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UKRAINE

ASSESSMENT OF THE POWER PLANT FUEL STATUS FOR THE 1995/1996 WINTER PERIOD

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I. EXECUTIVE SUMMARY

This report presents an assessment of the status of fuel supplies of Ukraine's thermal generating plants through the winter months of 1995/1996. The assessment is based on a forecast of power consumption and primary energy supply. The information in this Executive Summary presents findings and recommendations in capsule form, while the body of the report provides the detailed analysis.

The purpose for this study is to assist USAID to assess the need for foreign donor assistance to the Ukrainian power sector for providing either power plant fuels or funds or credits to purchase such fuels during the 1995-1996 winter period. An assessment was completed in October, 1995, utilizing the data and conclusions developed in this work which are now documented herein. This report also provides a well-developed starting point for further work contemplated during 1996 to assist the four thermal generating companies with improving their fuel procurement and management practices.

Overview

Electricity is produced in the Ukraine by thermal (fossil-fuel fired), nuclear and hydro generating stations. The electricity production problems currently being encountered are associated primarily with the thermal stations since adequate uranium is available for nuclear electricity production and hydro power is essentially dependent on natural events. In 1994, thermal power stations produced 60% of the country's power while nuclear and hydro produced 34% and 6%, respectively.

The monthly winter thermal plant fuel demand for primary energy is forecast for a range of warm to cold winters as shown below:

FORECAST WINTER FUEL DEMAND PER MONTH

Coal (Million Tonnes)	3.09-3.24
Mazut (Million Tonnes)	0.24-0.26
Natural Gas (Billion Cubic Meters)	1.65-1.75

Ukraine suffered last winter from power shortages due to insufficient funds reaching the generators for fuel purchases and there is concern about fuel shortages during the 1995-1996 winter for the same reason. A minimum 30-day fuel supply is recommended and should be maintained through purchasing strategies for coal, mazut or natural gas plants. A 60-day target should be established for situations where fuel supply interruptions are likely. All three fuels face supply interruption issues for a variety of reasons.

All fuel inventories were assessed as of September 1, 1995 and include strategic national reserves. Analysis of available data indicates that mazut (heavy fuel oil) inventories, at 314,000 tonnes, are low with an estimated 16-day supply. The cost to increase fuel inventory reserves to a 30-day level of 575,000 tonnes would be $26.1 million. Natural gas inventories are just above the recommended 60-day target with a 67-day supply available.

Coal-fired power stations are a crucial power production component of the 4 GENCO's as they comprise 79% of their total thermal generating capacity. As of September 1, 1995, coal inventory levels were critical at almost every power station. Data shows 81% of the coal-fired thermal plants had less than a 20-day supply of coal on-hand, and 43% had less than a 6-day inventory. The overall average across all coal-fired plants was only 12 days of coal inventory . In order to provide a minimum 30-day coal supply, an additional 6.3 million tonnes of inventory would be requested at an estimated cost of $221 million, assuming a delivered cost of $35 per tonne.

A further coal supply problem is that wages are not being consistently paid to coal miners. This condition, if continued, significantly increases the possibility of a coal supply interruption and could create an exacerbated problem as winter weather sets in. A prolonged miner's strike would seriously jeopardize the ability of the power industry to provide electric power through the winter. Any external funding of fuel supplies should include a stipulation which ensures that miners' back wages are immediately paid in order to reduce this risk.

The risk of a serious fuel shortfall will be greatly increased if supplies of natural gas or mazut are curtailed by Russia or Turkmenistan. If these supplies are cut off the coal-fired power stations would need to carry a larger portion of the load, and the ability to use coal at many stations would be compromised because of the requirement for co-firing mazut or natural gas with the low quality coal being burned. Also, the extremely low coal inventories, less than 3 days, at

several coal fired power stations could result in the inability to produce electric power at the full capacity of the power plants. In addition mazut and natural gas reserves are crucial for coal combustion because co-firing is necessary.

Individual Findings

1. There is a substantial risk of inadequate supply of primary energy for power stations in the Ukraine, based on the experience last winter, due to: a) the lack of funds to purchase fuel caused by inadequate collections of billed revenue and b) the potential for natural gas or mazut supplies being cut off by Russia or Turkmenistan, because of Ukraine's failure to pay its bills.

2. The coal industry production of steam coal has declined significantly, in response to lower fuel demand. As the power and heat industry struggles with inadequate revenues in a changing economic system, the steam coal production industry is seriously impacted. Because of insufficient revenue generation, little money is available to pay for delivered coal. This has resulted is unpaid wages to the mining labor force. Many workers recently have experienced no pay for as long as 3 months. Strikes have been implemented over the last 6 months and future strikes are proposed by labor management (see Appendix A). These strikes have been somewhat responsible for reducing coal inventories at the power stations.

3. There appears to be adequate domestic coal production capacity to provide for the coal consumption projections during the 1995/1996 winter months, if potential strikes by coal mining labor forces can be avoided. Some coal mines are scheduled to be shut down in the future, but based on January 1, 1995 production capacity and 1994 production the mines appear to be producing at a capacity factor of about 66%. The mines reportedly have a production capacity of 74 million clean tonnes while 1994 production was 48 million clean tonnes.

4. Currently, almost all power production is consumed domestically and very little, ½ of 1%, is exported. In 1994, total net electricity export was 1,024 billion kilowatt hours while 201,599 billion kilowatt hours were generated.

5. The 1995 year-to-date power production statistics show total power through the first six

months of 98,897 billion kilowatt hours in comparison to 1994 first half production of 101,704 billion kilowatt hours. This data indicates that the reduction in electricity production seen over the last 5 years is bottoming out, especially when considering that 1994 was a relatively warm winter. Primary energy demand over a 6 month winter period is forecast for a range of warm to cold winters expectations as shown below:

FORECAST 6 MONTH WINTER FUEL DEMAND

Coal (Million Tonnes)	18.55 - 19.71
Mazut (Million Tonnes	1.45 - 1.54
Natural Gas (Billion Cubic Meters)	9.88 - 10.50

6. It appears that power production shortfalls may not be significantly abated by importing electricity. Shortages of primary energy cause reduced generation output and lower system voltages. In the past, Russia has severed electrical transmission lines to guard against power drains to the Ukraine which are caused by the reduced voltage levels.

7. Thermal power stations produced 115,848 billion kilowatt hours of electricity which represents 58% of the total power generated in the Ukraine in 1994. Within the 4 energos, coal-fired generating stations are the primary power production components as they make up 79% of the thermal electricity generation capacity. Coal inventory levels are in a critical situation for 81% of coal-fired power plant production capacity. Of the total of 14 major thermal power stations, each comprised of several individual units, 11 have inventories with reserves less than 20 days. Only the Kurakhov station has coal reserves greater than the recommended 30-day minimum. As of September 1, 1995 the Uglegorsk, Tripolie, Ladyzhin, Zouvevsk, Zaporozhie, and Krivorozh plants, which represent 42% of the coal-fired plant capacity, have inventory levels below a 6 day supply. In order to establish minimum 30-day inventory levels at all plants, 6.3 million tonnes of coal should be added. The cost of increasing coal stockpiles to minimum 30-day recommended levels is in the neighborhood of $221 million, assuming a delivered coal price of $35/tonne.

   Mazut inventories of 314,000 tonnes are low with an inventory level of 16 days. The cost to increase stocks to the recommended 30-day level of 575,000 tonnes is $26.1 million, assuming a cost of $100 per tonne.

Total Ukraine natural gas inventories are at 10.9 billion cubic meters, but allocations to Minenergo are not understood as Minenergo projects only 5.9 million cubic meters of gas inventory. The 5.9 billion cubic meters would represent a 67-day fuel supply, which is appropriate for the current supply situation.

Recommendations

1. In the near term, a minimum primary energy inventory of 30 days should be adopted by the industry as a basic minimum inventory requirement. These inventory levels should be continuously monitored, evaluated and increased if necessary in response to potential supply disruptions which may appear on the horizon. As market competition matures, the management of fuel inventories will become subject to the normal forces of commercial practices, and GENCO management should be free to determine the appropriate levels of fuels inventories to sustain maximum profitability of their business.

2. Coal inventories at the power stations should be increased as much as is possible as the harsh winter weather is now underway. Action plans should also be devised and implemented to build mazut and coal inventories towards a 60-day supply level over the next 6-9 months in order to eliminate repetition of this problem during the 1996/1997 winter. Measures to ensure the inventories are not simply consumed again, including an implementable plan of action for reserve level maintenance should also be instituted and strictly followed.

3. Any funds made available for the power industry should be conditioned such that miners receive their back pay in order to reduce the risk of a major coal supply interruption.

4. A contingency plan should be prepared for the 1995/1996 winter in order to provide necessary resources in case any of the potential adverse events, such as a miners strike, do, in fact, occur. Necessary approvals should be gained and roadblocks removed in advance such that immediate remedial action could be taken.

5. Until such time as the Energomarket is operating, dispatch strategies being employed by the National Dispatch Center should be reviewed, checked, and continually monitored to ensure

they are being properly administered. August power plant dispatch figures show coal-fired plants with low coal inventories had substantial generation, while plants with higher coal inventories had low generation. This practice will only exacerbate the coal inventory problem at many power plants.

6. Current conditions exist where coal of approximately equal value is being delivered to stations with higher levels of inventory while some stations have immediate critical coal inventories of less than 3 days. Overall planning of coal deliveries among the plants should also be coordinated to maximize the total cash purchasing power available and maximizing potential to avoid power blackouts due to inadequate coal inventories.

7. Further work is recommended to more fully study the coal mining and transportation industries such that the intricacies of the supply of coal can be fully understood. Coal transportation capacities, costs, and infrastructure should also be defined in terms of coal supply to power stations. Defining how coal transportation will be accomplished in the new free market economic system should also be determined before the next winter. In addition, the coal supply chain should be described from the perspective of a need for an understanding of coal shipment payments in order to track the cash flow from the utilities to the coal producers to find out why the miners are not being paid regularly.

8. Additional work should be performed to prepare the mining industry with better coal contracting guidelines and support in preparation for free market reforms planned during 1996. This inter-industry transition must be correctly executed in order to be successful, especially when primary energy shortfalls are currently being experienced.

II. INTRODUCTION

Hagler Bailly Consulting, Inc. is under contract to USAID to provide services related to the on-going transition of the electric power and heat production industries in Ukraine to a free market based economy. One immediate concern is the ability of the electric, heat and fuel sectors to provide adequate energy resources to supply heat and electricity during the upcoming winter months of 1995/1996. This body of work consists of providing analysis of the supply and demand of primary energy products, with a focus on coal, during this period. As time is of the essence, a two week effort was made in the Ukraine to obtain an understanding of the fuel supply situation and collect the best information available. This data collection effort was followed by a period to analyze the information collected, formulate opinions, and present results.

Information was sought from Ukrainian and U.S. government agencies which could provide statistics on historical and forecast energy consumption and heat and electricity production. We have relied on the information supplied, both verbally and in written form, as being accurate; however, we attempted to obtain information from several sources which would verify the accuracy of the data. While we do not warrant specific findings or projections presented herein, we believe this report can be used to provide the best available information on the expectations for the upcoming 1995/1996 winter months energy supply and demand.

Providing necessary heat and electricity for the nation is critical to the credibility of the current governmental regime. The Ukraine is undergoing a transition from a socialistic based economy to a free market economy. As this restructuring develops, the conversion of the power production industry will lead the country in this transformation process. The ease of making the transition will be a critical indicator of success in the progress towards a free market based economy.

The impact of the fundamental changes within the power industry and its supporting industries, domestic energy production and transportation, have immediate consequences on inflation and domestic and international debt. Therefore, it is in the interest of world banking and international aid agencies to assist in and monitor the conversion process. This document is prepared to provide necessary basic information to support funding decisions by these agencies.

III. HISTORIC POWER SUPPLY AND CONSUMPTION

The total installed electric power station capacity is 55.4 million kilowatts. The breakdown by fuel type is shown below:

Table 1

INSTALLED CAPACITY
UKRAINE ELECTRIC POWER STATIONS

	Million Kilowatts	Percent
Thermal and Small Industrial Plants	36.9	67%
Hydro	4.7	8%
Nuclear	13.8	25%
Total	55.4	100%

Total power production for years 1993 and 1994 are contrasted to 1990 in Table 2. This data shows that the majority of power production, 58% comes from thermal power stations. Nuclear, hydro and small industrial power make portions are 34%, 6%, and 2%, respectively. The power stations in the Ukraine have been recently reorganized into 4 major Energos while the grouping of small power plants have been assigned to the local Oblenergos. Uranium fuel reserves have not been presenting any supply issues and hydro water resources are dependent upon natural events. This report focuses on the thermal power stations and their fuel inventories. The 4 major Energos account for 93% of the total thermal plant capacity as shown in Table 3.

Table 2

RECENT ELECTRICITY PRODUCTION AND CONSUMPTION
Kilowatt Hours (Billions)

	1990	1993	1994	1994 %
	Production			
Thermal	201,682	135,870	115,848	58
Nuclear	76,179	75,240	68,848	34
Hydro	10,704	11,210	12,299	6
Small Industrial	7,693	5,980	4,604	2
Total	296,258	228,300	201,599	100
	Consumption			
Total Net Export	27,970	1,152	1,024	1
Total Domestic Consumption	268,288	227,148	200,575	
Usage Index - 1990 Base	100	85	75	

Prediction of future primary energy consumption in the heat and power industries of Ukraine is complicated by the reduction in demand over the last 5 years. Impacts from Ukrainian nationalization, forced power outages due to the unavailability of sufficient funds to purchase fuel, and cold and warm winter conditions over the last two years makes prediction and trend analysis difficult. Energy consumption from the heat and power industry has been declining due to the elimination of uneconomic enterprises. Imports and exports of electricity recently have also been disrupted because of fluctuating system frequencies which have, in the past, forced the severing of Ukrainian transmission lines with Russia. However, as of September 1, it is understood that these tie lines are currently connected with Russia. This issue further complicates forecasting energy supply and demand. On a macro scale, the net domestic electricity consumption for 1994 was only 75% of that produced in 1990 as shown in Table 2.

Table 3
UKRAINIAN THERMAL POWER STATIONS

Energo	Station	Units	Fuel	Capacity MW
Centrenergo	Tripolie	1-4	Coal	1,200
	Tripolie	5-6	M/NG	600
	Uglegorsk	1-4	Coal	1,200
	Uglegorsk	5-7	M/NG	2,400
	Zmievsk	1-6	Coal	1,050
	Zmievsk	7-10	Coal	1,100
	Subtotal			7,550
Dniproenergo	Krivorozh	1-10	Coal	3,000
	Pridneprov	7-10	Coal	600
	Pridneprov	11-14	Coal	1,200
	Zaporozhie	1-4	Coal	1,200
	Zaporozhie	5-7	M/NG	2,400
	Subtotal			8,400
Donbassenergo	Kurakhov	3-9	Coal	1,470
	Lugansk	5-6	Coal	200
	Lugansk	8-15	Coal	1,600
	Slaviansk	3	Coal	80
	Slaviansk	5	Coal	100
	Slaviansk	6	M/NG	720
	Slaviansk	7	Coal	800
	Starobeshev	4-13	Coal	2,000
	Zouvevsk	1-4	Coal	1,200
	Subtotal			8,170
Zakhidenergo	Bourshtyn	1-12	Coal	2,400
	Dobrotvor	4-6	Coal	300

Energo	Station	Units	Fuel	Capacity MW
	Dobrotvor	7-8	Coal	300
	Ladyzhin	1-6	Coal	1,800
	Subtotal			4,800
Total Minenergo				28,920
Oblenergos	All	All	Coal & M/NG	2,200
Grand Total				31,120

Note: M/NG: Mazut/Natural Gas

The information in Table 2 shows that exported electricity has dropped substantially, 96 percent, while domestic consumption has decreased 25 percent from 1990 to 1994. Total electrical production has decreased 32 percent during this period. It can be seen that the production of electricity from the nuclear and hydro sectors have remained fairly consistent while reductions in power production have primarily been borne by the relatively higher-cost sources such as the thermal and small industrial sectors. The thermal and small industrial sector production has reduced 42.5%. Currently, almost all power production is consumed domestically and very little, ½ of 1%, is exported.

Future shortfalls in fuel supply will result in power production declines which immediately impact domestic consumption. From this information, it appears that fuel shortfalls could not be significantly reduced by importing electricity unless the Ukrainian fuel supply and system frequency control is improved and the transmission system remains connected with Russia. Shortage of primary energy can result in reduced voltage levels and heavy power inflows from Russia which, given past management practices, forces severing of electrical transmission lines. It should also be pointed out that the production figures presented above do not indicate the level of power shortages experienced during winter months for large areas within the Ukraine.

IV. HISTORIC PRIMARY ENERGY SUPPLY

Electrical generation figures over the past 5 years show more detailed information about the annual electric energy production by fuel type as shown in Table 4.

Table 4

POWER PRODUCTION HISTORY
Kilowatt Hours (Billions)

Fuel Source	1990	1991	1992	1993	1994
Thermal (a)	209,375	189,740	169,144	135,870	115,848
Nuclear	76,179	75,131	73,732	75,240	68,848
Hydro	10,704	11,904	8,069	11,210	12,299
Total	296,258	276,775	250,945	228,300	201,599
Usage Index	100	93	85	77	68

(a) Thermal and Small Industrial

This data shows a continual yet significant, 32%, decline in power production over the last 5 years. In 1994, nuclear and hydro plants provided 40% of the total power generated. The hydro and nuclear plants provide a relative cheap and reliable source of electrical energy such that the generation from these plants will be maximized.

The production of hydro and nuclear power is dependent on the availability of impounded water resources and uranium fuel. The 1,000 MW Unit No. 6 at Zaporozhie Nuclear Station came on line for power testing purposes in October 1995 with full production scheduled during the first quarter of 1996. The increase in 1996 nuclear generated electricity due to Zaporozhie No. 6 is expected to be 2,206 million kilowatt hours from 69,633 to 71,839 million, according to Minenergo. This represents a 3.2% rise in nuclear power and an 7.8% increase in nuclear generating capacity. The nuclear power forecast provided by Minenergo reflects the reduced operation of Zaporozhie No. 6 during the first half of 1996 to factor in the power testing schedule

prior to commissioning. The availability of nuclear and hydro power for the upcoming winter months is, therefore, expected to be similar to 1994/1995 winter figures.

The total power production shown above is of course dependent on weather. The impact on demand of the cold winter in 1993 and the warm winter in 1994 are implied within the production figures shown above. Forced power outages were also realized during the past two years. What can be surmised is that if average temperature winters occurred in 1993 and 1994, the production would have been less in 1993 and higher in 1994. For both years the production would have been higher if forced power outages had not occurred. The magnitude of these changes has not been established.

The fossil-fueled power industry uses coal, mazut, and natural gas primary energy supplies. Coal mainly comes from domestic production, while the mazut and natural gas are primarily imported commodities. Consumption of primary energy supplies by the country is shown in Table 5.

Table 5

PRIMARY ENERGY CONSUMPTION SUMMARY

Natural Gas
Cubic Meters (Billions)

	1990	1991	1992	1993	1994
Production	27.8	24.0	22.0	19.2	18.3
Import	87.3	89.5	89.1	79.8	69.1
Export	0.0	0.0	0.0	0.0	0.0
Net Consumption	115.1	113.5	111.1	99.0	87.4
Usage Index	100	99	97	86	76

Mazut

Tonnes (Millions)

	1990	1991	1992	1993	1994
Production	5.3	4.9	4.5	4.2	4.2
Import	54.3	49.6	35.3	19.7	15.8
Export	0.0	0.0	0.0	0.0	0.0
Net Consumption	59.6	54.5	39.8	23.9	20.0
Usage Index	100	91	67	40	34

Coal

Washed Tonnes (Millions)

	1990	1991	1992	1993	1994
Production	130.7	108.7	105.4	91.0	75.9
Import	21.1	12.7	11.7	8.7	7.5
Export	20.0	13.7	7.8	3.5	4.6
Net Consumption	131.8	107.7	109.3	96.2	78.8
Usage Index	100	82	83	73	60

The usage indexes above show how total domestic primary energy consumption has fallen over the last 5 years. The index is generated with year 1990 as the base at 100 units with the remaining units representing the percent consumption of the base year. In essence, over the five year period, natural gas consumption has declined 24%, mazut has decreased 66%, and coal has dropped 40%.

Primary energy consumption by Minenergo power plants is provided in Table 6.

Table 6

POWER STATION ENERGY CONSUMPTION
Reported by Minenergo

Fuel	1992	1993	1994
Natural Gas (Billion Cubic Meters)	26.5	20.2	19.5
Mazut (Million Tonnes)	7.4	4.8	3.0
Coal (Million Tonnes)	42.9	42.9	36.6

Comparison of total national primary energy supply versus the consumption of fuels for power by Minenergo is shown in Table 7.

Table 7

MINENERGO POWER STATION FUEL USE VERSUS TOTAL SUPPLY - 1994

Fuel	Total Supply	Minenergo Usage	Minenergo Percent
Natural Gas (Billion Cubic Meters)	87.4	19.5	22
Mazut (Million Tonnes)	20.0	3.0	15
Coal (Million Tonnes)	78.8	36.6	46

Of the natural gas and mazut consumed in the country 22% and 15%, respectively, are used to produce power. The primary difference in the production and consumption of coal is attributable to coking and steam (energy) coal products. Coking coal is used in the production of steel, while steam coal is consumed for generation of electricity by thermal steam power plants. Detailed historical coal production information is provided in Table 8.

Table 8 data shows domestic raw coal production has decreased 43% from 1990 to 1994. Raw coking coal production is down 45%, from 67.8 to 37.0 million tonnes and raw steam coal is

down by 40%, from 97.0 to 57.4 million tonnes. Domestic clean coal production for the Ukraine shows a 41% decline as it adjusts to the loss of the export market and the reduction of domestic coal demand. It is noted in the table that not all historical data is available. There is a difference in the data as the domestic raw coal index shows production has decreased during the 5 year period by 43% while domestic clean coal production has dropped 41%. This could represent an improvement in coal cleaning performance or the closure of poor quality mining operations. Total clean coal production, including import and export volumes, shows a 40% decrease indicating a net increase in imported coals.

The exported clean coal market has experienced an overall decrease of 77%, from 20.3 to 4.6 million tonnes. It can be seen in Table 8 that exported coal is almost exclusively a steam (energy) coal product. Exported volumes of clean coal for 1994 were 4.3 million for steam and 0.3 million tonnes for coking coal. Imported clean coal has also dropped sharply from 21.2 to 7.5 million tonnes per year, representing a 65% decrease. Imported clean coal is a mix of both energy and coking coal products.

Table 8
COAL PRODUCTION HISTORY 1990 - 1994
(Millions of Tonnes)

Fuel	1990	1991	1992	1993	1994
Domestic Raw Coal					
Coking Coal	67.8	55.3	54.9	45.4	37.0
Steam Coal	97.0	80.3	78.7	70.3	57.4
Total	164.8	135.6	133.6	115.7	94.4
Index	100	82	81	70	57
Domestic Clean Coal					
Coking Coal (a)	na	na	na	na	25.0
Steam Coal	na	na	na	na	51.4
Total	130.7	108.7	106.2	91.6	76.4
Index	100	83	81	70	59
Clean Coking Coal					
Domestic	na	na	na	na	25.0
Imported	10.0	5.2	6.0	2.4	4.7
Exported (b)	0.3	0.3	0.3	0.1	0.3
Total	na	na	na	na	29.4
Index					
Clean Steam Coal					
Domestic	na	na	na	na	51.4
Imported	11.2	7.6	5.9	6.3	2.8
Exported	19.7	13.5	7.5	3.9	4.3
Total	na	na	na	na	49.9
Index					
Total Clean Coal					
Domestic	130.7	108.7	106.2	91.6	76.4
Imported	21.2	12.7	11.8	8.7	7.5
Exported	20.3	13.8	7.9	4.1	4.6
Total	131.9	107.6	110.2	96.2	79.3
Index	100	82	84	73	60

(a) na: Information not available.

(b) The export volumes for 1990-1992 were estimated at 0.3 million tonnes per year.

V. PRIMARY ENERGY INVENTORIES

Coal

Coal is used as fuel for 14 major power stations with 22,800 megawatts (MW) of capacity as shown in Table 3, which represents 79% of the 28,920 MW capacity of the major power stations. Coal inventory levels in the Ukraine are, therefore, of paramount interest when an uninterrupted power supply is endeavored. The level of coal inventory that power station management selects to have on site depends on the overall energy supply situation. As the risk of supply interruptions increases, the amount of coal stockpiled should also increase.

The current total national target coal inventory for the Ukraine is 5 million tonnes of coal. A measure of comparison, which is a good pattern for the Ukraine, is the United States. Utilities in the U.S. commonly carry a 30-day minimum supply of coal in inventory, assuming a full load or 100% plant capacity factor. When labor strikes threaten, the utilities increase their stockpile levels up to the 60- to 90-day range, depending on the amount of labor union coal they purchase. These inventory levels have been successful in providing an uninterrupted supply of electricity to the U.S. consumer. The industry should develop minimum inventory levels under these guidelines and provide for a minimum of 30 days of coal inventories at each power station prior to the 1995/1996 winter season. This would require maintaining a total national target coal inventory of 10.2 million tonnes, about double the current Ukrainian target. Because of uncertainties surrounding the transition to a free market economy and concern over potential labor strikes, which is discussed later, it is prudent that 60-day inventories be gradually built up over the next year. This is advisable as these levels could partially offset situations where countries exporting fuel to the Ukraine cut off supplies for any number of reasons, as has been experienced recently.

Coal inventory levels were determined as of September 1, 1995 for each of the major coal-fired power stations in the Minenergo system. Information obtained from Minenergo's fuel and transportation department was confirmed by information received over a period of time from a few regional energos. The level of coal inventories stated in two stockpiles had been visually inspected and confirmed by Hagler Bailly Consulting. The stated level of the remainder of the inventories were therefore assumed to be reliable. The reserve levels for all fuels include the strategic inventories designated by government.

According to Minenergo, the total coal inventory, including the regional Oblenergos as of September 1, 1995 was 5,007,000 tonnes which is 637,000 tonnes, or 11% less than the coal inventory on the same date a year earlier. Table 9 shows the detail of plant inventories reported by Minenergo, excluding the Oblenergos, on hand as of September 1, 1995 which totals 4,131,000 tonnes. The Oblenergos, therefore, had 876,000 tonnes in stockpiles. The full load coal consumption was calculated for each major plant and an average of 12 days of plant operation was determined from the coal inventory levels, as shown on Table 9. Power stations were then classified according to the coal inventory levels shown in Table 10, considering the number of days of coal inventory assuming full production of all blocks.

Table 9

AUGUST FUEL CONSUMPTION AND INVENTORY ANALYSIS

Power Station	Total Plant Capacity MW	Full Load Coal Consumption Per Day Tonnes	September Beginning Inventory Tonnes	Inventory Level in Days of Operation	Inventory Level Need Status	Critical Need Status MW	Rebuild or Critical Need Status MW
Centrenergo							
Tripolie	1,200	15,830	24,000	2	Critical	1,200	1,200
Uglegorsk	1,200	16,999	30,000	2	Critical	1,200	1,200
Zmievsk	2,150	28,009	320,000	11	Critical	2,150	2,150
Subtotal	4,550	60,838	374,000	6	Critical	4,550	4,550
Dniproenergo							
Krivorozh	3,000	39,174	240,000	6	Critical	3,000	3,000
Pridneprov	1,800	23,008	621,000	27	Rebuild	0	1,800
Zaporozhie	1,200	19,387	66,000	3	Critical	1,200	1,200
Subtotal	6,000	81,569	927,000	11	Critical	4,200	6,000
Donbassenergo							
Kurakhov	1,470	29,225	1,095,000	37	In Range	0	0
Lugansk	1,800	25,518	402,000	16	Critical	1,800	1,800
Slaviansk	980	12,092	257,000	21	Rebuild	0	980
Starobeshev	2,000	25,006	277,000	11	Critical	2,000	2,000
Zouvevsk	1,200	20,160	51,000	3	Critical	1,200	1,200
Subtotal	7,450	112,001	2,082,000	19	Critical	5,000	5,980

Power Station	Total Plant Capacity MW	Full Load Coal Consumption Per Day Tonnes	September Beginning Inventory Tonnes	Inventory Level in Days of Operation	Inventory Level Need Status	Critical Need Status MW	Rebuild or Critical Need Status MW
Zakhidenergo							
Bourshtyn	2,400	41,646	490,000	12	Critical	2,400	2,400
Dobrotvor	600	11,617	183,000	16	Critical	600	600
Ladyzhin	1,800	33,371	75,000	2	Critical	1,800	1,800
Subtotal	4,800	86,634	748,000	9	Critical	4,800	4,800
Grand Total	22,800	341,042	4,131,000	12	Critical	18,550	21,330
Percent						81%	94%

Memo:

Inventory Status						
Critical	Rebuild	Min Target	In Range	Max Target	AboveMax	Excess
<20	20-30	30	30-60	60	60-80	>80 days

Table 10

FUEL INVENTORY LEVEL CLASSIFICATION

Days of Inventory	Inventory Status
< 20	Critical
20-30	Rebuild To Min. Target
30	Minimum Target
30-60	In Range
60	Maximum Target
>80	Excess Target

Reported coal inventory levels at each power station were then compared to the inventory requirements recommended in Table 10 to establish the coal inventory conditions at the GENCO power stations. The data in Table 8 shows that of a total plant capacity of 22,800 megawatts,

81% percent of the total coal-fired station capacity is in a critical inventory condition with reserves below the a critical 20-day level. Of the total major power station capacity, 94% require coal inventory rebuilding to place inventory levels at the recommended minimum 30-day target.

Power stations which are facing immediate critical coal inventory situations as of September 1, 1995 are Uglegorsk, Tripolie, and Ladyzhin with 2 days each, Zouvevsk and Zaporozhie with 3 days each, and Krivorozh with 6 days of coal inventory. These plants have a total capacity of 9,600 megawatts which represents 42% of the coal-fired plant capacity. Kurakhov is the only plant with adequate coal inventories at a 37-day level.

On the issue of critical need to survive the winter period, it is recommended that coal stockpiles be built to minimum 30-day inventory levels. Table 11 shows the additional coal tonnages required for each power station to achieve 30-day inventory levels. Centrenergo requires 1,451,152, Dniproenergo requires 1,520,062, Donbassenergo requires 1,496,272, and Zakhidenergo requires 1,851,021 tonnes of coal. The total minimum inventory build requirement is 6,318,507 tonnes. Assuming a conservative delivered cost of $35 per tonne, equal to the 1995 steam coal price paid to Poland for imports, the cost of building these inventories is about $221 million.

Table 11

MINIMUM COAL INVENTORY REQUIREMENTS

Power Station	Total Plant Capacity MW	Full Load Consumption Tonnes Per Day Average	September Beginning Inventory Tonnes	30 Day Inventory Requirement Tonnes	30 Day Inventory Build Requirement Tonnes	Inventory Build Cost $ (000) (a)
Centrenergo						
Tripolie	1,200	15,830	24,000	474,907	450,907	$15,782
Uglegorsk	1,200	16,999	30,000	509,973	479,973	$16,799
Zmievsk	2,150	28,009	320,000	840,273	520,273	$18,210
Subtotal	4,550	60,838	374,000	1,825,152	1,451,152	$50,790

Power Station	Total Plant Capacity MW	Full Load Consumption Tonnes Per Day Average	September Beginning Inventory Tonnes	30 Day Inventory Requirement Tonnes	30 Day Inventory Build Requirement Tonnes	Inventory Build Cost $ (000) (a)
Dniproenergo						
Krivorozh	3,000	39,174	240,000	1,175,232	935,232	$32,733
Pridneprov	1,800	23,008	621,000	690,225	69,225	$2,423
Zaporozhie	1,200	19,387	66,000	581,605	515,605	$18,046
Subtotal	6,000	81,569	927,000	2,447,062	1,520,062	$53,202
Donbassenergo						
Kurakhov	1,470	29,225	1,095,000	876,754	0	$0
Lugansk	1,800	25,518	402,000	765,527	363,527	$12,723
Slaviansk	980	12,092	257,000	362,768	105,768	$3,702
Starobeshev	2,000	25,006	277,000	750,176	473,176	$16,561
Zouvevsk	1,200	20,160	51,000	604,800	553,800	$19,383
Subtotal	7,450	112,001	2,082,000	3,360,025	1,496,271	$52,369
Zakhidenergo						
Bourshtyn	2,400	41,646	490,000	1,249,383	759,383	$26,578
Dobrotvor	600	11,617	183,000	348,516	165,516	$5,793
Ladyzhin	1,800	33,371	75,000	1,001,123	926,123	$32,414
Subtotal	4,800	86,634	748,000	2,599,021	1,851,021	$64,786
Grand Total	22,800	341,042	4,131,000	10,231,260	6,318,506	$221,148

(a) Coal Price: $35.00/tonne

Coal deliveries during August, 1995 to Pridneprov, and Kurakhov were 80,000 and 376,000 tonnes, respectively, ahead of plan. Pridneprov and Kurakhov both had relative higher coal inventories. It is not understood why these coal deliveries were permitted to continue when the inventory levels at other power stations were in dire need for inventory building.

Coal quality deliveries to Pridneprov during 1994 averaged 28.25% ash, while shipments to both Tripolie and Uglegorsk averaged about 31% ash. With both Tripolie and Uglegorsk suffering

from low stockpile levels it would seem logical that some of these shipments could have been diverted. The coal shipment/inventory need situation should be reviewed further.

Consumption of coal during August 1995 reflects power station dispatch orders from the National Dispatch Center (NDC). This consumption is shown in Table 12 on a tonne per day basis and compares August to the average 1994 daily consumption. Without the aid of specific plant familiarity or dispatching strategy, it is not clear why the dispatching process in August, 1995, apparently fails to consider the dire problem of low inventories at plants with critical inventory situations. Plants which have immediate critical inventory situations, but are consuming coal at rates higher than the average 1994 rate are Uglegorsk, Krivorozh, Zouvevsk, and Ladyzhin. The only immediate critical inventory plants which are operating at lower coal consumption rates than the 1994 average are Tripolie and Zaporozhie, but Zaporozhie is very close to the 1994 average. On the other hand, some plants with higher coal inventories such as Lugansk and Slaviansk are consuming coal at rates significantly, 36-37%, below the 1994 average consumption rates. This dispatch strategy is exacerbating the problem of low inventory levels. This inventory level versus coal consumption rate situation be studied.

Table 12

AVERAGE DAILY COAL CONSUMPTION: 1994 VERSUS AUGUST 1995

	Average Daily Consumption					
	1994			August '95	August '95	September 1994
	Consumption Thousands	Daily Consumption	August 1995	Change Over 1994	Compared To 1994	Beginning Inventory
Power Station	Tonnes	Tonnes	Tonnes	Tonnes	% Change	Tonnes
Centrenergo						
Tripolie	1,828	5,008	3,984	(1,024)	-20%	24,000
Uglegorsk	1,525	4,178	6,097	1,919	46%	30,000
Zmievsk	3,342	9,156	10,919	1,763	19%	320,000
Subtotal	6,695	18,342	21,000	2,658	14%	374,000
Dniproenergo						
Krivorozh	4,063	11,132	12,581	1,449	13%	240,000
Pridneprov	2,849	7,805	7,194	(612)	-8%	621,000
Zaporozhie	3,182	8,718	8,581	(137)	-2%	66,000
Subtotal	10,094	27,655	28,355	700	3%	927,000
Donbassenergo						
Kurakhov	4,513	12,364	12,065	(300)	-2%	1,095,000
Lugansk	2,019	5,532	3,532	(1,999)	-36%	402,000
Slaviansk	927	2,540	1,597	(943)	-37%	257,000
Starobeshev	3,584	9,819	12,613	2,794	28%	277,000
Zouvevsk	1,794	4,915	7,290	2,375	48%	51,000
Subtotal	12,837	35,170	37,097	1,927	5%	2,082,000
Zakhidenergo						
Bourshtyn	3,083	8,447	11,097	2,650	31%	490,000
Dobrotvor	821	2,249	6,016	3,767	167%	183,000
Ladyzhin	2,118	5,803	6,371	568	10%	75,000
Subtotal	6,022	16,499	23,484	6,985	42%	748,000
Grand Total	35,648	97,666	109,935	12,270	13%	4,131,000

Mazut

Mazut and natural gas are used to fire 9 of the units with a generating capacity of 6,120 MW as shown in Table 3 and to co-fire the coal-fired plants. Co-firing is employed by burning either natural gas or mazut with the coal to maintain flame stability.

Total mazut inventory levels as of September 1, 1995 were quoted by Minenergo at 314,000 tonnes. This inventory is 263,000 tonnes less than the reserves at the beginning of last winter. During 1994, mazut, or fuel oil, consumption was 3.0 million tonnes and the average daily consumption rate of mazut was 8,220 tonnes per day. The September 1st mazut inventory level, based on the full production burn rate, is estimated at a 16-day supply. This estimate assumes 20% of the capacity of the major mazut/natural gas power stations shown in Table 3 would use mazut and 80% would use natural gas. Co-firing mazut use is assumed at the 1994 rate.

Minenergo indicates the 314,000 tonnes represents a 10-day supply of mazut and that the minimum mazut inventory should be 500,000 tonnes. The basis for Minenergo's days of inventory estimate is not known, but their 10-day calculations indicate a daily consumption of 31,000 tonnes which is about 3 times the daily consumption observed in 1994. However, the current minimum mazut inventory target is near the 575,000 tonnes of mazut which would provide a 30-day supply recommended by this study. The cost to increase the mazut inventory to a 30-day level, at a $100/tonne mazut cost would be $26.1 million.

Most oil/natural gas fired power plants are said to maintain 20,000-30,000 tonnes of mazut in their on-site inventory. There is also a central storage area for mazut near the Uglegorsk plant whose data is assumed to be included below. Unconfirmed inventory levels at power stations, according to individual energo reports, are shown in Table 13 as of about September 1, 1995. The differential between these inventories and their total 314,000 tonnes is undetermined.

Table 13

MAZUT INVENTORY - SEPTEMBER 1, 1995

Energo	Station	Tonnes
Centrenergo (a)	Tripolie	na
	Uglegorsk	na
	Zmievsk	na
	Total	35,016
Dniproenergo (a)	Pridneprov	1,000
	Krivorozh	1,100
	Zaporozhie	22,000
	Total	24,200
Donbassenergo (b)	Kurakhov	5,200
	Lugansk	5,600
	Slaviansk	0
	Starobeshev	2,400
	Zouvevsk	100
	Total	13,300
Zakhidenergo (a)	Bourshtyn	6,900
	Dobrotvor	400
	Ladyzhin	900
	Total	8,200
Grand Total		80,716

(a) As of September 1, 1995

(b) As of September 18, 1995

Natural Gas

Natural gas consumption by the major power stations can be substituted for mazut, as discussed previously. The power stations using natural gas are shown in Table 3 and co-firing at the coal stations is also employed. Natural gas consumption during 1994 was reported by Minenergo at 19.5 billion cubic meters. This total includes the reduction in natural gas consumption that was likely due to the Turkmenistan natural gas embargo that lasted from November 1994 through mid-January 1995.

The natural gas reserves quoted by Minenergo are 5.9 billion cubic meters, but this figure may be misleading as the total Ukraine underground gas storage quantity is reported at 10.9 billion cubic meters. This natural gas is stored in the Bagarachanskoye and Bilchevolitskoye gas storage fields located in the western Ukraine. The amount of this gas which is dedicated to power plants is not clear; however, Minenergo uses about 20% of the total country natural gas consumption.

The 5.9 billion cubic meters of inventory quoted by Minenergo is equivalent to a 63-day supply of gas, based on 80% of the gas-fired station capacity, at a full production burn rate, as discussed in the mazut inventory calculation above. This work estimates that a minimum of 2.8 billion cubic meters of gas be established as a 30-day full load gas supply. The gas inventory appears to represent just over a 2 month supply. Given the recent problems with gas supply interruption, this inventory is likely adequate.

VI. WINTER FORECAST: POWER PRODUCTION AND ENERGY CONSUMPTION

Information on historical power production and energy consumption was used with 1995 year-to-date data to project normal, cold winter and warm winter cases for prediction of primary energy demand. The winter period assessed is assumed to be the six month period encompassing the 4th quarter of 1995 and the 1st quarter of 1996. Nomenclature used herein terms this the projection period and it corresponds with the same time frame one year earlier called the base period.

The 1995 year-to-date power production statistics through the second quarter show 98,897 billion kilowatt hours in comparison to 1994 first half production of 101,704 billion kilowatt hours. This minor -3% change indicates that the 32% drop in electricity production seen over the last five years is likely bottoming out, especially when considering 1994 was a warm winter year. This data can be seen in Table 14 along with the 1995 electricity consumption projection data.

The 1995 normal winter case power production is calculated from the base period with an adjustment for the 1994 warm winter which was realized. This assessment is shown in Table 15. This results in a normal winter projection with an overall 1% increase in power production for 1995 versus 1994 as also shown on Table 14. The warm and cold winter cases were determined by varying the fourth and first quarter consumption rates by 5.5% and 6.6%, respectively. The result is electricity production projections of 197,883 and 205,179 billion kilowatt hours for the warm winter and cold winter cases, respectively. These projections represent 98% and 102% for each case compared to the 1994 production rate. Within the projection calculations, the historical trend for hydro and nuclear power production was used as a base load with thermal and small industrial plant production modified to meet demand requirements as 1995 production was predicted. This data is also shown in Table 14.

Table 14

FORECAST POWER DEMAND FOR THE 1995/1996 WINTER QUARTERS

Quarterly Production History

Electricity Generation Billion KWh

	1994				1995	
Source	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2
Thermal	29,100	22,521	32,708	31,519	28,137	24,101
Hydro	3,120	5,401	1,874	1,904	2,123	3,865
Small Industrial	1,400	1,097	862	1,245	1,180	885
Total Nuclear	21,640	17,425	10,209	19,574	23,334	15,272
	55,260	46,444	45,653	54,242	54,774	44,123

1995 Normal Winter Consumption Projection

Electricity Generation Billion KWh

	Quarters 1&2		Quarters 3&4		Year	
	Actual	Actual	Actual	Projected	Actual	Projected
Source	1994	1995	1994	1995	1994	1995
Thermal	51,621	52,238	64,227	65,961	115,848	118,199
Hydro (a)	8,521	5,988	3,778	6,300	12,299	12,288
Small Industrial	2,497	2,065	2,107	2,175	4,604	4,240
Nuclear (b)	39,065	38,606	29,783	30,000	68,848	68,606
Total	101,704	98,897	99,895	104,436	201,599	203,333
%Change from '94 - '95		-3%		5%		1%

1995 Cold Winter Consumption Projection

Electricity Generation Billion KWh

	Quarters 1&2		Quarters 3&4		Year	
	Actual	Actual	Actual	Projected	Actual	Projected
Source	1994	1995	1994	1995	1994	1995
Thermal	51,621	52,238	64,227	67,759	115,848	119,997
Hydro	8,521	5,988	3,778	6,300	12,299	12,288
Small Industrial	2,497	2,065	2,107	2,223	4,604	4,288
Total Nuclear	39,065	38,606	29,783	30,000	68,848	68,606
Total	101,704	98,897	99,895	106,282	201,599	205,179
%Change from '94 - '95		-3%		6%		2%

1995 Warm Winter Consumption Projection

Electricity Generation Billion KWh

	Quarters 1&2		Quarters 3&4		Year	
	Actual	Actual	Actual	Projected	Actual	Projected
Source	1994	1995	1994	1995	1994	1995
Thermal	51,621	52,238	64,227	60,695	115,848	112,933
Hydro	8,521	5,988	3,778	6,300	12,299	12,288
Small Industrial	2,497	2,065	2,107	1,991	4,604	4,056
Total Nuclear	39,065	38,606	29,783	30,000	68,848	68,606
	101,704	98,897	99,895	98,986	201,599	197,883
		-3%		-1%		-2%

(a) Projection assumes historical annual hydro production levels

(b) Projection assumes historical annual nuclear production levels

Table 15

THERMAL POWER STATION WINTER POWER SUPPLY COMPARISON
Quarterly Percentage of Total Annual Thermal Power Supply

Case Basis	Weather Condition	Quarter 4	Quarter 1
Historical Energo	Average Winter Weather	28.8%	26.9%
Year 1994	Warm Winter Weather	27.2%	25.1%
Difference		1.6%	1.8%
Change to Base Case		5.5%	6.6%

Base Case Development Notes:
1. 1994 was a warm winter so a base for a 1995 normal winter must be increased in the 4th quarter by 5.5%. Warm and cold winters can then be forecast at + or -5.5% for the fourth quarter 1995. The same principle applies to the first quarter of 1996.
2. These principles apply because the year to date 1995 production of electricity is 97% of the 1994 power generation rate.
3. The base case change is to the quarterly electricity production, therefore the quarterly change must be made to the base quarterly index rather than the annual production base.

The 1995 projection was then used to predict primary energy consumption in the 4th quarter of 1995 and the first quarter of 1996. Typical year quarterly electricity production statistics were used to determine quarterly production. Total 1994 primary energy use was used with the quarterly electricity production statistics to forecast quarterly primary energy consumption. This data was then used to calculate the primary energy consumption for the upcoming winter quarters. The results provide a range of projections for primary energy consumption, dependent on winter conditions as shown in Table 16.

Table 16

PRIMARY ENERGY DEMAND - 1995/1996 WINTER

Fuel Source	Warm Winter	Cold Winter
Coal (Million Tonnes)	18.55	19.71
Mazut (Million Tonnes)	1.45	1.54
N. Gas (Billion Cubic Meters)	9.88	10.50

Detailed primary energy consumption projections are shown in Table 17 for 1995 and Table 18 for the 1995/1996 winter period. Average monthly and weekly primary energy demands for the 1995/1996 Winter period are shown in Table 19.

Table 17

FUEL CONSUMPTION FOR 1994 AND 1995

	Quarters 1&2		Quarters 3&4		Year	
	Actual	Actual	Actual	Projected	Actual	Projected
Fuel	1994	1995	1994	1995	1994	1995
Base Case						
Coal (M Tonnes)	16.44	16.46	20.15	20.66	36.58	37.12
Mazut (M Tonnes)	1.22	1.29	1.50	1.61	2.73	2.90
N. Gas (B Meters 3)	8.79	8.76	10.78	11.01	19.57	19.77
Cold Winter Case						
Coal (M Tonnes)	16.44	16.46	20.15	21.21	36.58	37.66
Mazut (M Tonnes)	1.22	1.29	1.50	1.66	2.73	2.94
N. Gas (B Meters 3)	8.79	8.76	10.78	11.30	19.57	20.06
Warm Winter Case						
Coal (M Tonnes)	16.44	16.46	20.15	19.00	36.58	35.45
Mazut (M Tonnes)	1.22	1.29	1.50	1.48	2.73	2.77
N. Gas (B Meters 3)	8.79	8.76	10.78	10.12	19.57	18.88

Table 18

FORECAST FUEL DEMAND FOR THE 1995/1996 WINTER PERIOD

Fuel	1995 Quarter 4	1996 Quarter 1	Period Total
Base Case			
Coal (M Tonnes)	10.10	9.32	19.42
Mazut (M Tonnes)	0.79	0.73	1.52
N. Gas (B Meters 3)	5.38	4.97	10.34
Cold Winter Case			
Coal (M Tonnes)	10.25	9.46	19.71
Mazut (M Tonnes)	0.80	0.74	1.54
N. Gas (B Meters 3)	5.46	5.04	10.50
Warm Winter Case			
Coal (M Tonnes)	9.65	8.91	18.55
Mazut (M Tonnes)	0.75	0.70	1.45
N. Gas (B Meters 3)	5.14	4.74	9.88

Table 19

WINTER MONTHLY & WEEKLY AVERAGE PRIMARY ENERGY DEMAND

	Monthly Demand		Weekly Demand	
Fuel	Warm Winter	Cold Winter	Warm Winter	Cold Winter
Coal (Million Tonnes)	3.09	3.24	0.77	0.81
Mazut (Million Tonnes)	0.24	0.26	0.06	0.06
Gas (Billion Cubic Meters)	1.65	1.75	0.41	0.44

VII. SUPPLY OF PRIMARY ENERGY DURING THE WINTER

Information on the Ukrainian coal industry and coal transportation network is very limited due to difficulties experienced in obtaining information from the Coal Ministry. Information produced by the mining associations was collected from PIER, Partners in Economic Reform, and the World Bank to summarize their coal reserves, coal production capacity, 1994 coal production, and number of employees. The production and capacity statistics are summarized in Table 20. The data is shown in raw tonnes. Raw coal is coal as-mined. Often, coal is purified through a coal washing process where the coal is floated in a heavy media or jig and the more dense non-coal material is allowed to sink. This separation process produces a "clean" or "washed" coal product.

Table 20 shows that the 1994 total raw coal production was 92.7 million tonnes. This compares favorably to the coal production data shown in Table 8 previously at 94.4 million tonnes. The data from Table 8 also shows the 1994 total clean coal product at 76.4 million tonnes. This indicates there is a clean coal recovery factor of 81%. Using this factor with the raw tonnes shown on Table 20, allows the prediction of clean coal production and capacities based on the mining association data. This prediction is shown in Table 21.

Table 20

RAW COAL PRODUCTION AND CAPACITY

	1994 Production (000) Tonnes			January 1, 1995 Production Capacity (000) Tonnes		
Mine Association	Steam Coal	Coking Coal	Total Coal	Steam Coal	Coking Coal	Total Coal
Donetskugol	2,896	6,664	9,560	4,740	9,160	13,900
Makeyevugol	1,173	4,871	6,045	1,580	6,265	7,845
Krasnoarmeiskugol	0	5,585	5,585	0	7,800	7,800
Selidovugol	2,124	0	2,124	3,300	0	3,300
Dobropolyeugol	1,029	3,099	4,128	1,000	4,150	5,150
Artyomugol	103	1,923	2,026	400	3,570	3,970
Ordzhonikidzeugol	1,031	662	1,693	2,520	1,530	4,050
Dzerzhinskugol	0	1,497	1,497	0	2,575	2,575
Shakhtyorskugol	1,529	0	1,529	2,655	0	2,655
Octoberugol	1,838	0	1,838	2,730	0	2,730
Torezanthracite	5,177	0	5,177	5,710	0	5,710
Luganskugol	5,299	256	5,556	5,550	350	5,900
Stakhanovugol	1,088	1,245	2,334	2,280	2,800	5,080
Pervomaiskugol	980	350	1,330	2,500	530	3,030
Lisitchanskugol	1,569	0	1,569	3,085	0	3,085
Krasnodonugol	48	3,437	3,485	na	6,630	6,630
Donbassanthracite	3,035	0	3,035	5,150	0	5,150
Anthracite	1,074	0	1,074	2,450	0	2,450
Rovenkianthracite	4,630	0	4,630	4,730	0	4,730
Sverdlovanthracite	3,246	0	3,246	6,730	0	6,730
Pavlogradugol	6,477	2,809	9,287	7,500	3,930	11,430
Ukrzapadugol	6,316	0	6,316	9,390	0	9,390
Alexandriaugol	2,659	0	2,659	6,780	0	6,780
Independent Mines	6,373	643	7,016	10,270	1,170	11,440
Total	59,695	33,041	92,737	91,050	50,460	141,510
Clean Coal Tonnes (a)	48,353	26,763	75,117	73,751	40,873	114,623
Capacity Factor (b)	66%	65%	66%			

na: data not available
(a) Assumes a clean coal recovery factor of 81%
(b) Usage/Capacity

Table 21

COAL MINING INDUSTRY PRODUCTION AND CAPACITY SUMMARY

	Millions of Tonnes		
Fuel	Steam Coal	Coking Coal	Total Coal
Raw Coal			
1994 Production	59.7	33.0	92.7
1/1/95 Production Capacity	91.0	50.5	141.5
Clean Coal			
1994 Production	48.3	26.7	75.0
1/1/95 Production Capacity	73.6	40.9	114.5

Comparison of the clean steam coal production for 1994 shows 48.3 million tonnes as shown in Table 21 versus 51.4 million tonnes as shown in Table 8. Because the information comes from two completely separate sources, this information is determined to be reliable, given this minor 6% variance. Based on this data, the six month production capacity of the steam coal sector of the mining industry is one half of 73.6 shown above or 36.8 million tonnes. Current production rates, assuming the same rates as 1994 for a six month period, would be 24.2 million tonnes, while the projected demand, shown in Table 16 reflects a cold winter need for 19.7 million tonnes of clean coal. It can be concluded that there is adequate domestic coal production capacity to fulfill the winter coal fuel demand by the GENCOS based on recent production history and the total industry production capacity for steam coal. The capacity factor employed at the mines is about 66%. This is adequate capacity to produce the necessary tonnage which could be burned but coal inventory build to a 30-day level could not be quickly attained. It will likely be very difficult to develop 30-day inventories before the winter is over, because of time constraints. Domestic and imported coal could help to alleviate the crucial inventory problems

and rolling power outages during the winter if the GENCOS can pay for the fuel. It is recommended that action plans be devised and implemented to build the coal inventories over the next 6-9 months to cope with the current winter fuel shortfall problem and to prepare for the 1996\1997 winter.

Domestic coal prices quoted by Minenergo for delivered steam coal range from $25 to $35 per tonne. Coal is generally purchased from Ukruglesbud, three cornered trade groups, or the coal associations. Some mines can now produce and sell quantities of coal beyond minimum production levels without government involvement and interference. Coal contracts provided to Hagler Bailly are simple one page documents which exhibit little control of the coal supply obligation. The coal transportation cost components of the above quoted prices are not documented nor understood within the confines of this study. It is recommended that additional work be performed to provide the GENCO's and the mining industry with better coal contracting guidelines and that the coal transportation capacities, costs, and infrastructure be defined in terms of coal supply to power stations.

The information available on the coal mining industry is incomplete. This work herein simply assumes recent past production capabilities could be used to fulfill the winter steam coal requirements. Intimate knowledge of the domestic coal industry is not organized and available to ascertain if there are specific limitations to coal production and consumption equations. An example would be the limitations in coal use by particular power stations due to the specific coal quality of the available coal. This analysis provides the best assessment available at this time, given the information which could not be obtained from the Ministry of Coal and the time frames available. It is recommended that further work be expended to more fully understand the coal mining and transportation industries and their relationship with the power plants.

A primary risk concerning a coal shortfall this winter is the potential for mine labor strikes. There is a history of recent strikes at several of the mines as coal miners feel they must demonstrate to force the government to pay back wages. Wages are often in arrears by three to four months. This issue is noticeably in the press and covers a wide range of mines. As recently as August, 1995 the government provided for special fund appropriations in order to pay miners back wages.

Information received from an independent mining labor union indicates the wage payment

problem still exists and further strikes are threatened. Please see Appendix A. The potential for longer strikes could seriously impact the capability of the industry to provide coal during the winter months. It is recommended that any funds which are provided be allocated in such a way that miners receive their back pay in order to reduce the risk of a major coal supply interruption.

Imported coal levels are currently increasing. Minenergo's forecast for 1995 and 1996 project 8.7 and 12.0 million tonnes, respectively, up from 7.5 million tonnes in 1994. The 1995 imported steam coal deliveries to Minenergo through the first 2 quarters currently total 5.6 million tonnes. Reasons for this include an improved coal quality, the impact of 3-way trading arrangements, and a desire by the power plant operators to press the domestic mining industry to begin producing a higher quality coal with less ash. Some domestic coal shortfall could be made up by importing coal from either Poland or Russia. This would require new three cornered trade agreements, hard currency, or foreign credit.

Coal prices calculated from Minenergo data show $26.00 for 2.6 million tonnes from Poland and $30.00 per tonne for 3.0 million tonnes imported in 1994 from Russia and Kazakhstan. Other reports indicate the 1995 Poland coal import costs at $35 per tonne.

Appendix A.

Independent Coal Miners of Ukraine

Appeal by theUnion Chairman
Mickhail Volynets

NPHU APPEAL

August 17,1995
Kiev, Ukraine

At this day, led by my moral commitments and professional obligation, I appeal to you, my mining brothers and fellow NPHU members.

At present, serious crisis has overcome the coal industry of this nation. The decline of production is continuing, that had shown itself in coal mining long before it became obvious in other industries. Only in 1995, production has fallen by nine million tons as compared to the same period of 1994. Now half as much coal is produced in Ukraine as in 1988. Current production levels, both per man and per unit of equipment, are some of the lowest in the world. In 1994, an average mine in Ukraine produced only 380 thousand tons of coal. Machine-building operations and coking plants are buying coal from Poland and Russia, thus contributing to their economic growth, not to that of Ukraine.

I would attribute this situation to the following reasons:

Firstly, for many years this ex-socialist country had been driven by a fallacious principle of making fast profit; therefore, investment would go to developing coal mines in Siberia and Kazakhstan, as opposed (and harmful) to Ukraine.

Secondly, in later years, the government of Ukraine has kept the industry and its problems at bay, depriving coal of the support it needed for further development.

Thirdly, another significant reason, or possibly a result of the above two was the fact that the industry came unprepared to the onset of reform. Also, today it is headed by people at the Ministry of Coal, who are unable to accomplish radical change and would rather gravitate toward the old command and administration system.

In these circumstances, when coal prices are fixed, and materials and equipment are to be purchased at free market value, the situation in the industry continues to deteriorate. At the same time, the Ministry attempts to centralize almost every function of managing mine operations; in parallel with

that, it has assumed the right to sell coal and distribute profits of better mines. Thus, the mines are deprived of any possibility to successfully compete, control their coal, keep accounts and deal with customers, attract investment, reduce the number of administrative staff and employees at non-productive (ancillary) operations.

The Ministry, coal associations and mines maintain dozens of operations that bear no direct relationship to mining coal. Together with social safety net facilities, these operations impose a heavy burden on the industry - that of added cost per ton of coal. No modernization is accomplished in terms of mining facilities; equipment is being worn out; liquid assets of mines are not replenished; wages are paid thirty or even sixty days after due. The very fact of not being paid in time puts miners in a difficult situation humiliating to miners, who have no other means to subsist and support their families. More and more miners get injured and suffer from occupational diseases. The pride and prestige once associated with being a coal miner are rapidly dwindling. As a result, skilled working men are now leaving the industry.

As a part of the Cabinet of Ministers, the Ministry of Coal proved unable to utilize the research and development potential it controls, and find a way out of crisis. Conversely, it became a barrier to the industry's development. "Ministerial management" resulted in a continued slide towards collapse and disaster.

In order to protect miners, NPHU (Independent Coal Miners of Ukraine) developed a number of proposals, meant to improve the status of the industry. These proposals that have been presented to both the Cabinet and the Ministry of Coal multiple times, include the following:

- Mines should be granted a right to independently sell coal and settle accounts with customers on their own; they also should be allowed to unite in financial groups, based on interests of particular enterprises.
- A part of social safety net facilities and ancillary operations should be taken off mines' books (balance sheets). This will allow to reduce cost per ton of coal by up to 40, and no less than 25 percent. Social costs should be covered from the national budget.
- Wages for basic occupations, including face and development workers, should be increased to reach a consumer budget level, that is to KRB 40 million/month.

These proposals, though presented to the Ministry and other government agencies numerous times, have been either ignored or postponed - reportedly for further consideration. At the same time, "official" union leaders attempted to stage several protest actions in spring/summer this year. Not only have they failed to achieve a positive result - their actions were harmful to both industry and the labor movement. Not a single demand out of seventeen that were set forth in May 1995 was practically satisfied. One cannot help thinking that the so-called protests and such were masterminded by the Ministry. As for the demands that we heard from some of the official union leaders, then, stripped of their rhetoric, they only meant to retain the existing structure and positions at the Ministry.

In light of the above, in order to safeguard the interest of coal miners, and based on my mandate and objectives, as defined by NPHU Constitution, I urge all NPHU locals to start preparation for protest actions, to be carried out in fall 1995.

Apart from that, a Local Chair Conference shall convene on September 6 and 7 to discuss the following issues:

- Current situation in the industry and the possible ways out of crisis;
- NPHU tactics to safeguard the interests and rights of miners in fall 1995.

Once again, I want to assure you that NPHU has enough strength and experience to protect Ukrainian coal Miners.

/s/ Mickhail Volynets Chairman of Independent Miners' Union of Ukraine

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