# CHAPTER 3

# PRESENT SITUATION OF ELECTRIC POWER SECTOR

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## 3.1 General

Azenerji, a joint stock company with its shares 100 % owned by the Azerbaijan Government, is the monopolistic power supply operator in the country covering power generation, transmission and distribution. Azenerji also supplies steam and heat produced in the Combined Heat and Power plant (CHP) to factories and local heat supply organizations. Azenerji takes the following activities:

(a) Preparation of development plans for a power generation, transmission and distribution

(b) Development, operation and maintenance of power facilities

(c) Promotion of efficient use of energy by commercial, industrial, transportation, agriculture and residential consumers

In the three Cities of Baku, Sumgait, and Ganja, the Cities purchase the energy from Azenerji and distribute it to consumers. A dual energy distribution system functions in these three cities, under which the energy is directly distributed by Azenerji to bulk consumers, especially large factories, whereas the rest is distributed by the municipal governments[1].

Figure I.3.1-1 shows the organizational structure of Azenerji. For the operation and maintenance of energy supply system, and sales of energy, the entire country is divided into 6 blocks, and into 56 operating and marketing area with establishing the branch called Power and Heat Network Enterprise. Each branch is in charge of operating and maintaining the transmission, substation and distribution facilities, metering, and billing and collecting within its jurisdiction. The maintenance work, which each branch is responsible for, includes monitoring, detection of the accidents, inspection, and repairing. The planning, design, and construction of energy supply facilities are under the jurisdiction of the head office.

## 3.2 Power Supply Facilities

### 3.2.1 Power Generation Facilities

The power generation capacity in Azerbaijan is 5,071 MW, comprising 4,224 MW by thermal power

[1] As explained in Section 1.5, As a result of Presidential Decree issued on June 14 2000, all distribution facilities with less than 35 kV in Baku City, which had been possessed by Azenerji has been transferred to JSC BEN, and the said dual energy distribution is dissolved.

generation and 847 MW by hydropower generation. There are three types of power generation plants: thermal power plants and CHP with natural gas and heavy oil as fuel, and hydropower stations. The thermal power plants include the Az-Gres, Ali-Bayramli and Severnaya thermal plants. There are 4 CHPs: Baku-1, Baku-2, Sumgait-1 and Sumgait-2. The major hydropower stations are Shamkhir, Mingechaur, Varvara (utilized for counter-adjustment against Mingechaur hydropower station) and Tar-tar along the country's largest Kura River and Araz hydropower station on the Araz River (refer to Appendix I.3.2-2). There are several hydropower plants installed on the waterway for irrigation purpose in various places. The Tar-tar hydropower station, however, is at present controlled by Armenia. The CHP with 71 MW capacity in Ganja, not listed in Appendix I.3.2-1, was sold to a British company in 1995 together with the country's largest aluminum plant and has not been providing electricity to the national grid since 1996.

Table I.3.2-1 Power generation facilities in Azerbaijan

| Type | Numbers | Total installed capacity | Effective capacity |
|---|---|---|---|
| Thermal power | 3 | 3,650 MW | 3,010 MW |
| CHP | 4 | 574 MW | 256 MW |
| (Subtotal) | (7) | (4,224 MW) | (3,266 MW) |
| Hydropower | 11 | 847 MW | 509 MW |
| Total | 18 | 5,071 MW | 3,775 MW |

(Source: Azenerji)

The problem of Azerbaijan's power generation facilities lies in the use of the facilities for a long period far beyond the technical life-span of the facilities, except the Az-Gres thermal power plant with the largest power generation capacity in Azerbaijan. This problem is especially serious for thermal power plants, which are always exposed to heavy heat stress. The lifetime of the outdated facilities is even shortened by improper and inadequate operation and maintenance work due to lack of funds and spare parts. This has resulted in a drop in heat efficiency. The outdated power plants consume about two times as much fuel (0.4 kg of fuel per kWh in 1998) compared to the plants with the latest technology. They are not equipped with discharge smoke/$SO^2$ eliminating device, causing environmental concern.

The hydropower stations are not as much exposed to heat stress as thermal power plants and are durable for a longer time. Hydropower generation still plays an important role in Azerbaijan's power generation. The Yenikand hydropower station is currently under construction with the financial assistance of EBRD (to be completed within the year 2000). The oldest Mingechaur hydropower station with 360 MW capacity is presently under rehabilitation with the financial assistance by the World Bank and EBRD, replacing the obsolete water turbine and generators to increase the capacity.

In addition, at the Severnaya power plant (the operation started in 1954, and only unit 7$^{th}$ are currently working), combined cycle power plant (400 MW) is being developed with the financial assistance by the Japanese Government.

### 3.2.2 Power Transmission Facilities

The Azerbaijan's energy transmission system was developed as a part of the Trans-Caucasian Integrated System constituting the USSR's European System. The system is connected with the Russian System with 500 kV and 330 kV lines and integrally operated except in Armenia. Figure I.3.2-1 shows the overview of Trans-Caucasian Integrated System including Azerbaijan, Georgia, and Armenia. As seen in Figure I.3.2-1, the Absheron Peninsula, the central demand area of Azerbaijan, is situated at the end of the Trans-Caucasian Integrated System. The network system in Azerbaijan is not formulated around the Absheron Peninsula including Baku.

The existing transmission system is composed of 500 kV, the main trunk line of the Trans-Caucasian Integrated System, 330 kV, 220 kV, and 110 kV lines. While the transmission capacity is maintained so as to meet demand, its transmission loss rate is high. High loss rate is deemed to be resulting from a long distance between the large power generation facilities and demand areas. Table I.3.2-2 shows the transmission line lengths by voltage. Appendix I.3.2-3 shows the detail.

Table I.3.2-2 Transmission line lengths by voltage

| Voltage | Length (circuit·km) |
|---|---|
| 500 kV | 694 |
| 330 kV | 1,025 |
| 220 kV | 1,210 |
| 110 kV | 4,770 |

(Source: Azenerji)

The substations include 1 of 500 kV substation, 5 of 330 kV substations, 8 of 220 kV substations, and 175 of 110 kV substations. Energy supply to consumers is made through 110 kV, 35 kV, 20 kV, 10 kV, and 6 kV substations. There are no consumers supplied by 110 kV lines or higher. The transformer capacities are 800 MVA for 500/220 kV, 1,915 MVA for 330/220-110 kV, and 3,001 MVA for 220/110 kV.

### 3.2.3 Power Distribution Facilities

The high voltage distribution network is composed of 35 kV, 20 kV, 10 kV and 6 kV lines. The low voltage distribution networks is composed of 380/220 V lines. Table I.3.2-3 shows line lengths by voltage. The substations include 620 of 35 kV and 17,500 of 6 - 20 kV. The values below do not include the distribution lines owned by the three cities of Baku, Sumgait and Ganja.

Table I.3.2-3 Distribution line lengths by voltage

| Voltage | Length (km) |
|---|---|
| 35 kV | 6,300 |
| 6 - 20 kV | 38,100 |
| Low voltage | 58,600 |

(Source: Azenerji and TACIS's Report)

### 3.2.4 System Control Facilities

Azenerji divides the whole electric power supply institution of Azerbaijan into 6 blocks and divide into 56 branch offices, and is selling the electrical energy and carrying out the operation and maintenance of electric facilities by each component. The load dispatching centers are established in accordance with the blocks and branches. The National Load Dispatching Center (NLDC) is at the head office building of Azenerji. NLDC is mainly controlling the 500 kV, 330 kV, and 220 kV systems and also carrying out the functions such as preparation and order of the generation plans, coordination of the interconnection with the neighboring countries, controlling the system frequency, and observation and controlling the main transmission system. The United Dispatching Service Centers (UDSC) are established in each of the 6 blocks and the Regional Dispatching Services (RDS) are also established in each branch offices. They are mainly managing the 110 kV or below system of each supply area. In the Baku area, Central Power and Heat Network Enterprise (CPHNE) and Absheron Power and Heat Network Enterprise (APHNE) are supplying energy, and controlling their system by each RDS.

The equipment of NLDC is composed of the graphic panel, dispatching table and communication equipment. The main power stations of the whole country and also 500 kV, 330 kV and 220 kV (part of 110 kV) transmission system are displayed and classified by color on the mosaic blocks of the graphic panel. The switch indicators of the circuit breakers are also displayed on the panel. The wiring of them, however, is not sufficient and some of them are dropping out from the lack of the spare parts, the function is not working at all. The indications of open/close position of the circuit breakers are switched manually by the load dispatchers through the telephone or radio communication with each power stations and substations. Though a desk top type computer is installed on the dispatching desk, it is only used for preserving the operation record not for the controlling the system.

## 3.3 Power Balance

### 3.3.1 Power Supply

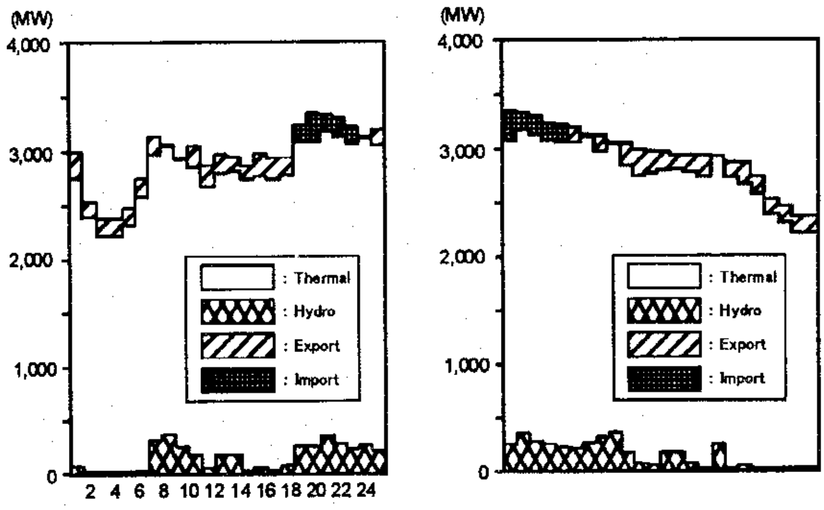
(1) Peak load and load curve

The peak load in Azerbaijan was recorded at 19:00 on December 18, 1998 at 3,452 MW, 3.0 % higher than the peak load in 1997 at 3,350 MW (Peak load in 1999 was 3,536 MW, and increased by 2.4 %). The peak demand was supplied by thermal power plants for 2,660 MW, CHP for 185 MW, and hydropower plants for 185 MW (total 3,115 MW) with a shortage of 337 MW imported from neighboring countries. Power imports at the maximum peak demand time from Turkey, Iran, and Dagestan are 37 MW, 40 MW, and 260 MW respectively. No energy was imported from Georgia on that day. The energy generated by the Araz hydropower plant and is imported from Turkey and Iran was supplied to the Nakhichevan Autonomous

Republic, which is presently disintegrated from Azerbaijan due to the Armenian occupation. Excluding this portion, the peak load of the Azenerji network system in 1998 was 3,352 MW.

As explained in Section 3.2.1, the installed power generation capacity is 5,071 MW. Considering the installed capacity only, the reserve capacity is 46.9% against the above mentioned peak load. The power generation capacity, however, is declining due to aging of the facilities and inadequate maintenance. In addition, the peak demand in Azerbaijan takes place in winter when hydropower generation capacity declines because the water level lowers and water inflow into reservoirs decreases. The effective power generation capacity in winter is 3,700 MW. A resultant reserve capacity at 7.2 %, without considering overhaul and accidental standstill, is extensively low level. Under this condition, it is difficult to maintain a stable operation of the system without depending on external power source.

Energy supply and demand in Azerbaijan is adjusted by importing energy from the neighboring countries at the evening peak time and exporting energy to them during lower load time. By this adjustment, the total energy generation in winter is maintained at lower than 3,200 MW, coping with a sudden increase of load, and accidental troubles in power generation facilities and tie lines. The daily load curve and the daily load duration curve on the day of maximum peak load, which presents the energy supply condition including energy interchange with neighboring countries, are shown in Figure I.3.3-1. As shown in this Figure, the thermal power plants including CHP are operated at flat level, and hydropower plants are regulated in accordance with the fluctuation of load within the available amounts of water. Then, the excess generation compared with the actual demand is exported to Dagestan, and the shortage is imported.




(a) Daily load curve (b) Daily load duration curve

Figure I.3.3-1 Daily load curves on the day of maximum peak demand (Dec. 18, 1998)

The daily load factor in the integrated system at the date when the peak load was recorded at 81.6 %, however, the load factor of generation plants in Azerbaijan was at high value 87.9 % due to energy accommodation with Dagestan.

### (2) Power generation amounts and power interchange with neighboring countries

To explain the situation where the thermal power output has declined, Table I.3.3-1 presents the transition of energy generation amounts by thermal power plants. As seen in this table, total energy generation amount in 1998 was dropped to 72% of 1990's level. In particular, the decline in CHP was remarkable. The figures in the bracket are of utilization factors based against the rated (left) and effective (right) output of power plant. These low utilization factors can be explained by the decline due to aging and deteriorated facilities, and extensively decreased demands in summer compared with those in winter. As for CHP, the utilization factor has lowered as the steam demands for industrial use has extremely declined due to economic stagnation, with having heating supply in winter as the main source of demands.

Table I.3.3-1 Power generation amounts by thermal power plants (unit: GWh)

| Power Plants | 1989 | 1990 | 1997 | 1998 | |
|---|---|---|---|---|---|
| Az-GRES | 9,562 | 10,613 | 8,110 | 10,090 | (48% / 58%) |
| Ali Bayramli | 6,870 | 6,446 | 5,636 | 4,732 | (49% / 60%) |
| Severnaya | 1,154 | 985 | 393 | 304 | (23% / 32%) |
| Sumgait-1 | 1,213 | 1,250 | 417 | 440 | (22% / 50%) |
| Sumgait-2 | 1,333 | 1,245 | 285 | 292 | (15% / 33%) |
| Baku-1 | 433 | 427 | 131 | 79 | ( 9% / 18%) |
| Baku-2 | 64 | 74 | 20 | 6 | ( 3% / 11%) |
| Total | 21,176 | 21,397 | 14,992 | 15,943 | (42% / 54%) |

(Source: Azenerji)

The total energy generation amount in 1998 was 17,894 GWh including 15,943 GWh by thermal power and 1,951 GWh by hydropower. Trade balance in 1998 was an excess import of 255 GWh with 903 GWh import and 648 GWh export. Most of this excess portion is from Turkey and Iran to Nakhichevan, and a trade balance with Dagestan is to be offset on an annual basis. Table I.3.3-2 shows the energy generation amount and energy amount imported in 1990, 1994, and 1998. Appendix I.3.3-1 shows the details. As seen in this table, the load factor is estimated to be 60%.

Table I.3.3-2 Change in energy generation, import and peak power

| | 1990 | 1994 | 1998 | 1999 |
|---|---|---|---|---|
| Energy generation (GWh) | | | | |
| Thermal | 21,397 | 15,654 | 15,943 | 16,558 |
| Hydro | 1,658 | 1,829 | 1,951 | 1,505 |
| Total | 23,055 | 17,483 | 17,894 | 18,064 |
| Energy accommodation (GWh) | -1,604 | 276 | 255 | 752 |
| Total input to Azerbaijan (GWh) | 21,451 | 17,759 | 18,149 | 18,816 |
| Peak Load (MW) | 3,673 | 3,213 | 3,452 | 3,536 |

(Source: Azenerji)

Energy supply to Nakhichevan is in severe condition. According to Azenerji, while total demand in the area is about 180 MW or 1,000 GWh, only available power generation facility is Araz hydropower station (22 MW or about 80 GWh/year). The energy shortage is compensated by import from Turkey and Iran. The amount of energy import, however, does not satisfied sufficiently due to the shortage of transmission capacity and economical reason.

### (3) Seasonal fluctuation in power supply amounts and peak load

Table I.3.3-3 presents the ratios of monthly energy supply amount and peak load in 1998 against those values on December (setting the value on December at 100%). The details are also presented in Appendix I.3.3-2. As seen in this table, the value on December is the biggest in both energy supply amount and peak load. The smallest energy supply amount is recorded on June with 62% of the maximum value on December and peak load on July with 71%.

Table I.3.3-3 Seasonal change in power supply amount and peak load (1998)

| | Jan. | Feb | Mar. | Apr. | May. | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power supply amount (%) | 99.5 | 87.6 | 94.3 | 74.4 | 70.1 | 62.4 | 65.2 | 66.7 | 66.0 | 77.6 | 86.8 | 100.0 |
| Peak load (%) | 98.5 | 99.2 | 97.2 | 93.8 | 81.8 | 71.3 | 70.9 | 72.6 | 76.9 | 83.7 | 92.4 | 100.0 |

(Source: Azenerji)

## 3.3.2 Demand

### (1) Energy sales by tariff categories

The total energy sale was 15,003 GWh in 1999. The energy wholesale to the three cities amounted to 4,506 GWh or 30 % of the total. Table I.3.3-4 below shows the energy sale by Azenerji during the past six years.

Table I.3.3-4 Energy sale by Azenerji by consumer category (unit : GWh)

| Item | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Rate of increase |
|---|---|---|---|---|---|---|---|
| 1. Wholesale | 3,109 | 3,136 | 3,669 | 4,058 | 4,603 | 4,506 | 7.7% |
| 2. Industrial | 4,252 | 3,326 | 3,989 | 2,887 | 2,360 | 1,980 | -14.2% |
| 3. Residential | 2,648 | 3,054 | 3,724 | 3,182 | 4,488 | 6,186 | 18.5% |
| 4. Agriculture | 2,473 | 2,445 | 1,975 | 1,884 | 1,639 | 533 | -26.4% |
| 5. Non-industrial | 786 | 683 | 568 | 546 | 541 | 841 | 1.4% |
| 6. Others | 377 | 331 | 341 | 412 | 588 | 957 | 20.5% |
| 7. Total | 13,644 | 12,975 | 13,276 | 12,969 | 14,262 | 15,003 | 1.9% |
| 8. Wholesale + residential | 5,757 | 6,190 | 7,393 | 7,240 | 9,091 | 10,692 | 13.2% |
| 9. Other Demand | 7,887 | 6,785 | 5,883 | 5,729 | 5,171 | 4,311 | -11.4% |

(Source: Azenerji)

Industrial energy consumption has been declining, reflecting recent economic stagnation. The total energy consumption, however, turned into rising conditions recently, as a result of an increase in residential energy use. In 1996, the sum of "wholesale" and "residential energy use" surpassed the sum of all other categories, then the difference between them has been expanding so far. The annual average growth rate for each sector (13.2 % and -11.4 % respectively) clearly indicates this contrast.

### (2) Wholesale energy to three cities

The amount of wholesale energy to Baku, Ganja, and Sumgait is shown in Table I.3.3-5 below. The wholesale amount to those three cities had yearly increased, but declined in 1999 due to a big fall in sales to Ganja City.

Table I.3.3-5 Amount of energy wholesale to three cities (unit : GWh)

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Rate of increase |
|---|---|---|---|---|---|---|---|
| 1. Baku | 2,349 | 2,298 | 2,654 | 2,950 | 3,367 | 3,619 | 9.0% |
| 2. Ganja | 458 | 564 | 690 | 757 | 865 | 367 | -4.3% |
| 3. Sumgait | 303 | 274 | 325 | 351 | 371 | 366 | 3.9% |
| Total | 3,109 | 3,136 | 3,669 | 4,058 | 4,603 | 4,352 | 6.7% |

(Source: Azenerji and Azenerji's Annual Report)

### (3) Number of customer by tariff category

Table I.3.3-6 shows the number of Azenerji's consumers by tariff category. The number of residential consumers covered by Azenerji accounted for about 38% of the national population (assuming herein 4 persons per one family). An overall electrification ratio in Azerbaijan is difficult to estimate since the number of residential consumer other than those directly covered by Azenerji and BEN in Baku. In addition, the situation where each refugee camp is treated as one customer without reflecting actual number of family has further made it difficult to estimate the electrification ratio.

Table I.3.3-6 Number of consumers by tariff category

| Tariff Category | 1997 | 1998 |
|---|---|---|
| 1. Wholesales | 5 | 5 |
| 3. Residential | 673,765 | 753,250 |
| 2. Industrial | 1,795 | 1,783 |
| 4. Agriculture | 2,580 | 2,883 |
| 5. Non-industrial | 4,800 | 4,567 |
| 6. Others | 15,895 | 16,961 |
| Total | 698,885 | 779,449 |

(Source: Azenerji)

### 3.3.3 Losses

Energy loss is defined as the difference between the amount of energy inputted into the system and the amount reaching the consumers. In calculating the energy loss ratio in Azerbaijan, the amount of energy provided into the system needs to be estimated taking into consideration the amount accommodated with neighboring countries as well as amount generated.

### (1) Energy for station use

Thermal power plants consume a certain volume of energy, normally 3～5% of the generated amount, to supply fuel, steam or cooling water required for power generation. Hydropower stations, on the contrary, consume only negligible amount of energy needed for operating auxiliary equipment. Table I.3.3-7 shows the own consumption of thermal power plants by year. Appendix I.3.3-3 also shows the value by power station. The average rate of energy amount for station use against the generated amount has ranged between 6.0 and 7.4% in the past 5 years. This figure is higher than that of normal thermal plants, and can be explained by the decline in efficiency as already mentioned in Section 3.3.1.

Table I.3.3-7 Own consumption of thermal power plants (unit : GWh)

| Item | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Own energy generation | 15,654 | 15,401 | 16,148 | 14,992 | 15,943 | 16,558 |
| Station use | 1,166 | 1,098 | 1,036 | 1,011 | 970 | 1,027 |
| | (7.4%) | (7.1%) | (6.4%) | (6.7%) | (6.0%) | (6.2%) |

(Source: Azenerji)

### (2) Transmission and distribution loss

Technical loss is defined as the loss of energy caused by resistance against the current in the transmission and distribution lines between power plants and consumers. Non-technical loss refers to meter errors, mistake in meter reading, wrong invoicing, tampered meters and theft. While technical loss can be theoretically measured by simulating the amount of current within a certain time frame using computers, this work requires a large volume of computation with little fruit. Then, the difference between input amount and output amount of energy is usually calculated and regarded as the loss. Thus, the loss of Azenerji facilities is estimated in Table I.3.3-8. This loss include the portion explained by non-technical loss, however, the complete separation between technical and non-technical is extremely difficult.

Table I.3.3-8 Loss of Azerenerji's facilities (unit : GWh)

| Item | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Energy at sending end | 16,311 | 15,853 | 16,642 | 15,687 | 16,918 | 17,037 |
| Imported energy | 276 | 477 | 461 | 739 | 255 | 752 |
| Total input energy | 16,587 | 16,330 | 17,103 | 16,426 | 17,173 | 17,789 |
| Sold energy | 13,644 | 12,975 | 13,276 | 12,969 | 14,262 | 15,003 |
| T/L & D/L losses | 2,943 | 3,355 | 3,827 | 3,457 | 2,911 | 2,786 |
| | (17.7%) | (20.5%) | (22.4%) | (21.0%) | (17.0%) | (15.7%) |

(Source: Azenerji)

In Azerbaijan, a long distance between the power plants and Baku, the major demand area in Azerbaijan, is generally considered a major factor to explain high loss rates. Transmission loss, however, is not judged to be at a problematically high level, considering the peak load in Baku at around 1,000 MW and the transmission network configuration. Distribution loss would also be low, since 380/220 V is applied to the distribution network. On these bases, a large part of the losses mentioned above is judged as caused by non-technical factors.

As each loss rate shown in Tables I.3.3-7 and I.3.3-8 are estimated with different input energy amounts, the loss rate based on the total of generated and imported amount is shown below.

Table I.3.3-9 Trend in system loss (%)

| Item | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Station use | 6.6 | 6.3 | 5.7 | 5.8 | 5.4 | 5.4 |
| T/L & D/L losses | 16.6 | 19.2 | 21.1 | 19.8 | 16.0 | 14.8 |
| System losses | 23.2 | 25.5 | 26.8 | 25.6 | 21.4 | 20.2 |

### (3) Loss rate including the three cities

The loss rate shown in Table I.3.3-9 is that of Azenerji's transmission and distribution network facilities, not representing the rate of the entire country, considering the three energy distribution operators. According to Azenerji's Annual Report in 1998, the amount lost in three cities' energy distributing operations is 803 GWh, and the loss rate of the entire country including those lost amounts is 21.6% (3,714 GWh). This figure is very high, and the amount lost in the three cities represent 5.6% of the total supply amount or 22% of the total transmission and distribution loss.

## 3.4 Power Tariff

### 3.4.1 Power Tariff System

The power tariff regime effective from January 1, 1999 was revised again on July 1, 2000. The former tariff regime and the latest one are shown in Table I.3.4-1. The tariff regime shown below is applied throughout the country, including the three cities, which supply energy to respective customers through their own distribution networks. All customer groups need to pay VAT (20% of the corresponding tariff) in addition to the tariff specified below. The tariff regime is to be set so as to ensure that a certain ratio of operating profit against Azenerji's total operation cost (comprising of fuel cost and other costs appropriated by the government) shall be secured. According to TACIS study report as of June 1999, the ratio is set as 20 %.

The tariff regime in Azerbaijan is a simple one, applying single rate for each customer group, and not reflecting actual generation costs depending on demand restrictions and differences of seasonal and hourly load changes and facility utilization factor. In particular, the total energy supply and monthly peak load in winter (December) have been 1.5 and 1.4 times respectively as large as those in summer (July), resulting in the decline of yearly utilization factor of the generation facilities and rise in the generation costs. It is understood, therefore, that application of seasonal tariff system is of great importance to facilitate demand suppression and sound management and operation of the electric utility.

It is also observed that the tariff for the city and countryside population (residential) has been set at the lowest level in spite of the highest energy supply cost, resulting in a substantial cross-subsidization among the consumer groups. At the tariff revision dated on July 1, 2000, the uniform tariff (AZM 130/kWh) common to every sector except for the residential and wholesale was adopted, and is lower than before in all categories in order to simplify the revenue calculation and activate the industrial sectors.

Some residential customer groups are exempted and partly exempted from a payment. Those privileged groups are limited to refugee, veteran and person who need considerable social allowances.

Table I.3.4-1 Power tariff (AZM/kWh)

| Tariff Categories | Tariff from July 1 2000 | Tariff from Jan. 1 1999 |
|---|---|---|
| Industry and construction | 130 | 160 |
| Electric railway company | 130 | 198 |
| City transport and water company | 130 | 132 |
| Budget organization | 130 | 160 |
| Non-industry | 130 | 265 |
| Commercial | 130 | 340 |
| Agriculture | 130 | 140 |
| Wholesale | 72 | 72 |
| City and country-side population (residential) | 80 | 96 |

(Source: Azenerji)

The historical change in energy tariff by tariff category from March 1 1994 to the latest revision is indicated in Appendix I.3.4-1. Parentheses in the table are expressed in USC/kWh converted from the exchange rates prevailing at respective time.

### 3.4.2 Energy Sales Revenue, Billing and Collection

The data on energy sales revenue and charge collection performance by Azenerji at national level in 1999 is presented in Table I.3.4-2. According to this table, energy charge collection rate at national level has been extensively poorer than that (50.1%: explained in Section 4.4) in Baku area by Azenerji's branch (Central Electric Network and Absheron Electric Network).

As shown in the table below, the low collection rate has been caused by remarkably poor payment performance by the residential and energy retailer including BEN.

Table I.3.4-2 Energy sales revenue and collection performance at national level in1999

| | Sales | Revenue | Collection (billion AZM) | | | Collection rate |
|---|---|---|---|---|---|---|
| | (GWh) | (billion AZM) | Barter | Cash | Total | (%) |
| Azenerji's customer | 10,496.7 | 1,227.8 | 314.3 | 159.6 | 473.8 | 38.6 |
| Industry | 1,980.4 | 369.3 | 187.5 | 52.4 | 239.9 | 65.0 |
| Residential | 6,186.4 | 404.5 | 15.6 | 30.7 | 46.3 | 11.4 |
| Agriculture | 532.7 | 89.5 | 0.0 | 0.7 | 0.7 | 0.8 |
| Non-industry | 840.7 | 178.3 | 3.0 | 56.8 | 59.7 | 33.5 |
| Commerce | 53.2 | 21.7 | 0.4 | 18.9 | 19.3 | 89.1 |
| Water company | 546.4 | 86.6 | 27.6 | 0.1 | 27.7 | 32.0 |
| Transportation | 356.9 | 78.0 | 80.2 | 0.0 | 80.2 | 102.9 |
| Retail seller | 4,506.2 | 389.3 | 8.4 | 41.7 | 50.1 | 12.9 |
| BEN | 3,618.7 | 312.7 | 5.6 | 36.0 | 41.6 | 13.3 |
| Others | 887.6 | 76.7 | 2.7 | 5.7 | 8.4 | 11.0 |
| Total | 15,003.0 | 1,617.2 | 322.7 | 201.3 | 523.9 | 32.4 |

(Source: Azenerji)

The energy charge collection rate by Azenerji is as low as 32.4 %. The worst performance is recorded by the agricultural sector, where the energy charge has been rarely collected. Then, charged residential and the retail seller (the three cities) including BEN follow. The retail sellers and charged residential that account for some 49 % of total revenue actually pay only 12.1 % of the their bill. Furthermore, the energy sales amount for the residential sector includes some free-supply amounts (around 30 % of total residential demand) to the privileged (charge-exempted) group including veterans, therefore, actual collection rate would be much worse if this is taken into account.

The high collection rate, on the other hand, is recorded by industrial, commercial and transportation sectors, that can afford to settle relatively larger portion of their energy payment by barter.

## 3.5 Financial Performance of AZERENERJI

With the advice of EBRD, Azenerji started to adopt the international standard accounting system since 1994. In Azerbaijan, the fiscal year is from January 1 to December 31. The notable point in its financial performance is that while Azenerji has brought about net profit (after tax) during last three years in the profit and loss statements, both account receivable and payable have been accumulated in its balance sheet. While having seemingly secured the profit on the profit-loss calculation, Azenerji has poorly performed for the accumulation and appropriation of funds from own revenue, and faced difficulties in cash-flow management. Yearly accumulated account receivable has been caused by poor performance of energy charge collection as explained above. Macro-economic factors including the hovering in economic activity and wage level and unstable employment have been seen behind the poor performance of collection. Currently Azenerji saves around 4.4% of gross receivable as a reserve for doubtful debt in view of providing for expected losses.

As for accounts payable, fuel payments for oil and gas companies command a majority. An accumulation in accounts payable have been brought about, as the actual amount of energy charge collection from the customers is so insufficient that payment to the creditors needs to be put off. Such cash-flow performance has presumably made Azenerji seek for continuous budget support from foreign/international financial institutions for financing its investment activity, and prevented it from operating with financial independence. Financial performance of Azenerji from 1995 to June 1999 is summarized as follows:

Table I.3.5-1 Balance sheet and profit and loss statement of Azenerji (in billion AZM)

| BALANCE SHEET | 1995 | 1996 | 1997 | 1998 | 1999/6 |
|---|---|---|---|---|---|
| Total Assets | 1,504.6 | 4,606.2 | 5,732.7 | 7,446.4 | 7,972.5 |
| - Current Assets | 1,329.9 | 2,372.5 | 3,501.7 | 5,201.7 | 5,715.5 |
| (Net receivables in the above) | (1,154.7) | (2,067.3) | (3,104.0) | (4,474.7) | (4,853.9) |
| - Fixed Assets | 174.7 | 2,233.7 | 2,231.0 | 2,244.7 | 2,257.0 |
| Total Liabilities | 1,100.9 | 2,151.9 | 3,291.4 | 4,655.1 | 5,297.2 |
| - Current Liabilities | 1,095.2 | 2,093.3 | 3,151.5 | 4,447.9 | 5,015.6 |
| (Net payables in the above) | (1,094.9) | (1,930.5) | (3,142.2) | (4,429.8) | (4,996.5) |
| - Long-tern Borrowings | 5.7 | 58.7 | 139.9 | 207.2 | 281.6 |
| Equity/Capitalization | 403.7 | 2,454.3 | 2,441.3 | 2,791.3 | 2,675.3 |
| (Retained earnings in the above) | (403.7) | (326.0) | (313.0) | (663.0) | (547.0) |
| PROFIT AND LOSS | 1995 | 1996 | 1997 | 1998 | 1999/6 |
| Total Operating Revenue | 1,499.8 | 1,628.8 | 1,650.8 | 1,648.5 | 821.2 |
| - Operating Revenue | 1,476.2 | 1,548.7 | 1,604.5 | 1,611.3 | 806.4 |
| - Other Operating Revenue | 23.6 | 80.1 | 46.3 | 37.2 | 14.8 |
| - Less: Operating Expenses | 1,154.5 | 1,568.1 | 1,551.0 | 1,503.8 | 755.2 |
| Net Profit (before financing expenses/tax) | 345.3 | 60.7 | 99.9 | 144.7 | 66.0 |
| - Less: Financing Expenses | 49.2 | 42.8 | 49.3 | 64.7 | 23.6 |
| Net Profit (before tax) | 296.1 | 17.9 | 50.5 | 80.0 | 42.4 |
| - Less: Income Tax | 44.5 | 42.9 | 20.6 | 20.3 | 9.5 |
| Net Profit (after tax) | 251.6 | -25.0 | 29.9 | 59.7 | 32.9 |

(Source: Azenerji)

## 3.6 Existing Electricity Demand Forecast for Azerbaijan

Two existing energy demand forecasts for Azerbaijan shown in Table I.3.6-1 are considered relevant. The demand forecast by Azenerji is detailed in Appendix I.3.6-1.

No data were available concerning the assumptions underlying these forecasts. The Azenerji's forecast was prepared in 1995, followed by a forecast until 2020 in 1997. The Azenerji's power system development plan presented in Section 3.7 was prepared based on the above demand forecast. The Azenerji's 1998 figure is a forecast and lower than the actual demand in 1998 as shown by the TACIS forecast. The Azenerji's forecast is characterized by a high growth rate of the industrial sector and, in contrast, a low growth rate for residential use. Growth of construction, transportation, and agriculture demand is set at intermediate levels. The growth rates of industrial, construction and transportation demand are somewhat close to the recent long-term economic growth prospect by international aid organizations.

The TACIS forecast is the most recent power demand forecast for Azerbaijan. It presents the total power demand forecast with no sector-wise forecast. The growth rates in the two scenarios are set lower than the Azenerji's forecast.

Table I.3.6-1 Existing energy demand forecast for Azerbaijan (Unit :GWh)

| Organization | | 1998 | 2010 | 1998-2010 Growth (%/year) |
|---|---|---|---|---|
| Azenerji (1997) | Industry | 2,340 | 6,690 | 9.1 |
| | Construction | 360 | 780 | 6.7 |
| | Transportation | 320 | 700 | 6.7 |
| | Agriculture | 1,630 | 2,950 | 5.1 |
| | Residential | 9,070 | 9,500 | 0.4 |
| | Commercial | 0 | 0 | - |
| | Other | 419 | 83 | -12.6 |
| | Total net demand | 14,139 | 20,703 | 3.2 |
| TACIS (1999) | High growth scenario | 17,829 | 25,160 | 2.9 |
| | Low growth scenario | 17,829 | 23,892 | 2.5 |

## 3.7 Azenerji's Development Plan

"Middle-term Investment Plan" was prepared in 1995 for Azenerji by ENERGYGROUP under TACIS program. The plan covers a period of three years from 1997 to 1999. Development of power facilities during this period has been implemented based on this plan, according to the Azenerji' annual report 1998 ("AAR 1998 " hereafter).

AAR 1998 gives an overview of the ongoing, committed and planned power development projects in Azerbaijan. The following is a summary;

### (1) Ongoing Project

(a) Yenikand Hydropower Station

- Planned year of completion: 1999
- Production of power energy: 547 GWh/year
- Amount of fuel oil to be saved: 140,000 ton/year
- Finance: EBRD Credit: US$ 53.24 million
  Azenerji: US$ 19.00 million

(b) Mingechaur Energy Project

- Planned year of completion: 2000
- Reconstruction of Mingechaur Hydropower with upgraded capacity of 60 MW and production power energy of 80 GWh/year
- Construction of Imishli 330/110 kV substation and 110 kV transmission lines

- Construction of Az-Gres power station and 330 kV transmission lines to Imishli 330/110 kV substation
- Finance: EBRD: US$ 24.54 million
  World Bank: US$ 13.71 million

(c) Construction of Severnaya Combined Thermal Power Station
- Planned year of completion: 2003
- Construction of steam-gas power unit in the existing facility with a capacity of 400 MW
- Finance: US$ 240 million (partly financed by the Japan Bank for International Cooperation: JBIC)

(d) Rehabilitation of 220-110 kV Substations in Absheron Peninsula
- Planned year of completion: 2000
- Finance: US$ 20 million (partly financed by German KfW)

## (2) Committed Project

(a) Baku Thermal Power Central-1 (TPC)
- Planned year of completion: 2000
- Rehabilitation of facilities with installment of two gas-turbines (2 x 25 MW)
- Finance: US$ 80 million (partly financed by Baurishe Landene Bank (FRG))

(b) Rehabilitation of Sumgait Thermal Power Central-1 (TPC)
- Planned year of completion: 2004
- Installment of two gas-turbines (2 x 200 MW)
- Finance: US$ 250 million (to be assigned)

## (3) Proposed Project

(a) Installment of Power Unit No.9 in Az-Gres Thermal Power Station
- Increase of power energy production by 1,800 GWh/year
- Finance: US$ 32 million

(b) Installment of Power Unit No.2 in Severnaya Combined Thermal Power Station
- Finance: US$ 250 million
- A preliminary analysis finished by TACIS

(c) Rehabilitation of Small Hydro Power Stations
- Finance: US$ 10 million

(d) Construction of Khachmaz 330/110 kV Substation
- Construction of substation with connecting to the existing 330 / 110 kV transmission lines
- Finance: US$ 20 million

(e) Construction of Wind Power Stations in the Absheron Peninsula
- Capacity: 30 MW
- Production Power Energy: 100 GWh/year

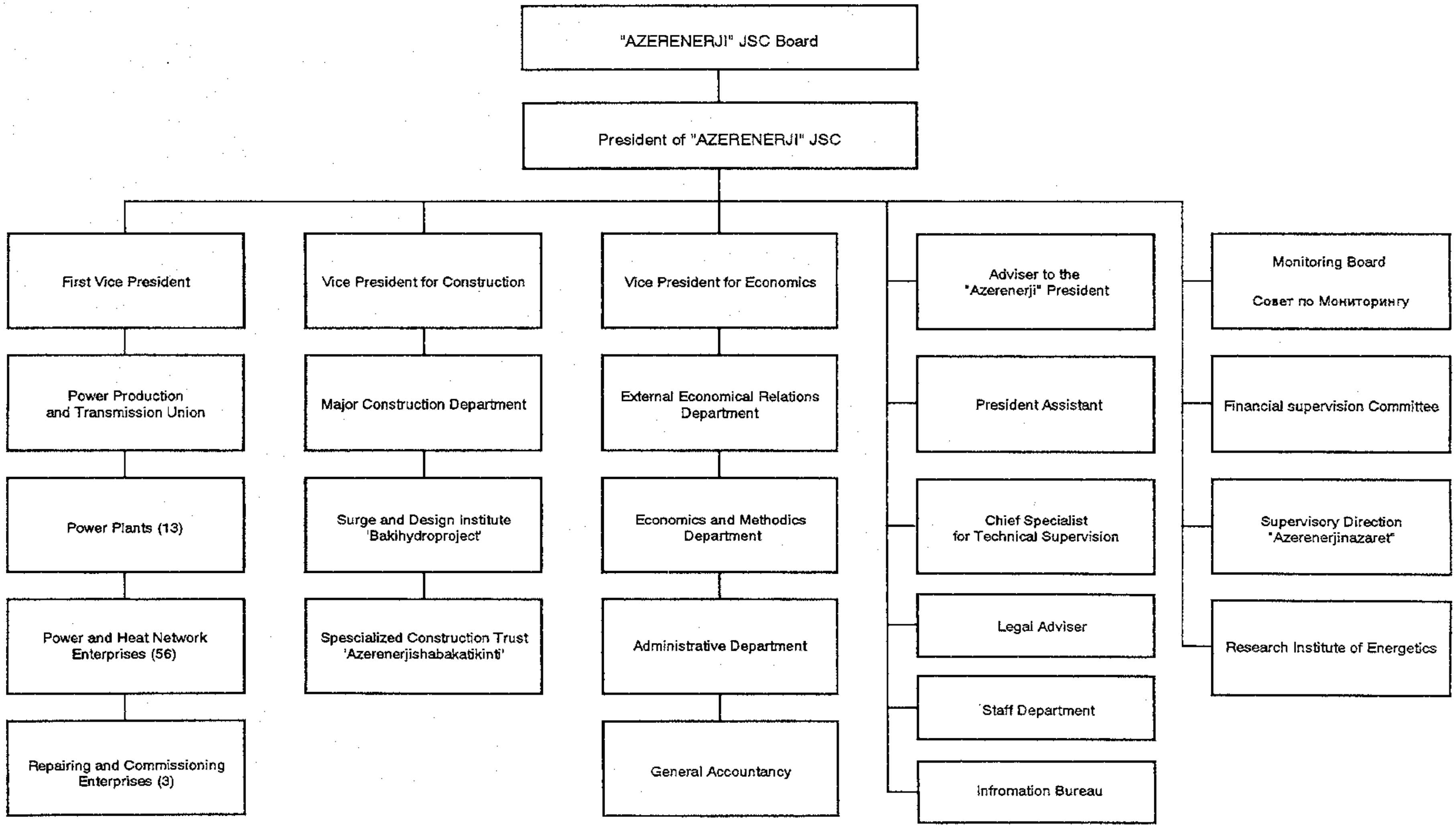
(f) Construction of Hydro Power Stations in the Nakhichevan Autonomous Republic
- Eight small hydro-electric stations with a total capacity of 32 MW
- Vaikhir hydro-electric station with a capacity of 4.7 MW
- Arpachay hydro-electric station with a capacity of 12 MW

Appendix I.3.7-1 lists the projects planned by Azenerji with annual total capacity, forecasts peak load and reserve until the year 2010. The projects mentioned above are included into this plan. The following Table I.3.7-1 summarizes the entire plan.

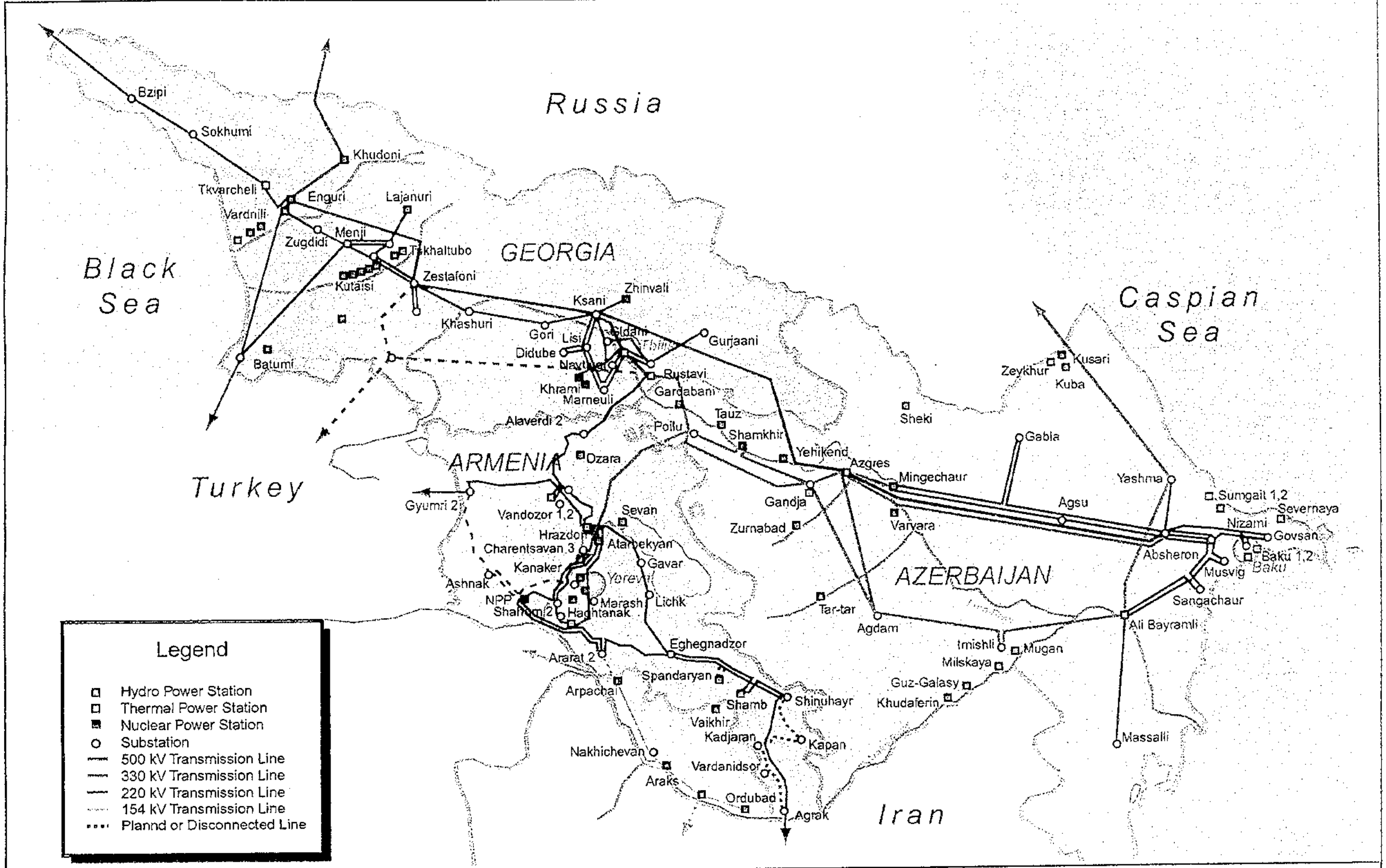
Table I.3.7-1 Azenerji's development plan until 2010

| Year | Total Capacity (MW) | Forecast Peak Load (MW) | Reserve (%) |
|---|---|---|---|
| 1999 | 4,431 | 3,625 | 22.2 |
| 2000 | 4,901 | 3,815 | 28.4 |
| 2005 | 5,547 | 4,580 | 21.1 |
| 2010 | 6,190 | 5,140 | 20.4 |

(Source: Azenerji' annual report, 1998)




| | | |
|---|---|---|
| Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku<br>Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку | | Figure / Схема I.3.1-1<br>Title / Название Рисунка<br>Organization Chart of AZERENERJI |
| Baku Electric Network<br>ПО "БАКЭЛЕКТРОСЕТЬ" | Japan International Cooperation Agency<br>Японское Агентство Международного Сотрудничества | |
| Joint Venture Nippon Koei Co., Ltd. & KRI International Corp.<br>Совместное предприятие НИППОН КОЕИ и KRI Интернешнл Корп. | | |




Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku
Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку

Baku Electric Network
ПО "БАКЭЛЕКТРОСЕТЬ"

Japan International Cooperation Agency
Японское Агентство Международного Сотрудничества

Joint Venture Nippon Koei Co., Ltd. & KRI International Corp.
Совместное предприятие НИППОН КОЕЙ и KRI Интернешнл Корп.

Figure / Схема I.3.2-1
Title / Название Рисунка
Transcaucasian Integrated System

Appendix I.3.2-1 Thermal Power Plants

| No. | Name of Power Station | Coms. Year (Plant) | Unit No. | Rated Capacity (MW) | Effect. Output (MW) | Heat Product. (MWh) | Coms. Year (Unit) | Kind of Fuel | Present Conditions |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Az-Grez (Minegechaur city, 350km northwest of Baku) | 1981 | #1 | 300 | 250 | | 1981 | NG/HFO | Operation |
| | | | #2 | 300 | 250 | | 1982 | NG/HFO | Operation |
| | | | #3 | 300 | 250 | | 1983 | NG/HFO | Operation |
| | | | #4 | 300 | 250 | | 1984 | NG/HFO | Operation |
| | | | #5 | 300 | 250 | | 1985 | NG/HFO | Operation |
| | | | #6 | 300 | 250 | | 1986 | NG/HFO | Operation |
| | | | #7 | 300 | 250 | | 1988 | NG/HFO | Operation |
| | | | #8 | 300 | 250 | | 1990 | NG/HFO | Operation |
| | Subtotal | | 8 | 2,400 | 2,000 | | | | |
| 2 | Ali Bayramli | 1962 | #1 | 155 | 120 | | 1962 | NG | Operation |
| | | | #2 | 155 | 120 | | 1962 | NG | Operation |
| | | | #3 | 155 | 120 | | 1963 | NG | Operation |
| | | | #4 | 155 | 120 | | 1963 | NG | Operation |
| | | | #5 | 160 | 140 | | 1966 | HFO | Operation |
| | | | #6 | 160 | 140 | | 1967 | HFO | Operation |
| | | | #7 | 160 | 140 | | 1968 | HFO | Operation |
| | Subtotal | | 7 | 1,100 | 900 | | | | |
| 3 | Severnaya | 1950 | #7 | 150 | 110 | | | NG/HFO | Operation |
| 4 | Baku 1 CHP | 1902 | #6 | 50 | 25 | | 1973 | NG/HFO | Operation |
| | | | #7 | 50 | 25 | | 1974 | NG/HFO | Operation |
| | Subtotal | | 2 | 100 | 50 | 694 | | | |
| 5 | Baku 2 CHP | 1953 | #1 | 6 | | | 1953 | NG/HFO | Operation |
| | | | #2 | 6 | | | 1953 | NG/HFO | Operation |
| | | | #4 | 6 | | | 1964 | NG/HFO | Operation |
| | | | #5 | 6 | | | 1964 | NG/HFO | Operation |
| | Subtotal | | 4 | 24 | 6 | 383 | | | |
| 6 | Sumgait 1 CHP | 1952 | #8 | 60 | 25 | | 1959 | NG/HFO | Operation |
| | | | #9 | 60 | 25 | | 1960 | NG/HFO | Operation |
| | | | #10 | 60 | 25 | | 1961 | NG/HFO | Operation |
| | | | #11 | 50 | 25 | | 1962 | NG/HFO | Operation |
| | Subtotal | | 4 | 230 | 100 | 760 | | | |
| 7 | Sumgait 2 CHP | 1966 | #1 | 60 | 25 | | 1966 | NG/HFO | Operation |
| | | | #2 | 50 | 25 | | 1967 | NG/HFO | Operation |
| | | | #3 | 60 | 25 | | 1971 | NG/HFO | Operation |
| | | | #4 | 50 | 25 | | 1972 | NG/HFO | Operation |
| | Subtotal | | 4 | 220 | 100 | 990 | | | |
| Total | | | | 4,224 | 3,266 | 2,827 | | | |

Source : AZERENERJI (TA-SIC's Report, Part VII)

Remarks :

a) NG = Natural gas (34.42$/1000m3 at 1994)

b) HFO = Heavy fueloil (calorific value : 9500 - 9800Kcal/kg, density : 0.92 - 0.93gr/cm3, 23.38$/t at 1994)

c) Ganja CHP has been privatirized by the firm of England since 1995.

Appendix I.3.2-2 Hydropower Plants

| No. | Name | River | Purpose | Installed Capacity | | | Effect | Annual | Turbine | Dam | | | Reservoir | | Mean | Effect | Comis. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | No. | Unit (MW) | Total (MW) | Output (MW) | Energy (GWh) | Type | Type | Length (m) | Height (m) | Total (mil. $m^3$) | Effect (mil. $m^3$) | ($m^3$/s) | Head (m) | Year | |
| 1 | Shamkhir | Kura | Multi | 2 | 190.0 | 380.0 | 340.0 | 830.0 | Kaplan | Rock-fill | 1,700.0 | 70.0 | 2,770.0 | 1,420.0 | 315.0 | 47.5 | 1982 | |
| 2 | Minegechaur | Kura | Multi | 6 | 60.0 | 360.0 | 160.0 | 1,050.0 | Kaplan | Earth-ill | 1,550.0 | 80.0 | 15,700.0 | 9,800.0 | 396.0 | 52.5 | 1955 | |
| 3 | Varvara | Kura | Multi | 3 | 5.5 | 16.5 | | 90.0 | Francis | | | | 60.0 | 14.0 | | 5.5 | 1958 | Re-regulation |
| 4 | Araz | Araz | Multi | 2 | 11.0 | 22.0 | 0.0 | 86.0 | Kaplan | Earth-fill | 900.0 | 40.0 | 1,350.0 | 1,150.0 | | 20.0 | 1971 | not connected to central network |
| 5 | Tar-tar | Tar-tar | Multi | 2 | 25.0 | 50.0 | 0.0 | 120.0 | Francis | | | | 560.0 | 520.0 | | 87.5 | 1976 | under Armenian control |
| 6 | Kusari | Canal (Samur-Absheronsky) | Power | | | 1.2 | 9.0 Small hydro total | 6.3 | | | | | | | | 7.0 | 1956 | |
| 7 | Kuba | Kudiakchay | Power | | | 1.2 | | 1.5 | | | | | | | | 44.0 | 1936 | Outage |
| 8 | Mugan | Canal (Mugan) | Power | | | 3.6 | | 14.4 | | | | | | | | 7.8 | 1962 | |
| 9 | Shelki | Kishchay | Multi | | | 1.7 | | 6.3 | | | | | | | | 165.0 | 1936 | Outage |
| 10 | Zurnabad | Gangahay | Multi | | | 2.8 | | 12.8 | | | | | | | | 875.0 | 1928 | Outage |
| 11 | Zeykhur | Canal (Top-Zeykhur) | Multi | | | 8.0 | | 35.2 | | | | | | | | 107.5 | 1973 | |
| Total | | | | | | 847.0 | 509.0 | 2,252.5 | | | | | | | | | | |

Sourse : AZERENERJI

Appendix I.3.2-3 Transmission Lines of 220 kV and above

| No. | Voltage (kV) | Name of Station | | Line Length (km) | CCT | CCT·km | Conductor | | Commis Year |
|---|---|---|---|---|---|---|---|---|---|
| | | From | To | | | | Kind | Size (sq.mm) | |
| **500 kV** | | | | | | | | | |
| 1 | 500 | Az-Gres P/S | Absheron | 250.4 | 1 | 250.4 | ASO | 3x300 | 1989 |
| 2 | 500 | Az-Gres P/S | Mukhravinis Veli | 197.0 | 1 | 197.0 | ASO | 3x300 | 1986 |
| | (Total) | | (Georgia) | | | 447.4 | | | |
| **330 kV** | | | | | | | | | |
| 1 | 330 | Az-Gres P/S | Absheron | 243.0 | 1 | 243.0 | ASO | 3x300 | 1986 |
| 2 | 330 | Mingechaur P/S | Az-Gres | 4.8 | 1 | 4.8 | ASO | 1x480 | 1958 |
| 3 | 330 | Az-Gres P/S | Ganja | 88.7 | 1 | 88.7 | ASO | 1x480 | 1958 |
| 4 | 330 | Az-Gres P/S | Agdam | 100.0 | 1 | 100.0 | ASO | 2x300 | 1983 |
| 5 | 330 | Agdam | Imishli | 114.3 | 1 | 114.3 | ASO | 2x300 | |
| 6 | 330 | Agdam | Ganja | 107.3 | 1 | 107.3 | ASO | 2x300 | |
| 7 | 330 | Ali Bayramli P/S | Imishli | 85.1 | 1 | 85.1 | ASO | 2x300 | 1967 |
| 8 | 330 | Ali Bayramli P/S | Yashma | 117.3 | 1 | 117.3 | ASO | 2x300 | 1979 |
| 9 | 330 | Yashma | Delbent (Russia) | 166.4 | 1 | 166.4 | ASO | 2x300 | 1974 |
| 10 | 330 | Agstafa | Gardabani (Georgia) | 63.8 | 1 | 63.8 | ASO | 1x480 | 1958 |
| 11 | 330 | Shamkir | Agstafa | 87.5 | 1 | 87.5 | ASO | 2x300 | 1968 |
| 12 | 330 | Ganja | Agstafa | 94.5 | 1 | 94.5 | ASO | 2x300 | 1958 |
| 13 | 330 | Ganja | Shamkir | 42.5 | 1 | 42.5 | ASO | 2x300 | 1958 |
| | (Total) | | | | | 1,315.2 | | | |
| **220 kV** | | | | | | | | | |
| 1 | 220 | Ali Bayramli P/S | Masalli | 114.0 | 1 | 114.0 | ASO | 1x240 | 1976 |
| 2 | 220 | Mingechaur P/S | Akhsu | 123.0 | 1 | 123.0 | ASO | 1x340 | 1949 |
| 3 | 220 | Mingechaur P/S | Gabala | 96.0 | 1 | 96.0 | ASO | 1x300 | 1978 |
| 4 | 220 | Akhsu | Absheron | 108.0 | 1 | 108.0 | ASO | 1x340 | 1949 |
| 5 | 220 | Gabala | Absheron | 225.0 | 1 | 225.0 | ASO | 1x300 | 1954 |
| 6 | 220 | Ali Bayramli P/S | Mushfig | 110.0 | 1 | 110.0 | ASO | 2x300 | 1962 |
| 7 | 220 | Ali Bayramli P/S | Sangachaur | 71.2 | 1 | 71.2 | ASO | 2x300 | 1962 |
| 8 | 220 | Sangachaul | Khirdalan | 45.1 | 1 | 45.1 | ASO | 2x300 | 1962 |
| 9 | 220 | Mushfig | Khirdalan | 15.0 | 1 | 15.0 | ASO | 2x300 | 1988 |
| 10 | 220 | Absheron | Govsany | 82.6 | 1 | 82.6 | ASO | 1x500 | 1976 |
| 11 | 220 | Khirdalan | Govsany | 41.0 | 1 | 41.0 | ASO | 1x500 | 1976 |
| 12 | 220 | Absheron | Khirdalan | 24.0 | 1 | 24.0 | ASO | 1x300 | 1949 |
| 13 | 220 | Absheron | Khirdalan | 24.0 | 1 | 24.0 | ASO | 1x300 | 1954 |
| 14 | 220 | Absheron | Yashma | 35.0 | 1 | 35.0 | ASO | 1x500 | 1979 |
| 15 | 220 | Absheron | Khirdalan | 25.0 | 1 | 25.0 | ASO | 1x500 | 1995 |
| | (Total) | | | | | 1,138.9 | | | |

(Source : Azenerji)

Appendix I.3.3-1 Annual Energy Generation by Power Stations and System Peak

| No. | Power Station | Annual Energy Production in GWh | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| 1 | Azerbaijan GRES | 10,613 | 11,833 | 9,680 | 8,650 | 8,650 | 8,384 | 9,760 | 8,110 | 10,090 | 10,157 |
| 2 | Ali Bayramli GRES | 6,446 | 6,300 | 5,523 | 5,260 | 4,723 | 4,830 | 5,103 | 5,636 | 4,732 | 5,348 |
| 3 | Severnaya GRES | 985 | 794 | 498 | 668 | 591 | 599 | 300 | 393 | 304 | 324 |
| 4 | Sumgait TETS No.1 | 1,250 | 1,046 | 1,024 | 752 | 705 | 831 | 478 | 417 | 440 | 371 |
| 5 | Sumgait TETS No.2 | 1,245 | 1,073 | 849 | 802 | 654 | 477 | 324 | 285 | 292 | 288 |
| 6 | Baku TETS No.1 | 427 | 346 | 243 | 298 | 236 | 194 | 147 | 131 | 79 | 63 |
| 7 | Baku TETS No.2 | 74 | 61 | 53 | 48 | 40 | 32 | 36 | 20 | 6 | 7 |
| 8 | Ganja TETS | 156 | 127 | 55 | 58 | 55 | 54 | 0 | 0 | 0 | 0 |
| 9 | Krasin GRES | 201 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | (Thermal Total) | 21,397 | 21,598 | 17,925 | 16,536 | 15,654 | 15,401 | 16,148 | 14,992 | 15,943 | 16,558 |
| 1 | Mingechaur GES | 869 | 887 | 745 | 1,227 | 1,126 | 797 | 737 | 739 | 1,104 | 807 |
| 2 | Shamkir GES | 593 | 723 | 849 | 1,011 | 548 | 638 | 698 | 875 | 772 | 642 |
| 3 | Araz GES | 99 | 92 | 141 | 156 | 145 | 111 | 96 | 93 | 73 | 55 |
| 4 | TerTer GES | 82 | 4 | 3 | 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | Small Hydro | 15 | 12 | 11 | 10 | 10 | 10 | 7 | 5 | 2 | 2 |
| | (Total Hydro) | 1,658 | 1,718 | 1,749 | 2,426 | 1,829 | 1,556 | 1,538 | 1,712 | 1,951 | 1,506 |
| | (Generation Total) | 23,055 | 23,316 | 19,674 | 18,962 | 17,483 | 16,957 | 17,686 | 16,704 | 17,894 | 18,064 |
| (Impot) - (Export) | | -1,604 | -1,703 | -631 | 47 | 276 | 477 | 461 | 739 | 255 | 752 |
| | Import in GWh | 0 | 0 | 0 | 494 | 540 | 886 | 801 | 1,288 | 903 | 1,172 |
| | Export in GWh | 1,604 | 1,703 | 631 | 447 | 264 | 409 | 340 | 549 | 648 | 420 |
| Total Energy Input to Azeri | | 21,451 | 21,613 | 19,043 | 19,009 | 17,759 | 17,434 | 18,147 | 17,443 | 18,149 | 18,816 |
| Maximum output of own generation | | 4,080 | 3,923 | 3,571 | 3,334 | 3,173 | 3,118 | 2,963 | 3,025 | 3,215 | 3,188 |
| System Peak in MW | | 3,676 | 3,921 | 3,513 | 3,365 | 3,213 | 3,098 | 3,195 | 3,350 | 3,452 | 3,536 |

(Sourse : Azenerji)

Remarks

(a) Energy generated by Varvara hydro power station is included in the energy generated by Mingechaur P/S.

Appendix I.3.3-2 Monthly Energy Production by Plant (1998)

| No. | Power Station | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thermal Power Plant | | | | | | | | | | | | | | |
| 1 | Az-Gres | 1,022 | 918 | 978 | 792 | 650 | 549 | 637 | 792 | 837 | 908 | 993 | 1014 | 10,090 |
| 2 | Ali Bayramli | 538 | 453 | 519 | 353 | 310 | 207 | 331 | 324 | 294 | 383 | 449 | 572 | 4,733 |
| 3 | Severnaya | 53 | 50 | 54 | 22 | 0 | 0 | 0 | 0 | 0 | 39 | 49 | 38 | 305 |
| 4 | Sumgait-1 | 66 | 46 | 43 | 29 | 26 | 18 | 20 | 23 | 23 | 37 | 43 | 67 | 441 |
| 5 | Sumgait-2 | 24 | 25 | 26 | 22 | 23 | 19 | 15 | 20 | 19 | 25 | 29 | 46 | 293 |
| 6 | Baku-1 | 15 | 18 | 10 | 3 | 0 | 0 | 0 | 1 | 3 | 4 | 11 | 14 | 79 |
| 7 | Baku-2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| | Thermal Total | 1,719 | 1,511 | 1,631 | 1,222 | 1,009 | 793 | 1,003 | 1,160 | 1,176 | 1,396 | 1,574 | 1,752 | 15,946 |
| Hydrppower Plant | | | | | | | | | | | | | | |
| 8 | Mingechaur | 126 | 126 | 130 | 80 | 72 | 75 | 95 | 92 | 64 | 71 | 78 | 95 | 1,104 |
| 9 | Shamkir | 63 | 42 | 50 | 49 | 107 | 135 | 47 | 44 | 54 | 70 | 38 | 71 | 770 |
| 10 | Araz | 11 | 10 | 8 | 3 | 6 | 5 | 7 | 6 | 3 | 4 | 4 | 8 | 75 |
| | Hydro Total | 200 | 178 | 188 | 132 | 185 | 215 | 149 | 142 | 121 | 145 | 120 | 174 | 1,949 |
| Total Generation | | 1,919 | 1,689 | 1,819 | 1,354 | 1,194 | 1,008 | 1,152 | 1,302 | 1,297 | 1,541 | 1,694 | 1,926 | 17,895 |
| Power Exchange | | | | | | | | | | | | | | |
| | Import | 58 | 52 | 58 | 67 | 145 | 184 | 93 | 43 | 44 | 44 | 57 | 57 | 902 |
| | Export | 77 | 68 | 77 | | 0 | 0 | 0 | 72 | 82 | 103 | 94 | 74 | 647 |
| | Total | -19 | -16 | -19 | 67 | 145 | 184 | 93 | -29 | -38 | -59 | -37 | -17 | 255 |
| | | | | | | | | | | | | | | (Max) |
| Net Energy Input to Azeri | | 1,900 | 1,673 | 1,800 | 1,421 | 1,339 | 1,192 | 1,245 | 1,273 | 1,259 | 1,482 | 1,657 | 1,909 | 1,909 |
| | % against Max | 99.5 | 87.6 | 94.3 | 74.4 | 70.1 | 62.4 | 65.2 | 66.7 | 66.0 | 77.6 | 86.8 | 100.0 | |
| Peak Power (MW) | | | | | | | | | | | | | | (Max) |
| | Max. Generated Power | 3,100 | 3,115 | 3,075 | 2,895 | 2,487 | 2,087 | 2,033 | 2,223 | 2,353 | 2,733 | 2,908 | 3215 | 3,215 |
| | % against Max | 96.4 | 96.9 | 95.6 | 90.0 | 77.4 | 64.9 | 63.2 | 69.1 | 73.2 | 85.0 | 90.5 | 100.0 | |
| | System Peak | 3,401 | 3,426 | 3,354 | 3,237 | 2,824 | 2,463 | 2,449 | 2,506 | 2,654 | 2,890 | 3,190 | 3452 | 3,452 |
| | % against Max | 98.5 | 99.2 | 97.2 | 93.8 | 81.8 | 71.3 | 70.9 | 72.6 | 76.9 | 83.7 | 92.4 | 100.0 | |

Sourse : Azenerji

Appendix I.3.3-3 Annual Energy Used for Generation by Power Stations

| No. | Power Station | Annual Energy Used for Production in GWh | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| 1 | Azerbaijan GRES | 371 | 400 | 446 | 385 | 361 | 377 | 359 | 412 | 380 | 433 |
| 2 | Ali Bairamli GRES | 455 | 433 | 429 | 402 | 377 | 370 | 370 | 380 | 411 | 352 |
| 3 | Severnaya GRES | 81 | 74 | 62 | 38 | 52 | 55 | 53 | 34 | 42 | 34 |
| 4 | Sumgait TETS No.1 | 200 | 205 | 187 | 136 | 123 | 127 | 119 | 77 | 62 | 61 |
| 5 | Sumgait TETS No.2 | 161 | 156 | 153 | 143 | 134 | 112 | 88 | 52 | 44 | 49 |
| 6 | Gaku TETS No.1 | 86 | 86 | 93 | 83 | 85 | 80 | 70 | 67 | 62 | 36 |
| 7 | Baku TETS No.2 | 18 | 20 | 19 | 22 | 20 | 19 | 15 | 14 | 10 | |
| 8 | Krain GRES | 26 | 18 | 3 | | | | | | | |
| 9 | Ganja TETS | 68 | 62 | 67 | 44 | 45 | 26 | 24 | | | |
| 10 | Mingechaur | | | | | | | | | | |
| 11 | Shamkir | 8 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 12 | Araz | | | | | | | | | | |
| 13 | Tartar | | | | | | | | | | |
| | Total | 1,474 | 1,461 | 1,465 | 1,259 | 1,203 | 1,172 | 1,104 | 1,042 | 1,017 | 971 |

Source : Azenerji

Remarks :

1) GRES means Condenser Thermal Power Plant.

2) TETS means Co-generate Thermal Power Plant.

3) GES meansHydro Power Plant

4) Mingechaur includes Varvara GES as Hydro Power Plants cascade.

Appendix I.3.4-1 Historical change in electricity tariff by tariff category in Azerbaijan

| Effective on | 11/23/93 | 3/1/94 | 6/15/94 | 10/25/94 | 11/22/94 | 2/1/95 | 4/21/95 | 7/15/96 | 9/25/96 | 11/21/96 | 4/1/97 | 10/10/97 | 7/1/98 | 1/1/99 | 7/1/00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | AZM/kWh | | | | | | | | | | | | | | |
| | (USC/kWh) | | | | | | | | | | | | | | |
| Industry <750kVA | 2.6 | 4.3 | 10.9 | 38.1 | 51.4 | 141.5 | 184.0 | 184.0 | 184.0 | 184.0 | 184.0 | 183.0 | 160.0 | 160.0 | 130.0 |
| | (2.18) | (0.25) | (1.11) | (1.92) | (1.79) | (3.26) | (4.19) | (4.29) | (4.35) | (4.39) | (4.57) | (4.66) | (4.14) | (4.11) | (2.92) |
| Electric railway | 2.6 | 4.2 | 10.6 | 37.2 | 50.2 | 138.1 | 184.0 | 184.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 130.0 |
| | (2.18) | (0.24) | (1.08) | (1.87) | (1.75) | (3.18) | (4.19) | (4.29) | (4.68) | (4.77) | (4.91) | (5.05) | (5.13) | (5.08) | (2.92) |
| City transport & water company | 1.9 | 3.0 | 7.6 | 26.6 | 35.9 | 98.7 | 128.0 | 128.0 | 140.0 | 140.0 | 140.0 | 140.0 | 132.0 | 132.0 | 130.0 |
| | (1.60) | (1.72) | (0.77) | (1.34) | (1.25) | (2.28) | (2.91) | (2.98) | (3.31) | (3.37) | (3.48) | (3.57) | (3.42) | (3.39) | (2.92) |
| Budget organization | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 160.0 | 130.0 |
| | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | (4.11) | (2.92) |
| Non-industry | 3.6 | 5.8 | 14.8 | 51.7 | 69.8 | 191.9 | 250.0 | 250.0 | 264.0 | 264.0 | 264.0 | 265.0 | 265.0 | 265.0 | 130.0 |
| | (3.02) | (3.35) | (1.51) | (2.60) | (2.44) | (4.43) | (5.69) | (5.82) | (6.25) | (6.36) | (6.55) | (6.76) | (6.86) | (6.80) | (2.92) |
| Commerce, trade and service | 4.6 | 7.6 | 19.2 | 67.3 | 90.9 | 250.0 | 325.0 | 325.0 | 338.0 | 338.0 | 338.0 | 340.0 | 340.0 | 340.0 | 130.0 |
| | (3.86) | (4.36) | (1.96) | (3.39) | (3.17) | (5.77) | (7.39) | (7.57) | (7.90) | (8.15) | (8.39) | (8.67) | (8.81) | (8.72) | (2.92) |
| Agriculture | 1.4 | 2.4 | 5.9 | 20.8 | 28.1 | 77.5 | 100.0 | 120.0 | 138.0 | 138.0 | 138.0 | 150.0 | 140.0 | 140.0 | 130.0 |
| | (1.18) | (1.35) | (0.61) | (1.05) | (0.98) | (1.79) | (2.27) | (2.80) | (3.26) | (3.33) | (3.43) | (3.82) | (3.63) | (3.59) | (2.92) |
| Wholesale<br>Î ï õï âû å êî ì ï àí èè | -- | 1.9 | 3.5 | 8.1 | 11.0 | 32.5 | 42.5 | 60.0 | 64.0 | 67.0 | 74.3 | 82.0 | 80.0 | 72.0 | 72.0 |
| | -- | (1.07) | (0.36) | (0.41) | (0.38) | (0.75) | (0.97) | (1.40) | (1.51) | (1.62) | (1.84) | (2.09) | (2.07) | (1.85) | (1.62) |
| Residential (VAT inclusive) | 0.3 | 0.4 | 1.0 | 2.0 | 2.7 | 10.0 | 18.0 | 36.0 | 40.0 | 50.0 | 75.0 | 96.0 | 96.0 | 96.0 | 96.0 |
| | (0.25) | (0.23) | (0.10) | (0.10) | (0.09) | (0.23) | (0.41) | (0.84) | (0.95) | (1.21) | (1.86) | (2.45) | (2.49) | (2.46) | (2.15) |
| Exchange rate AZM/US$ | 119.1 | 174.2 | 980.0 | 1,987.5 | 2,866.0 | 4,336.0 | 4,396.0 | 4,292.3 | 4,227.0 | 4,184.3 | 4,028.0 | 3,923.0 | 3,861.0 | 3,896.9 | 4,456.0 |

Source: Azenerji, BEN and JICA study team calculation

Appendix I.3.6-1 Power Demand Forecast by Azerenerji

(Unit : GWh)

| Item | 1998 | 1999 | 2000 | 2005 | 2010 | 2020 |
|---|---|---|---|---|---|---|
| Power Generation | 17,895 | 18,430 | 19,000 | 21,940 | 25,259 | 30,350 |
| Import | 1,313 | 1,300 | 1,300 | 1,500 | 1,500 | 2,040 |
| Export | 1,063 | 1,050 | 1,050 | 1,500 | 1,500 | 2,250 |
| Import - export | 250 | 250 | 250 | 0 | 0 | -210 |
| | | | | | | |
| Total demand | 18,145 | 18,680 | 19,250 | 21,940 | 25,259 | 30,140 |
| Losses (%) | 16.7 | 16.0 | 16.0 | 14.0 | 13.0 | 13.0 |
| Needs in the system | 976 | 975 | 970 | 1,107 | 1,272 | 1,520 |
| Net demand | 14,139 | 14,716 | 15,200 | 17,761 | 20,703 | 24,702 |
| Industry | 2,340 | 2,600 | 2,800 | 4,700 | 6,690 | 9,500 |
| Construction | 360 | 400 | 550 | 680 | 780 | 790 |
| Transportation | 320 | 360 | 500 | 640 | 700 | 760 |
| Agriculture | 1,630 | 1,700 | 1,900 | 2,160 | 2,950 | 4,040 |
| Residential | 9,070 | 9,240 | 9,300 | 9,450 | 9,500 | 9,612 |
| Commercial | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | 419 | 416 | 150 | 131 | 83 | - |

Source : Azenerji

Appendix I.3.7-1 Azerenerji's Development Plan of Power Generation facilities

| Year | Projects | Cange in total capacity (MW) | Total Effective Capacity (MW) | Forecast Peak Load (MW) | Capacity Reserve (MW) |
|---|---|---|---|---|---|
| 1995 | Removal of the Ganja PS from the operation | -70 | 4,161 | - | - |
| 1995 | Reduction of the Baku TPP capacities | -50 | 4,111 | 2,969 | 38.4 |
| 1996 | Reduction of Sumgait TPP-1 capacities (phase 1). | -100 | 4,001 | 3,151 | 27.0 |
| 1997 | Rehabilitation of Azerbaijan HPS capacity (phase 1) | 100 | 4,101 | - | - |
| 1997 | Reduction the Sumgait TPP-2 capacities | -50 | 4,051 | 3,320 | 22.0 |
| 1998 | Rehabilitation of the rated capacity of Azerbaijan HPS (phase 2) | 100 | 4,151 | 3,452 | 20.2 |
| 1999 | Rehabilitation of the rated capacity of Azerbaijan HPS (phase 3) | 112.5 | 4,261 | - | - |
| 1999 | Completioin of the Yenikend HPS construction | 100 | 4,361 | - | - |
| 1999 | Reconstruction of Mingechaur HPS (phase 1) | 70 | 4,431 | 3,625 | 22.2 |
| 2000 | Rehabilitation of the rated capacity of Azerbaijan HPS (phase 4) | 300 | 4,731 | - | - |
| 2000 | Operatrion Start of Power Unut (No 9) of Azerbaijan HPS | 100 | 4,831 | - | - |
| 2000 | Reconstruction of Mingechaur HPS (phase 2) | 70 | 4,901 | 3,815 | 28.4 |
| 2001 | Removal of Baku TPP-2 from opertion | -24 | 4,877 | - | - |
| 2001 | Reduction of Sumgait TPP-1 capacity (phase 2) | -100 | 4,777 | 3,985 | 20.0 |
| 2002 | Operatrion start of new steam-and-gas unit with 400 MW capacity at Severnaya HPS | 400 | 5,177 | - | - |
| 2002 | Operatoin start of new wind PS with capacity of 30 MW | 30 | 5,207 | 4,155 | 25.3 |
| 2003 | Operation start of two new gas-turbine units of 50MW capacity each at Baku TPP | 100 | 5,307 | - | - |
| 2003 | Removal of the old equepment from Baku TPP (phase 2) | -50 | 5,257 | 4,300 | 22.2 |
| 2004 | Operation start of new steam-and-gas unit in capacity of 400 MW at Sumgait TPP | 400 | 5,657 | - | - |
| 2004 | Removal of of the old power unit in capacity of 150 MW at Severnaya HPS | -130 | 5,527 | - | - |
| 2004 | Removal of the old equepment from Sumgait TPP-2 | -150 | 5,377 | 4,440 | 21.1 |
| 2005 | Operation start of new steam-and-gas unit (No 2) in capacity of 400 MW at Severnaya HPS | 400 | 5,777 | - | |
| 2005 | Removal of the old equipment from the Ali-Bayramly HPS 2x150 MW (phase 1) | -230 | 5,547 | 4,580 | 21.1 |
| 2006 | Operatoin start of the Ordubad HPS in capacity of 3 x 10 MW | 30 | 5,577 | - | - |
| 2006 | Operatoin start of the Sheki HPS in capacity of 3 x 1.2 MW | 3 | 5,580 | 4,680 | 19.2 |
| 2007 | Operation start of the new steam-and-gas unit in capacity of 400 MW (for area south from Absheron peninsula) | 400 | 5,980 | - | - |
| 2007 | Removal of the old equipment from the Ali-Bayramly HPS 2x150 MW (phase 2) | -230 | 5,750 | 4,780 | 20.2 |
| 2008 | Operaton start of the Tovuz HPS 3 x 126 MWt | 380 | 6,130 | - | - |
| 2008 | Removal of the old equipment from the Ali-Bayramly HPS 1x150 MW (phase 3) | -110 | 6,020 | 4,900 | 22.8 |
| 2009 | | 0 | 6,020 | 5,020 | 22.3 |
| 2010 | Ooperation start of new steam-and-gas unit (No 2) in capacity of 400 MW | 400 | 6,420 | - | |
| 2010 | Removal of the old equipment from the Ali-Bayramly HPS 2x150 MW (phase 4) | -230 | 6,190 | 5,140 | 20.4 |

Source : Azenerji

# CHAPTER 4

# AZENERJI'S POWER SUPPLY TO BAKU CITY

# CHAPTER 4 AZENERJI'S POWER SUPPLY TO BAKU CITY

## 4.1 General

Each of the three cities of Baku, Sumgait and Ganja has a dual electric power supply system, by which power is supplied by city organizations as well as directly by Azenerji for the non-residential consumers. In Baku, some non-residential consumers are served directly by Azenerji with power through 35 kV, 20 kV, 10 kV and 6 kV medium voltage distribution lines. Azenerji wholesales in bulk the power stepped down to 10 kV and 6 kV at the 110 kV and 35 kV substations to BEN. BEN distributes the purchased power through its own 10 kV and 6 kV distribution system, and sells the power to consumers through 0.4 kV low voltage distribution network.

There are two types of borderlines between BEN's and the Azenerji's jurisdiction. One borderline is at the secondary side of the transformers of the 110 kV and 35 kV substations. The other is at the sending ends of 10 kV and 6 kV feeder exit of the substations. The former case is often seen in relatively older substations in the central part of Baku, while the latter case is found at relatively newer substations established by Azenerji. In the former case, the 10 kV or 6 kV switchgears in the substations are owned, operated and managed by BEN. Such dual system is considered to be initiated at the time of BEN's separation from Azenerji 40 years ago. The substations, which were constructed after the separation, are mostly owned and operated by Azenerji.

## 4.2 Organization of Azenerji

The area under the control of Azenerji is the Absheron peninsular except the city of Sumgait, covering a population of 1.8 million and an area of 2,140 km$^2$. To this area, the two regional offices of Azenerji, Central Power and Heat Network Enterprise (CPHNE) and Absheron Power and Heat Network Enterprise (APHNE), are managing the electricity supply. The area managed by APHNE is the tip of the Absheron peninsular, including almost the total of Sabunnchi, Surakane, Azizbayov administrative areas and the parts of Nizami and Khatai areas. CPHNE is handling the bottom of the Peninsular including the central part of Baku. These regional offices are conducting operation and maintenance work of transmission, substation and distribution facilities in respective regions and load dispatching and sales activities of below 110 kV system and the wholesale of electricity to BEN.

The headquarters of Azenerji manages the planning, design and construction of the electric power facilities.

The activities of the regional offices are limited to small-scale repair and maintenance work. The organization chart of APHNE is shown in Figure I.4.2-1. The staffing of the two regional offices (as of end 1998) are given in Table I.4.2-1.

Table I.4.2-1 Staffing of Azenerji

| Type of staff | CPHNE | APHNE | Total |
|---|---|---|---|
| Administrative & Specialist | 251 | 177 | 428 |
| - Leaders | 70 | 60 | 130 |
| - Specialist | 181 | 117 | 298 |
| Workers | 345 | 242 | 487 |
| Others | 3 | 4 | 7 |
| Total | 599 (150) | 423 (85) | 1,022 (235) |

(Source: Azenerji, CPHNE and APHNE) Notes: The numbers in parentheses indicate female staff.

## 4.3 Power Supply System of Azenerji

Severnaya thermal plant, and Baku-1 and Baku-2 CHP supply electric power, heated water, and steam (particularly to surrounding factories) to Baku City. The operation and maintenance work for these plants are undertaken by other organizations for power generation. In this section, the condition of power transporting system including transmission lines, substations and distribution network is explained.

### 4.3.1 Transmission System

Table I.4.3-1 shows the total length of transmission lines by voltage in each branch. Appendix I.4.3-1 also shows the details. The 500 kV transmission line is a part of the lines between the nations largest Az-Gres thermal power station and Absheron substation. The 330 kV transmission line is also a part of the lines both between the Az-Gres thermal power station and Absheron substation, and between the Ali Bayramli thermal power station and Yashma substation. The 330 kV line between the Az-Gres thermal power station and Absheron substation is designed on 500 kV basis. The network system is outlined in Figure I.4.3-1.

Table I.4.3-1 Line length of CPHNE and APHNE (unit : circuit-km)

| Voltage | CPHNE | APHNE | Total |
|---|---|---|---|
| 500 kV | 57 | - | 57 |
| 330 kV | 109 | - | 109 |
| 220 kV | 414 | 71 | 485 |
| 110 kV | 421 | 332 | 753 |
| Total | 1,001 | 403 | 1,404 |

(Source: Azenerji, CPHNE and APHNE)

All the 220 kV transmission lines are overhead lines. Substations are linked with single circuit line, except between the Absheron 500 kV substation and Khirdalan 220 kV substation (though this section is linked with quartet circuit line, one circuit line is not linked with the Khirdalan substation). The 220 kV transmission system, however, does not seem to be reliable, because the use of circuit breakers is minimized with a number of Pi-form branches installed in the line. All the 110 kV transmission lines are also overhead lines and used as power distribution transmission lines. The major substations are linked with double circuit each other. Substations in the middle of the major substations are connected by double circuit with T-form branch.

The supporting structures of transmission lines are, in many cases, steel tower. Concrete poles or even wooden poles are used in some parts. Steel materials in most towers are not galvanized and rusted except the newly constructed towers.

### 4.3.2 Substation

Table I.4.3-2 and Appendix I.4.3-2 presents an outline of the substations in Baku City.

Table I.4.3-2 Transformer capacities by network and voltage

| Item | Voltage | CPHNE | APHNE | Total |
|---|---|---|---|---|
| Number of Substation | 500/330 kV | 1 | - | 1 |
| | 220 kV | 3 | 2 | 5 |
| | 110 kV | 18 | 17 | 35 |
| | Total | 22 | 19 | 41 |
| Transformer Capacity (primary voltage) | 500 kV | 534 MVA | - | 534 MVA |
| | 300 kV | 266 MVA | - | 266 MVA |
| | 220 kV | 1,196 MVA | 550 MVA | 1,746 MVA |
| | 110 kV | 1,320 MVA | 1,237 MVA | 2,557 MVA |
| | Total | 3,316 MVA | 1,787 MVA | 5,103 MVA |

(Source: Azenerji, CPHNE and APHNE)

Concrete poles are used as the cable supporting structure in the substations except the newly constructed substations. It is often seen that equipment in the substations is supported by concrete structures. Many cases where equipment is installed in an unsatisfactory manner are observed. The grounding of the neutral points of the transformers are attached directly to the ground.

### 4.3.3 Distribution System

The medium voltage distribution system of Azenerji is composed of 35 kV, 20 kV, 10 kV and 6 kV facilities. An outline of the medium voltage distribution facilities by regional branch is shown in Table I.4.3-3. In Appendix I.4.3-3, the substation facilities, which serve to supply energy to BEN in the Study area, are presented and the detail of distribution lines connected to those substations is provided in Appendix I.4.3-4, with their location shown in Figure I.4.3-2.

The 35 kV lines in the suburbs are more often overhead, while those in downtown are rather underground.

Table I.4.3-3 Medium voltage distribution facilities by regional branch

| Item | Voltage | CPHNE | APHNE | Total |
|---|---|---|---|---|
| Line length | 35 kV (O/H) | 368.0 km | 396.4 km | 764.4 km |
| | 35 kV (U/G) | 92.5 km | 9.2 km | 101.7 km |
| | 20 kV (O/H) | 29.0 km | 47.6 km | 76.6 km |
| | 20 kV (U/G) | 5.4km | 15.0 km | 20.4 km |
| | 10 kV (O/H) | - | 13.6 km | 13.6 km |
| | 10 kV (U/G) | 5.1 km | 1.0 km | 6.1 km |
| | 6 kV (O/H) | - | 85.4 km | 85.4 km |
| | 6 kV (U/G) | - | 6.5 km | 6.5 km |
| | Total | 500.0 km | 574.7 km | 1,747 km |
| Transformer capacity | 35 kV | 888.2 MVA | 728.7 MVA | 1,616.9 MVA |
| | 20 kV | 106.7 MVA | 114.2 MVA | 220.9 MVA |
| | 10 kV | 2.0 MVA | 37.6 MVA | 37.8 MVA |
| | 6 kV | 0.8 MVA | (included 10 kV) | (included 10 kV) |
| | Total | 997.7 MVA | 880.5 MVA | 1,878.2 MVA |

(Source: Azenerji CPHNE and APHNE)

### 4.3.4 Network System Control

The Regional Dispatching Services (RDS), managing the 110 kV and below system of Azenerji, are established by each branch office. Those of CPHNE and APHNE are in the Khirdalan 110 kV substation and the Surakane 220 kV substation respectively. This is because the RDS of APHNE is very old and deteriorated and it is hardly working now, the new RDS is now under construction in the yard of APHNE office. At present the interior construction work is nearly completed and a part of the graphic panel is already carried in. The completion time is, however, not clear because of the shortage of the budget.

The RDS is composed of the graphic panel, dispatching table and communication equipment similar to the NLDC as mentioned in Section 3.2.4. The RDS of CPHNE is doubling as the control room of the substation and two load-dispatchers are working for 24 hours on a four-shift a day basis. Besides, two operation and maintenance staffs of the substation are working.

The graphic panel of the RDS of CPHNE has a size of 3x18 m and the transmission lines and substations of 500 kV, 330 kV, 220 kV, 110 kV, and 35 kV in the supply area are displayed and classified by color on the mosaic panel. Although the facilities of the RDS of CPHNE are newer than that of the NLDC, it is incomplete and the switch indicators such as circuit breakers are equipped on the panel but the back wiring of them are not connected. The pushbutton switch disk for the operation is installed on the panel, it is, however, incomplete and not functioning at all. There are no measuring instruments at all such as voltmeter and watt-meter except for the frequency-meter on the panel and they are not planning to install. The automatic record equipment for the operation data is also not installed. There are communication instruments such as telephone and radio equipment in the RDS and the load-dispatchers confirm the situation of each substation and issue the operation command through them. The indications of open/close position of the switchgears are switched manually by the load-dispatchers. The accident record, recovery records and system operation commands are recorded to the notebook each time.

The facilities of the RDS of APHNE are very old in comparison with that of CPHNE. Just the main transmission network is displayed on the graphic panel and there is no equipment for indicating the system condition. The operation of the system is drawn on the past experience and storage of the load-dispatchers and the elderly load-dispatchers confirm the situation of each substation and issue the operation command through the telephone and radio equipment.

## 4.4 Power Supply and Demand

In Baku City, Azenerji is in charge of energy supply to large customer including factories except residential customers (however, wholesale to a part of the apartments is undertaken) as well as wholesale supply to BEN. Power supply and demand condition in Baku, therefore, needs to be analyzed, considering the condition in Azenerji's part as well.

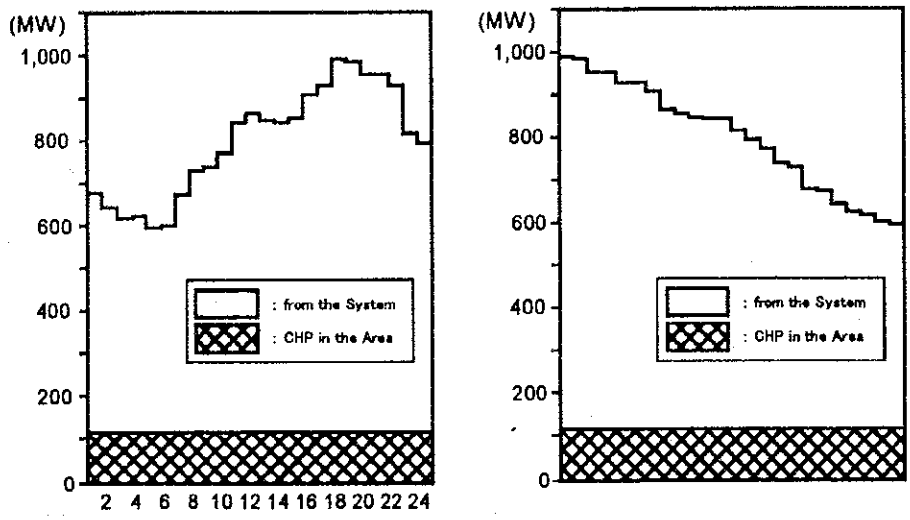
### 4.4.1 Power Supply by Azenerji

#### (1) Load curve

Most of the energy consumption in Baku is generated by the Az-Gres and Ali Bayramli Thermal Power Plants and a group of hydropower stations of the Kura River System and supplied through the transmission system described in Section 4.3.1 to Baku. The Severnaya Thermal Power Plant and co-generation plants supplement the energy supply to Baku.

Daily load curve, an indicator of the energy balance situation in Baku, can be drawn based on the power supply to Baku through 220 kV transmission lines, and power sent to Sumgait City through 110 kV transmission lines and power output by the power plants located in Baku.

Figure I.4.4-1 presents the daily load curve and a daily load duration curve on December 16, 1998 in Baku area, when hourly measurement and recording were carried out on a nationwide. Usually measurement is carried out by a four to five hour interval. According to this, the peak load on that day was 990 MW, equivalent to around 30 % of the peak load (3,353 MW) of Azerbaijan's network system excluding Nakhichevan region. The daily load factor on that day is 80 %.




(a) Daily Load Curve (b) Daily Load Duration Curve

Figure I.4.4-1 Daily Load Curve in Baku City (Dec. 16 1998)

## (2) Energy supply amount

Annual energy generation amount by the power plants consolidated for identifying the daily load curve explained above and annual energy supply amount through transmission lines are shown in Table I.4.4-1.

Table I.4.4-1 Energy supply amount to Baku City (GWh)

| Items | 1998 | 1999 |
|---|---|---|
| (1)Energy generation by the power plants in Baku City | 389.0 | 394.0 |
| (2)Energy supply through transmission lines | 5,525.9 | 5,182.6 |
| (3)Energy sent out by transmission lines | 445.3 | 370.6 |
| (4) Total energy supply to Baku City | 5,469.6 | 5,206.0 |

From the above explanation, the annual load factor in 1998 is estimated as 63.1 %.

## (3) Annual load factor

The above mentioned annual load factor is derived by combining Azenerji's own demand mainly comprising of industrial demand (around 70%) and transportation demand (around 14%), and BEN's demand represented by residential demand (accounting for 80% in 1998). The load curve for the former is characterized with high load factor and its peak during daytime, and the latter is with a low factor and its peak during night. Furthermore, the former is less influenced by a seasonal fluctuation of demand, but the latter is strongly influenced due to a heating demand during winter season. These situations have made the difference of the annual load factors for each much wider. Considering these factors, annual load factor for Azenerji's own demand is assumed as 80 % and for BEN's demand as 55 % in this Study. Then, the peak load for each is derived as 235 MW and 755 MW respectively.

### 4.4.2 Energy Consumption by Azenerji's Customers

#### (1) Energy sales amounts

Energy sales amount in Baku in 1998 was 4,953.4 GWh, comprising 34.7% of total sales amount of Azerbaijan. Excluding the wholesale amount to BEN, the figure amounts to 1,634.8 GWh (33% of total demand in Baku). Of the figure, 877.6 GWh was consumed by the central part in Baku. Table I.4.4-2 presents the energy sales amount during 1997-1999, and the detail is shown in Appendix I.4.4-1. Although the average annual growth rate of wholesale amount to BEN represents very high figure, the retail sales amount of Azenerji regional branch which has little residential customer has been grown less due to the lowering in industrial activity.

Table I.4.4-2 Energy sales amount of Azenerji's regional branch in Baku City (unit: GWh)

| Category | 1997 | 1998 | | 1999 | |
|---|---|---|---|---|---|
| | Energy sales | Energy Sales | Growth rate (%) | Energy Sales | Growth rate (%) |
| Wholesale | 2,934.4 | 3,318.6 | 13.1 | 3,610.2 | 8.8 |
| Industry | 1,236.0 | 1,150.1 | -7.0 | 949.7 | -17.4 |
| Non-industry | 70.4 | 60.2 | -14.5 | 33.8 | -43.9 |
| Commercial | 9.2 | 17.5 | 90.0 | 22.8 | 30.2 |
| Transportation | 138.9 | 223.5 | 61.0 | 265.4 | 18.7 |
| Others | 206.2 | 183.5 | -10.8 | 214.1 | 16.7 |
| Total | 4,595.1 | 4,953.4 | 7.8 | 5,095.9 | 2.9 |
| Exc. wholesale | 1,660.7 | 1,634.8 | -1.6 | 1,485.7 | -9.1 |

(Source: Azenerji, CPHNE and APHNE)

#### (2) Losses

The transmission and distribution loss by Azenerji in Baku City is thus estimated as 516 GWh in 1998, equivalent to 9.4 % of total energy supply to Baku, and 3.0 % of total supply to Azerbaijan. This value also accounts for 17.7 % of total transmission and distribution loss by Azenerji (2,911 GWh). The loss value 9.4 % is considered as very high, taking into account that BEN's (bulk energy buyer at 10 and 6 kV) consumption accounts for 67 % (in 1998) of total consumption in the area.

#### (3) Energy wholesales to Baku City (BEN)

Energy wholesales to BEN from Azenerji is made through more than 80 feeders of 10 and 6 kV. The record of power purchases on BEN side is kept by every administrative district (Sabail, Yasamal, Nasimi, Narimanov, and Binagady) and the rest of network branches. Among the Study area, the power supply condition in the 4 administrative districts is not clear enough. To understand the power supply amounts to every 6 administrative districts in the Study area, the wholesale amounts to each of those districts which was recorded by each Azenerji's substations is shown in Table I.4.4-3. The figures in the table, however, are only for reference use to estimate energy use condition. The figure was derived by taking into account in which district the concerned substations are located. In other words, as there are some substations which supplies to more than one administrative districts, the figure does not necessarily represent accurate power supply situation of each district.

Table I.4.4-3 Energy wholesales amount to each district (1998)

| Districts | Energy amount (GWh) |
|---|---|
| Study Area | |
| Sabail | 275.3 |
| Yasamal | 310.5 |
| Nasimi | 455.6 |
| Narimanov | 98.3 |
| Nizami | 162.3 |
| Khatai | 459.5 |
| Other districts | 1,557.1 |
| Total | 3,318.6 |

### (4) The number of customer

Table I.4.4-4 shows the number of customer in Azenerji. Non-industry in the table comprises public facility including schools, hospitals, athletic facility, and governmental and local governmental. It should be noted, however, that BEN covers public facilities for general resident. While, the facilities in Azenerji's "non-industry" category are mainly schools and hospitals for military personnel. "Residential" category in Azenerji mainly comprises the wholesale to apartments and settlements.

Table I.4.4-4 The number of customer in Azenerji (1998)

| Tariff category | CPHNE | APHNE | Total |
|---|---|---|---|
| Wholesale (BEN) | 1 | 1 | 2 |
| Residential (inc. apartment) | 6 | 11 | 17 |
| Industry | 187 | 187 | 374 |
| Non-industry | 54 | 14 | 68 |
| Commerce | 32 | 31 | 63 |
| Transport | 4 | 4 | 8 |
| Agriculture | 3 | 29 | 32 |
| Others | 2 | 30 | 32 |
| Total | 289 | 307 | 596 |

(Source: Azenerji, CPHNE and APHNE)

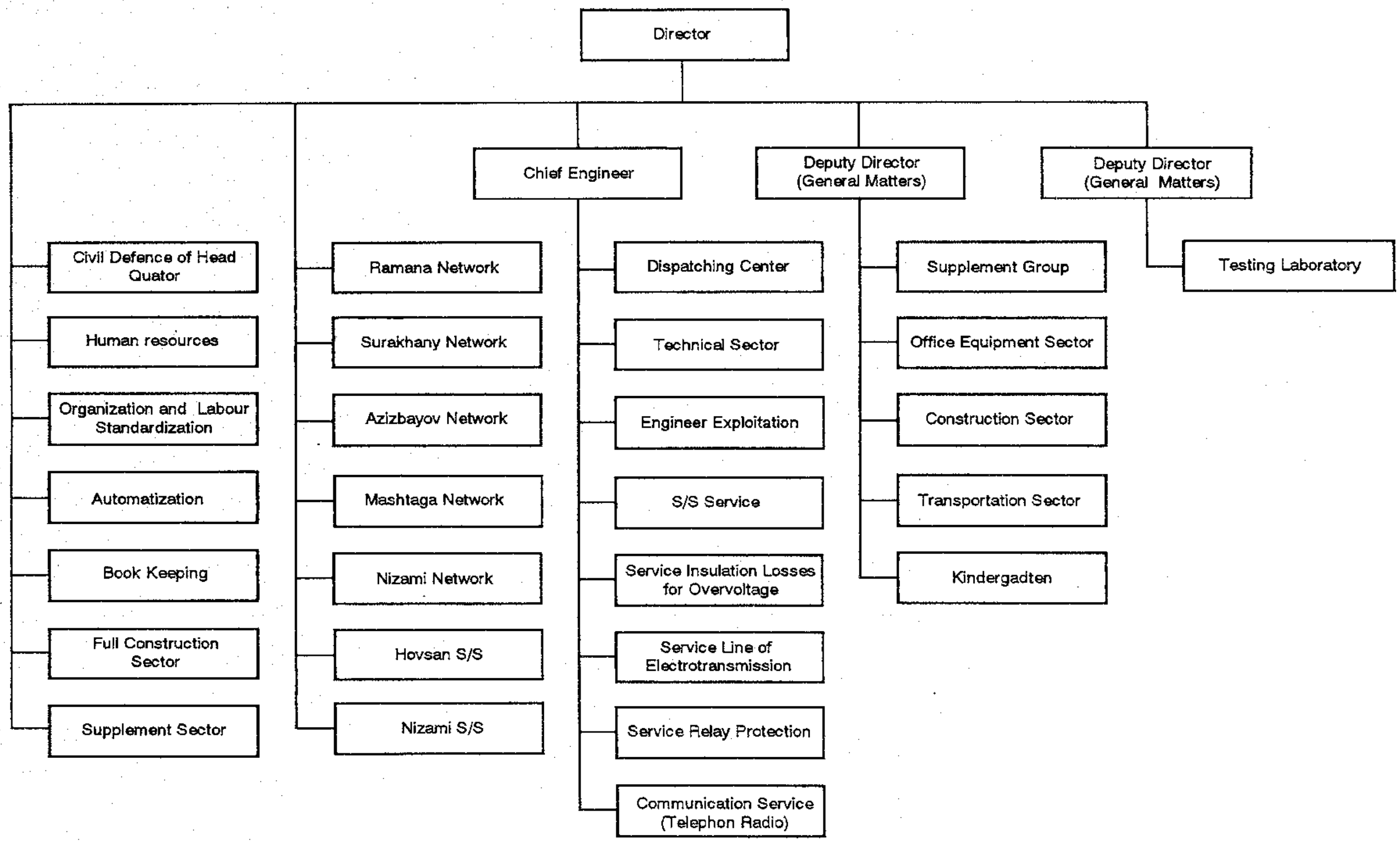
### (5) Energy sales revenue and charge collection

The data on energy sales revenue and charge collection performance in Baku City by Azenerji (each branch: CPHNE and APHNE) during 1998-1999 are shown in Table I.4.4-5. The breakdown by tariff category is provided in Appendix I.4.4-2. Compared with the collection rate (49.5 %) in 1998, notable improvement during 1999 (50.1 %) has not been observed. As shown in the Table below, the sales revenue from industry and other account for around 50 % of the total in Baku City. In spite of a heavily stagnated economy, those sectors show a good rate of payment as much as 73 %. However, the same rate by BEN, which is largely responsible for the residential customer, goes no further than recording around 20%, thus worsening the entire collection performance.

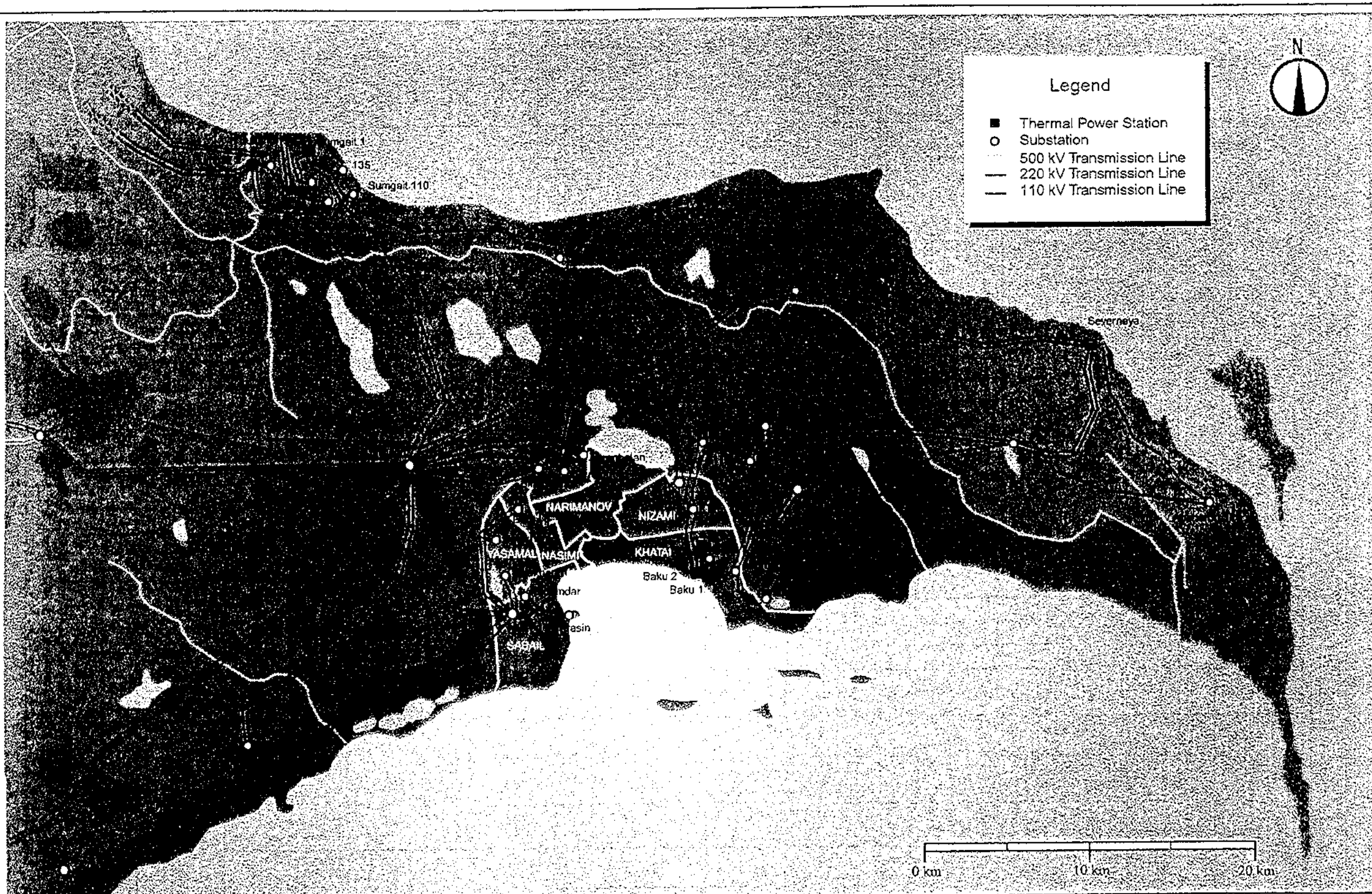
Table I.4.4-5 Energy sales revenue and charge collection performance in Baku City (1998-1999)

| | | 1998 | | | 1999 | | |
|---|---|---|---|---|---|---|---|
| | | Billing (AZM mil.) | Collection (AZM mil.) | Rate (%) | Billing (AZM mil.) | Collection (AZM mil.) | Rate (%) |
| CPHNE | Wholesale to Baku | 173,320 | 38,987 | 22.5 | 163,829 | 44,876 | 27.4 |
| | Industrial sector | 117,619 | 99,772 | 84.8 | 79,939 | 64,048 | 80.1 |
| | Others | 52,287 | 45,754 | 87.5 | 64,407 | 51,113 | 79.4 |
| | Total | 344,226 | 184,516 | 53.6 | 308,175 | 160,037 | 51.9 |
| APHNE | Wholesale to Baku | 153,734 | 24,149 | 15.7 | 148,089 | 17,398 | 11.7 |
| | Industrial sector | 128,218 | 102,602 | 80.0 | 102,701 | 100,068 | 97.4 |
| | Others | 29,927 | 13,197 | 44.1 | 27,052 | 16,313 | 60.3 |
| | Total | 311,879 | 139,948 | 44.9 | 277,842 | 133,779 | 50.1 |
| Total | Wholesale to Baku | 327,054 | 63,136 | 19.3 | 311,918 | 62,272 | 20.0 |
| | Industrial sector | 245,837 | 202,374 | 82.3 | 182,640 | 164,116 | 89.9 |
| | Others | 83,214 | 58,954 | 70.8 | 91,459 | 67,428 | 73.7 |
| | Total | 656,105 | 324,464 | 49.5 | 586,017 | 293,816 | 50.1 |

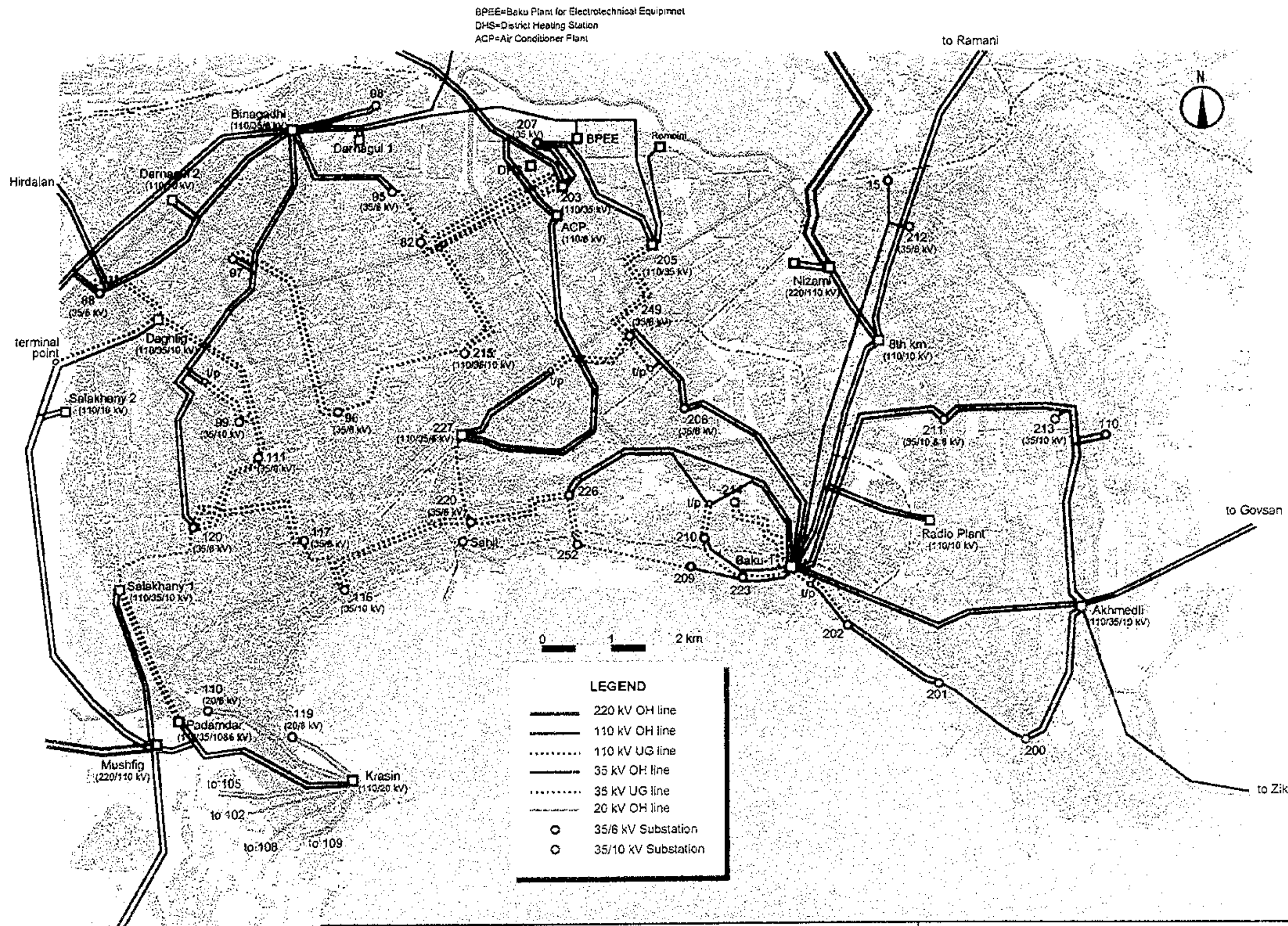
(Source: Azenerji, CPHNE and APHNE)



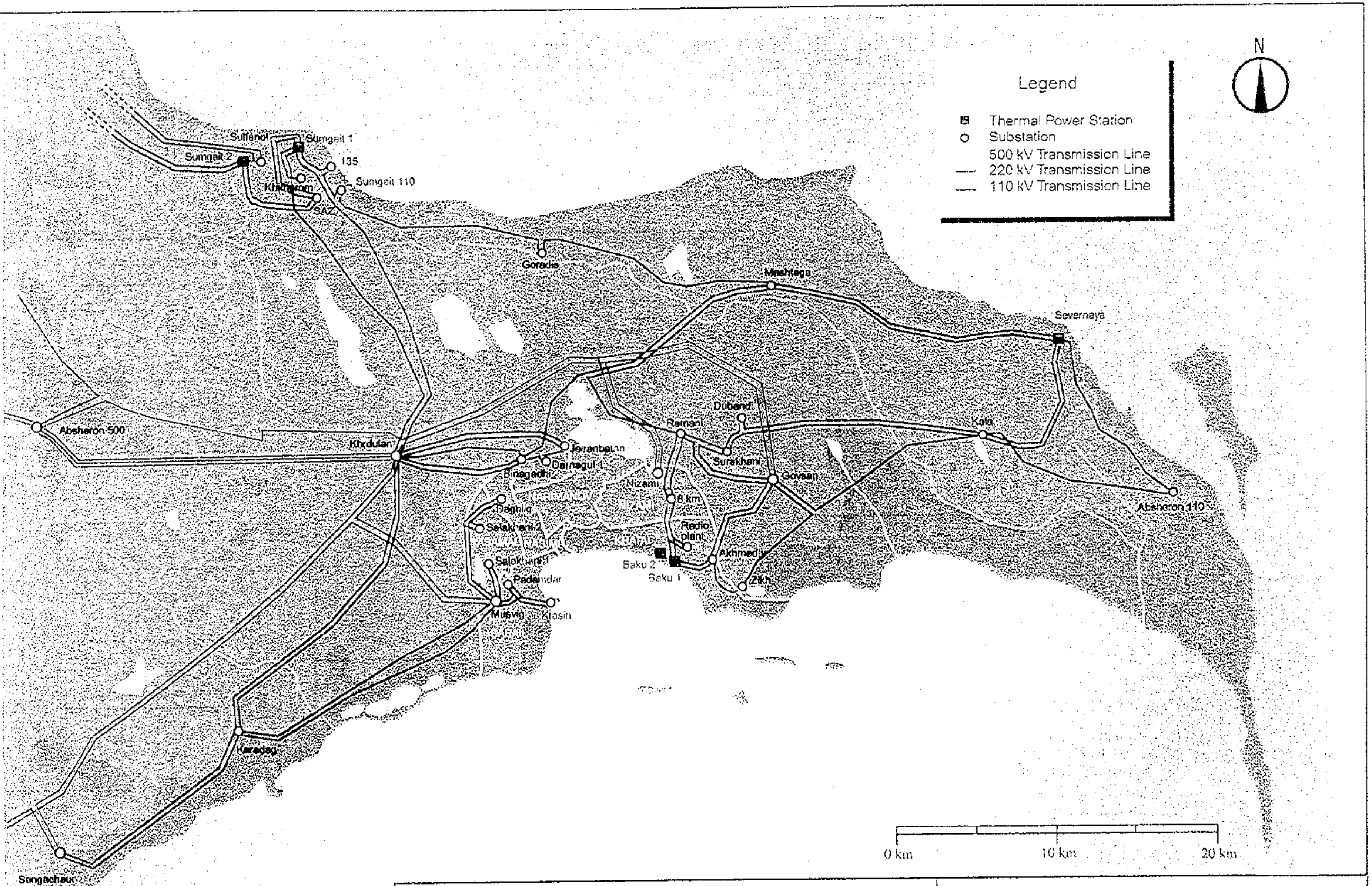

| | |
|---|---|
| Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku<br>Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку | Figure / Схема I.4.2-1 |
| Baku Electric Network<br>ПО "БАКЭЛЕКТРОСЕТЬ" / Japan International Cooperation Agency<br>Японское Агентство Международного Сотрудничества | Title / Название Рисунка<br>Organization Chart of APHNE |
| Joint Venture Nippon Koei Co., Ltd. & KRI International Corp.<br>Совместное предприятие НИППОН КОЕИ и KRI Интернешнл Корп. | |



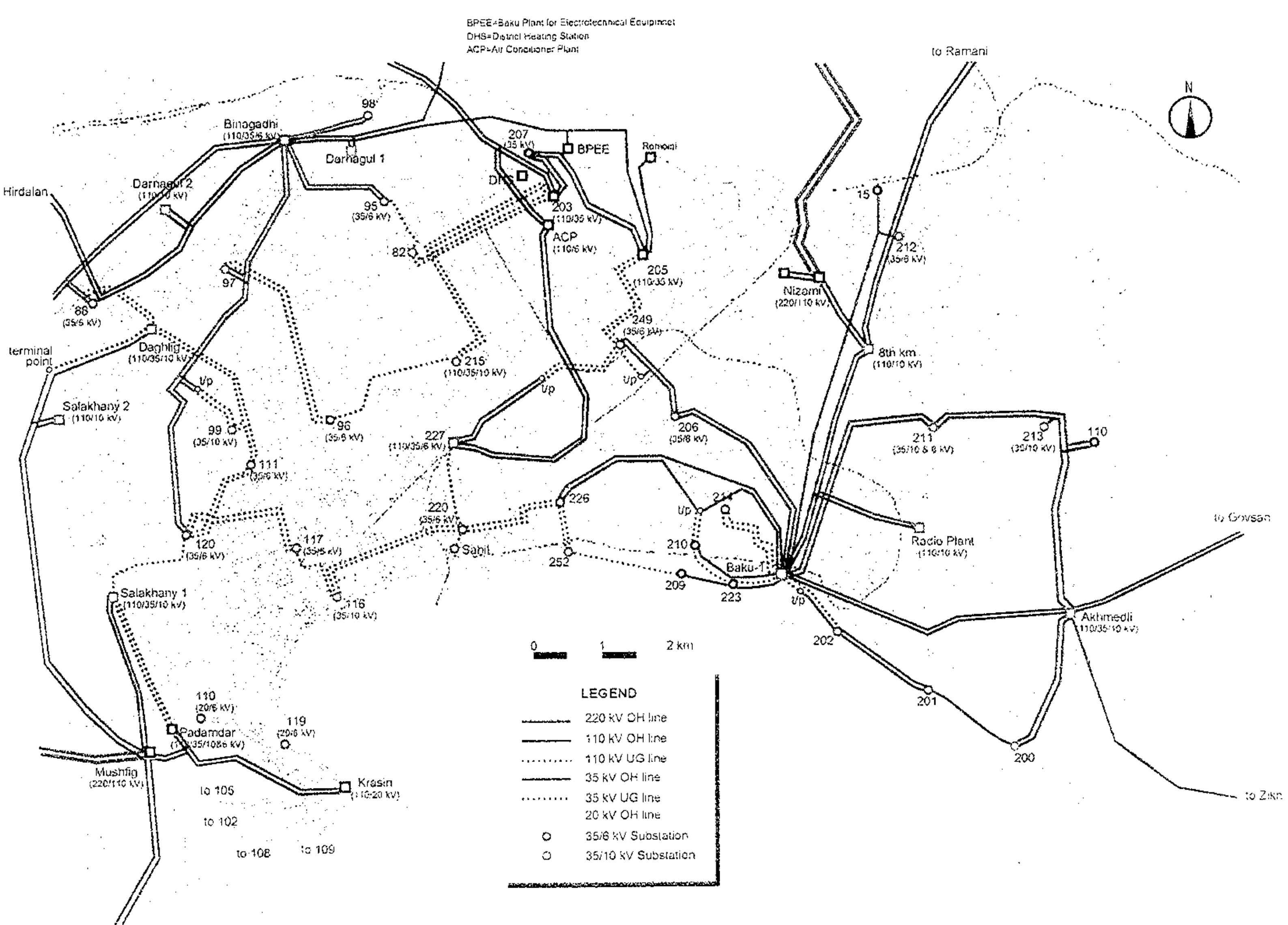

| Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku<br>Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку | | Figure / Схема I.4.3-1<br>Title / Название Рисунка<br>Power Transmission System in Absheron Peninsula |
|---|---|---|
| Baku Electric Network<br>ПО "БАКЭЛЕКТРОСЕТЬ" | Japan International Cooperation Agency<br>Японское Агентство Международного Сотрудничества | |
| Joint Venture Nippon Koei Co., Ltd. & KRI International Corp.<br>Совместное предприятие НИППОН КОЕЙ и KRI Интернешнл Корп. | | |




| Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku<br>Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку | | Figure / Схема I.4.3-2 |
|---|---|---|
| Baku Electric Network<br>ПО "БАКЭЛЕКТРОСЕТЬ" | Japan International Cooperation Agency<br>Японское Агентство Международного Сотрудничества | Title / Название Рисунка |
| Joint Venture Nippon Koei Co., Ltd. & KRI International Corp.<br>Совместное предприятие НИППОН КОЕЙ и KRI Интернешнл Корп. | | AZERENERJI's System Network in Baku |




| Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku<br>Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку | | Figure / Схема 1.4.3-1<br>Title / Название Рисунка<br>Power Transmission System in Absheron Peninsula |
|---|---|---|
| Baku Electric Network<br>ПО "БАКЭЛЕКТРОСЕТЬ" | Japan International Cooperation Agency<br>Японское Агентство Международного Сотрудничества | |
| Joint Venture Nippon Koei Co., Ltd. & KRI International Corp.<br>Совместное предприятие НИППОН КОЕЙ и KRI Интернешнл Корп. | | |




| | | |
|---|---|---|
| Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku<br>Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку | | Figure / Схема I.4.3-2<br>Title / Название Рисунка |
| Baku Electric Network<br>ПО "БАКЭЛЕКТРОСЕТЬ" | Japan International Cooperation Agency<br>Японское Агентство Международного Сотрудничества | AZERENERJI's System Network in Baku |
| Joint Venture Nippon Koei Co., Ltd. & KRI International Corp.<br>Совместное предприятие НИППОН КОЕИ и KRI Интернешнл Корп. | | |

Appendix I.4.3-1 Azerenerji's Transmission Lines in Baku (1/2)

| No. | Voltage (kV) | Subtations From | To | Line Length (km) | Cct | Cct·km | Conductor Kind | Size (sq.mm) | Commis. Year |
|---|---|---|---|---|---|---|---|---|---|
| **220 kV** | | | | | | | | | |
| **(CPHNE)** | | | | | | | | | |
| 1 | 220 | Alibayramli | Mushfig | 36.50 | 1 | 36.5 | AC | 2 x 300 | 1961 |
| 2 | 220 | Alibayramli | Sangachal | 25.90 | 1 | 25.9 | AC | 2 x 300 | 1962 |
| | (Length of above 2 lines : partial) | | | | | | | | |
| 3 | 220 | Absheron | Khirdalan | 23.20 | 1 | 23.2 | MN | 240 | 1949 |
| 4 | 220 | Absheron | Khirdalan | 23.70 | 1 | 23.7 | M | 240 | 1954 |
| 5 | 220 | Absheron | Khirdalan | 24.80 | 1 | 24.8 | AC | 600 | 1995 |
| | | | | | 1 | 0.0 | AC | 500 | 1995 |
| | | | | | 1 | 0.0 | AC | 300 | 1995 |
| 6 | 220 | Khirdalan | Mushfig | 14.70 | 1 | 14.7 | AC | 300 | 1988 |
| 7 | 220 | Khirdalan | Sangachal | 44.80 | 1 | 44.8 | ACO | 2 x 300 | 1962 |
| 8 | 220 | Khirdalan | Hovsan (T) | 16.65 | 1 | 16.7 | ACC | 500 | 1975 |
| 9 | 220 | Khirdalan | Aghsu | 39.70 | 1 | 39.7 | MN | 240 | 1949 |
| | | | | | | 0.0 | AC | 300 | 1949 |
| 10 | 220 | Absheron | Hovsan (T) | 38.70 | 1 | 38.7 | ACO | 500 | 1975 |
| 11 | 220 | Absheron | Gabala | 38.80 | 1 | 38.8 | MN | 240 | 1954 |
| | (Partial) | | | | 1 | 0.0 | AC | 300 | 1954 |
| | Total | | | | | 327.5 | | | |
| **(APHNE)** | | | | | | | | | |
| 1 | 220 | T-branch point | Hovsan | 24.40 | 2 | 48.80 | ACO | 500 | |
| 2 | 220 | T-branch point | Nizam | 11.20 | 2 | 22.40 | AC | 2x300 | |
| | (Total) | | | | | 71.20 | | | |
| | | | | | | | | | |
| **110 kV** | | | | | | | | | |
| **(CPHNE)** | | | | | | | | | |
| 1 | 110 | Khirdalan | CHP | 13.90 | 1 | 13.9 | M | 95 | 1958 |
| 2 | 110 | Khirdalan | CHP | 16.80 | 1 | 16.8 | M | 95 | 1955 |
| 3 | 110 | Khirdalan | MKZ(ZBK) | 16.10 | 1 | 16.1 | ACK | 300 | 1967 |
| 4 | 110 | Binagadi | Khirdalan | 12.10 | 1 | 12.1 | M | 120 | 1954 |
| 5 | 110 | Binagadi | Khirdalan | 12.20 | 1 | 12.2 | M | 120 | 1949 |
| 6 | 110 | Binagadi | 205 | 7.70 | 1 | 7.7 | M | 120 | 1963 |
| 7 | 110 | Binagadi | Khirdalan | 12.70 | 1 | 12.7 | ACK | 185 | 1970 |
| 8 | 110 | Khirdalan | MKZ(ZBK) | 19.10 | 2 | 38.2 | ACK | 185 | 1967 |
| | | | | | 2 | 0.0 | ACK | 300 | 1967 |
| 9 | 110 | Khirdalan | 83 | 12.50 | 2 | 25.0 | M | 95 | 1982 |
| | | | | | 2 | 0.0 | ACK | 185 | 1982 |
| 10 | 110 | Surahany | 83 | 23.40 | 2 | 46.8 | M | 95 | 1940 |
| | | | | | 2 | 0.0 | ACK | 185 | 1940 |
| 11 | 110 | Buta | Khirdalan | 20.20 | 1 | 20.2 | M | 120 | 1954 |
| 12 | 110 | Buta | Khirdalan | 20.30 | 1 | 20.3 | AC | 185 | 1956 |
| 13 | 110 | Darnagul | Binagadi | 5.87 | 1 | 5.9 | M | 120 | |
| | | | | | 1 | 0.0 | AC | 185 | |
| 14 | 110 | Buta | Mushfig | 10.40 | 1 | 10.4 | AC | 185 | 1989 |
| 15 | 110 | Buta | Mushfig | 10.60 | 1 | 10.6 | AC | 185 | 1989 |
| 16 | 110 | Sangachal | Buta | 22.90 | 1 | 22.9 | AC | 95 | 1951 |
| | | | | | 1 | 0.0 | AC | 150 | 1951 |
| 17 | 110 | Sangachal | Buta | 23.80 | 1 | 23.8 | M | 70 | 1951 |
| 18 | 110 | Sangachal | Sangachal | 2.80 | 1 | 2.8 | AC | 70 | 1951 |
| 19 | 110 | Sangachal | Sangachal | 2.80 | 1 | 2.8 | AC | 70 | 1951 |
| 20 | 110 | Sangachal | Sangachal | 2.80 | 1 | 2.8 | AC | 120 | 1982 |
| 21 | 110 | Sangachal | Sangachal | 2.80 | 1 | 2.8 | AC | 120 | 1982 |
| 22 | 110 | Alat | Sangachal | 31.40 | 1 | 31.4 | AC | 150 | 1934 |
| 23 | 110 | Alat | Sangachal | 31.80 | 1 | 31.8 | M | 70 | 1957 |
| 24 | 110 | DOZ | Buta | 2.40 | 1 | 2.4 | AC | 120 | 1982 |
| 25 | 110 | DOZ | Buta | 2.40 | 1 | 2.4 | AC | 120 | 1982 |

Appendix I.4.3-1 Azerenerji's Transmission Lines in Baku (2/2)

| No. | Voltage (kV) | Subtations From | To | Line Length (km) | Cct | Cct·km | Conductor Kind | Size (sq.mm) | Commis. Year |
|---|---|---|---|---|---|---|---|---|---|
| 26 | 110 | Buta | Mushfig | 4.00 | 1 | 4.0 | ACK | 185/29 | 1988 |
| 27 | 110 | Buta | Mushfig | 3.80 | 1 | 3.8 | ACK | 185/29 | 1988 |
| 28 | 110 | Surakhany | Mushfig | 3.80 | 1 | 3.8 | ACK | 120/19 | 1988 |
| 29 | 110 | Surakhany | Mushfig | 2.40 | 1 | 2.4 | ACK | 185/129 | 1988 |
| 30 | 110 | Daghlig | Mushfig | 6.60 | 1 | 6.6 | AC | 185 | 1988 |
| 31 | 110 | Daghlig | Mushfig | 6.60 | 1 | 6.6 | AC | 185 | 1988 |
| 32 | 110 | MKZ(ZKB) | 227 | 4.70 | 1 | 4.7 | ACK | 185 | 1967 |
| 33 | 110 | MKZ(ZKB) | 227 | 4.70 | 1 | 4.7 | ACK | 185 | 1967 |
| | | | | | | 431.4 | | | |
| (APHNE) | | | | | | | | | |
| 1 | 110 | Hovsan | Bakikhanov | 7.40 | 1 | 7.40 | AC | 300 | |
| 2 | 110 | Hovsan | Bakikhanov | 7.43 | 1 | 7.43 | AC | 300 | |
| 3 | 110 | Gunashly incoming | | 0.10 | 2 | 0.20 | AC | 300 | |
| 4 | 110 | Bakikhanov | Ramany | 3.00 | 1 | 3.00 | AC | 185 | |
| 5 | 110 | Bakikhanov | Surakhany | 3.02 | 1 | 3.02 | AC | 120 | |
| | | | | 3.92 | 1 | 3.92 | AC | 185 | |
| | | | | 7.66 | 1 | 7.66 | AC | 300 | |
| 6 | 110 | Ramany | Surakhany | 2.99 | 1 | 2.99 | M | 70 | |
| | | | | 0.22 | 1 | 0.22 | M | 95 | |
| 7 | 110 | Ramany | 8th km | 4.70 | 2 | 9.40 | M | 120 | |
| | | | | 0.30 | 2 | 0.60 | AC | 0.5 | |
| 8 | 110 | 8th km | Baku I CHP | n/a | 2 | | n.a | n.a | |
| 9 | 110 | Surakhany | Gala | 0.50 | 1 | 0.50 | M | 95 | |
| | | | | 12.20 | 1 | 12.20 | M | 70 | |
| | | | | 1.20 | 1 | 1.20 | AC | 150 | |
| 10 | 110 | Airport incoming | | 0.50 | 2 | 1.00 | M | 70 | |
| 11 | 110 | Surakhany | Gala | 0.50 | 1 | 0.50 | M | 95 | |
| | | | | 12.50 | 1 | 12.50 | M | 70 | |
| | | | | 1.40 | 1 | 1.40 | AC | 150 | |
| 12 | 110 | Hovsan | Sewage Plant | 9.00 | 1 | 9.00 | AC | 120 | |
| 13 | 110 | Hovsan | Zikh | 3.00 | 1 | 3.00 | M | 95 | |
| | | | | 2.10 | 1 | 2.10 | AC | 120 | |
| 14 | 110 | Zikh | Akhmedly | 2.60 | 1 | 2.60 | AC | 150 | |
| | | | | 0.50 | 1 | 0.50 | M | 120 | |
| | | | | 5.00 | 1 | 5.00 | M | 95 | |
| 15 | 110 | Hovsan | Akhmedly | 6.40 | 2 | 12.80 | AC | 185 | |
| 16 | 110 | Hovsan | Gala | 10.64 | 1 | 10.64 | M | 95 | |
| | | | | 1.86 | 1 | 1.86 | AC | 150 | |
| 17 | 110 | Gala | Severnaya | 13.90 | 1 | 13.90 | M | 150 | |
| | | Gala | Severnaya | 14.30 | 1 | 14.30 | M | 120/150 | |
| 18 | 110 | Gala | Dubandy | 17.90 | 1 | 17.90 | M | 95 | |
| 19 | 110 | Severnaya | Dubandy | 17.00 | 1 | 17.00 | M | 120/150 | |
| 20 | 110 | Severnaya | Mashtaga | 7.60 | 2 | 15.20 | ACO | 480 | |
| | | | | 8.00 | 2 | 16.00 | AC | 500 | |
| | | | | 6.00 | 2 | 12.00 | AC | 300 | |
| | | | | 4.30 | 2 | 8.60 | AC | 240 | |
| | | | | 0.20 | 2 | 0.40 | AC | 150 | |
| 21 | 110 | Mashtaga | Vishnevka | 2.70 | 2 | 5.40 | AC | 150 | |
| 22 | 110 | Mashtaga | Zarbat | 0.15 | 1 | 0.15 | ACK | 150 | |
| | | | | 8.83 | 1 | 8.83 | M | 95 | |
| 23 | 110 | Ramany | Mashtaga | 11.00 | 1 | 11.00 | M | 95 | |
| | | | | 10.00 | 1 | 10.00 | M | 120 | |
| | | | | 4.80 | 1 | 4.80 | AC | 120 | |
| | | | | | | 278.12 | | | |
| | | | | | | | | | |

(Source : Azenerji, CPHNE and APHNE)

Appendix I.4.3-2 Azerenerji's Substations in Baku



| No. | Substation | Unit No. | Voltage (kV) 1st | 2nd | 3rd | Capacity Primary | Commis. year of unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| **CPHNE** | | | | | | | | |
| | **500 kV** | | | | | | | |
| 1 | Absheron | 1 | 500 | 220 | | 267.0 | | |
| | | 2 | 500 | 220 | | 267.0 | | |
| | Total of 500 kV | 2 | | | | 534.0 | | |
| | **330 kV** | | | | | | | |
| 1 | Absheron | 1 | 330 | 220 | | 133.0 | | |
| | | 2 | 330 | 220 | | 133.0 | | |
| | Total of 330 kV | 2 | | | | 266.0 | | |
| | **220 kV** | | | | | | | |
| 1 | Khyrdalan | 1 | 220 | 110 | 10 | 240.0 | | |
| | | 2 | 220 | 110 | | 240.0 | | |
| | | 3 | 220 | 110 | | 190.0 | | |
| 2 | Mushfig | 1 | 220 | 110 | 10 | 200.0 | | |
| | | 2 | 220 | 110 | | 200.0 | | |
| 3 | Sangachaur | 1 | 220 | 110 | | 63.0 | | |
| | | 2 | 220 | 110 | | 63.0 | | |
| | Total of 220 kV | 7 | | | | 1,196.0 | | |
| | **110 kV** | | | | | | | |
| 1 | Heating Plant | 1 | 110 | | - | 40.0 | | |
| | | 2 | 110 | | - | 31.5 | | |
| 2 | Ulduz | 1 | 110 | 10 | | 16.0 | | |
| | | 2 | 110 | 10 | | 16.0 | | |
| 3 | Badamdar | 1 | 110 | | | 40.0 | | |
| | | 2 | 110 | | | 40.0 | | |
| 4 | Salakhany-I | 1 | 110 | 35 | 10 | 31.5 | | |
| | | 2 | 110 | 35 | 10 | 40.0 | | |
| 5 | Salakhany-II | 1 | 110 | 35 | 10 | 25.0 | | |
| | | 2 | 110 | 35 | 10 | 25.0 | | |
| 6 | Bayil | 1 | 110 | 20 | | 40.0 | | |
| | | 2 | 110 | 20 | | 40.0 | | |
| | | 3 | 110 | 20 | | 40.0 | | |
| | | 4 | 110 | | | 20.0 | | |
| 7 | Puta | 1 | 110 | 35 | 6 | 40.0 | | |
| | | 2 | 110 | 35 | 6 | 31.5 | | |
| 8 | Garadagh | 1 | 110 | 35 | 6 | 40.0 | | |
| | | 2 | 110 | 35 | 6 | 40.0 | | |
| 9 | Sangachaur-I | 1 | 110 | 35 | 6 | 16.0 | | |
| | | 2 | 110 | 35 | 6 | 16.0 | | |
| 10 | Sangachaur-II | 1 | 110 | 35 | 6 | 25.0 | | |
| | | 2 | 110 | 35 | 6 | 25.0 | | |
| 11 | Binagadi | 1 | 110 | 35 | 6 | 40.0 | | |
| | | 2 | 110 | 35 | 6 | 40.0 | | |
| | | 3 | 110 | 35 | 6 | 40.0 | | |
| | | 4 | 110 | 35 | 6 | 40.0 | | |
| 12 | Darnagul-I | 1 | 110 | | | 25.0 | | |
| | | 2 | 110 | | | 25.0 | | |
| 13 | DSK-4 | 1 | 110 | 35 | 6 | 10.0 | | |
| | (Building Const.-4) | 2 | 110 | 35 | 6 | 25.0 | | |
| 14 | Darnagul-II | 1 | 110 | 35 | 6 | 25.0 | | |
| | | 2 | 110 | 35 | 6 | 40.0 | | |
| 15 | Daghlig | 1 | 110 | | | 40.0 | | |
| | | 2 | 110 | | | 40.0 | | |
| 16 | 205 | 1 | 110 | 35 | 6 | 25.0 | | |
| | | 2 | 110 | 35 | 6 | 25.0 | | |
| | | 3 | 110 | 35 | 6 | 40.0 | | |
| | | 4 | 110 | 35 | 6 | 31.5 | | |

Appendix I.4.3-2 Azerenerji's Substations in Baku

| No. | Substation | Unit No. | Voltage (kV) 1st | 2nd | 3rd | Capacity Primary | Commis. year of unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| 17 | Air Conditioner Plant | 1 | 110 | 35 | 6 | 40.0 | | |
| | | 2 | 110 | 35 | 6 | 40.0 | | |
| 18 | Oil Equipment Plant | 1 | 110 | 35 | 6 | 25.0 | | |
| | | 2 | 110 | 35 | 6 | 25.0 | | |
| | | | | | | | | |
| | Total of 110 kV | 42 | | | | 1,320.0 | | |
| | | | | | | | | |
| **APHNE** | | | | | | | | |
| | **220 kV** | | | | | | | |
| 1 | Hovsan | 1 | 220 | 110 | | 200.0 | | |
| | | 2 | 220 | 110 | | 200.0 | | |
| 2 | Nizami | 1 | 220 | 110 | | 125.0 | | |
| | | 2 | 220 | 110 | | 125.0 | | |
| | Total of 220 kV | 4 | | | | 650.0 | | |
| | **110 kV** | | | | | | | |
| 1 | Ramany | 1 | 110 | 20 | - | 40.5 | | |
| | | 2 | 110 | 20 | - | 40.0 | | |
| | | 3 | 110 | 20 | - | 30.0 | | |
| 2 | Bakikhanov | 1 | 110 | 10 | | 25.0 | | |
| | | 2 | 110 | 35 | 10 | 25.0 | | |
| 3 | Gunashly | 1 | 110 | 10 | | 40.0 | | |
| | | 2 | 110 | 10 | | 20.0 | | |
| 4 | Surakhany | 1 | 110 | 20 | 6 | 31.5 | | |
| | | 2 | 110 | 20 | 6 | 40.0 | | |
| 5 | Airport Bina | 1 | 110 | n.a | n.a | 25.0 | | |
| | | 2 | 110 | n.a | n.a | 25.0 | | |
| 6 | 8th km | 1 | 110 | 10 | 35 | 31.5 | | |
| | | 2 | 110 | 10 | 35 | 31.5 | | |
| | | 3 | 110 | 6 | 6 | 40.0 | | |
| | | 4 | 110 | 6 | | 20.0 | | |
| | | 5 | 110 | 6 | | 20.0 | | |
| 7 | Ahmedly | 1 | 110 | 35 | 10 | 63.0 | | |
| | | 2 | 110 | 35 | 10 | 63.0 | | |
| 8 | Zikh | 1 | 110 | 35 | 6 | 25.0 | | |
| | | 2 | 110 | 35 | 6 | 25.0 | | |
| | | 3 | 110 | 35 | 6 | 25.0 | | |
| 9 | Sewage Plant | 1 | 110 | 6 | | 16.0 | | |
| | | 2 | 110 | 6 | | 16.0 | | |
| 10 | Radio | 1 | 110 | 10 | | 40.0 | | |
| | | 2 | 110 | 10 | | 25.0 | | |
| 11 | Zabrat | 1 | 110 | 35 | 10 | 40.0 | | |
| | | 2 | 110 | 35 | 10 | 40.0 | | |
| 12 | Mashtaga | 1 | 110 | 35 | 6 | 31.5 | | |
| | | 2 | 110 | 35 | 6 | 40.0 | | |
| 13 | Factory | 1 | 110 | 6 | | 10.0 | | |
| | | 2 | 110 | 6 | | 10.0 | | |
| 14 | Gala | 1 | 110 | 35 | 6 | 40.0 | | |
| | | 2 | 110 | 35 | 6 | 40.0 | | |
| 15 | Dubandy | 1 | 110 | 35 | 6 | 31.5 | | |
| | | 2 | 110 | 35 | 6 | 31.5 | | |
| 16 | Azeroil Fuel-1 | 1 | 110 | 6 | | 20.0 | | |
| | | 2 | 110 | 6 | | 20.0 | | |
| | | 3 | 110 | 6 | | 20.0 | | |
| 17 | Azeroil Fuel-2 | 1 | 110 | 6 | | 40.0 | | |
| | | 2 | 110 | 6 | | 40.0 | | |
| | | | | | | | | |
| | Total of 110 kV | 40 | | | | 1,237.5 | | |

Appendix I.4.3-3 35 kV and 20 kV substations in Baku

| No. | Substation | Transformer | | | Voltage | | Year of Installation | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | Nos. of Unit | Unit Capacity (kVA) | Total Capacity (kVA) | 1st (kV) | 2nd (kV) | | |
| **CEN : 35kV Substations** | | | | | | | | |
| 1 | 82 | 2 | 10,000 | 20,000 | 35 | 10 | | |
| 2 | 88 | 2 | 16,000 | 32,000 | 35 | 6 | | |
| 3 | 95 | 2 | 16,000 | 32,000 | 35 | 6 | | |
| 4 | 96 | 2 | 10,000 | 20,000 | 35 | 6 | | |
| 5 | 97 | 2 | 16,000 | 32,000 | 35 | 10 | | |
| 6 | 98 | 2 | 6,300 | 12,600 | 35 | 6 | | |
| 7 | 111 | 2 | 10,000 | 20,000 | 35 | 6 | | |
| 8 | 116 | 1 | 10,000 | 10,000 | 35 | 10 | | |
| | | 1 | 16,000 | 16,000 | 35 | 10 | | |
| 9 | 117 | 1 | 10,000 | 10,000 | 35 | 10 | | |
| | | 1 | 16,000 | 16,000 | 35 | 10 | | |
| 10 | 120 | 2 | 10,000 | 20,000 | 35 | 6 | | |
| | | 2 | 7,500 | 15,000 | 35 | 6 | | |
| 11 | 206 | 2 | 10,000 | 20,000 | 35 | 6 | | |
| | | 1 | 5,600 | 5,600 | 35 | 6 | | |
| 12 | 207 | 2 | 10,000 | 20,000 | 35 | 6 | | |
| 13 | 209 | 1 | 5,600 | 5,600 | 35 | 6 | | |
| | | 1 | 7,500 | 7,500 | 35 | 6 | | |
| 14 | 210 | 2 | 5,600 | 11,200 | 35 | 6 | | |
| 15 | 215 | 1 | 16,000 | 16,000 | 35 | 6 | | |
| 16 | 220 | 3 | 16,000 | 48,000 | 35 | 6 | | |
| 17 | 226 | 3 | 5,600 | 16,800 | 35 | 6 | | |
| 18 | 249 | | | 0 | 35 | | | |
| 19 | 252 | 1 | 7,500 | 7,500 | 35 | 6 | | |
| | | 1 | 6,300 | 6,300 | 35 | 6 | | |
| | Subtotal | (40) | | (420,100) | | | | |
| **AEN : 35kV Substation** | | | | | | | | |
| 1 | 200 | 1 | 6,300 | 6,300 | 35 | 6 | 1994 | 2(20):BEN |
| | | 1 | 5,600 | 5,600 | 35 | 6 | 1983 | |
| 2 | 201 | 3 | 10,000 | 30,000 | 35 | 6 | 1977 | 1(25):BEN |
| 3 | 202H | 1 | 5,600 | 5,600 | 35 | 6 | 1969 | 1(1):BEN |
| | | 1 | 6,740 | 6,740 | 35 | 6 | 1940 | |
| 4 | 211 | 2 | 10,000 | 20,000 | 35 | 10 | 1967 | 11(17):BEN |
| | | 1 | 10,000 | 10,000 | 35 | 6 | 1992 | |
| | | 2 | 6,300 | 12,600 | 35 | 6 | 1984 | |
| 5 | 212 | 1 | 10,000 | 10,000 | 35 | 10 | 1995 | All feeders:BEN |
| 6 | 213 | 1 | 10,000 | 10,000 | 35 | 10 | 1996 | All feeders:BEN |
| 7 | 214 | 2 | 25,000 | 50,000 | 35 | 6 | 1973 | 1(22):BEN |
| | Subtotal | (16) | | (166,840) | | | | |
| **CEN : 20kV Substations** | | | | | | | | |
| 1 | 110 | 2 | 5,600 | 11,200 | 35 | 6 | | |
| 2 | 119 | 1 | 10,000 | 10,000 | 35 | 10 | | |
| | | 1 | 16,000 | 16,000 | 35 | 10 | | |
| | | 1 | 6,300 | 6,300 | 35 | 10 | | |
| | Subtotal | (5) | | (43,500) | | | | |
| | **Total** | **(61)** | | **630,440** | | | | |

Appendix I.4.3-4 35 kV and 20 kV lines in the study area

| No. | Type | Substations | | Length | Cct | Cct·km | Conductor | | Commis. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Kind | Size | Year |
| | | From | To | (km) | | | | (sq.mm) | |
| **CPHNE (35kV)** | | | | | | | | | |
| 1 | OH | Binagadi | 95 | 1.90 | 2 | 3.80 | M,AC | 70,120,95 | 1963 |
| 2 | OH | Binagadi | 98 | 1.80 | 2 | 3.60 | AC,M | 70,120 | 1953 |
| 3 | OH | Binagadi | 97-120 | 8.30 | 2 | 16.60 | M,AC | 95,150 | 1954 |
| 4 | OH | 210 | 226 | 4.10 | 1 | 4.10 | M | 120 | 1947 |
| 5 | OH | 223 | 209 | 1.90 | 1 | 1.90 | M | 120 | 1965 |
| 6 | OH | Binagadi | 87-88-TB | 12.30 | 2 | 24.60 | M | 95 | |
| 7 | OH | CHP | 206 | 2.80 | 2 | 5.60 | M | 120 | 1952 |
| 8 | OH | CHP | 210 | 2.20 | 1 | 2.20 | M | 95 | |
| 9 | OH | CHP | 226 | 5.40 | 1 | 5.40 | M | 95 | 1932 |
| 10 | OH | 206 | 249 | 1.90 | 2 | 3.80 | M | 120 | 1952 |
| 11 | OH | 249 | 227 | 1.50 | 2 | 3.00 | M | 120 | 1952 |
| 12 | OH | BETK | 207 | 4.50 | 2 | 9.00 | AC | 95 | 1951 |
| | (35kV Overhead Line Total) | | | (48.60) | | (83.60) | | | |
| 13 | UG | 205 | 249 | 1.86 | 2 | 3.72 | AOCB | 3 x 150 | 1955 |
| 14 | UG | BETK | 215 | 4.85 | 2 | 9.70 | AOCB | 3 x 150 | 1967 |
| 15 | UG | 116 | 220 | 2.25 | 2 | 4.50 | AOCB | 3 x 150 | 1971 |
| 16 | UG | 117 | 120 | 2.90 | 2 | 5.79 | AOCB | 3 x 150 | 1967 |
| 17 | UG | 96 | 97 | 3.56 | 2 | 7.12 | OCB | 3 x 120 | 1966 |
| 18 | UG | Daghlig | 111 | 3.40 | 1 | 3.40 | AOCB | 3 x 150 | 1974 |
| 19 | UG | Daghlig | 111 | 3.30 | 1 | 3.30 | AOCB | 3 x 125 | 1985 |
| 20 | UG | Salakhany | 120 | 1.80 | 2 | 3.60 | OCB | 3 x 120 | 1967 |
| 9 | UG | 209 | 252 | 1.93 | 1 | 1.93 | OCB | 3 x 150 | 1936 |
| 10 | UG | 226 | 252 | 0.86 | 2 | 1.73 | OCB | 3 x 120 | 1936 |
| 11 | UG | 220 | 227 | 1.70 | 1 | 1.70 | AOCB | 3 x 150 | 1970 |
| 12 | UG | 220 | 226 | 1.47 | 1 | 1.47 | OCB | 3 x 120 | 1946 |
| 13 | UG | 220 | 226 | 1.64 | 1 | 1.64 | OCB | 3 x 120 | 1951 |
| 14 | UG | 220 | 227 | 1.56 | 1 | 1.56 | OCB | 3 x 150 | 1954 |
| 15 | UG | 220 | 227 | 1.56 | 1 | 1.56 | OCB | 3 x 150 | 1951 |
| 16 | UG | 220 | 227 | 1.70 | 1 | 1.70 | AOCB | 3 x 150 | 1970 |
| 17 | UG | Daghlig | 88 | 3.00 | 2 | 6.00 | AOCB | 3 x 150 | 1973 |
| 18 | UG | BETC | 82 | 3.40 | 2 | 6.80 | OCB | 3 x 150 | 1978 |
| 19 | UG | Hotel Europe Incoming | | 0.81 | 2 | 1.62 | OCB | 3 x 150 | 1998 |
| 20 | UG | 116 | 117 | 1.20 | 1 | 1.20 | AOCB | 3 x 150 | 1981 |
| 21 | UG | 96 | 215 | 2.85 | 1 | 2.85 | AOCB | 3 x 150 | 1976 |
| | | | | (47.60) | | (72.88) | | | |
| **APHNE (35kV)** | | | | | | | | | |
| 1 | OH | Akhmedli | 200 | 3.50 | 2 | 7.00 | AC | 95, 150 | 1955 |
| 2 | OH | Akhmedli | 211 | 5.80 | 1 | 5.80 | AC | 150 | 1955 |
| 3 | OH | Akhmedli | 211 | 5.80 | 1 | 5.80 | M | 95 | 1955 |
| 4 | OH | 213:T-branch from Akhmedli-211 line | | 0.13 | 1 | 0.13 | AC | 95 | 1996 |
| 5 | OH | CHP "Bayramzade" | 211 (No. 8) | 3.80 | 1 | 3.80 | AC,M | 120, 95 | 1955 |
| 6 | OH | CHP "Bayramzade" | 211 (No. 9) | 3.90 | 1 | 3.90 | M | 95 | 1955 |
| 7 | OH | CHP "Bayramzade" | 212 | 7.20 | 1 | 7.20 | M,AC | 70, 150 | 1951 |
| 8 | OH | 200 | 201 | 1.90 | 1 | 1.90 | M | 70, 95 | 1931 |
| 9 | OH | 201 | 202H | 1.20 | 1 | 1.20 | M | 70 | 1931 |
| 10 | OH | 201 | 202H | 1.20 | 1 | 1.20 | M | 120 | 1931 |
| 11 | OH | 202 | CHP "Bayramzade" | 0.90 | 1 | 0.90 | M | 70 | 1953 |
| | (35kV Overhead Line Total) | | | (35.33) | | (38.83) | | | |
| 12 | UG | CHP "Bayramzade" | 214 | | | | | | |
| **CPHNE (20kV)** | | | | | | | | | |
| 1 | OH | Bayil | 110-119 | 3.20 | 1 | 3.20 | M,AC | 70,95 | 1928 |
| 2 | OH | Bayil | 110 | 2.70 | 1 | 2.70 | M,AC | 70,95 | 1931 |
| 3 | OH | Bayil | 102 | 2.40 | 1 | 2.40 | M | 95 | 1915 |
| 4 | OH | Bayi | 105 | 2.10 | 2 | 4.20 | M | 95 | 1931 |
| 5 | OH | Bayil | 109 | 1.00 | 2 | 2.00 | M | 120 | 1930 |
| 6 | OH | Bayil | 118 | 2.00 | 1 | 2.00 | M | 120 | 1935 |
| | (Overhead Line Total) | | | 13.40 | | 16.50 | | | |
| 7 | UG | Bayil | 119 | 1.38 | 1 | 1.38 | OCB | 3 x 120 | 1959 |
| 8 | UG | Bayil | 119 | 1.39 | 1 | 1.39 | OCB | 3 x 120 | 1959 |
| | | | | (29.58) | | (35.78) | | | |

(Source : Azenerji, CPHNE and APHNE)

Appendix I.4.4-1 Energy sales record in Baku

| Tariff Category | 1997 Energy (GWh) | 1998 Energy (GWh) | 1998 Growth (%) | 1999 Energy (GWh) | 1999 Growth (%) |
|---|---|---|---|---|---|
| **A : Central Power and Heat Network Enterprise (CPHNE)** | | | | | |
| 1 Wholesales | 1,580.6 | 1,779.7 | 12.6 | 1,896.2 | 6.5 |
| 2 Industry | 594.6 | 535.9 | -9.9 | 416.5 | -22.3 |
| 3 Non-industry | 23.3 | 25.0 | 7.3 | 10.9 | -56.4 |
| 4 Commercial | 9.1 | 13.2 | 45.1 | 17.9 | 35.6 |
| 5 Transportation | 93.8 | 173.7 | 85.2 | 239.9 | 38.1 |
| 6 Others | 181.6 | 129.7 | -28.6 | 112.6 | -13.2 |
| 7 Total | 2,483.0 | 2,657.2 | 7.0 | 2,694.0 | 1.4 |
| **B : Absheron Power and Heat Network Enterprise (APHNE)** | | | | | |
| 1 Wholesales | 1,353.8 | 1,538.9 | 13.7 | 1,714.0 | 11.4 |
| 2 Industry | 642.0 | 614.2 | -4.3 | 533.2 | -13.2 |
| 3 Non-industry | 47.1 | 35.2 | -25.3 | 22.9 | -35.0 |
| 4 Commercial | 0.1 | 4.3 | - | 4.9 | 13.7 |
| 5 Transportation | 45.1 | 49.8 | 10.6 | 25.5 | -48.8 |
| 6 Others | 24.1 | 53.8 | 122.9 | 101.5 | 88.8 |
| 7 Total | 2,112.1 | 2,296.2 | 8.7 | 2,401.9 | 4.6 |
| **C : Total** | | | | | |
| 1 Wholesales | 2,934.4 | 3,318.6 | 13.1 | 3,610.2 | 8.8 |
| 2 Industry | 1,236.6 | 1,150.1 | -7.0 | 949.7 | -17.4 |
| 3 Non-industry | 70.4 | 60.2 | -14.5 | 33.8 | -43.9 |
| 4 Commercial | 9.2 | 17.5 | 90.0 | 22.8 | 30.2 |
| 5 Transportation | 138.9 | 223.5 | 61.0 | 265.4 | 18.7 |
| 6 Others | 205.7 | 183.5 | -10.8 | 214.1 | 16.7 |
| 7 Total | 4,595.1 | 4,953.4 | 7.8 | 5,095.9 | 2.9 |

Appendix I.4.4-2 Energy sales revenue and charge collection by tariff category (1999)

| Tariff Category | Sold Energy (GWh) | Claimed Amount (Mil. AZM) | Paid Amount (Mil. AZM) | Deficit (Mil. AZM) | Ratio of (%) | Unit Price (AZM /kWh) |
|---|---|---|---|---|---|---|
| Central Network | | | | | | |
| 1 Industrial and construction | 416.5 | 79,938.8 | 64,048.1 | 15,890.7 | 80.1 | 191.9 |
| 2 Special expenditure (Azeneji's staff) | 1.0 | 194.5 | 194.5 | 0.0 | 100.0 | 194.5 |
| 3 Wholesales | 1,896.2 | 163,829.2 | 44,875.6 | 118,953.6 | 27.4 | 86.4 |
| 4 Agriculture | 1.7 | 285.9 | 145.9 | 140.0 | 51.0 | 168.2 |
| 5 Railway | 44.4 | 10,548.4 | 5,381.8 | 5,166.6 | 51.0 | 237.6 |
| 6 Urban transportation | 195.5 | 30,988.8 | 27,247.4 | 3,741.4 | 87.9 | 158.5 |
| 7 Non-industry | 10.9 | 3,466.7 | 1,485.4 | 1,981.3 | 42.8 | 318.0 |
| 8 Commercial and services | 17.9 | 7,309.0 | 6,220.8 | 1,088.2 | 85.1 | 408.3 |
| 9 Populated Area (Settlement) | 103.9 | 11,427.1 | 10,261.0 | 1,166.1 | 89.8 | 109.9 |
| 10 Residential (50% conpensation) | 0.2 | 13.4 | 13.4 | 0.0 | 100.0 | 67.0 |
| 11 Free of charge (100% conpensation) | 4.7 | 0.0 | 0.0 | 0.0 | | |
| 12 Foreign country's customers | 1.1 | 173.0 | 163.4 | 9.6 | 94.5 | 157.3 |
| Subtotal | 2,694.0 | 308,174.8 | 160,037.3 | 148,137.5 | 51.9 | 114.4 |
| Absheron Network | | | | | | |
| 1 Industrial and construction | 532.9 | 102,700.8 | 100,068.1 | 2,632.7 | 97.4 | 192.7 |
| 2 Special expenditure (Azenerji's staff) | 0.9 | 163.2 | 163.2 | 0.0 | 100.0 | 192.0 |
| 3 Wholesales | 1,714.0 | 148,088.7 | 17,397.9 | 130,690.8 | 11.7 | 86.4 |
| 4 Agriculture | 5.5 | 920.6 | 291.8 | 628.8 | 31.7 | 168.0 |
| 5 Railway | 10.1 | 2,409.3 | 2,033.7 | 375.6 | 84.4 | 237.6 |
| 6 Urban transportation | 15.4 | 2,431.4 | | 2,431.4 | 0.0 | 158.4 |
| 7 Absheron water company | 43.7 | 6,925.2 | 3,210.1 | 3,715.2 | 46.4 | 158.4 |
| 8 Non-industry | 22.9 | 7,269.5 | 5,494.0 | 1,775.5 | 75.6 | 318.0 |
| 9 Commercial and services | 4.9 | 1,995.1 | 2,150.0 | -154.9 | 107.8 | 408.0 |
| 10 Populated Area (Settlement) | 0.7 | 29.3 | 13.7 | 15.6 | 46.9 | 40.7 |
| 11 Residential | 50.7 | 4,870.1 | 2,888.4 | 1,981.7 | 59.3 | 96.0 |
| 12 Chemical enterprise | 0.3 | 38.9 | 68.2 | -29.3 | 175.4 | 144.1 |
| Subtotal | 2,401.9 | 277,842.1 | 133,779.1 | 144,063.0 | 48.1 | 115.7 |
| Total | 5,095.9 | 586,016.9 | 293,816.4 | 292,200.5 | 50.1 | 115.0 |