

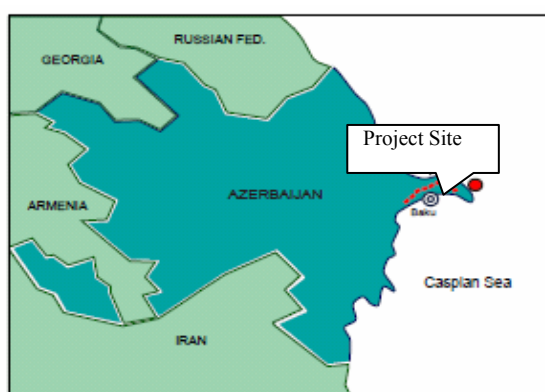
Azerbaijan

Severnaya¹ Gas Combined Cycle Power Plant Project (I) (II)

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Field Survey: October 2006, January 2007

1. Project Profile and Japan's ODA Loan



Map of project area



Severnaya Gas Combined Cycle Power Plant

1.1 Background

After gained independence from the Soviet Union (1991), Azerbaijan experienced negative economic growth due in part to a conflict with the neighboring country of Armenia, and the size of its economy shrunk significantly compared to its pre-independence period. Following the cease-fire agreement with Armenia in May 1994, the Azerbaijani government aimed to stabilize the macro-economy, and it began full-scale economic reforms in January 1995. In April of the same year, assistance from international agencies started to flow in, and foreign direct investment such as ones in oil field development acquired momentum against the backdrop of political and economic stability. This led to positive GDP growth in 1996 (1.3%) for the first time since independence. In the following year of 1997, as foreign direct investment continued to grow steadily, the GDP grew at 5.8%, and the growth was expected to continue. At the time of the project appraisal (1997-1998), the country's electric power demand would increase by more than 3% per annum accompanying the economic growth while there was concern over a decline in power generation capacity due to the aging of the existing facilities.

1.2 Objective

¹ The plant is currently called Shimal Power Plant in Azeri, the language of Azerbaijan, and "Severnaya" means "north" in Russian.

The project's objective is to boost the electric power supply capacity and efficiency by converting the existing oil-burning thermal power plant (150MW) in the Severnaya area on the outskirts of the capital city of Baku into a gas combined cycle power plant (400 MW) and by constructing a gas pipeline, thereby contributing to the stable economic growth of Azerbaijan.

1.3 Borrower/Executing Agency

Government of the Republic of Azerbaijan/Azerenergy and Azerigas

1.4 Outline of Loan Agreement

	Phase I	Phase II
Loan Amount/ Loan Disbursed Amount	20,699 million yen 20,673million yen	18,332million yen 18,331 million yen
Exchange of Notes/Loan Agreement	February 1998 February 1998	October 1999 October 1999
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	0.75% 40 years (10 years) General untied	0.75% 40 years (10 years) General untied
Final Disbursement Date	May 2004	December 2005
Main Contractors	Mitsui & Co., Ltd.	Mitsui & Co., Ltd. Toyo Engineering Corporation
Consultant Services	Burns and Roe Enterprise	Burns and Roe Enterprise
Feasibility Study (F/S), etc.	1998 Azerenergy	1998 Azerigas

2. Evaluation Result

2.1 Relevance

2.1.1 Relevance at the time of appraisal

At the time of the appraisal of this project, Azerbaijan's Public Investment Plan (1997-1999) centered on rehabilitation and improvement of age-worn facilities, and the priority sectors were electric power, transportation, oil and gas, and irrigation. In particular, the electric power sector

accounted for 25% of the total investment allocation, the largest amount of any sector. At that time, electric power demand was forecast to grow by more than 3% per year, and maximum electricity demand was expected to reach 4,000 MW in 2000 and 5,900 MW in 2010. The total power generation capacity at the time was 4,200 MW, but due to the age of the facilities, further decline in capacity was anticipated. For that reason, this project to build a power plant outside the capital city of Baku, where electricity demand would increase, was wholly consistent with the policy at the time. Moreover, because this was a project to respond to the need for increased power generation capacity in the electric power sector, the relevance was considered high.

2.1.2 Relevance at the time of evaluation

Looking at the electric power sector's share of public investment at the time of evaluation, the sector accounted for approximately 31% of the total investment amount in 2006. In 2007 and thereafter as well, although the amount fluctuates depending on the year, 3% to 10% of total investment is planned to be allocated for the sector. Electricity demand continues to remain high; in 2005, whereas the power generation capacity was 3,750 MW, the maximum electric power demand was 4,020 MW.² In 2010, the maximum electric power demand is forecast to reach 4,750 MW. The Azerbaijani government prepared the National Fuel and Energy Development Plan (2005-2015), in which it plans to continue expansion of the country's power generation capacity to meet the growing electric power demand.³ The project is considered highly consistent with the above-mentioned sector development plan and is considered highly relevant for meeting the growing demand for electricity.

Table 1: Share of the Electric Power Sector
in Public Investment¹⁾

(unit: million AZN)

	2005	2006	2007	2008	2009	2010
Public investment	164.0	882.3	1,818.0	1789.0	1,965.0	1915.0
Electric power sector investment	6.7	272.5	60.6	64.3	212.0	208.0
Share (%)	4.1	30.9	3.3	3.6	10.8	10.9

source: Azerbaijan's Ministry of Economic Development

Note 1): Figures for 2007 and thereafter are planned figures

² Electric power shortages are met primarily through imports from Russia.

³ To contribute to the easing of electric power shortages, the Japan Bank for International Cooperation (JBIC) is implementing a project for the construction of Unit 2 (400 MW) at the same power plant (loan agreement May 2005).

Table 2: Trends and Forecast of Maximum Electric Power Demand and Supply¹⁾

(unit: MW)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Maximum electric power demand	3,614	3,600	3,788	4,140	4,156	4,020	4,050	4,450	4,530	4,630	4,750
Electric power supply capacity	3,390	3,395	3,551	3,680	3,800	3,750	3,880	4,200	4,450	4,700	5,000

source: Azerenergy

Note 1): Figures for 2006 are forecasts; figures for 2007 and thereafter are planned levels.

2.2 Efficiency

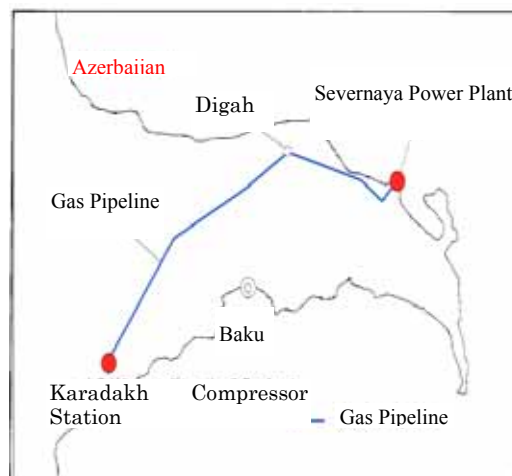
2.2.1 Outputs

At the time of appraisal for the Phase I of this project, it was planned to construct a gas combined cycle power plant with one generator unit (400 MW) and a gas pipeline (45 km in length between Severnaya and Digah) to supply natural gas to the power plant (Figure 1). Initially, the Azerbaijani government was to implement construction of the gas pipeline between Digah and Karadakh (including the compressor station), but due to the increase in the estimation of construction cost⁴ and shortage of matching fund in local currency, this pipeline and

compressor station was included in the scope of the project at the time of appraisal for Phase II.

The construction was implemented basically according to plan. The route of the gas pipelines was altered in order to shorten the construction period, and so the actual length constructed was 86.88 km (cf. planned length, 95 km). Moreover, the design of the access road to the compressor station was altered to ensure safety.

Figure 1: Map of Project Site



2.2.2 Project Period

The project period was planned for February 1998 to August 2002, a total of 55 months. However, in actuality 70 months were required from the loan agreement (in February 1998) to the project completion (in November 2003), a period approximately 1.3 times that of the

⁴ The reasons for the increase in the construction cost estimate are (1) a compressor station with a larger capacity than anticipated at the time of appraisal became necessary to provide the necessary gas pressure, and moreover, at the time of appraisal it was assumed that one generator unit would be constructed, but a second unit became necessary as a back-up, (2) the premises for the cost estimates were switched from Russian standards to Western standards, and (3) the pipeline route which had not been confirmed at the time of appraisal was confirmed, and because a portion passed across a lake, the construction cost estimate increased.

planned period. The delay was due to the time for the bidding process of gas pipeline construction.

The power plant was handed over at the end of November 2002 and began operation. Until the completion of the gas pipeline under this project (in November 2003), a small gas compressor was installed near the power plant and connected to an existing gas pipeline to supply natural gas so that the operation of the power plant was unaffected.

2.2.3 Project Cost

The project cost planned at the time of appraisal for Phase I (29,421 million yen) increased to 39,817 million yen in Phase II due to the additional construction of gas pipeline (including the compressor station) which was initially scheduled to be carried out by the Azerbaijani government, as stated above. The actual project cost was 39,004 million yen (97.9% of the planned cost in Phase II), which was basically in line with plan.

2.3 Effectiveness

2.3.1 Project's contribution to electric power supply in Azerbaijan

The gas combined cycle power plant constructed by this project began operation at the end of November 2002, and its energy production since 2003 is shown in Table 3. Because this power plant produces approximately 10% of the electric power consumed nationally, it is considered to play a vital role as a base-load power plant in Azerbaijan's electric power supply.

Table 3: Power Plant's Energy Production
as a Share of Nationwide Electric Power Consumption

	2003	2004	2005
Severnaya Gas Combined Cycle Power Plant's Energy Production ⁵ (GWh)	1,840	2,145	2,526
Nationwide energy consumption (GWh)	22,602	22,725	23,430
Power plant's energy production as a share of nationwide electric power consumption (%)	8.1	9.4	10.8

source: Azerenergy (Percentage figures were calculated from the above data by the evaluators.)

2.3.2 Operating condition of the Severnaya Gas Combined Cycle Power Plant

From the operating condition of the power plant in terms of operation and effect indicators, the indicators improved across the board after the beginning of operation in 2003. As of 2005, the maximum output, net electric energy production, availability factor,⁶ and plant load factor⁷

⁵ Net electric energy production

⁶ Availability factor = (annual operation hours/hours in year) × 100

⁷ Plant load factor = annual energy production/(rated output × hours in year) × 100

achieved more than 80% of the level planned in the F/S. Moreover, the auxiliary power ratio and the gross thermal efficiency have performed at favorable levels since 2003 (Tables 4 and 5). Furthermore, the outage hours and the number of times of outages for type of cause become shorter and have declined in frequency since the start of operation (Figure 2), and so the operating condition of this power plant is stable.

Table 4: Operating Condition I of Severnaya Gas Combined Cycle Power Plant

	Ex-ante Plan ¹⁾	2003	2004	2005
Maximum output (unit: MW)	400	344	420	402
Net electric energy production (unit: GWh/year)	2,936	1,840	2,145	2,526
Availability factor (unit: %)	90	79.2	82.9	90
Plant load factor (unit: %)	85	52.5	61.1	72.1

source: Azerenergy

Note 1): The planned levels in the F/S for the net electric energy production, plant load factor, and availability factor were calculated based on figures used in the F/S conducted in 1997.

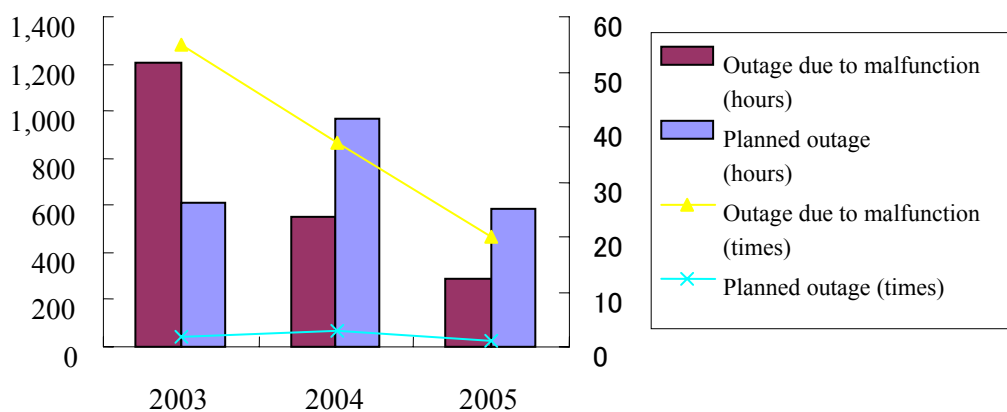
Table 5: Operating Condition II of Severnaya Gas Combined Cycle Power Plant

(unit: %)

	2003	2004	2005
Auxiliary power ratio	3.33	3.22	3.22
Gross thermal efficiency	54.15	54.84	54.73

source: Azerenergy

Figure 2: the outage hours and the number of times of outages for type of cause at the Severnaya Gas Combined Cycle Power Plant



source: Azerenergy

2.3.3 Operating condition of the Karadakh Compressor Station

Gas is also being supplied in a stable manner. The volume of gas sent from Karadakh Compressor Station varies depending on the demand situation, at 5 million m³/day in the winter and 4 to 4.5 million m³/day in the summer, as so it can be considered to be operating according to the plan (of 5 million m³/day).



Karadakh Gas Compressor Station

The gas is also being transported at a pressure above the planned level of 26 bar⁸. Moreover, there has not been a single stoppage of gas transport from the start of operation up to the present.

Table 6: Operating Condition of the Karadakh Gas Compressor Station

	2003	2004	2005
Volume of gas transported (unit: million m ³ /year)	1,068	1,599	1,591
Gas pressure (unit: bar)	30-36 bar	30-36 bar	30-36 bar

source: Azerigas

2.3.4 Recalculation of financial internal rate of return (FIRR)

The Financial Internal Rate of Return (FIRR, the power plant only) was recalculated as 18%, taking as a benefit the income from electricity sales, taking as costs the initial investment in the construction of the power plant and the operation and maintenance cost, and assuming a project life of 30 years. This exceeds the rate of 5.8% calculated at the time of appraisal. The higher FIRR was due primarily to the increase in electricity rates and the decrease in business costs (forecast).

2.3.5 Recalculation of Economic Internal Rate of Return (EIRR)

The Economic Internal Rate of Return (EIRR, the power plant only) was recalculated as 10%, taking as benefits the reduction of fuel consumption, reduction of transmission and distribution loss, and reduction of NO_x and CO₂ emissions, taking as a cost the initial investment in the construction of the power plant, and assuming a project life of 30 years. This is less than the rate of 15.3% calculated at the time of appraisal. This is primarily due to that one of the benefits,

⁸ Bar: a unit of pressure.

reduction of fuel consumption, was lower than forecast at the time of appraisal because the net heat consumption of the Severnaya Gas Combined Cycle Power Plant exceeded the assumptions at the time of appraisal, and moreover, the net heat consumption of existing power plants, which it was hypothesized would have generated the power if the new plant had not been built, was lower than assumed.

2.4 Impact

2.4.1 Contribution to economic growth

Azerbaijan's gross domestic product (GDP) is growing rapidly, achieving growth above 10% since 2000 and reached 26.4% in 2005, spurred by an increase oil production and a surge of international oil prices.

Table 7: Azerbaijan's GDP Growth Rate

(unit: %)

1998	1999	2000	2001	2002	2003	2004	2005
10.0	7.4	11.1	9.9	10.6	11.2	10.2	26.4

source: Statistical Yearbook of Azerbaijan 2006

From trends in electricity consumption nationwide in Azerbaijan by user, electricity consumption by the industrial sector increased approximately 1.8 times from 2000 to 2005 (Table 8). In order to understand the effects of the project on the business operation of companies, which are the final consumers, interviews were conducted at several companies located on the Apsheron Peninsula, including in Baku. In the interviews, compared to prior to the project, nearly all the companies responded that the number of outages decreased, and all the companies responded that the stability of the voltage had improved. It is difficult to identify the companies that directly benefit because the electric power generated at the Severnaya Gas Combined Cycle Power Plant is transmitted to the grid; however as stated above, because the power plant generates approximately 10% of the electric power consumed nationwide, it can be considered to have contributed sufficiently to the improvement of Azerbaijan's electric power supply and can be considered to be supporting the country's economic growth. Furthermore, the estimated beneficiaries of this project number approximately 910,000⁹ (about one-tenth of the 8.40 million population of Azerbaijan).

⁹ Estimated based on 2005 data as follows: (Annual power production of the plant/Azerbaijan's per capita electric power consumption)

Table 8: Change in Electric Power Consumption Nationwide by User

(unit: GWh)

	2000	2005	Index with the Year 2000 as 100
Households	9,902 (60.3%)	12,253 (61.1%)	123.7
Industry	2,671 (16.3%)	4,697 (23.4%)	175.8
Construction	36 (0.2%)	210 (1.0%)	583.3
Agriculture	803 (4.9%)	499 (2.5%)	62.1
Transport	537 (3.3%)	587 (2.9%)	109.3
Other	2,474 (15.1%)	1,797 (9.0%)	72.6
Total	16,423 (100%)	20,043 (100%)	122.0

source: Statistical Yearbook of Azerbaijan 2006

2.4.2 Other

2.4.2.1 Environmental impact

According to an interview with the executing agency Azerenergy, the air quality is tested periodically by Azerbaijan's Ministry of Environment and Natural Resources, and heretofore the air pollution has been within government standards. Water pollution caused by discharge from the power plant is supervised by the local government's staff in charge of environmental management, and heretofore it has been within government standards.

2.4.2.2 Impact on local residents

Because the gas combined cycle power plant was constructed on the site of an existing power plant, neither land acquisition nor resettlement of residents was required. The gas pipeline was laid on public land, and so no land acquisition was required for its construction. Moreover, the pipeline route was adjusted to avoid buildings such as residences, and so no resident relocation was required.

2.5 Sustainability

2.5.1 Executing agency

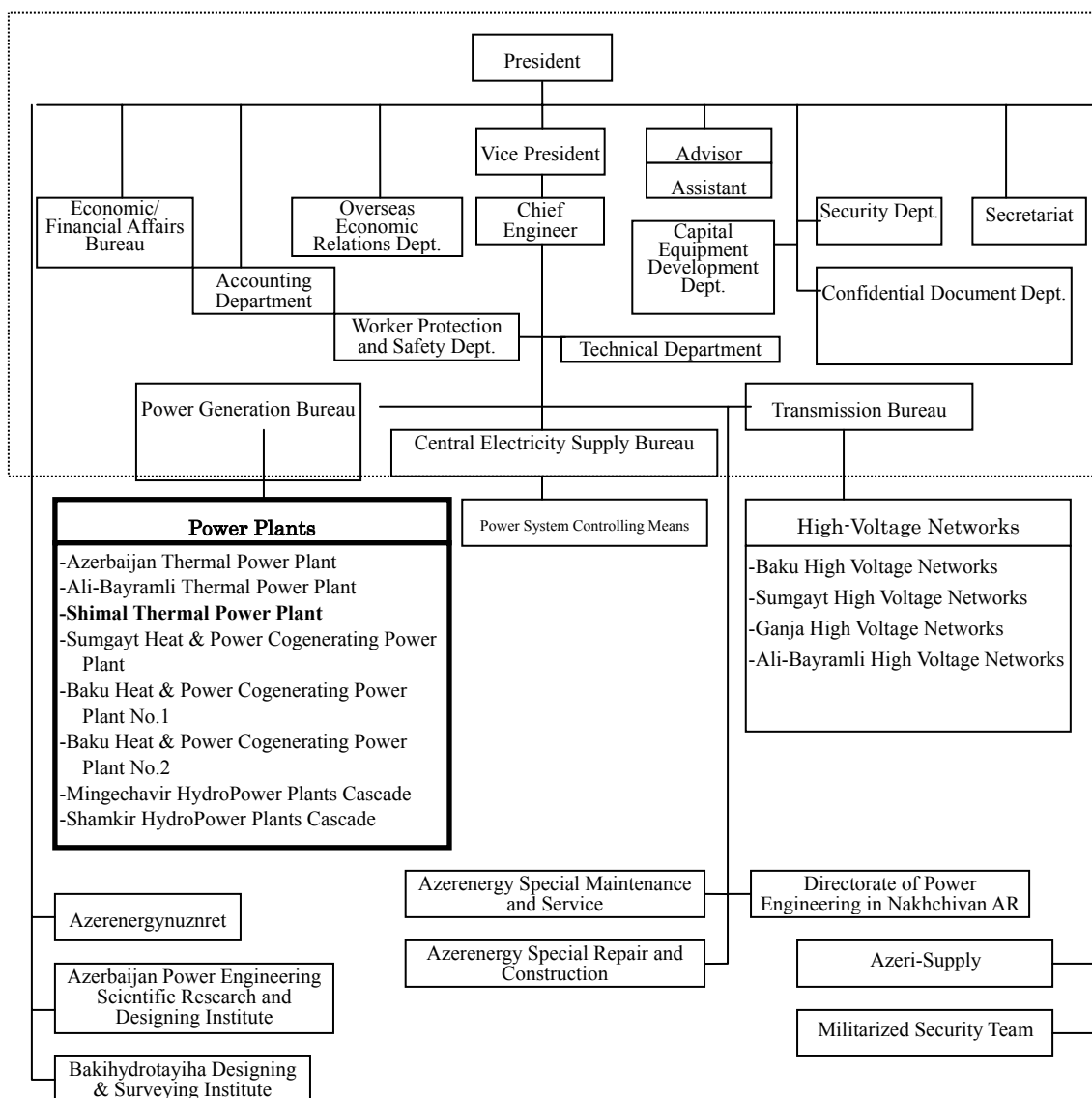
2.5.1.1 Technical capacity

There appears to be no problem in the technical capacity required for operation and maintenance of the power plant, pipeline, and compressor station, although there are occasional cases when requests for technical assistance are made to foreign manufacturers. Because training was conducted as part of the project and experience has been accumulated during the two years of the plant's operation up to now, currently the in-house staff is basically capable handling technical issues.

2.5.1.2 Operation and maintenance system

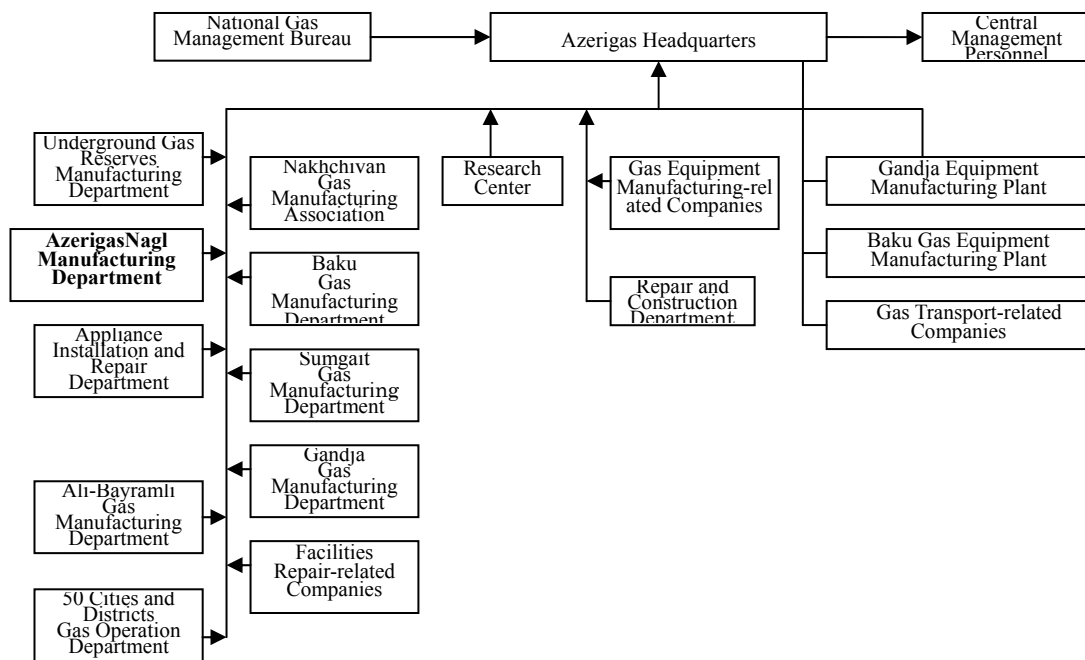
Azerenergy is an electric power company that conducts domestic power generation, transmission, and distribution (not nationwide) operations with the government as its sole shareholder. At the time of the appraisal, it was planned to gradually sell off company stock shares to the private sector; however, at the time of evaluation, it appears that there is no privatization plan and the former organization remains unchanged. The Severnaya Power Plant became a limited responsibility organization in 2002, but in fact it is part of Azerenergy. The Technical Manufacturing Department (staffed by 64 including 48 engineers) within the power plant is in charge of operation and maintenance of the power plant, and the Power Generation Department of Azerenergy (staffed by 44 including 32 engineers) conducts supervision.

Figure 3: Organization of Azerenergy



Azerigas is a state-owned enterprise which supplies gas domestically for commercial and private consumer use and also constructs, operates, and maintains gas pipelines. AzerigasNagl, the arm in charge of the company's gas pipelines, is responsible for operation and maintenance. With regard to gas pipelines, operation and maintenance is carried out by AzerigasNagl's Control Group (staffed by 20, nearly all engineers) in the Apsheron Main Gas Pipeline Consumer Service Department. The Karadakh Compressor Station (staffed by 47 including 9 engineers) is in charge of the operation and maintenance of that compressor station.

Figure 4: Organization of Azerigas



2.5.1.3 Financial status

With regard to the financial status of Azerenergy, although (1) electricity fees were capped by the government resulting in a structure where beneficiaries did not bear their share of the cost and (2) a deficit persisted because of the low rate of fee collection, government subsidies such as fuel payments were provided continually until 2006, and so the company performed without problem (Table 9). However, on January 6, 2007, the price committee announced a hike of electricity tariff, and two days later the new tariff schedule (Table 10) was applied. Electricity tariff are three times of its previous level. The government subsidies to Azerenergy are being

halted. The transition to structure where beneficiaries bear the cost of the electricity began. At the same time, Azerenergy is taking steps to raise the fee collection rate by promoting the installation of tariff meters, etc. However, at this point in time immediately following the rate hike, it is difficult to predict the course of tariff collection, and so it is difficult to forecast the effects of the rate hike on the future financial status of Azerenergy.

Table 9: Financial Status of Azerenergy

(unit: million AZM)

	2002	2003	2004
Sales	1,238,508	1,156,785	1,272,669
Operating loss	-800,253	-1,091,390	-1,114,173
Current net loss	-719,002	-597,265	-777,771
Government subsidies	1,049,400	1,253,796	2,008,080
Capital adequacy ratio (%)	30.9	31.0	39.9
Liquidity ratio (%)	50.8	47.3	33.0
Quick ratio (%)	44.0	40.1	25.5

source: Azerenergy (Ratios were calculated by evaluator)

Table 10: Electricity Fee Collection Rate

(unit: %)

	2003	2004	2005	2006 Forecast
Ordinary households	17.9	23.4	22.5	50.0
Industry	106.9	100.5	104.2	100.0
Non-manufacturing	157.2	131.0	86.7	94.0
Commercial	96.1	92.1	96.0	100.0

source: Azerenergy

Table 11: Electricity Fee System (2001 – 2006)

(unit: AZM/kWh)

Category	Fee
Wholesale	71
Ordinary household	96
Industrial, agricultural, non-manufacturing, railway	130
Commercial	250

Source: Azerenergy

Table 12: New Electricity Fee System (effective January 2007)

Category	Fee (unit: AZN/kWh)	Old currency unit (AZM) equivalent ¹⁾
Wholesale	0.041	205
Retail	0.06	300
Electricity transmission	0.002	10

source: Decision of Price Committee concerning electricity fees (January 2007).

Note 1: Converted at 1 AZN (the new manat) = 5,000 AZM (the old manat). (In January 2006, Azerbaijan redenominated its currency and introduced the AZN as its new currency.)

The financial status of Azerigas is shown on Table 13 below. Inasmuch as the financial statements reveal, there are no significant problems in the company's financial status. Gas tariff, like electricity tariff, was revised in January 2007¹⁰, basically doubling tariff for all except ordinary households (Table 14). The document stating the rate revision simultaneously specifies that Azerigas should complete the installation of gas meters in a short period. It appears that Azerigas, like Azerenergy, is moving toward becoming a self-sustaining company by raising tariff and improving the collection rate. However, it is difficult to predict what the effects of the gas rate hike will be on the future financial status of Azerigas.

Table 13: Financial Status of Azerigas

(unit: thousand AZN)

	2004	2005	2006 (January to September)
Sales	134,172	269,071	221,286
Operating profit/loss	-25,851	26,451	7,620
Current net profit	13,093	84,669	11,039
Capital adequacy ratio (%)	13.4	12.1	12.5
Liquidity ratio (%)	96.2	97.2	98.5
Quick ratio (%)	85.1	83.5	84.4

source: Azerigas (Ratios were calculated by evaluator)

Table 14: Gas Fee System (2001 – 2006)

(unit: AZM/1,000m³)

Category	Fee	
	2001 – October 2004	November 2004 - 2006
Ordinary households	35,560	236,000
Public services, etc.	106,301	
Azerenergy	194,700	
Industrial and commercial	236,000	
SOCAR	83,200	

source: Azerigas

Table 15: New Gas Fee System (effective January 2007)

Category	Fee (unit: AZN/1,000m ³)	Old currency unit (AZM) equivalent ¹⁾
Ordinary households	47.2	236,000

¹⁰A gas rate hike for ordinary households was implemented in November 2004, but the 2007 rate hike is expected to have more effect on ordinary households as the installation of gas meters, which is currently underway, progresses.

Other	100	500,000
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source: Azerigas

Note 1): Converted at 1 AZN (the new manat) = 5,000 AZM (the old manat).

Table 16: Gas Fee Collection Rate

(unit: %)

	2003	2004	2005	2006 Forecast
Ordinary households	52.4	57.4	22.9	86.9
Public services, etc.	26.8	39.2	81.5	100.0
Azerenergy	—	113.0	88.9	100.0
Industrial and commercial	63.9	99.6	105.0	100.0
SOCAR	59.5	58.1	198.7	100.0
Total	53.4	73.7	49.1	88.9

source: Azerigas

2.5.2 Operation and Maintenance Status

There appears to be no particular problem since the facilities built by the project undergo regular inspections.

3. Feedback

3.1 Lessons Learned

N.A.

3.2 Recommendations

- The hike in electricity fees and gas fees is in accordance with the “user pays” principle and is a desirable step in the long term. However, because it is difficult to predict the future tariff collection rate given the substantial rate hikes, the outlook for the financial status of the executing agencies (Azerenergy and Azerigas) is rather indecipherable. For this reason, the continuation of efforts by the executing agencies to improve the fee collection rate, such as completion of the installation of meters as planned, is important for their achievement of financial independence in the future.

Comparison of Original and Actual Scope

Item	Plan	Actual
1) Output		
1. Construction of gas combined cycle power plant	400 MW×1 unit	As planned (Gas 264.4 MW, steam 137 MW); The outer wall of transformer facilities was rebuilt instead of being repaired. Spare parts for gas turbine inspection were additionally purchased.
2. Construction of pipeline	<p><u>At Appraisal for Phase I</u> -45 km (Digah – Severnaya) of the total length 90 km (Karadakh – Severnaya)</p> <p><u>At Appraisal for Phase II</u> - Karadakh Gas Refinery Plant to Severnaya Power Plant, approximately 95 km</p> <p>-Compressor Station</p>	<p>-Basically as planned (86.88km) (Route altered to bypass lake to shorten construction time)</p> <p>-Basically as planned (2 units) (Change in design of access road)</p>
2) Project period	<p><u>At Appraisal for Phase I</u> February 1998 – October 2002 (57 months)¹</p> <p><u>At Appraisal for Phase II</u> February 1998 – August 2002 (55 months)</p>	February 1998 – November 2003 (70 months)
1. Gas combined cycle power plant construction		
Consultant selection/service:		
Bidding:	January 1998 – August 2002	April 1998 – November 2002
Construction:	May 1998 – May 2000 June 2000 – August 2002	August 1998 – August 1999 June 2000 – November 2002
2. Pipeline Construction		
Consultant selection/service:		
Bidding:		
Construction:	May 1999 – August 2002 November 1999 – November 2000 November 2000 – August 2002	May 1999 – November 2004 August 2000 – March 2002 May 2002 – October 2003
3) Project Cost	<p><u>At Appraisal for Phase I</u> 29,421.00 million yen</p> <p><u>At Appraisal for Phase II</u> 39,817.00 million yen</p>	
Foreign Currency	39,003.10 million yen	39,004.00 million yen
Local Currency	786.00 million yen	0 yen
Total	39,817.00 million yen	39,004.00 million yen
ODA Loan Portion	39,003.10 million yen	39,004.00 million yen
Exchange Rate	1US\$ = 116.69 yen (as of March 1999)	1US\$ = 115 yen (average during 1999 – 2004)