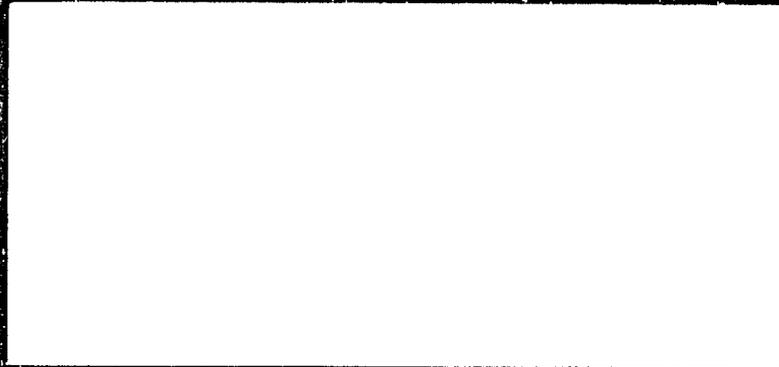


PN-ABK-335 10/38

A Report of the

Office of Energy



Bureau for Science and Technology
United States Agency for International Development

Report No. 92-01

A Report of the
Office of Energy and Infrastructure
Bureau for Research and Development
United States Agency for International Development

ASSESSMENT OF THE CONDITION
OF THE
ELECTRIC AND DISTRICT HEATING SECTOR
IN MONGOLIA

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Private Sector Energy Development Program
Project Number 936-5738
DHR-5738-C-00-1088-00

February 5, 1992

The Office of Energy and Infrastructure

The Agency for International Development's Office of Energy and Infrastructure plays an increasingly important role in providing innovative approaches to solving the continuing energy crisis in developing countries. Three problems drive the Office's assistance programs: high rates of energy use and economic growth accompanied by a lack of energy, especially power in rural areas; severe financial problems, including a lack of investment capital, especially in the electricity sector; and growing energy-related environmental threats, including global climate change, acid rain, and urban air pollution.

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Further information regarding the Office of Energy and Infrastructure projects and activities is available in our Program Plan, which can be requested by contacting:

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ASSESSMENT OF THE CONDITION OF THE ELECTRIC
AND DISTRICT HEATING SECTOR IN MONGOLIA

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SUMMARY

ASSESSMENT OF THE CONDITION OF THE ELECTRIC
AND DISTRICT HEATING SECTOR IN MONGOLIA

Summary

1. The Consultant visited Mongolia between January 14 and January 24, 1992. Had interviews with officials from the Ministry of Power and Fuel and site visits to assess the condition of the electricity/hot-water system of the country.
2. The power system consists of: a Central Energy System (CES) of five coal-fired plants generating electricity and hot water for the heating system, with a total installed capacity of 788 MW, integrated into a single grid serving six provinces with 60% of the total population; and small diesel generators in the other ten provinces.
3. The transmission system consists of 220, 110 and 35 kilovolt lines. There is a 220 kilovolt line between Mongolia and the former USSR, which was used until recently (1991) to import power in order to assist the Mongolian system during peak load periods (to reduce the oscillation of frequency, which is an important parameter of electric systems). This tie line is no longer in operation; Mongolia does not have the hard currency requested by the Russians to pay for power.
4. The plants in the Mongolian CES are operating normally from the mechanical and electrical points of view. Ruling out a major equipment breakdown, they should be able to operate for the rest of the winter season.
5. Some spare parts have been made available to the CES through US\$ 10.0 million grant from the U.S. Government to the Government of Mongolia in late 1991. A total of US\$ 3.5 million worth of spare and supplies have been purchased and are already in Mongolia.
6. Additional essential supplies and spare parts are still needed for the winter season, with an estimated cost of US\$ 2.5 million.
7. The single most important issue concerning the continuity of operation of the electricity/hot water system in Mongolia for the winter season of 1992 is the appropriate supply of fuels, both coal and "mazout".
8. The supply of coal to the CES plants has declined due to problems in the coal-mining operations. It has not yet been reduced to critical amounts but there is uncertainty within the coal mining sector as to whether the already low levels of

supply can be maintained, considering equipment conditions and the lack of spare parts.

9. The required supply of coal to the plants normally oscillates between a normal value of 355,000 metric Tons and a "minimum" value of 422,000 metric Tons for the month of January (this range is a function of outdoors temperature and how much electric load can be shed); this is equivalent to a supply of between 5635 and 6698 train carloads total for the month (182 and 216 carloads per day, respectively). Present supplies are 5533 carloads/month (178 carloads/day), or 18% below the "normal" value and 2.2% below the "minimum" value.
10. The present reserve of "mazout" fuel (7-10) days of full load operation) is very low; no hard currency seems to be available to the power sector to pay for additional imports from Russia to increase the reserves. It has been indicated that urgent negotiations are being carried out in Moscow to find a solution to the situation.
11. Diesel fuel oil can replace "mazout"; however, the present situation of lack of hard currency would be equally valid for the purchase of diesel fuel.
12. The coal mining sector requires spare parts and supplies for a minimum of US\$ 5.6 million for the winter period of 1992. Reliability of the coal mining operations is considered very low by officials in the coal mining sector.
13. A high-level Commission has been appointed by the Government to deal with the present situation in the energy sector. This Commission is entitled to take necessary or possible measures within the existing constraints.
14. According to Ministry of Energy officials the progressive steps would be:
 - (a) Further shedding of load; there is some room to offset further declines in the supply of coal by way of power cut-offs. In the worst-case situation, a minimum of 170 MW would have to be generated in order to supply vital industries (viz., hospitals, food processing plants, etc).
 - (b) Further reductions in the heating water temperature, but not below the minimum required to maintain the 12-14°C temperature inside the dwelling.
 - (c) Diverting whatever coal available to maintain the power system and preserve the heating water supply for as long as possible (this decision was confirmed by officials responsible for the coal-mining operations).

(d) Moving the population now living in apartments heated by the CES to typical Mongolian felt houses ("gears"), of which it is claimed that there are around 50,000 in the Ulaanbaatar area. This would entail mobilizing 131,000 persons now living in apartments heated by the CES, and an additional 77,000 persons living in dwellings heated from local hot water plants if these are also deprived of coal.

15. The scheme presently in use for load-shedding seems fair to the extent that it includes all consumers in all districts with the exception of a few Government services such as hospitals, the Post Office, the Government House and Department Stores, which are exempted from power cut-offs; the Police is supplied from the same circuit as the Government House and thus it is not cut off from service. Army installations are included in the load-shedding program, but they rely on their own diesel generators during the periods of load shedding.

16. The only action that appears feasible in the short term (until the end of the winter season) to alleviate the situation existing in the power sector of Mongolia seems to be the acquisition of hard currency for:

(a) Purchasing "mazout" fuel for the remainder of the winter season; it is estimated that a total of 37,965 metric Tons are required for the first two quarters of 1992, with an estimated cost between US\$ 5.32 and 6.84 million. If "mazout" should not be available from its Russian sources for reasons other than the required payment in hard currency, purchase an equivalent quantity of diesel fuel.

(b) Purchasing some "essential" materials and spare parts required by the power sector for the remainder of the winter season of 1992, estimated to cost US\$ 2.5 million.

(c) Obtaining urgently needed spare parts for the coal-mining operations in order to prevent the further deterioration of coal supplies to the power sector. It is estimated that US\$ 5.6 million are required.

MONGOLIA

REQUIREMENTS OF "MAZOUT" FUEL FOR THE POWER /HOT-WATER SYSTEM
(Measured in tanker cars carrying 10,000 gals. each)

PLANT	QUARTER				YEAR TOTAL
	I	II	III	IV	
Power Plant No. 2	4.4	4.4	4.4	4.4	17.6
Power Plant No. 3	86.4	51.3	52.7	60.0	250.4
Power Plant No. 4	202.2	175.8	158.2	190.5	726.7
Darhan	17.6	16.1	13.2	11.7	58.6
Erdenet	26.4	20.5	20.5	20.5	87.9
Sainshand Heating Plant	54.1	16.0	----	----	70.1
Choibalsan	6.6	3.5	5.1	5.3	20.5
Choir Heating Plant	<u>306.2</u>	<u>124.8</u>	<u>52.5</u>	<u>293.0</u>	<u>776.5</u>
TOTALS	703.9	412.4	306.6	585.4	2008.3
Average tankers/day	7.7	4.5	3.3	6.4	5.5

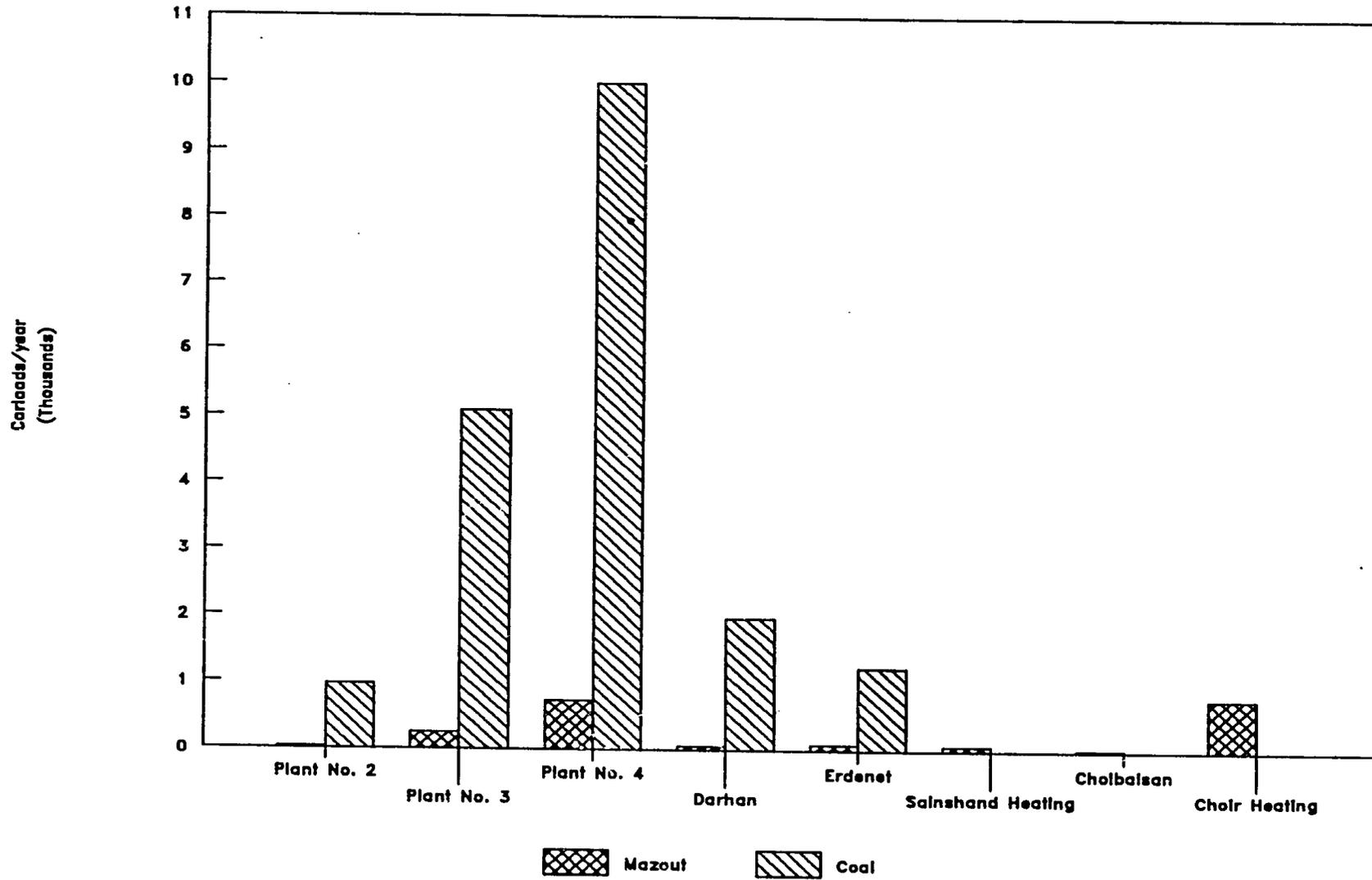
NORMAL REQUIREMENTS OF COAL FOR THE POWER PLANTS
(Measured in railroad carloads)

PLANT	Jan	Feb	Mar	TOTAL
Power Plant No. 2	349.2	285.7	333.3	968.2
Power Plant No. 3	1825.4	1619.0	1634.9	5079.3
Power Plant No. 4	3412.7	3206.3	3381.0	10010.0
Darhan	682.5	634.9	666.7	1984.1
Erdenet	428.6	396.8	412.7	1238.1
TOTALS	6698.4	6142.7	6428.6	19279.7
Average carloads/day	216.1	211.8	207.4	211.9

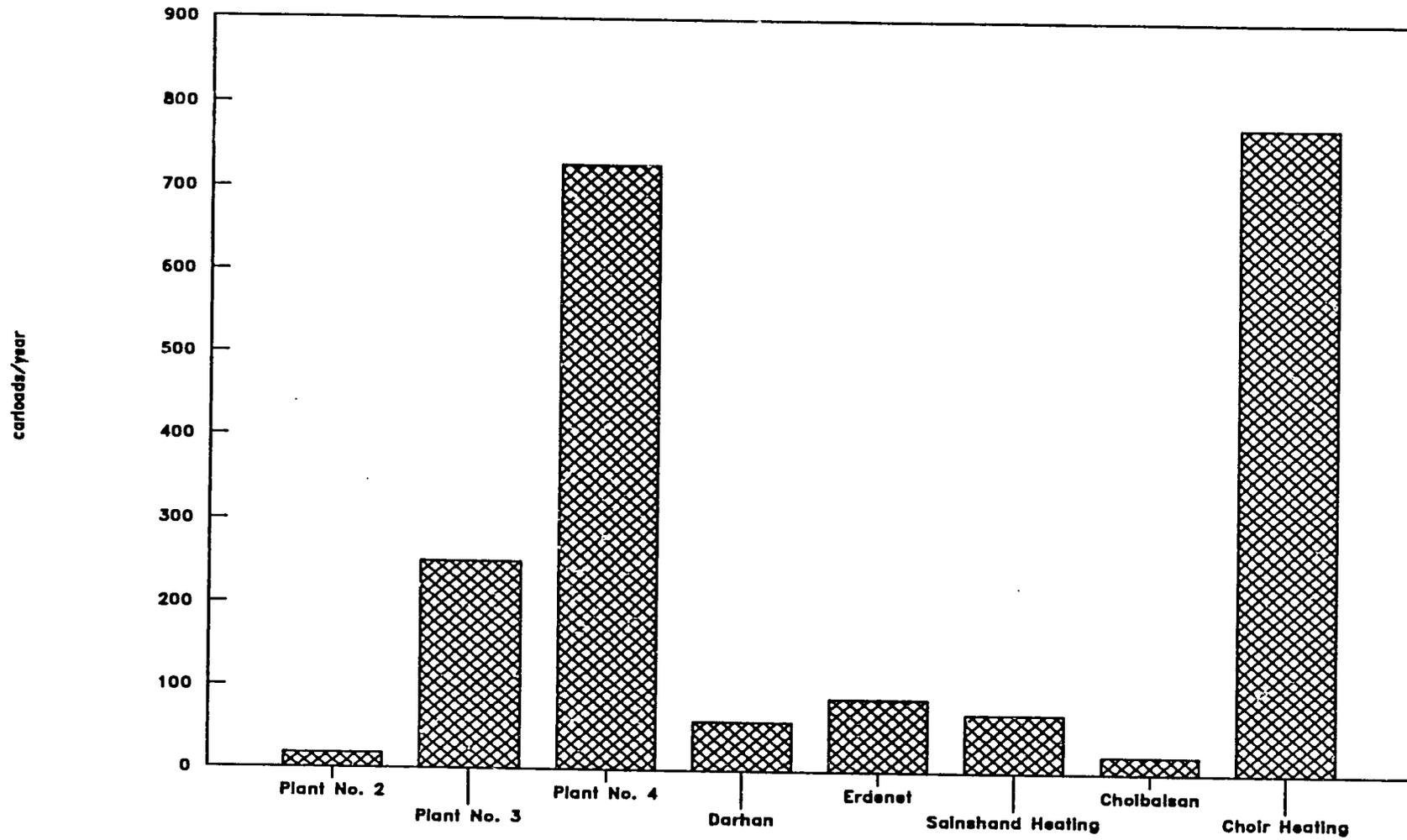
MONGOLIA
POWER STATIONS IN THE CENTRAL ENERGY SYSTEM

Power Station	Unit No.	Installed Capacity (MW)	Dependable Capacity (MW)	Commissioning Date
Ulaanbaatar No. 2	1	6		December 1961
	2	6		December 1961
	3	<u>12</u>		December 1961
		24	18	
Ulaanbaatar No. 3	1	12		August 1973
	2	12		December 1973
	3	12		June 1974
	4	12		December 1975
	5	25		December 1977
	6	25		October 1978
	7	25		December 1978
	8	<u>25</u>		
	148	125		
Ulaanbaatar No. 4	1	80		October 1983
	2	100		November 1984
	3	100		December 1985
	4	100		December 1986
	5	80		February 1990
	6	<u>80</u>		
	540	480		
Darhan	1	12		October 1965
	2	12		October 1965
	3	12		October 1965
	4	<u>12</u>		
	48	36		
Erdenet	1	12		September 1987
	2	8		December 1988
	3	<u>8</u>		September 1989
		20		
Total		788	679	

Use of Mazout (ASTM 6) and Coal



Use of Mazout (ASTM 6)



REPORT BY CONSULTANT

**ASSESSMENT OF THE CONDITION OF THE ELECTRIC
AND DISTRICT HEATING SECTOR IN MONGOLIA**

Report by the Consultant

1. Purpose: The Consultant visited Mongolia from January 14 to January 24, 1992, with the purpose of: (i) assessing the conditions of the existing steam plants' installations and to provide stop-gap measures to better maximize their output, within the limits established by existing financial limitations; (ii) assisting the MPR authorities to formalize plans to allocate fairly, among all user, curtailments of service when supply from the plants cannot satisfy the load; and (iii) collecting pertinent information to facilitate the establishment of the plans for the subsequent year.

In carrying out his tasks the Consultant held interviews with:

Mr. Byambyn Jigjid - Minister of Fuel and Energy;
Mr. Olziibayaryn Gurjav - Senior Vice-Minister for Energy;
Mr. Tumendembereliin Purevsuren - Head, Department Coal Industry, Ministry of Fuel and Energy;
Mr. Seitiin Syezd - General Director, Mongolian Foreign Trade Company;
Mr. Avgaanzhambin Tserendorzh - General Director, Mongolian Company "NUURS" P.L.C.;
Mr. Sereenengiin Jigjid Dorj - Chief Engineer, Energy Policy Council of the Ministry of Energy;
Mr. Battsend Dava - Chief Engineer, Power Station No. 4; and
Mr. A. Batkhishig - Head Director of the Central Power System, MPR (Load dispatching center).

2. The Power System in Mongolia:

The Central Energy System provides electricity and heating water to six provinces integrated into a single grid (60% of the total population); the remaining provinces are supplied by local diesel generators. In the Central Energy System, power is produced by five coal-fired plants: three are located in Ulaanbaatar, one in the city of Darhan and one in the city of Erdenet. These plants have cogeneration of electricity and pressurized steam; part of the steam goes to industrial use and the other is used to produce hot water for the heating system.

The transmission system consists of 220 kV lines linking Ulaanbaatar, Erdenet, Baga Nuur and Darhan, and 110 kV and 35 kV

subtransmission lines. There is a 220 kV link with the former Soviet Union; until the recent past (January 1991) this link was used to import power from Russia (50-60 MW, 250-300 GWh per year) in order to maintain frequency regulation during peak load periods in Mongolia. At present there are no imports of power from Russia for lack of hard currency to pay for them. In the absence of this input, frequency oscillates between 49 and 50.5 Hz around the nominal 50 Hz frequency at peak load with some "peak shaving" being used to try to reduce frequency oscillations. Maximum load varies between 500 MW during the winter and 320 MW during the summer, while base load is around 60% of maximum load. 170 MW is the minimum generation that will supp[ly essential services (hospitals, food factories and heating plants).

Energy generation for 1990 was around 3000 GWh from coal-fired plants and 300 GWh from diesel-fired generation.

3. Power Generating System Operation and Maintenance:

Investigations relating to the steam plants focused primarily on the short-term reliability of operation and maintenance of the plants (for the winter season of 1992).

Continuity of reliable operations of the steam plants for the winter season of 1992 must consider (i) the availability of fuel and (ii) the availability of materials, supplies and spare parts for the short term.

3.1 Fuel Supply for Steam Plant Operation:

The most important factor for the continuous operation of the steam plants during the winter season is the supply of fuel (both coal and "mazout").

3.1.1 Coal:

The total requirements of coal for electricity and heating at the five power plants for the first quarter of 1992 are between 355,000 and 422,000 metric Tons for the month of January; between 387,000 and 333,000 Tons for February; and between 348,000 and 405,000 Tons for the month of March. The higher value in each case corresponds to a "normal condition" in which peak-load shaving of around 40 MW is performed because the system is not capable of regulating frequency at peak load; the lower ("minimum condition") values correspond to the situation in which load reductions of 80-100 MW may be required.

For the month of January coal is being supplied to the power plants at a rate of 336,000 Tons/month, 19,000 Tons/month below the

quantity corresponding to the "minimum condition". At present coal stockpiles maintained at the plant-sites represent a three-day full-load operation reserve which would be depleted in the event of a major disruption in the supply of coal.

Power Station No. 4 in Ulaanbaatar is now receiving 100 carloads of coal per day (the equivalent of 190,000 Tons/month), but requires 105 carloads to generate at minimum conditions; Power Station No. 3 receives 40 carloads (75,000 Tons/month) but requires 42 carloads for minimum conditions; and Power Station No. 2 receives 7 truckloads, but requires 8 carloads per day. Darhan Power Station receives 25 carloads but would require 35 carloads; Erdenet Power Station receives 12 carloads but would require 17.

Only two coal mines supply coal to power stations in the Ulaanbaatar area: Sharyn Gol and Baga Nuur, since there are no railway connections between the remaining fourteen mines and Ulaanbaatar.

The absolute minimum supply of coal for the plants in order to maintain essential electricity service and provide hot water to the heating system are the following: Power Station No. 4, 80 carloads; Power Station No. 3, 40 carloads; Power Station No. 2, 7 carloads; Darhan Power Station, 25 carloads; and Erdenet Power Station, 12 carloads.

At the time of the mission there was uncertainty as to whether supplies will not deteriorate further in the very near future due to problems in the mining of coal.

The decrease in the supply of coal to the plants is being offset basically by frequent reductions of electric service. Load shedding has recently been increased to 50-60 MW; every consumer is now cut off from service three times a week for a period of 1 1/2 hours each time or 4 1/2 hours per week total per consumer (the frequency was only two times a week until January 14). Under extreme conditions in electricity generation a minimum of 170 MW must be supplied to the grid in order to maintain essential services in the central area (hospitals, food factories, and heating plant operations).

The temperature of water supplied to the heating system has been established as a linear function of the outdoor temperature: for an outdoor temperature of -10°C the hot-water temperature must be 100°C and for an outdoor temperature of -39°C the hot water temperature must be 150°C . Heating and hot water is provided by heat interchangers at the buildings; the temperatures of the hot water returning to the power plants are 60°C and 70°C for the two conditions of outdoor temperature referred to above. If the supply of coal to Power Station No. 4 drops below the indicated minimum of 80 carloads per day, the temperature inside the dwellings would fall to between 12°C and 14°C ; it was indicated that 12°C is the

absolute minimum temperature the population would accept. During the period of the mission the outdoor temperature ranged between -10°C and -15°C most of the time; the temperature of the hot water being fed into the system was between 90°C and the normal 100°C .

In addition to shedding more electric load if coal supply is reduced still more, some reduction in the hot water temperature can be expected, provided ambient temperature inside the dwellings does not fall below 12°C .

It was indicated that in the Ulaanbaatar area there are forty-six "furnaces", which are not supplied hot water from the major plants of the CES, independently burning 150,000 Tons of coal per year for heating; also in the same area, there are around 50,000 families living in the typical Mongolian felt houses ("gears") who are also independent from the CES since they burn coal directly for heating, consuming around 100,000 Tons per year.

Overall, for the whole of the country, the CES supplied heating water to 131,000 persons: 77,000 in "self-heating", and the rest of the population burning coal directly in "gears". In the event of a collapse in the production of heating water from the major CES plants during the winter season, the primary concern of the Government would be the mobilization and safety of 131,000 persons. It was indicated that in such an event a last-resort measure would be to move these persons with those living in the typical "gears".

3.1.2 Mazout:

"Mazout" is a liquid fuel which has three basic uses: (a) for the start-up of cold boilers before they can be fed with coal fuel; (b) to sustain boiler combustion in the presence of low-quality coal; and (c) for the operation of the water heating plant at Choir. It was indicated that "mazout" can be and has been replaced occasionally by diesel fuel (which is lighter than mazout). When requested for the chemical or physical composition of "mazout", the Mongolians stated that the composition was unknown to them. Our investigations in the U.S. showed that "mazout" is close to Bunker C (ASTM #6).

Mazout has been traditionally supplied by the former USSR. The "mazout" reserve is now ten days of operation (it must be pointed out that this indicated ten day "reserve" of "mazout" was not changed in the ten days of the mission in Mongolia); the Russians refuse to provide any more mazout unless they are paid in hard currency. It was indicated that a mission from Mongolia would be in Moscow during the week of January 20 to try to negotiate emergency deliveries of this fuel. In fact, during the closing meeting with the Vice-Minister of Energy on the January 23, it was confirmed that as late as the morning of that day, the Minister had

been in contact with the mission in Russia, which had not yet achieved any positive results.

It is estimated that 24,000 metric Tons of mazout are required for the first quarter of 1992; of this total, 150 Tons are required by Power Station No. 2; 2,850 Tons by Power Station No. 3; 6,900 Tons by Power Station No. 4; 600 Tons by the Darhan Power Station; and 900 Tons by the Erdenet Power Plant. The remaining requirements are distributed as follows: 1,845 Tons for the heating boiler at Sainshand; 225 Tons for the Choibalsan power plant; and 10,450 Tons (by far the largest share) for the heating boiler at Choir.

For the remaining quarters of 1992, mazout requirements are estimated at: 14,045, 10,465 and 20,580 Tons, respectively, with the total annual requirement at 69,010 Tons. With a cost between US\$ 140 and 180/Ton, annual requirements amount to between US\$ 9.66 and 12.4 million.

3.2 Load dispatching operation:

There is a centralized load dispatching center in Ulaanbaatar which controls load dispatching for the city. Baga Nuur, Erdenet and Darhan. In addition, three other small cities as well as six other provinces, have small load dispatch centers.

Although the center in Ulaanbaatar controls the power stations in the Central Energy System, no least cost on-line dispatching of plants is performed. Efficiency calculations are performed ex-post on a monthly basis citing heat content of 3,200 kcal/kg for coal from the Baga Nuur coal mine (costing 101 tugriks at the electric plant site in Ulaanbaatar) and 3,800 kcal/kg from the Sharyn Gol mine (costing 124 tugriks in Ulaanbaatar). It was indicated that the overall efficiency for the power plants (considering the efficiency of boilers, turbines and generators) were: (a) 35% for Power Station No. 3; (b) 37% for Power Station No. 4; (c) 29% for Power Station No. 2; (d) 32-34% for Darhan Power Station; and (e) 32-34% for the Erdenet Power Station. These values seem to be too high. The average cost per kWh generated was given as 0.12 tugrik for 1990 (no figures had yet been calculated for 1991), with an average sale price of 0.18 tugrik/kWh in 1990, which was increased to 0.35 tugrik/kWh in 1991.

System supervision is performed by monitoring parameters of plants, lines and substations transmitted by line-carrier to the dispatch center. However, there is no remote-controlled operation of plants, transmission lines or substations.

Any and all operations performed on system components such as transmission-line breakers or substation feeder breakers, for example, are performed locally and manually by personnel assigned permanently to the operation points.

In the event of a system perturbation or of load shedding operations, a telephone communication is established between the dispatching center operators and the local personnel, either to verify the status of the equipment or to perform the breaker operations required to shed or to recover loads.

3.3 Spare Parts and Supplies for Power Plant Operation and Maintenance:

The power plants system is presently operating without major problems and, ruling out a major equipment breakdown, can be expected to continue to do so through the rest of the winter although some additional supplies and materials are required. Of course, the major issue relating to the continuity of the operation of the system is and will continue to be the reliability of fuel supplies (coal and mazout).

A United States Government grant of US\$ 10 million was received last year by the Mongolian Government. Of this total, the amount of US\$ 3.5 million was allocated for the procurement of spare parts for the electricity sector. These spares, which have already been received include: spare parts for station transformers, metering equipment, turbines, pumps, electric motors, heating equipment, diesel generators, as well as high quality cement for boilers, electric motors, bearings, D.C. motors, chemicals, engine oil, welding electrodes, high pressure tubes for boilers, etc.

It was indicated that other materials and supplies are required for the first quarter of 1992. The Consultant was provided with a list of "urgently needed materials for the energy branches" including chemicals, boiler maintenance supplies (sheet metal, tubing, bricks), electrodes, etc., with an estimated total cost of US\$ 2.5 million (See Attachment, which lists the required materials and the corresponding suppliers).

The equipment installed in the Mongolian power system is of Russian manufacture. Hence operation and maintenance supplies and spares have always been produced or manufactured in the former Soviet Union. When a list of the equipment and spare parts suppliers was requested, it was indicated that it is limited to the following sources:

- (a) For boilers used at Power Station No. 3, model БК3-75-39), the Bielogorod Boiler Factory located near the city of Nartov); for model БК3-220-110, the Barnaul Boiler Factory located near Krasnoyarsk.
- (b) For turbines used at Power Station No. 3: model PT ПТ-12-35, the Kolujskii Turbine Factory, near Moscow; model PT П 29-90, the Uralskii Turbine Factory near Ekaterinburg.

- (c) For Boilers used at Power Station No. 4, model БК3-420-110, the Barnaul Boiler Factory near Kravsnoyarsk.
- (d) For turbines used at Power Station No. 4, model Т-80-100 and model Т-100, the Leningrad Metal Factory at Saint Petersburg.

Mongolian officials claim that the Russians are capable and willing to deliver spare parts and supplies if they are paid for in hard currency. They also claim that the power sector does not have any hard currency whatsoever to purchase spare parts and supplies.

In terms of personnel for operation and maintenance personnel, electric sector officials consider that the number and quality of personnel available is sufficient for operation, repairs and maintenance of the existing equipment, although some training is required. On-site training was provided by the Russians; in their absence, the Mongolians lack the required trainers and training facilities.

3.4 Power Sector Planning:

Planning for the power sector in Mongolia includes:

(a) Rehabilitation of the pulverized coal system used for the boilers in Power Station No. 4. It is expected that US\$ 40 million from the Japanese Government will finance this rehabilitation, planned for 1992-1993.

(b) Reconstruction of Power Station No. 4, shifting from coal from the Sharyn Gol mine to coal from the Baga Nuur mine. The source of coal will be changed because both the production and the reserves at Sharyn Gol are low. The shift from the brown coal from one mine to the stone coal of the other will require the reconstruction of boilers at Power Station No. 4. At present a study funded by TDP is being done by United Engineering and Construction (USA).

(c) Renovation of the Darhan Power Station. Date not yet defined. No changes are planned for power Station No. 2 or the Erdenet Power Station.

(d) Development of a hydro power station at Egingol. No feasibility studies have yet been prepared for this project; it is expected that financing from the Asian Development Bank will be made available for this purpose.

(e) Future development of a new 300-600 MW coal-fired plant at the Baga Nuur coal mine.

4. Coal Mining Sector:

There are now sixteen coal mines in Mongolia; two are underground mines and the remaining fourteen are open pit mines. The annual production is around 8.0 million metric Tons. In 1989, 8.1 MTONs were produced; 8.3 MTON in 1991. Production planned for 1992 is 8.0 MTON. Around 4.6 MTON are used by the power plants; 2.6 MTON by other boilers for hot water production in Ulaanbaatar and the provinces; 0.4 MT are used by industry, and the remaining production are used for heating of the felt houses typical to Mongolia both in Ulaanbaatar and the provinces ("gears"), of which it was indicated that there are 50,000 in the area around Ulaanbaatar.

For the coal mining operations it was indicated that an estimated 40% of the dump trucks are down for lack of spare parts; 40% of the locomotives are down either for lack of spares or fuel; and that there is a need for bulldozers and excavators. Coal mining officials appear to be very pessimistic regarding the levels of coal production that can be maintained in the short term, in view of the deterioration of the existing equipment and the lack of spare parts for maintenance.

No spares have been supplied for the last two years; an order for US\$ 25 million was placed with the Russians in July 1991 with no deliveries made so far, Mongolian officials indicate that the suppliers have indicated that they are capable and willing to deliver on short notice, but that they will be unable to do so unless payments are in hard currency (U.S. dollars). A list of minimum "essential spare parts" (required for the winter of 1992) with a cost of US\$ 5.6 million has been prepared (See Attachment); a list of all main spare parts and equipment required for the same period totals US\$ 24.7 million (See Attachment).

The present reserve of dynamite, a material critical to the coal mining operations, now stands at 2 1/2 months of operations. Dynamite reserves are not a constraint for coal production for the immediate future.

When questioned about the possibility of transferring to the electric/hot-water system whatever coal should be available in order to preserve the electricity-heating system in the event of even more serious declines in coal production, coal mining officials responded that this would indeed be the case, that the Government has already taken such a decision in principle.

5. High-level Emergency Commission:

To deal with the present situation in the energy sector the Government has appointed a high-level Commission consisting of:

Mr. B. Jigjid - Minister of Fuel and Energy, as Director
Mr. Orchirjav - Collaborator of the Government, as Secretary

Members:

Mr. Amarsaikhan, Mayor of the city of Darhan
Mr. Ganbold, Vice-Mayor of Ulaanbaatar
Mr. Romorbaatar, Vice-Minister of Fuel and Energy
Mr. Misha, Vice-Minister of Fuel and Energy
The Deputy Chairman of the Police Board
The Vice-Minister of Law

It is the responsibility of this Commission to monitor the evolution of the situation and to take whatever measures are required or possible within the existing limitations.

6. Conclusions:

1. The single most important issue concerning the continuity of operation of the electricity/hot water system in Mongolia for the winter season of 1992 is the appropriate supply of fuels, both coal and "mazout".
2. The supply of coal has not yet been reduced to critical amounts but there is uncertainty, even within the coal mining sector, as to whether the already low levels of supply can be maintained, considering equipment conditions and the lack of spare parts.
3. The present reserve of "mazout" fuel is already critical specially since no hard currency seems to be available to the power sector to pay for additional imports from the CIS to increase the reserves. It has been indicated that urgent negotiations are being carried out in Moscow to find a solution to the situation.
4. Diesel fuel oil can replace "mazout"; however, the present situation of lack of hard currency would be equally valid for the purchase of diesel fuel.
5. The coal mining sector requires spare parts and supplies for a minimum of US\$ 5.6 million for the winter period of 1992. Reliability of the coal mining operations is considered very low by officials in the coal mining sector.

6. Ruling out a major equipment breakdown, the power system can operate during the winter season, thanks to the availability of some spares and supplies purchased with US\$ 3.5 million allocated to the power sector from a 1991 United States Government grant of US\$ 10 million.
7. However, Mongolian power sector officials consider that spare parts and supplies costing an additional amount of US\$ 2.5 million are still required.
8. A high-level Commission has been appointed by the Government to deal with the present situation in the energy sector. This Commission is entitled to take whatever necessary or possible measures within the existing constraints.
9. According to Ministry of Energy officials the progressive steps would be:
 - (a) Further shedding of load to the population; there is some room to offset further declines in the supply of coal by way of power cut-offs. In the worst-case situation, a minimum of 170 MW would have to be generated in order to supply vital industries (viz., food processing plants).
 - (b) Further reductions in the heating water temperature, but not below the minimum required to maintain the temperature inside the dwelling below 12-14°C.
 - (c) Diverting whatever coal is available to maintain the power system and preserve the heating water supply for as long as possible (this decision was confirmed by officials responsible for the coal-mining operations).
 - (d) Moving the population now living in apartments heated by the CES to typical Mongolian felt houses ("gears"), of which it is claimed that there are around 50,000 in the Ulaanbaatar area. This would entitle mobilizing 131,000 persons now living in apartments heated by the CES, and an additional 77,000 persons living in dwellings heated from local hot water plants if these are also deprived of coal.
10. The scheme presently in use for load-shedding seems fair to the extent that it includes all consumers in all districts with the exception of a few Government services such as hospitals, the Post Office, the Government House and Department Stores, which are exempted from power cut-offs; the Police is supplied from the same circuit as the Government House and thus it is not cut off from service.

Army installations are included in the load-shedding program, but they rely on their own diesel generators during the periods of load shedding.

11. The only action that appears feasible in the short term (until the end of the winter season) to alleviate the situation existing in the power sector of Mongolia seems to be the acquisition of hard currency for:

- (a) Purchasing "mazout" fuel for the remainder of the winter season; it is estimated that a total of 37 965 metric Tons are required for the first two quarters of 1992, with an estimated cost between US\$ 5.32 and 6.84 million. If "mazout" should not be available from its Russian sources for reasons other than the required payment in hard currency, purchase an equivalent quantity of diesel fuel.

- (b) Purchasing some "essential" materials and spare parts required by the power sector for the remainder of the winter season of 1992, estimated to cost US\$ 2.5 million.

- (c) Obtaining urgently needed spare parts for the coal-mining operations in order to prevent further deterioration of coal supplies to the power sector. It is estimated that US\$ 5.6 million are required.

8. Comment:

The Consultant endured considerable difficulties and loss of time during the interviews and site visits because of the extremely poor capabilities of the translators. The situation became almost pathetic when dealing with technical topics or terms proper to electric power systems. This comment has no other purpose than pointing out the need of improving this aspect for the benefit of future missions to Mongolia.

Juan Barnes G.
January 30th, 1992

MONGOLIA
POWER STATIONS IN THE CENTRAL ENERGY SYSTEM

Power Station	Unit No.	Installed Capacity (MW)	Dependable Capacity (MW)	Commissioning Date
Ulaanbaatar No. 2	1	6		December 1961
	2	6		December 1961
	3	<u>12</u>		December 1961
		24	18	
Ulaanbaatar No. 3	1	12		August 1973
	2	12		December 1973
	3	12		June 1974
	4	12		December 1975
	5	25		December 1977
	6	25		October 1978
	7	25		December 1978
	8	<u>25</u>		
	148	125		
Ulaanbaatar No. 4	1	80		October 1983
	2	100		November 1984
	3	100		December 1985
	4	100		December 1986
	5	80		February 1990
	6	<u>80</u>		
	540	480		
Darhan	1	12		October 1965
	2	12		October 1965
	3	12		October 1965
	4	<u>12</u>		
	48	36		
Erdenet	1	12		September 1987
	2	8		December 1988
	3	<u>8</u>	<u>20</u>	September 1989
Total		788	679	

APPENDICES
(Source: Mongolia)

List of urgently needed materials
for energy branches of Mongolia
in the 1. quarter 1992

The name of materials	Unit	Quant.	Value		Suppliers
			Unit price (US \$)	Total	
1. Corrosive natrium, technical. hard					Meleuzov chem.ind. Bashkir
2. Sulphate coalCK-I	tn	50	250,0	12,0	"
3. Sulphate	tn	50	250,0	15,8	"
4. Fire-bricks, 250x123x65 mm	tn	300	380,0	114,0	East-Syberian Refractory Fact. Irkutsk
5. Asbestos pulver	tn	200	115,0	23,0	"
6. Shamot pulver in sacks	tn	120	115,0	13,8	"
7. Thermoinsolation plate 500x170x60 mm	m	200	90,0	18,0	"
8. Steel, aluminium wire with profile 25-150 mm	tn	200	2000,0	400,0	"
9. Winding wire 3 mm, 5 mm	tn	30	6700,0	201,0	"
10. Cable and wire	km	53	5700,0	302,0	"
11. Rolls of black metals, sheet steel round, angle, girder	tn	1300	850,0	1105,0	"

12. Rolls of non-ferrous metals/tubes. sheet aluminium/	tn	50	3970.0	198.5	Uralsmash industry
13. Electrode "AHO" "03C" 3 mm and 4 mm	tn	40	670.0	26.8	-----
14. Steel tube, seamless hot rolled steel 20 diameter 60x4.0	tn	20	530.0	10.6	Belgorod boiler works.
15. Steel tube, seamless hot rolled steel 20 diameter 60x4.0	tn	20	750.0	15.0	-----
TOTAL				2515.8	

Нүүрсний уурхайнуудын өөртөө их ачааллыг
 давахад дутагдалтай байгаа салбар материалын жагсаалт
 Names of essential parts for the winter period

1992.01.16

: Наименование и номер детали :(Prescription, Parts No)	: Ед.изм. : measuring unit	: Кол-во : Quantity	: Цена :(Price) :(USP)	: Сумма :(Amount) :(USP)	: Адрес продавца : Address of the plant
: 1	: 2	: 3	: 4	: 5	: 6
5 : Ковш 10м83 (bucket body)	: шт	1	94947	94947:	Украина
: Электрод АНО-6Н	: тн	50	779	38950:	Новоукраинский машинностроительный завод РФР "Тяжпромэкспорт"
6 : ЗАПАСНЫЕ ЧАСТИ К КИСЛОРОДНОЙ СТАНЦИИ					Ukraina Novokramatorsk excavator plant Tiazpromexport
: Цилиндр 1-3 ст(Cylinder)	: шт	2	5477	10954:	Украина
: Цилиндр 2 ст(Cylinder)	: шт	2	2170	4340:	Краснодарский
: Цилиндр 4 ст(Cylinder)	: шт	2	3086	6172:	компрессорный
: Цилиндр 5 ст(Cylinder)	: шт	2	1918	3836:	завод
: Кольцо У21086 (Ring)	: шт	4	63	252:	
: Кольцо У16584 (Ring)	: шт	8	31.5	252:	
: Кольцо У5082.5 (Ring)	: шт	16	31.5	504:	
: Кольцо У5084 (Ring)	: шт	4	31.5	126:	
: Поршень лабиринтный (Piston)	: шт	2	82	164:	
: Клапан комбинированный (valve)	: шт	5	330	1650:	
: Клапан комбинированный тарельчатый(valve):	: шт	10	179	1790:	
: Вкладыш ватунного подшипника (Sealing)	: шт	4	2	8:	
: Вкладыш ватунного подшипника (Sealing)	: шт	4	2	8:	
7 : МАТЕРИАЛЫ					
: Кабель (Cabels)					
: марки КТЗ 3835+1810	: км	5	22280	111400:	РФР
: 3850+1816	: км	5	23243	116215:	ВВО Тяжпромэкспорт
: 3870+1825	: км	5	29300	146500:	
: 3890+1825	: км	5	51007	255035:	
: Канат (Ropes)					
: 39.0-Г-1П-0-Н-170 Ø39.0 мм	: тн	50	575	28750:	
: 45.5-Г-1П-0-Н-170 Ø45.5 мм	: тн	70	575	40250:	
: 52.0-Г-1П-0-Н-170 Ø52.0 мм	: тн	80	575	46000:	
: 64.0-Г-1П-0-Н-170 Ø64.0 мм	: тн	90	575	51750:	
: Вентилятор СВН-6Н (Ventilator)	: шт	3	4560	13680:	
: Вентиляционная труба (Ventilation pipe) Ø500-600 мм	: п/м	6000	690	4140000:	
: Газовый анализатор ВМ-10 (Gas analyzer)	: шт	5	105	525:	
: Светильник головной типа СГГ-5 (Light bulb)	: шт	1000	113	113000:	
: Запчасти и оборудования для ВРС4 (Apparatus for mine rescue team)					
: Аппаратура горноспасательной высокочастотной связи "Кварц" (Rescue apparatus)	: ком	2	200	400:	
: Молоток гидравлический с переносным агрегатом питания МГП	: ком	2	345	690:	

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~~Чүүрсний вурхайнуудын өвлийн их ачааллыг
давахад дутагдалтай байгаа ээлбэг материалын жагсаалт~~
Names of essential parts for the winter period

1992.01.16

: Наименование и номер детали : (Prescription, Parts No)	:Ед.изм. :measuring: : unit	:Кол-во :Quantity :	:Цена :(Price) :(USP)	:Сумма :(Amount) :(USP)	: Адрес продавца : Address of the plant
: 1	: 2	: 3	: 4	: 5	: 6
: (pneumatic hammer)	:	:	:	:	:
: Захтний интерферометр ИИ-12 : (mine indicator)	: шт	2	150	300:	
: Эксплозиметр горноспасательной ЗГ-1 : (explosion degree meter)	: шт	1	285	285:	

Всего (Amount) 5587985.

ПЕРЕЧЕНЬ НАЗВАНИЙ ГОСУДАРСТВ, ЗАВОДОВ-ИЗГОТОВИТЕЛЕЙ,
ПОСТАВЛЯЮЩИХ В МОНГОЛИЮ ДЛЯ НУЖД УГЛЕДОБИВАЮЩИХ
ПРЕДПРИЯТИЙ ОСНОВНЫХ ОБОРУДОВАНИЯ И ЗАПАСНЫХ ЧАСТЕЙ К НИМ НА 1992Г.

NAMES OF MAIN SPARE PARTS, EQUIPMENTS AND THEIR PRODUCERS
FOR THE MONGOLIAN COAL MINING INDUSTRY FOR THE WINTER
PERIOD OF 1992

N	НАЗВАНИЕ ГОСУДАРСТВ	НАИМЕНОВАНИЕ ЗАВОД-ИЗГОТОВИТЕЛЯ	НАИМЕНОВАНИЕ ОБОРУДОВАНИЯ И ЗАПАСНЫХ ЧАСТЕЙ	ПРЕДВАРИТЕЛЬНЫЙ РАСЧЕТ ВАЛЮТНЫХ СРЕДСТВ (тыс. ам. долларов)			ПРИМЕЧАНИЕ
	NAMES OF STATE	NAMES OF PRODUCER FACTORY	NAMES OF EQUIPMENTS AND SPARE PARTS	ВСЕГО TOTAL	из них from it	REMARKS	
					запасные: новое parts : equipments:		
A	1	2	3	4	5	6	7
1	Федеративная республика РОССИЯ Russian Fed. Republic	- г. Екатеринбург Уральский завод тяжелого машино- строения* Ekaterinburg URAL heavy machine building factory	Экскаваторы типа ЭШ-15/90, ЭШ-20/90, ЭКГ-5А, ЭКГ-4.6 Б и запасные части к ним Excavators and spare parts	2500.0	1200.0	1400.0	
2	--	- г. Санкт-Петербург Ижорский завод тяжелого машино- строения им. А.А.Вданова - S' Petersburg Ijorsk heavy machine building factory	Экскаваторы-мехлопаты ЭКГ-8м, ЭКГ-4у и запасные части к ним Rope excavators ЕКГ-81, ЕКВ-40 and spare parts	1350.0	1350.0		
3	--	- г. Кострома Костромский экскаваторный завод - g. Kostroma Kostrom excavator factory	- Экскаваторы с ковшем ёмкостью до 2м3 и запасные части Excavator buckets 2 cubic meter and spare parts	741.0	261.0	480.0	

A	1	2	3	4	5	6	7
4	--	- г. Брянск Брянский машино-строительный завод	Тепловозы ТЭМ-2 и запчасти	2528.0	128.0	2400.0	
		- g. Briansk Machine building factory	Industrial locomotives TEM-2 and spare parts				
5	--	- г. Пенза Пензенский дизельный завод	-Дизель-генераторные установки тепловоза ТЭМ-2 и запчасти	200.0	200.0		
		- g. Penza Diesel engine factory	Diesel generators and spare parts				
6	--	- г. Ярославль Ярославский моторный	Двигатель ЯМЗ и их запчасти	210.0	210.0		
		- g. Jaroslavl Motor factory	Engine JAMZ and spare parts				
7	--	В/О Тяжпромэкспорт	- Канаты, кабель	800.0	800.0		
		ТЯЖПРОМЭКСПОРТ	Ropes, cables				
8	--	- г. Москва Технаэкспорт	Взрывчатые вещества	3200.0	3200.0		
		- s. Moscow TEKMASHEXPORТ	Explosive materials				
9	--	- г. Нижнетагиль Нижнетагильский металлургический комбинат	- железнодорожные рельсы Р65, Р50	500.0	500.0		
		- s. Niznetagil Niznetagilsk metallurgical kombinat	Railway gauge P65, P50				

	4	5	6	7	
10	- г. Еданов Едановский металлургический завод "Азовсталь"	- железнодорожные рельсы и скрепления	490.0	490.0	
	- s. Jdanov Jdanov metallurgical factory "Azovsteel"	Railway gauge and supports			
11	- г. Саранск Завод "Электровыпрямитель"	-Оборуд. и запчасти для желе- знодорожной аппаратуры автомати- ки, телемеханики и связи	40.0	40.0	
	- s. Saransk Factory "Elektrovyprjavitel"	Equipments and spare parts for railway automatic tele- mechanics and communication apparatus			
12	- г. Волгоград Волгоградский линейно-механичес- кий завод	-Оборуд. и запчасти для желе- знодорожной аппаратуры автомати- ки, телемеханики и связи	75.0	75.0	
	- s. Volgograd Volgograd forking mechanical factory	Equipments and spare parts for railway automatic tele- mechanics and communication apparatus			
13	- г. Челябинск Челябинский тракторный завод	- Тракторы и бульдозеры типа ДЭТ-250, БЗ-126, Т-130	1230.0	820.0	410.0
	- s. Chilibinsk Chilibinsk tractor factory	Tractors and bulldozers DET-250, BZ-126, T-130			
14	- г. Москва Машиностроительный завод им.Первого Мая	Запчасти к м.д. крану КДЗ-253	120.0	120.0	
	- s. Moscow Machine building factory in honour Pervogo maja	Spare parts for railway crane KOE-253			

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A	1	2	3	4	5	6	7
15	--	- г. Киров Кировский машиностроительный завод ин.1 мая	- Путевые машины типа ВПМ-02, запчасти к ним	260.0	40.0	220.0	
		- s. Kirov Kirovsk mashine building factory in parts honour 1 maia	Railway cars ВПМ-02 and spare parts				
16	--	- г. Екатеринбург Завод резино-технического изделия	Ленты транспортерные, изделия резино-технические	240.0	240.0		
		- s. Ekaterinburg Rubber parts making plant	Conveyor belts and gumi production				
17	--	- г. Узловск Узловский машиностроительный завод	Горношахтное оборудование и запчасти к ним	850.0	850.0		
		- s. Uzlovsk Uzlovsk mashine building plant	Mine equipments and spare parts				
18	--	- г. Астрахан Астраханский тепловозно-ремонтный завод	-Заводской ремонт тепловозов ТЭМ-2	400.0	400.0		
		- s. Astrahan Astrahanski diesel locomotive maintenance plant	Plants maintenance for locomotives TEM-2				
19	--	- г. Калининград Калининградский вагоностроительный завод	Вагоны ЗВС-105, запчасти	1100.0	1100.0		
		- s. Kalinengrad Kalinengradsk's wagon building plant	Wagon Bunkari ZVS-105 and spare parts				

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A	1	2	3	4	5	6	7
20	-	- г. Карпинск Карпинский машиностроительный завод СВБ-2М, ЗСВВ-200-60 и запчасти	- Буровой станок СБР-160А-24, Drill rigs СВК-160А-24 SVB-2M, ZSVCN-200-60 and spare parts	555.0	105.0	450.0	
ИТОГО: (TOTAL)				17489.0	12129.0	5360.0	
21	Республика УКРАИНА Republic Ukraina	- г. Киев Днепропетровский электровозостроительный завод	- Промышленные электровозы типа ДНЭ-1А, запчасти Mine industrial locomotives Dnepropetrovsk locomotive building plant	1625.4	1625.4		
22	-	- г. Полтава Полтавский турбокомпрессорный завод	- Компрессоры типа КТ-6, КТ-6ЭМ Compressors КТ-6, КТ-6ЕЛ and spare parts	100.0	100.0		
23	-	- г. Кременчуг Кременчугский автомобильный завод	Автосамосвалы КРАЗ-256В и запчасти к ним Dnep trucks KRAZ-256B and spare parts	730.0	280.0	450.0	
24	-	- г. Бузуль Бузульский машиностроительный завод	- Буровой станок ЗСВВ-200Н Drill rigs ZSVCN-200N	375.0	75.0	300.0	
25	-	- г. Донецк Донецкий завод горноспасательной аппаратуры	- Горноспасательные аппаратуры и приборы Mine rescue apparatus and equipments	120.0	120.0		

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№	1	2	3	4	5	6	7
26	-	- г. Краснолуч Краснолучинский машиностроительный завод	Режцы и зубки горные шахтные комбайны	118.0	118.0		
		- г. Krasnoluz Krasnoluzski mashine building plant	Nives and teeth to shearers				
27	-	- г. Краматорск Новоκραматорский машиностроительный завод	-Вагачи экскаватори ЗИ-13/50, ЗИ-10/70 запчастн к ним	700.0	700.0		
		- г. Kramatorsk Mashine building plant	Draglines ECH-13/50, ECH-10/70 and spare parts				
28	-	- г. Ясиноватск Ясиноватский машиностроительный завод	Щековая дробилька СМД-60А, запчастн к ним	305.0	305.0		
		- г. Jasinovatsk Mashine building plant	Crusher SMO-60A and spare parts				
29	-	- г. Белолух Ясиноватский машиностроительный завод	Ленточные конвейеры, запчастн	360.0		360.0	
		- г. Belolugh Mashine building plant	Belts konveier and spare parts				
ИТОГО: (TOTAL)				4433.4	3323.4	1110.0	
30	Республика БЕЛОРУСЬ	- г. Минск Минский автомобильный завод	-Автомобиль МАЗ-509А, запчастн	68.0	20.0	48.0	
	Republic BELORUSS	- г. Minsk Avtomobile plant	Automobile MAZ-509A, spare parts				
31	-	- г. Минск Белорусский автомобильный завод	- Автомобили Белаз-54В, Белаз-540, запчастн к ним	1380.0	1278.0	602.0	
		- г. Minsk Belorussk avtomobile plant	Dump trucks Belaz-54B, Belaz-540 and spare parts				

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			4	5	6	7
32	-	- г. Бобруйск Бобруйский шинный завод - s. Bobruisk Belorusk tyre plant	-Крупногабаритные шины к авто- мобилям Белаз и Краз Tyres to BELAZ, KRAZ	600.0	600.0	
ИТОГО: (TOTAL)			2548.0	1898.0	650.0	
33	Республика АРМЕНИИ Republic ARMENIA	- г. Истинь - Истинский машиностроительный завод - s. Istin Istinsk mashine building plant	-Бытовые машины ИСВУ-3, ПРМ-3 запчасти к ним Frieght rail cars ИСЧУ-3, ПРМ-3 and spare parts	200.0	50.0	150.0
ИТОГО: (TOTAL)			200.0	50.0	150.0	
ВСЕГО: (TOTAL SUMM)			24570.4	17400.4	7270.0	

ГАДААА ХУДАЯДАА, ХАНГАНЗИАН "НУУРС" КОМПАНИ

MONGOLIAN COMPANY "NUURS"

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Coal consumption of the Power Plants,

Thousand ton

Power plant	Kind of energy		January			February			March		
			Required value			Required value			Required value		
			normal condition	minimum condition	in fact	normal condition	minimum condition	implemented	normal condition	minimum condition	implemented
Power plant No2	Total		22.0	10.0	8.0	18.0	8.0		21.0	9.0	
	therein	for elec.	7.0	3.0		6.0	3.0		7.0	3.0	
		for heat	15.0	7.0		12.0	5.0		14.0	6.0	
Power plant No3	Total		115.0	80.0	75.0	102.0	78.0		103.0	79.0	
	therein	for elec.	46.0	32.0		41.0	30.0		50.0	39.0	
		for heat	69.0	48.0		61.0	48.0		53.0	40.0	
Power plant No4	Total		215.0	200.0	190.0	202.0	190.0		213.0	198.0	
	therein	for elec.	129.0	120.0		122.0	114.0		135.0	125.0	
		for heat	86.0	80.0		80.0	76.0		78.0	73.0	
Power plant arhan	Total		43.0	40.0	40.0	40.0	37.0		42.0	39.0	
	therein	for elec.	17.0	12.0		16.0	15.0		18.0	16.0	
		for heat	26.0	28.0		24.0	22.0		24.0	23.0	
Power plant ardenet	Total		27.0	25.0	23.0	25.0	20.0		26.0	23.0	
	therein	for elec.	8.0	8.0		8.0	6.0		9.0	8.0	
		for heat	19.0	17.0		17.0	14.0		17.0	15.0	