Goris Division (Goris city, 106 employees), and
3. The Vanadzor Division (Vanadzor city, 125 employees).

The main pipeline system is in an advanced stage of deterioration. As a result, the system operates at half capacity. The working pressure of the pipelines is 15-40 ATMs. Inadequate maintenance of gas meters causes readings to deviate from actual throughput volumes by 2.5-10%, compared to an admissible tolerance of 0.5%-5%.

2. The Haigasard Gas Distribution System

The gas distribution system in the Republic of Armenia consists at present of 10 Haigasard daughter enterprises including Yerevan, Gumri, Vanadzor, Hrazdan, Idjevan, Armavir, Ararat, Kapan, Kamo, and Spitak. Cathodic protection is installed throughout the system, but whether it is operational or not is an open question. The Haigasard "Anticorrosion State Enterprise" is in charge of protecting the system which is in a critical situation because of electric outages which render the cathodic protection system useless and the deterioration and wear of surface gas facilities. Current gas deliveries are made to industrial and agricultural enterprises, to municipal facilities, and to the power sector. In the residential sector, several attempts were made in 1995 to deliver natural gas to villages, using a single master meter per village. These experiments failed, due to a lack of individual metering and billing and the inability to disconnect non-paying consumers. The resumption of gas deliveries to the general population is a high priority.

3. The Haigasard Gas Storage System

Seasonal continuity and reliability of gas deliveries are provided by the Haigasard storage system which is shown in Figure 2 as a Division of the Transgas State Enterprise. The underground gas storage facility in the Abovian District is built into a salt stratum and has 18 underground reservoirs with 1.7 million cubic meters of total cavern volume. At maximum design pressure, the storage facility will hold 250 million cubic meters of gas, for a net working volume of 210 million. The construction of eight additional reservoirs with a projected cavern volume of 1.2 million cubic meters was started but never completed. If the construction of these additional reservoirs had been completed, the total net storage capacity for natural gas would have been 340 million cubic meters.

The compressor station at the storage facility is in disrepair. It is an open question whether the compressors can be repaired cost-efficiently, since the repair will involve very significant expenses but will do nothing to reduce high current operating expenses. A complete overhaul or even the replacement of the existing compressor stations may be more cost-effective. Another problem associated with the salt storage facility is the disposition of waste brine in an environmentally benign and acceptable manner.

4. The Haigasard Liquefied Gas Supply System

Liquefied gas is imported into Armenia by private entrepreneurs and by the Haigasard Industrial Regasification and Sales daughter enterprise, shown in Figure 2 under the name of "Butane Liquid Gas State Enterprise". The firm is headquartered in the City of Abovian and has a total of 87 employees. Liquefied gas storage facilities are located at selected sites throughout Armenia. They consist of a central 50,000 cubic meter underground facility (for a storage capacity of 25.5 tonnes of butane) and a total of 4,000 cubic meters of above-ground metal tanks that are located at various sites in Armenia.

This daughter enterprise once operated a German-built facility to regasify butane by mixing it with appropriate amounts of air. This butane-air mixture had a thermal content equivalent to that of processed natural gas. It was injected into pipelines and delivered to distribution systems in lieu of natural gas whenever a gas shortage arose. However, with natural gas selling at world prices, the mixing of air and butane has become prohibitively expensive and the mixing facility is no longer in use.

Overall, the liquefied gas supply system is in satisfactory working condition, but in a year or two its equipment is expected to deteriorate to the point where the enterprise will face serious problems

5. The Haigasard Motor Transport Re-fueling System

This system ("Automotive Gas State Enterprise" in Figure 2) sells compressed gas as a motor fuel. This is the most profitable and efficient system in the gas sector since natural gas sells at about half the price of other fuels. There are five re-fueling stations in operation in the motor transport re-fueling system, two at Yerevan and one each at Vanadzor, Hrazdan, and Gumri. Each of these stations is designed for a storage capacity of approximately 250 days of sales. Additional unfinished stations are located in Armavir, Echmiadzin, Ararat and Idjevan. The completion of these non-operating stations and the installation of new compressors at the operating re-fueling stations will enable the system to carry out the re-fueling process when the pipeline pressure is low (0.5-4.0 ATMs). High-pressure motor fuel tanks operate at a pressure of 6 ATMs when full.

6. The Haigasard Industrial System

The industrial system within Haigasard SC is primarily engaged in the production and maintenance of natural gas equipment. This task is considered important by the Government in the face of the current energy embargo. The following production companies operate in the Concern:

- The Gas Meter Joint Venture Enterprise with participation of the Slovakian "Khiran" Joint-Stock Company has branches in Idjevan and Vanadzor. It has approximately 250 employees and produces gas meters, gas pressure regulators and spare parts;
- The Vanadzor Gas Equipment Manufacturing State Enterprise has approximately 75 employees and produces spare parts for gas equipment, water regulators, thermoregulators, stove regulators, etc.;

- The Armavir Gas Equipment State Enterprise has about 150 employees and produces welding machines, oil-processing equipment, and equipment for the construction and maintenance of gas pipelines;
- The Kazmgas Lease Company has 11 employees. The company produces gas burners and spare parts for gas regulators. It is now a joint stock company with 20% private ownership.

As mentioned earlier, one prerequisite for the resumption of gas deliveries to the residential sector will be the installation of gas meters and disconnect capabilities at each apartment. If competitively viable, the production of residential gas meters would likely take place at the Gas Meter Joint Venture Enterprise, provided residential gas deliveries are resumed and the required investment is obtained. The firm claims that the total market potential of 440,000 meters can be met by the plant in the period of 1996-1998.

7. The Haigasard Construction System

There are two pipeline construction companies within the Haigasard system. One of these, the Transgas Construction State Enterprise specializes in the construction and repair of high-pressure trunk lines and the other, Armgas Construction State Enterprise, works with medium and low pressure distribution systems. These two companies have at their disposal relatively modern if deteriorated trucks and machinery, among them American and Japanese equipment.

In recent years, the high-pressure construction company has taken on foreign construction projects in the Ukraine, Asia, and Georgia, to offset the absence of important orders in Armenia. Wear and tear of machinery and the shortage of spare parts caused considerable problems in this system. It would take the company about US\$ 1.0 million to repair the foreign equipment and to return to operations with its former efficiency.

Also part of the Haigasard Construction System is the Construction Material State Enterprise that specializes in trenching and pipe coating operations.

8. Other Haigasard Affiliates

Included among those are a central "Vehicle Maintenance State Enterprise" charged with repairing and maintaining all Haigasard vehicles, a Training Center that serves essentially the Transgas and Gas Distribution State Enterprises, a "Central Procurement State Enterprise" that serves as a purchasing agent for the entire system, a Liaison Branch in Moscow, and various minor companies some of which are relics from the old social system, such as the Bazum Agricultural Subsidiary which produces farm products for company employees, the Commodity Procurement for Employees State Enterprise that does the same with non-farm products, the ANI Kindergarten, and the KARIN Resort Facility which currently serves as a refugee center.

COMPARISON WITH WESTERN ORGANIZATIONAL STANDARDS

Some of the apparent anomalies, compared to market-oriented privately-owned gas transmission and distribution corporations, include the existence of two separate construction and maintenance companies. In the West, pipeline construction work is typically performed by contractors. Routine maintenance and repair work is done, especially in distribution networks, by specialized divisions that are located in the individual distribution companies.

As mentioned, the Commodity Procurement State Enterprise, the Karin Resort Facility and the ANI Kindergarten cover unrelated activities that are in part left-overs of the old centrally regulated regime that typically aimed for maximum economic self-containment. With the possible exception of the Automotive Gas State Enterprise which maintains a network of compressor stations across the country to fill high-pressure gas tanks on top of utility vehicles, especially buses, most of the other State Enterprises would be separate enterprises in the West, and they should be reviewed with such a separation and privatization in mind.

Gas sales to residences, industry, power plants, and other customers are listed, by distribution district, for the peak year 1989 and for the latest available full year, 1995, in Table 2. Also listed, where available, are estimates of the percentages of successful collections and numbers of consumers (not including residences) and employees. For the Yerevan Distribution Company, for example, total sales were 2.37 billion cubic meters in 1989, compared to 425 million cubic meters in 1995. That is less than 20% of consumption in the peak year. Of that 1995 total, deliveries to residences were for all practical purposes zero. Percentage collection, nearly 100 per cent for all distribution companies in 1989, had dropped to 21% in Yerevan in 1995. This kind of information will be useful in future restructuring decisions when the issue will invariably come up whether and at what level to maintain existing distribution networks.

Similar information is presented in Table 3 for the three trunkline regions. The Goris Region is, for all practical purposes, shut down, yet it maintains its employee strength at 70% of the 1989 peak year.

Table 4 lists the various Armgasard State Enterprises and their estimated levels of activity for 1989 and 1995. For example, the Armgas Construction Company has essentially been shut down but maintains 438 employees. The one and only growth company has been the Automotive Gas State Enterprise which now sells 50% more compressed gas to utility vehicles than it did when it was founded in 1991, and with fewer employees. Again, these are not hard and fast figures, but hard and fast figures do not exist. This is about as good a set of information of past and present activities of non-gas Haigasard companies as can be had, and it will prove useful in deciding whether and where to effect separations from the parent company.

POST-AUGUST-1995 DEVELOPMENTS IN THE NATURAL GAS SECTOR

The World Bank has continued its efforts to speed the gas sector on its way towards eventual privatization. A draft report dated November 17, 1995, suggested, as a condition for negotiations, that the Government of Armenia designate Armgas as the only **state owned or controlled** (their emphasis) entity authorized to procure gas, but leaving private buyers free to import gas directly, paying Armgas for transmission, storage, and distribution services at rates to be set by the Government, and eventually by an independent commission.

To facilitate the transition from barter to cash payments and as a means of imposing financial discipline, the World Bank draft report also suggested the setting up of a separate settlement account for the purchase of gas. Start-up funds for this account were to be provided by short-term Government credit. Once in operation, the account was to be replenished solely from payments received from consumers, constraining Armgas to purchase gas only in so far as it can pay for it from the special settlement account. The draft report also called for the elimination of state guarantees for gas imports.

Table 2 - HAIGASARD DISTRIBUTION COMPANIES

Gas Sales to:	YEREVAN CITY DISTRIB. COMPANY				GUMRI CITY DISTRIBUTION COMPANY			
	1989		1995		1989		1995	
	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect
Residences	210.9		0.2	N/A	130.5		0	N/A
Industry	634.4		61	N/A	49.8		1	N/A
Power Plants	1220.8		320	N/A	0		9	N/A
Other	300		44	N/A	30.1		0	N/A
Total	2366.1	98%	425	21%	210.4	N/A	10	13%
Nbr. Connections (a)	730		650		140		12	
Nbr. Employees	996		413		510		235	

Gas Sales to:	ARARAT REGION DISTRIB. COMPANY				IDJEVAN CITY DISTRIBUTION COMPANY			
	1989		1995		1989		1995	
	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect
Residences	146		0	N/A	133.9		0	N/A
Industry	129		32.3	N/A	63.6		1.1	N/A
Power Plants	0		0	N/A	0		0	N/A
Other	65.1		1.4	N/A	37.9		0.4	N/A
Total	340.1	95%	33.7	40%	235.4	90%	1.5	46%
Nbr. Connections (a)	167		21		160		16	
Nbr. Employees	430		217		580		258	

Gas Sales to:	KAPAN CITY DISTRIBUTION COMPANY				HRAZDAN CITY DISTRIB. COMPANY			
	1989		1995		1989		1995	
	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect
Residences	24.8		0		191.3		3.4	N/A
Industry	39.9		0		402.2		17.2	N/A
Power Plants	0		0		732		836.4	N/A
Other	35.1		0		155.8		11.1	N/A
Total	99.8	96%	0		1481.3	94%	868	1.60%
Nbr. Connections (a)	34		0		282		43	
Nbr. Employees	374		183		468		349	

Gas Sales to:	VANADZOR CITY DISTRIB. COMPANY				GAVAR REGION DISTRIB. COMPANY			
	1989		1995		1989		1995	
	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect
Residences	160		0	N/A	160		0.1	N/A
Industry	56.6		2.6	N/A	46		0	N/A
Power Plants	136.5		9.4	N/A	0		0	N/A
Other	44.8		0	N/A	34		0	N/A
Total	398	97%	12	19%	240	N/A	0.1	94%
Nbr. Connections (a)	280		15		340		1	
Nbr. Employees	728		279		366		180	

Gas Sales to:	SPITAK CITY DISTRIBUTION COMPANY				ARMAVIR REGION DISTRIB. COMPANY			
	1989		1995		1989		1995	
	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect	10 ⁶ CM	% Collect
Residences	2		0	N/A	156		0.1	N/A
Industry	0.3		0.1	N/A	160		15.9	N/A
Power Plants	0		0	N/A	0		0	N/A
Other	1.9		0	N/A	65.5		0.1	N/A
Total	4.2	97%	0.1	90%	381.5	N/A	16.1	40%
Nbr. Connections (a)	20		1		210		13	
Nbr. Employees	34		116		618		323	

NOTE: (a)-Does not include Residences
N/A-Not Available

Table 3

HAIGASARD TRUNK LINE COMPANIES

Sales to:	ABOVIAN REGION		VANADZOR REGION		GORIS REGION	
	1989	1995	1989	1995	1989	1995
	10 ⁶ CM					
Power Plants	4809	1343	848.2	235.1	99.8	0
Nbr. Employees	192	202	136	130	135	94

Table 4

STATE ENTERPRISES

	Production, %		Nbr. Employees	
	1989	1995	1989	1995
TRANSGAS CONSTRUCTION SE	100%	22%	1253	659
ARMGAS CONSTRUCTION SE	100%	2%	1038	438
AUTOMOTIVE GAS SE (a)	100%	150%	149	130
CONSTRUCTION MATERIALS MF SE	100%	10%	420	193
VANADZOR GAS EQUIPM. SE (b)	100%	78%	N/A	51
GAS METER JOINT ENTERPR. (b)	100%	19%	284	186
ARMAVIR GAS EQUIPMENT SE (b)	100%	28%	N/A	138
BUTANE LIQUID GAS SE	100%	35%	252	138
KAZMGAS SE	100%	N/A	133	130
CENTRAL PROCUREMENT SE	100%	25%	N/A	35
ANTICORROSION SE	100%	4%	353	177
BAZUM AGRICULTURE SUBSID.	100%			
OTHER ENTERPRISES				
TRAINING CENTER	100%	N/A	26	12
COMM. PROCUREMENT EMPLOYEES	100%	5%	32	63
ANI KINDERGARDEN	100%	100%	56	43
	Nbr. Vehicles		Nbr. Employees	
	1989	1995	1989	1995
VEHICLE MAINTENANCE SE (c)	800	200	1187	472

NOTES: (a)-Company Established in 1991, Initial Percentage and Employees Shown for 1991.
(b)-Company Established in 1992, Initial Percentage and Employees Shown for 1992.
(c)-Estimated
N/A-Not Available

In addition, the World Bank called for the issuance of a Government Decree incorporating the conditions outlined above. On December 27, 1995, Decree Number 361 was issued by the Prime Minister to meet the conditions stipulated in the World Bank report. The formal provisions of that Decree stipulate that:

- The Haigasard State Concern is the sole authorized concern which has the right to transport natural gas into the Republic;
- The Government of the Republic of Armenia assumes no economic liability and gives no warranties to ensure natural gas imports and payments;
- The Haigasard State Concern has permission by the guarantee of the Government of the Republic of Armenia to use credit in the amount of US\$ 6.0 million to purchase natural gas; and
- The Ministry of Energy will submit to the Government a proposal regarding structural improvements of the Haigasard State Concern and the Armturtrade State Enterprise.

In its Letter of Development Policy for the Republic of Armenia, the World Bank addressed natural gas barter trade and stipulated that the Government refrain from interfering in gas-related barter and that it allow gas importers to operate only on a commercial basis. Recognizing the need for a structural adjustment of the economy to a market basis, a critical restructuring of the gas subsector was called for. With regard to monopolistic energy markets in general, the document stipulated the adoption, by May 1, 1996, of an energy law that would assure the commercialization and privatization of sector corporations, the facilitation of foreign private investment, and the definition of the role of an independent regulator in the energy sector. By July 1, 1996, a regulator was to be appointed within the Government, and he or she was to become independent by December 31, 1996. With respect to the natural gas sector, the task of the regulator was to set tariffs, monitor the quality of supply, issue licenses, and ensure access to gas transmission lines and storage facilities by third parties. These and other provisions are partially contained in the current draft version of the Energy Law of the Republic of Armenia, which has been under review for nearly two years and which is now being considered for submission to the National Assembly.

These World Bank efforts were supported by parallel actions of USAID which, on May 6, 1996, signed a \$15 million gas purchase agreement with the Government of Armenia, but with certain stipulations regarding Armenian moves towards market reform. In the gas sector, the agreement called for the Ministry of Energy to develop and approve a natural gas restructuring plan and implementation time table during the second quarter of 1996. The plan stipulated that the gas transmission, storage, and distribution functions be separated and that joint stock companies be formed to implement them.

The Ministry of Energy responded to World Bank and USAID suggestions by submitting a restructuring plan for the natural gas sector. This plan called for the establishment of a natural gas importing and transmission company ("Armgasard" State Concern) and a separate natural gas distribution State Enterprise. Beyond these two main gas enterprises, several of the dependent enterprises were to be re-shuffled and some were to have their status changed from Daughter Enterprises to State Enterprises, but there were no visible eliminations or mergers of subsidiaries. The entire system was to be held together by an "Authorized Management Enterprise" that has the faint ring of a US holding company, without of course the equity holdings implications that would be

present in the United States. Overall, the plan did not entail a deep reorganization of the natural gas sector, so that its ultimate rejection by the Prime Minister's office came as no surprise.

Other restructuring plans have been proposed in the gas sector, notably one that was put out by Haigasard and that reflects their vision of what the Government would need or want. That plan leans on the Ministry of Energy plan that has been obsoleted by the Prime Minister, so its life as a credible guide for future action appears to be limited.

The organizational diagram of Haigasard State Concern, shown earlier as Figure 2, is somewhat interpretive and possibly inaccurate in places, but it has the virtue of showing all the constituent parts that today make up the Armenian natural gas sector. As mentioned, the two principal companies within the Haigasard S.C. structure are the high-pressure trunkline transmission company, Transgas State Enterprise, and the Gas Distribution State Enterprise.

A Natural Gas Import Agreement was concluded in 1996 between Haigasard State Concern and "ITERA", an American Energy Company. Unlike earlier gas purchasing agreements, this one stipulates definite terms of payment, including a natural gas price at the Armenian border in the amount of US\$75.00 per cubic meter (\$2.12/MCF) if paid in part by barter and US\$55.00 (\$1.56/MCF) if paid in cash.

ONGOING AND PLANNED TECHNICAL ASSISTANCE IN GAS SECTOR RESTRUCTURING

As noted in an earlier report, *Petroleum Sector Development, Gas Sector Restructuring, MIS System, Merklein and Associates - Hagler Bailly Consulting, Inc., May 1996*, three natural gas related TACIS projects were under way in early 1996. They are:

1. the Snamprogetti "Gas Pipeline Testing and Rehabilitation Project",
2. the Kantor "Armenian Energy Sector Review of Pricing, Financing & Collection Arrangements for the Supply of Gas", and
3. the "Gaz de France Technical Support for the Restructuring of the Gas Sector in Armenia".

Two new players have since entered the natural gas field: Burns and Roe with plans to rehabilitate or replace gas compressors, and Hagler Bailly Consulting, Inc., with plans to (a) commercialize and restructure the gas market and (b) install pilot gas distribution systems in selected areas.

SNAMPROGETTI

The Snamprogetti Project In Early 1996: This is a technical project that does not deal with structural issues. Its objectives are to determine the structural integrity of the main gas pipelines, to specify repairs and technical improvements in the gas distribution network, to develop an overall rehabilitation plan for the entire gas transport and distribution system, and to undertake a pilot demonstration for the rehabilitation of a selected section of the Yerevan distribution network.

In April of 1996, work began on this 1.4 million ECU project, following establishment of an office at the Energy Institute. This one-year program had originally been scheduled to start in January 1996 and it was to be completed by January 1997.

With regard to the high-pressure transmission line, a section had been selected for testing by inspection, by pressure tests, and with the use of an intelligent pig. Meanwhile, the distribution network in Yerevan was under review for the selection of a suitable city block where about 100 residential gas meters were to be installed for the purpose of testing the feasibility of a metering/collection pilot program. The results of both the trunk line and distribution system pilots were to be used to estimate the cost of rehabilitating the entire natural gas system and to develop a detailed rehabilitation plan.

The Snamprogetti Project, December 1996: The project has been plagued by technical problems, cost overruns and scheduling difficulties. By the end of November, approximately 80 percent into the project cycle, the project is 30 percent complete. Snamprogetti has asked for and been granted an extension of their work schedule, which has been rescheduled for completion by September 1997.

The trunk line has sharp bends that preclude running the intelligent pig. Snamprogetti has asked for permission to modify their testing method by switching to "another methodology", i.e., to essentially scrap the intelligent pig runs. Instead, Snamprogetti has proposed to cut into the lines at selected places for visual inspection and resistivity measurements of corrosion. TACIS has granted Snamprogetti's request, and the project is now proceeding under its revised terms of reference.

The distribution system has similarly resisted analysis for reasons that are for the moment unexplained. Suffice it to say here that Snamprogetti has also requested permission to revise the terms of reference of its distribution project. In addition, the company requested additional funding to finance what turned out to be a much more expensive project. As of November 22, TACIS had not responded to the requested change in procedures and for additional funding.

KANTOR

The Kantor Project In Early 1996: As originally proposed, the Kantor project deals with management systems that would become important input into any restructuring project, even though the terms of reference do not specifically address natural gas sector restructuring issues. The original study consisted of three interrelated tasks which were to be pursued in parallel. These tasks were:

1. A review and analysis of the gas billing and collection system,
2. A review and analysis of gas tariffs, and
3. Information dissemination and consumer education.

The gas billing and collection task entailed a review of the current natural gas industry situation in Armenia, including procedures, performance, staffing, organization and responsibilities, support tools, and process management. To be included were visits to selected European countries, including Central/Eastern European countries, to examine how they have dealt with billing and collection arrangements. This was to be followed by the identification of areas in Armenia where improvements are likely to be effective, by an analysis of alternative options for improving the gas sector billing and collection performance, by the selection of the most suitable option and, finally, by a seminar on billing and collection where the TACIS findings were to be presented. All of this was to result in a gas billing and collection plan that was to include a spreadsheet type management reporting system to monitor the billing and collection process. Information requirements were to be identified, but a LAN system was not included in the project.

The gas tariff task was to involve a review of the current situation and an analysis of international experiences, similar to the billing and collection task. This was to be followed by the development of a tariff setting computer model based on long run marginal costs. A small-scale household survey was to be run to determine gas consumption needs, coupled with a pilot installation of a small number of meters in households that currently receive gas to determine differences from the norms presently in use, the impact of trade-offs for electricity, and general consumption patterns.

This work was to yield proposed tariff structures which were to be analyzed for their financial viability and their impact on the consuming public. Necessary investments in information, accounting and support systems were to be identified, but the systems themselves were not part of this task. Again, the results of this work was to be presented in a formal seminar.

The information dissemination task was to entail a one-week study tour of three Ministry of Energy and Haigasard officials to visit gas utilities in a European country. This was to be followed by an information and consumer education campaign that was to be handled by Armenian counterparts.

The Kantor Project, December 1996: As of November 1996, the Kantor project is 70 percent complete. A presentation of their first project took place on in mid-1996. Labeled "A Review of Billing, Collection and Financial Arrangements in the Armenian Gas Sector", this work is essentially a spreadsheet model that projects natural gas consumption and prices, determines investment needs under stipulated scenarios, defines the operational and cost characteristics of the system and combines all of this information in a financial module that permits the assessment of various financial variables. A second presentation on November 28, 1996, dealt with natural gas metering, billing, and collection systems. Kantor recommends the establishment of a decentralized metering, billing and collection system using 15 "Consumer Service Departments" (5 in Yerevan and 10 elsewhere) that will service some 35,000 to 40,000 accounts each. There was no mention of the underlying corporate structure at the presentation (and the full report will not be out for another few weeks), but one got the impression that the natural gas will be delivered throughout Armenia by one large distribution company.

Other recommendations include the use of a two-month metering and billing cycle, the introduction of a conventional and manual billing system, the use of a two-tiered pricing structure (with different natural gas prices for cooking and space heating) and the installation of two gas meters per household to keep track of the two-tier billing mechanism. There is also a provision for a security deposit and a cut-off procedure for non-payment, but with many exceptions (disabled or aged persons, pensioners, hospitals, etc.). A modest LAN system (4-5 PC's, one Server, 2 Laser Printers) is recommended for administrative purposes, with software to be developed in Armenia. Based on 40,000 accounts per service center, the estimated cost of equipping one center is approximately \$3.3 million. This includes the meters themselves, fully installed, at \$80 per meter, plus peripheral expenses in the amount of \$93,000.

There was a considerable debate regarding the merit of a two-tier, two-meters-per-household system, with most of the objections coming from European consultants.

GAZ DE FRANCE

The Gaz De France Project In Early 1996: This project, originally budgeted at 1.0 million ECUs, has a total level of effort of some 40-plus person-months to be expended over a period of one year. According to its original terms of reference, the project's four objectives are as follows:

1. Identify a rational and modern organization structure for the gas sector and provide the Government with an appropriate restructuring plan;
2. Establish a suitable framework for the development of the private initiative in the gas sector;
3. Provide Haigasard with a modern system for the control and operation of the transport network;
4. Upgrading of the infrastructure already constructed.

Gaz de France was to be the lead contractor, with SODETEG and PARTEX as subcontractors. The on-location project responsibility was to be divided as follows:

- SODETEG for items (1) and (2),
- PARTEX for items (3) and (4).

The original terms of reference do not include the privatization of the "strategic activities of gas supply and transport", i.e., of the trunkline transmission and distribution activities of the natural gas sector. The tender document states that "the supply of gas is strategic and the gas sector has, therefore, to be rationalized in order to support the efforts of the Government for the economic development of the country. Armgazprom, as other similar concerns established under the SU, is a large and diversified group of enterprises under state control and requires to be restructured to focus on the strategic activities of gas supply and transport and **privatize the non-strategic ones**" (emphasis added).

In short, there is no language to suggest that the principal gas activities, importing, transmission, and distribution will ever be privatized under this plan. Coming from Gaz de France, their otherwise unsupported assertion regarding the need for Government ownership and supervision of "strategic activities" comes as no surprise. These activities, the importation, transmission, and distribution of natural gas, being presumably strategic functions, only need to be rationalized (i.e., restructured and made more efficient under State Ownership), or so it is claimed. The one concession to the private sector is that Gaz de France believes, and their terms of reference state, that some of Haigasard's current peripheral activities are to be spun off and privatized. As was pointed out in the cited earlier report, this is a major disconnect from World Bank and USAID objectives.

Four specific actions were identified in the terms of reference, to meet the stated objectives. They include:

1. **The development of a restructuring plan** for the Haigasard State Concern, including the identification of non-strategic activities to be privatized, and the development of a gas tariff strategy. A verbatim description of what is included in this action follows:

- Analysis of the Haigasard organization structure, evaluation of the activities and performance of the different units and enterprises covering manpower, infrastructure, available operating and production facilities, technology and operating procedures, assets, financial situation, and legal status.
 - Identification, in concert with the local authorities, of the activities to be considered strategic for the development of the sector and the non-strategic activities to be eventually privatized and/or eliminated.
 - Elaboration of a restructuring plan for Haigasard to improve and adapt the organization to manage and operate its strategic activities, including introduction of new financial and accounting arrangements, development of a Management Information and Control System, reorganization of employment, analysis of wages and salaries systems and suggestions for improvement.
 - Analysis of the gas supply, transport, and distribution costs, including underground storage, and elaboration of a strategy plan for gas tariffs. Elaboration of a Business Plan for the re-organized structure.
 - Elaboration of a privatization plan for non-strategic activities, including:
 - ◊ definition of the relevant development strategies, legal framework, and privatization procedures,
 - ◊ identification of potential local and/or foreign industrial/financial partners,
 - ◊ preparation of a time schedule of the privatization plan with indication of the actions to be undertaken by the Government, Haigasard and other concerned Authorities for the implementation.
2. **Upgrading of the five industrial enterprises** that are engaged in manufacturing equipment for gas distribution and uses, and assisting in negotiations with relevant foreign partners and potential joint venture partners for the improvement and modernization of the production processes, including the introduction of API standards. A detailed description of the tasks to be undertaken in connection with the five industrial enterprises includes an analysis of their organization, evaluation of their products, assessment of local and other CIS markets, identification of prospective joint-venture partners, and others.
 3. **Design of a safe remote-control system** for the gas transmission and storage facilities of Haigasard and development of a computer model for the main gas pipeline network. In short, the design of a SCADA System for the high-pressure line, not including any SCADA equipment. This is essentially a technical function aimed at improving operational efficiency and somewhat remote from ongoing or planned restructuring efforts.
 4. **Upgrading or disposal of the Abovian LNG plant** whose construction was stopped several years ago. This, too, is a technical function and of little importance as regards gas sector restructuring efforts.

As mentioned, there is a disconnect with USAID thinking in the Gaz de France project, due to the fact that restructuring and eventually privatizing the natural gas market is a conditionality in a US/Armenia Memorandum of Agreement that provided for the purchase of \$15 million worth of natural gas for Armenia. That amount was to be monetized and eventually used for energy sector development

activities. Privatization of Armenia's natural gas markets is also a World Bank conditionality on related energy sector commitments.

The Gaz De France Project, December 1996: According to Gaz de France, the project is running on time and budget. The presentation of results and delivery of a draft report are scheduled for May 21, 1997, with the final report due in July. As regards the Gaz de France restructuring task, their position is that they will propose a corporate structure that would be capable of functioning in either a private-sector or public-sector environment.

BURNS AND ROE

The Burns And Roe Project: This USAID-funded project deals with the rehabilitation or replacement of certain natural gas compressors. This task, while important for the resumption of efficient natural gas operations nevertheless has little to do with restructuring activities and will be ignored here.

HAGLER BAILLY CONSULTING, INC.

The Hagler Bailly Project: This project envisions the development of a gas sector commercialization and reorganization plan and the installation of several pilot projects to supply and test metered gas deliveries to the residential sector.

Commercialization and Reorganization of the Gas Sector appears to be in competition with the Gaz de France TACIS project. However, the Government of Armenia has committed itself to privatize the gas sector by the end of 1997, and it would like to hear alternative views on complete privatization.

The Pilot Projects are meant to provide insight into the difficulties and costs that might be expected in rehabilitating the residential gas distribution system in Armenia. Discussions are currently under way with representatives of Haigasard and the Ministry of Energy regarding the selection of six rural areas and one city block where natural gas deliveries will be resumed. Some of the problems to be expected were revealed in a field visit at one of the candidate locations, the village of Dzoraghjpur. A brief description of the situation in that village is given in Appendix A.

RECOMMENDED USAID ACTION

GENERAL

USAID has steadfastly pursued a course that envisions the eventual privatization of the Armenian natural gas sector. The TACIS terms of reference do not require such a course of action, and the winning TACIS contractor, Gaz de France, will almost guarantee that under their proposal all but the peripheral manufacturing enterprises will remain under state ownership.

We believe that USAID would be well advised to seek clarification on the fundamental issue of state versus private ownership of the natural gas sector. This clarification will probably require early discussions with high-ranking officials of the Armenian Government. The Prime Minister's office is the appropriate venue since it made a forceful statement in favor of decentralization by rejecting the Ministry of Energy's largely cosmetic restructuring plan.

Another reason for seeking the support of the Prime Minister's office is to advise his office early as to the intent and progress of the project, and to cultivate and retain the Prime Minister's interest, thereby streamlining current procedures that generally include the development of a proposal subject to many reviews, each of them chipping away at the original plan, so that the Prime Minister, by the time he receives the proposal, has no inkling as to what it originally looked like.

Even with such an early clarification by the Prime Minister's office regarding the fundamental ownership issue, a step-by-step procedure with checks as to the adequacy of Governmental performance is recommended. For example, after the USAID pilot project has been completed and a detailed set of recommendations regarding the commercialization of the gas sector has been agreed upon with the Government, further funding should be made conditional upon concrete evidence of Government adherence to the agreement. Thus, if the agreement calls for the spinning off and separate privatization of some of Haigasard's peripheral manufacturing concerns through regular Armenian Government channels, support activities for the remaining utility concerns to be targeted for commercialization, such as the introduction of an accounting and MIS system and supportive computer software and hardware, should only be begun after the Privatization and Denationalization Commission (or, after it has become operational, the Ministry of Privatization and Foreign Investments) has actually initiated steps toward disposing of the spin-off candidates.

On the assumption that the eventual privatization is the Government's ultimate objective, we would suggest the following restructuring actions, subject to review and confirmation by an in-depth analysis of all relevant factors.

- That any attempt to spin off and privatize peripheral commercial enterprises of the Armenian natural gas sector be preceded by an expeditious review of their financial viability.
- That a small-scale corporatization program be implemented for those companies that are found to be potentially viable.
- That such a program would entail the setting up of separate and independent management and profit centers of the companies destined for ultimate privatization, at least for the major enterprises such as the larger manufacturing concerns and construction companies.

SPECIFIC COMPANY RECOMMENDATIONS

Transgas State Enterprise

We recommend that the Transgas State Enterprise remain intact as one unit throughout Armenia, with or without (and preferably with) the current structure of three regional subdivisions, that the company be privatized, that the right to negotiate natural gas imports be conferred upon Transgas or any interested third party, for transmission by Transgas, and that Transgas fall under the jurisdiction of an independent regulatory authority as envisioned under the pending Energy Law. As the country's only gas transmission monopoly, Transgas should operate under an open-access regime, should operate the gas storage facility as an unbundled activity, and should have tariffs set by an independent Commission rather than the Ministry of Energy or any other Agency or Unit directly responsible to the Government. Those tariffs should be based on the principle of full cost recovery.

Since the survival of Transgas is absolutely essential to assure the economic viability of the State, the company should be given the full support of USAID in converting it to a market mode. This would involve the company's full-fledged corporatization, including a review of its organizational structure, its manpower uses and needs, the establishment of a computerized accounting and billing system, and generally the introduction of modern-day operating procedures. A legal document spelling out the obligations and commitments of both the aid donor and the aid recipient should be drawn up prior to proceeding with major hardware or software investments. That document should spell out in detail the company's commitments to train and man the new computer installations, to develop data for submission to the Ministry of Energy's data center and generally to invest in personnel training so that the newly acquired equipment will be fully utilized.

Armturtrade

It is recommended that Armturtrade be phased out. There is already general agreement that all natural gas import activities should be based on a commercial footing, i.e., that barter trade is to be eliminated, except on agreements between private parties (such as, for example an Armenian industrial concern and a foreign supplier) who would operate under the unrestricted pipeline access provisions that are currently envisioned under the Energy Law. Due to their inherent inefficiencies, such private-party barter deals outside the jurisdiction of the State are likely to die out once the natural gas sector is established on a solidly commercial basis.

Gas Storage Division

It is recommended that the Gas Storage Division be retained by Transgas State Enterprise, but as a separate cost center, so that the storage of natural gas can eventually be brought into the calculation of unbundled gas tariffs.

Gas Distribution State Enterprise

It is recommended that the Gas Distribution State Enterprise be dissolved. We suggest that the ten Gas Distribution Subsidiaries either become independent companies or that they be partially consolidated, for a total of 4 to 6 distribution companies, pending a more detailed analysis, to take full advantage of resulting economies of scale. In either event, these companies should be subject to regulatory controls by an independent authority.

The proposed Authorized Management Enterprise or any such artificial creation designed to place all distribution enterprises into one central management and financial structure will not be an efficient unit. Its creation should be rejected. One reason for the proposed creation of the Authorized Management Enterprise is the funneling of subsidies to those distribution companies now shut down for lack of gas, such as Goris City and others. Clearly, there is good reason to maintain the delivery system until such time, perhaps not too far in the future, when gas starts to flow again to those cities, but it would be far better to have them as separate cost centers with transparent and identifiable subsidies rather than to create a financial conglomerate with hard-to-identify costs. If nothing else, the separate cost structure will permit political authorities to deal with hard facts if and when the time comes to decide whether and under what conditions to continue the subsidy program.

We have visited the Yerevan Gas Distribution Company and found them to be quite sophisticated in the technical arena, where they have pushed an ancient 286-model computer to the limits by computerizing all of their line drawings, down to a scale of 500:1. Since the system lacks memory,

these drawings are kept on numerous 5.25-inch diskettes. In the accounting and billing arena, however, the company is far behind. All metering, billing, and collection is currently done by hand. As far as we could tell, there is no computer in use in the accounting or management division.

We recommend that the ten gas distribution companies be given the same full-fledged support as Transgas. The Hagler Bailly natural gas distribution pilot projects, currently in the design stage, will provide intimate familiarity as to the capabilities of the distribution companies to rapidly absorb sophisticated management techniques. For the moment, it would appear that the Yerevan Distribution Company, by far the largest and most sophisticated, would be capable of absorbing anything in short order. A more gradual and less sophisticated transition to management information and accounting systems may be preferable in the smaller distribution companies.

Transgas Construction Enterprise

It is recommended that the construction firm Transgas Construction State Enterprise be spun off and turned over to the Privatization and Denationalization Commission. Depending on available funding, guidance should be given regarding corporatization prior to spin-off, since this company might have a genuine chance of survival.

Armgas Construction Enterprise

It is recommended that the low-pressure pipeline construction firm Armgas Construction be absorbed in pieces into the various active Distribution Companies where they will become maintenance divisions.

Vehicle Maintenance State Enterprise

It is recommended that the Vehicle Maintenance State Enterprise and the Anticorrosion State Enterprise be similarly absorbed as maintenance divisions in currently active Distribution Companies.

Automotive Gas State Enterprise

We recommend that the Automotive Gas State Enterprise be privatized after a short period of corporatization.

Butane Liquid Gas Enterprise

It is recommended that the Butane Liquid Gas Enterprise become a privately owned company, subject to continued competition with independent private sector imports of natural gas liquids.

Manufacturing Subsidiaries

It is recommended that the five manufacturing plants (Construction Material State Enterprise, Vanadzor Gas Equipment Manufacturing State Enterprise, the Gas Meter Joint-Venture Enterprise, Armavir Gas Equipment State Enterprise, and the Kazmgas Lease Enterprise) be spun off and privatized. If funding is available and, after an expeditious review, their market situation warrants it, these companies should be supported by providing them with some re-orientation towards modern-day management concepts, without however the full investment of computer equipment that is recommended for the transmission and distribution companies.

Training Center

We recommend that the Training Center be re-established as an industry-wide training and research center, similar to the U.S. Gas Research Institute which is supported by minimal levies on the gas tariff.

Procurement Company

It is recommended that the procurement of company supplies be made internal to the transmission company and the individual distribution companies.

Other Peripheral Companies

Finally, we recommend that the "hold-over" establishments (the Bazum Agricultural Subsidiary, the Commodity Procurement Company for Employees, the KARIN Resort Facility, and possibly the ANI Kindergarten) be spun off or terminated immediately.

Final Observation

These actions require the careful establishment of transition plans and they also require technical support in managerial areas such as budgeting, accounting, billing, the establishment of revolving short-term and long-term management plans, and so on. These efforts are impossible to perform in any meaningful way without the use of advanced planning tools, especially computers and management information systems. The acquisition of and training in the effective use of management information systems and techniques will go a long way in assisting the companies in achieving the difficult transfer to market environments and in surviving under a regime of uncertainty and change.

Since the natural gas sector in Armenia has never before operated in a commercial environment, its markets are basically not well understood. Its infrastructure has been frozen in its central control pattern, except that the market has shrunk beyond what in the West would have been survival rates. Current capacity utilization rates are as follows:

High-pressure system (trunklines)	25%,
Medium-pressure system (part transportation and part distribution)	25%
Low-pressure system (distribution)	2.5%

By themselves, these shrinkages would have been devastating, but the cash-flow problem in the natural gas sector is exacerbated through direct barter deals that tend to dilute cash flows and since the principal consumers, power generators and large industrial concerns, are themselves suffering from low bill collection and non-payment.

Current revenues are inadequate to maintain existing facilities, with absolutely no funds available for investments in new installations that are indispensable for the transition to commercial operations and for economic survival. With internal cash generation foreclosed as a short-term source of funds for rehabilitating the natural gas sector (barring an unexpectedly rapid tariff conversion to full-cost recovery), its future depends on external funding, i.e., on Government or external investor funding. However, the Government is an unlikely source of funds, given its own cash-flow predicament.

This leaves the external, and realistically, the foreign investor, as the only potential source of funds. To attract that investor, corporatization and privatization must proceed apace, along the lines indicated in

the foregoing, including immediate and thorough unbundling of operations to present a well-defined set of investment targets to interested parties. This would include the corporatization, commercialization and privatization of all key natural gas operations, including natural gas storage, transmission, and distribution, the preparation of business plans for the targeted companies, and the search for and negotiations with interested private investors.

APPENDIX A

HAGLER BAILLY CONSULTING, INC., PILOT PROJECT

INSPECTION OF RESIDENTIAL GAS DISTRIBUTION NETWORK VILLAGE OF DZORAGHPJUR

The Haigasard gas transport system is designed to operate at three pressure levels: 50 ATM (735 psig) on the high-pressure trunk lines, 3 to 12 ATM (44 to 176 psig) on the intermediate pressure feeder system, and 0.05 ATM (0.74 psig) at the distribution level. Because of the deteriorated condition of the high-pressure lines, that system operates at 30 to 80 percent of design pressure, depending on location.

The inspection team visited three areas of interest: the high to medium pressure reduction station, the medium to low pressure reduction station, and the low pressure distribution system including points of gas delivery to residential installations. This was a cursory inspection conducted for the purpose of gaining some understanding of the difficulties that a gas metering pilot project might present.

High to Medium Pressure Reduction Station. This station had three pressure reduction assemblies one of which was in operation. The other two had their pressure reduction valves taken apart, with some valve parts lying around in the shed that housed the system, but no tools in sight, suggesting that work was not really in progress on the two idle runs. One got the impression that the two idle runs were being robbed for parts to keep the operating run in working order.

There was a mechanical filter upstream of the pressure reduction assemblies. The operator explained that the filter is routinely being cleaned every two weeks, with little dirt being removed. A safety valve on the medium pressure line was designed to release gas through a nearby riser to the atmosphere. A signaling arrangement sounds the alarm at the operator's office when the safety valve was tripped. That office was not within sight of the pressure reduction station. There was no pilot flame at the top of the riser so that the released gas would freely enter the atmosphere unless and until remedial measures were taken by the operator who had to travel some distance to arrive on the scene. The operator, who was on hand during the tour, explained that the safety valve was engaged about two times during the last fifteen or so years.

There was a heavy smell of gas and mercaptane at the station suggesting gas leakages on the premises. The station itself was located at a secure distance from traffic and other likely trouble sources. The nearest residence was a good quarter mile away, and up-hill from the station.

Medium to Low Pressure Reduction Station. The unit we inspected was not in operation and, judging from the degree of deterioration, had been out of commission for some time. The unit was installed inside a metal cabinet that was located at surface level by the roadside. It was essentially unprotected from errant motor vehicles, a disaster waiting to occur when in operation.

The pressure reduction equipment consisted of a diaphragm-operated valve mounted between two flanges (that had some of the mounting screws missing). There was a bypass connection that enabled the operator to manually bypass the regulator in the event of a system failure. When we asked how

such a bypass feed would be orchestrated, we were told that a two-step procedure was involved: first, the pressure on the medium pressure feeder line would be suitably reduced and second, to the extent that the feed pressure was still too high for unrestricted admission of natural gas into the low pressure system, the bypass valve would be cracked a bit to permit slow leaking of gas into the low pressure delivery system. We assume, but do not know for sure, that this procedure would require the presence of an operator at the site who would manipulate the by-pass valve as needed, based on visual pressure readings on the downstream pressure gauge. Such a procedure is extremely dangerous, so much so that it seems a bit incredible that it would be part of an accepted operating procedure. If it is, though, this is one of many areas where the need for the development and enforcement of safety standards is inescapable. Neglect of even the simplest safety measures is even more obvious at the distribution level.

The Low Pressure Delivery System. The residential gas delivery system we inspected had not been in operation for several years. Accordingly, it had been subject to severe deterioration. Perhaps the worst deterioration had taken place at the connections to and within the gas-burning units of the residential users. Again, blatant violations of even the most primitive safety rules were evident. For example, most of the approximately 3/4-inch feeder lines to the residences were exposed. They typically tapped into a buried main that ran along the side of the street, were elevated to some 8 feet with no more protection than being inside a 2-inch or so riser, and were then connected, sometimes in a free-swinging arc, to the nearest wall or house. From there, hugging the outside of the wall or house at some elevation of, maybe 8 feet, the gas lines were led to the location of the residential gas-burning facility, typically a boiler that was used for heating purposes.

By Western standards, there were serious safety violations on the gas-company operated delivery system, as well as on the home-owners' gas-burning facilities. Among the former were rubber-sleeve type connections which probably were not part of the original installation, but they were in place now. Where the 3/4-inch lines rounded corners as they ran along the outside of residences, they had simply been bent, instead of using L's, and that without bending tools, so that the pipe was severely pinched at the turns. There was a wooden plug at the end of one line. And, of course, the lines were exposed everywhere.

We did not take a very close look at the residential gas-burning facilities, except to note that some had deteriorated to the point where, in the West, they would be candidates for junking. The boilers were at times installed at places where access to them, and work on them, was nearly impossible. It appeared that the units were not equipped with proper venting facilities. We did not feel comfortable with penetrating into the interior of residences to inspect the piping arrangement to and facilities in the kitchens, the other place inside a residence where gas-burning facilities are likely to be found.

Overall Impressions. We believe that any attempt at rehabilitation without a pilot project would be foolhardy. The essential question that would be faced by the rehabilitation crew would be whether to use a band-aid approach, fix what has to be fixed but not change operational and safety standards in the process, or whether the installation should involve a change of standards that would approach (but would never be on par with) Western standards. We believe that, at the pilot stage, both approaches should be used. That one or two of the rehabilitation candidates should involve minimal changes in standards, except to the extent that immediate danger points should be fixed, while another one or two pilot installations should follow a new set of higher-level standards such as, for example, re-laying gas

lines at less exposed locations and replacing pinched 90-degree curves with L's, etc. The use of both types of procedures, the band-aid variety and a higher-standard approach, would give some clue as to the ultimate cost involved in bringing the entire system back on a strictly transitory vs. a more long-term basis.