

Project Name Ukraine-Hydropower 2 Project

Region Europe and Central Asia

Sector Energy

Project ID UAPA40565

Borrower Either Dniesterhydroenergo alone (with Government guarantee of repayment), or Government with on-lending to Dniesterhydroenergo

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Date PID Prepared November 1, 1995

Projected Appraisal Date October, 1996

Projected Board Date April 30, 1997

Country and Sector Background

I. Country Background: Ukraine declared its independence from the Soviet Union in August 1991. It has a land mass that, with the exception of European Russia, is the largest in Europe and a population of 52 million, the third highest in Europe. GNP per capita was estimated at US\$ 1,570 in 1994. The economy is mainly based on industry and agriculture, which together accounted for more than 70 percent of GDP in 1991. Ukraine, despite its size, is also heavily dependent on trade, notably with the rest of the former Soviet Union (FSU).

II. The economic decline in Ukraine has been dramatic. Real GDP contracted by 14 percent in 1993, bringing the cumulative fall in output since 1990 to 38 percent. This trend accelerated in 1994 as GDP declined by about 23 percent. The rate of inflation rose to an average of 4,735 percent in 1993 (up from 1,210 percent in 1992) due to loose fiscal and monetary policy. In the first half of 1994, the inflation rate came down to single digit levels, primarily on account of flagging demand, itself the result of a large drop in real wages and a stringent credit policy. A freeze in the adjustment of administered prices (particularly energy) after December 1993 also contributed to the slowdown in inflation.

III. In July 1994, Ukraine elected a new President who called for a radical break from past economic policies. A comprehensive program of macroeconomic stabilization and structural reforms was developed with the assistance of the IMF and the World Bank. A series of difficult and far-reaching measures were implemented in October 1994 to demonstrate

the Government's commitment, and the IMF approved a first purchase of US\$ 365 million under the Systemic Transformation Facility in support of the stabilization program. A Rehabilitation Loan of US\$ 500 million was approved by the Bank in December 1994 to support the implementation of structural reform measures necessary to create the conditions for future economic growth led by a vibrant private sector.

IV. Significant economic improvement has been realized since October, 1994. Fiscal and credit policies have been tightened and inflation sharply reduced. Monthly rates of inflation have fallen from 20% in early 1995 to around 5 percent during April-July, 1995. However, there remains significant room for improvement. The fiscal deficit (on a cash basis) for the first half of 1995 stood at 4 percent of GDP, slightly above the IMF program target of 3.3 percent, and has been accompanied by a build-up of domestic and external arrears (primarily gas payments). The real economy also continues to decline. After a 23 percent drop in 1994, real GDP is estimated to have continued to decline by an additional 10 percent in 1995, largely reflecting the continued contraction of the state sector.

V. Sector Background: Installed electricity generation capacity of the Ukrainian Power System was 52,122 MW in 1993. This consisted of 12,818 MW of nuclear power, 32,364 MW of thermal power, 3,824 MW of which are combined heat-and-power units, and 4,700 MW of hydrocapacity. Total electricity generation was 228,316 GWh in 1993. This consisted of 135,875 GWh produced by thermal plants, 75,242 GWh from nuclear plants, 11,214 GWh (including 200 GWh by a pump storage plant) from hydroelectric generation, and 5,985 GWh from industrial plants. Peak demand in 1993 occurred in January and was about 37,000 MW. The minimum demand in that year was in June and was about 17,000 MW.

VI. Energy demand in Ukraine is heavily influenced by the high share of industry (iron and steel, and basic chemicals) in total energy consumption, and the low efficiency of the technology employed by industries in the country. Following a decline in consumption of 11% between 1985 and 1990, the energy intensity of GDP increased by 40% in the 1990-1993 period, reaching 2.5 kilogram oil equivalent/US\$. Energy consumption per capita during 1993 was about 3,500 kilogram oil equivalent, which is still quite high by Western standards. Domestic energy production, consisting of fossil fuels and primary electricity (hydro- and nuclear power), represented 48% of consumption in 1993-1994. The main import items were crude oil and oil products, originating most exclusively in Russia, and natural gas from Russia and Turkmenistan.

VII. Breakup of the Former Soviet Union led to political separation of countries that had once formed a regional power grid. Inability of the Ukrainian Power System to maintain the balance of supply and demand in real time, as measured by the system frequency and power flows through the interconnections with neighboring systems, led to the separation of all neighboring systems causing further deterioration of system performance and reduction in export capacity. The forced separation of the Ukrainian power system, in November 1993, from the hydro plants on the Volga river that controlled system frequency, revealed some serious structural and functional weaknesses in the Ukrainian power system, with negative consequences to overall system operation, security, reliability

and quality of power supply. Most of the plants in the Ukrainian power system are base-loaded, with limited load-following capabilities. The system also lacks peaking and spinning reserve capacity. Although the Russian electric power system has recently (May 1995) been contracted to provide the peaking power necessary to maintain frequency stability and control, this is seen as only an interim solution, and the country urgently needs to develop long-term solutions to this problem.

VIII. Structural Changes in the Power Sector: Until very recently, the energy sector was dominated by vertically integrated state owned sub-sector monopolies. These were controlled by the State Coal Committee, the Ministry of Power and Electrification (Minenergo), the State Nuclear Energy Committee (Goskomatom), and the State Oil and Gas Committee. In 1994, the Government started a corporatization program in the oil, gas and power subsectors, with the long-term objective of privatizing some of those activities. In early 1994, the Parliament passed a Law on Energy Conservation. The Law provided economic incentives for investments in energy conservation, including subsidies and earmarked loans.

IX. On May 21, 1994, the President of Ukraine signed Decree 244/94 on Market Transformation Measures in the Electricity Sector of Ukraine. The Decree ordered a broad restructuring of the power industry, separating generation, transmission, and distribution functions, and corporatizing and privatizing the generating and distribution companies, setting up a competitive wholesale market for electricity, and establishing an independent agency to regulate the industry. The Government adopted an Action Plan to implement the Decree on November 2, 1994. Subsequently:

- The 8 Regional Dispatch Centers were combined into a new state enterprise- ENERGO MARKET, whose structural organization was finalized by Minenergo Executive Order Number 113 of 30 June 1995. The Energomarket is the wholesale purchaser and seller of electricity in the country;
- All fossil-fueled power plants with capacity of 500 MW or larger have been corporatized into "joint stock" companies (Zakhidenergo, Tsentrenergo, Donbasenergo, and Dniproenergo);
- Hydropower stations on the Dnieper have been formed into a "joint stock" company known as DniproHydroEnergo;
- All Dniester River hydropower stations (including the proposed Dniester Hydroelectric Pumped Storage Project) have been formed into a "joint stock" company known as DniesterHydroEnergo (DnHE);
- A new state corporation known as the National Electricity Company (NEC) has been formed to manage the high voltage transmission network (220 kV and higher) of the country;
- Management and supply of low voltage electricity has been assigned to Oblenergos, which are "joint stock" companies operating in each oblast, and in the cities of Kiev and Sevastopol.

X. The World Bank has been assisting the Government of Ukraine with the restructuring of its energy sector since 1992. Bank/Government sector work preceded the first energy project for Ukraine. The

"Hydropower Rehabilitation and System Control" was approved by the Bank's Board of Directors in April, 1995.

XI. The Hydropower Rehabilitation and System Control Project (Hydropower I), which addresses the rehabilitation of 10 hydropower plants and system control, has the objectives of (i) improving the efficiency, reliability, safety and environmental performance of hydropower plants; (ii) increasing hydropower generation capacity; (iii) improving the quality of electricity supply by upgrading load and frequency control, which would also improve the safety of nuclear plants; and (iv) reducing fuel costs by facilitating the economic dispatch of generating units. It also set the stage for follow-up projects in the energy sector, particularly those that will address the system-wide problems of frequency and voltage regulation. The main benefits of this project are therefore expected to be improvement in the efficiency and availability of hydropower plants to supply power to the national grid, and increased efficiency in the loading of hydro- and thermal power generation units. Additional benefits expected are: (i) increased security of the power system that will lead to fewer blackouts; (ii) improved stability of frequency that will enhance nuclear safety; (iii) better environmental performance of the hydropower plants that will reduce the pollution of rivers; and (iv) improved monitoring of dams and reservoirs that will reduce the risk of dam breaks.

XII. The Ministry of Energy (Minenergo) completed the unbundling of the power sector on July 1, 1995, and established the necessary structures for the introduction of a competitive power market. Currently, the power industry is halfway between the old centrally controlled system and a new market-based system where competition and transparent licenses provide a different type of control. Market operating and settlement rules have been drafted, and negative difference between household and industrial electricity prices greatly reduced. The growth of payment arrears also appears to have stopped. However, political pressure has slowed the reform process. Major reasons for this are i) criticism from oblast authorities and other interest groups, ii) lack of fuel at power plants, iii) difficulty with cutting power to non-paying customers and with reducing existing accumulated arrears, and iii) lack of technical readiness to begin live market operations. The next critical stage of the reform process is expected to be the privatization of the generating and supply companies.

Project Objectives

XIII. The objective of the Hydropower 2 Project will be to continue the work directed at providing system-wide improvement in quality of electricity supply that was started under the first hydropower project. The project would include measures to improve the mix of generation capacity, contributing to the stabilization of system frequency and system security, and the implementation of other priority measures that are essential for reliable operation of the national system and its integration with neighboring power systems. This will require additional peak load capacity and spinning reserve. The economic benefits of achieving these technical goals would be i) reduced costs of supply, and ii) improved system reliability and quality of supply

(particularly during the peak demand hours) when power is most needed and most valuable. It is expected that these objectives can be met in large part by completing 3 of the planned 7 units of the partially constructed Dniester Hydroelectric Pump Storage Project (DHPSP).

Description

XIV. The DHPSP was begun under the FSU, and is located on the right bank of the Dniester River approximately 11 km downstream of the existing Dniester Hydropower Scheme. It consists of an upper reservoir, underground penstocks, turbine hall and tail race exiting into a "buffer reservoir". When completed, the DHPSP is to consist of 7 reversible Francis, single stage pump-turbines equipped with built-in ring gates. The plant's installed capacity will be 2268 MW in turbine mode and 2856 MW in pump mode. (see 1/) Preliminary consultant estimates suggest that about 20% of the electro-mechanical equipment and 65% of the civil works of the total project (all seven aggregates) had been completed as of November 1994.

XV. The water of the lower reservoir, or "buffer dam", is impounded by an afterbay dam built 9 km downstream of the DHPSP. The Buffer Dam is finished, but the turbine hall and turbines (with an installed capacity of 45 MW) have yet to be completed.

XVI. The Hydropower 2 Project would include the following components (although these components may change depending on the results of the feasibility study and environmental assessment to be completed as part of project preparation):

- Completion of three units of the Dniester Hydropower Pump Storage Project, which would be capable of supplying about 1000 MW of peak power (with review of the phasing of construction for the other 4 units of the power station). The original purpose of the DHPSP was to provide peaking power to a regional power grid (including Ukraine, Russia and other neighboring countries). There is no longer a uniformly managed regional grid and it is unlikely that Ukraine will need to bring more than 3 units of the proposed DHPSP on line in the present energy planning period. Three units, or about 1000 MW, represents the minimum peak power needed for the domestic system without prejudicing other options for providing peak power in the future;
- Completion of the after-bay (buffer) hydropower plant at the lower dam of the DHPSP;
- Strengthening of the transmission system (including switch yard construction/improvement) to a degree necessary to link DHPSP to the transmission network, and to control system voltages;
- Further priority upgrades of the dispatch control and communications systems, needed to improve (a) control of system frequency, system voltages, power interchange and power dispatch; (b) functioning of the electricity market;
- Technical assistance for project implementation.

XVII. The DHPSP component of the project will need to include

completion and lining of underground penstocks, construction of a turbine hall and tailrace structures, the earth and cement works and control structures needed to complete the upper reservoir, 3 Francis turbines and associated motor-generators, frequency convertors and other generating equipment, switchyard transformers and equipment, 330/750 Kv transmission line hookup to the national transmission system (rating to be decided during project preparation), and communication and control equipment.

Project Financing

XVIII. At present, estimated project cost is envisaged to be about US\$ 350 million. Perhaps as much as 50-60% of this amount would be financed from local sources leaving a foreign exchange component of about US\$ 200 million. These estimates are obviously very preliminary and will be firmed up during the proposed Feasibility Study and Mission project preparation.

XIX. Civil construction has been ongoing for a number of years, but the rate of deterioration of earth and cement works is faster than new construction, and maintenance has not kept pace with the rate of deterioration. Some electro-mechanical equipment is on order and has been for some time. Some of these orders will be filled and others, because of the long delay and problems with local suppliers, will need to be placed again. Foreign exchange costs would be financed from a Bank loan and, if needed, from other (still to be identified) sources. Local costs would be financed from internally generated cash.

Implementation

XX. The DHPSP was initially included as a component in the Hydropower Rehabilitation and System Control Project recently signed by the Government of Ukraine. It was dropped from this project because preparation difficulties justified its processing as a separate project. However, it was included in the Hydropower Rehabilitation Study undertaken by SGI Engineering as part of the preparation process for this first hydropower project, and was submitted in November, 1994. Since this study was only undertaken at a prefeasibility level, and addressed the viability of completing all 7 aggregates originally proposed, it is now necessary to undertake a more thorough assessment of completing only part of the DHPSP (at least as part of the proposed Hydropower II Project).

XXI. A full technical feasibility study will be prepared which will include the technical, financial, institutional, and economic feasibility of elements that will eventually make up the Hydropower 2 Project. The feasibility study will examine the technical and economic viability of the DHPSP, and its role in the Ukrainian power system. The study will review in detail the existing project design and the work which has been completed. The study will provide recommendations for project completion, changes in design (if necessary), assessment of project costs (separating foreign and local components), and overall justification of the project, including quantification of project costs, calculation of project benefits, and calculation of an internal rate of return on investment in the project. Sufficient information will be

included in the study to form a basis for the Ukrainian authorities to update project design to reflect the new "phasing" of project completion, and to prepare works and equipment tenders needed to complete the works financed under the Hydropower II project.

XXII. The feasibility study is expected to commence by late November 1995, and should be completed within a 7 month period. It will be conducted by a team composed of Ukrainian and foreign experts. Grant funds will be sought to finance the work of foreign experts, and possibly part of the work of local consultants.

XXIII. It is expected that the Bank will be asked by the bilateral agency funding the feasibility study to administer the work. Day to day supervision of the consultant team in Ukraine will rest with the DnHE, or its designated representative. A formal Steering Committee is also to be established, which will supervise the ongoing output of the feasibility study team, and be responsible for reviewing and approving study reports. The Steering Committee will include representatives of Minenergo, the DnHE, the National Dispatch Center (NDC), and other stakeholders (for example, the Ministries of Economy, Finance and Environment, and the National Electricity Regulatory Commission-NERC).

XXIV. In addition to the feasibility study for DHPSP, other inputs will also be taken into account during project preparation. These will include the input of a "Dam and Dike Safety Review Group" (to be established to satisfy requirements of the Bank's OP 4.37 on dam safety -to be issued- and related policy directives), the updated Ecological Expertise (see the attached Environmental Data Sheet), the Dutch-funded Communications and Metering Study (currently underway), the earlier SGI feasibility study on the Hydropower Rehabilitation and System Control Project, and the proposed TACIS-funded study of the Ukrainian electricity grid, as well as other relevant studies and information. The Mission preparation work will also include an assessment of DnHE's cash generation capacity and its credit worthiness so that a realistic financing plan for the project can be prepared.

Sustainability

XXV. Implementation of Presidential Decree No. 244/94 that commercializes power generation and supply, and improved collection of electricity supply tariffs, will be necessary if civil construction of the DHPSP is to keep pace with Bank preparation of the project loan. If availability of local finance causes delays in completion of civil works (civil construction has been underway since 1985, albeit very slowly since the breakup of the FSU) then the project runs the risk that existing works may deteriorate adding significantly to project costs, and the timely procurement of equipment may also be problematic. The availability of local financing for civil construction could therefore have short to medium-term impact on the project objectives of improvement in quality of power transmission and supply.

XXVI. This is particularly important since the project has system-wide importance. Significant steps have already been made in regard to electricity pricing. Average price of electricity as of December 23, 1994 was \$0.0311/kWh. As of May, 1995 this had risen to \$0.036/kWh.

New prices for coal and electricity were introduced on May 1, 1995 for all categories of consumers (except residential). Although considerable progress has been made to reform power pricing, more work is needed before market pricing is reached. The need to strengthen and further advance institutional reform in the power sector begun under Hydropower I, will be reviewed during project preparation of the Hydropower II Project.

Lessons Learned from Past Operations in the Country/Sector

XXVII. The proposed project is the second in a series of power projects designed to improve the quality, reliability and long-term viability of the power supply system in Ukraine. Experience from the Hydropower 1 loan suggests that it is essential to have strong commitment to project preparation by the agency in the sector ministry responsible for the project. Also, contradictory internal regulations make channeling of money through the Ministry of Finance somewhat cumbersome. Early decision should therefore be made regarding the project financing plan, and borrowing/on-lending arrangements for the World Bank loan.

Poverty Category

XXVIII. Not applicable to this project.

Environmental Aspects

XXIX. While it is unlikely that a significant volume of water will be lost to the Dniester River as a result of the operation of the DHPSP, the completion of 3 of 7 units of the scheme will affect the discharge regime of the river. This could have impacts on instream and river floodplain ecology, existing and potential downstream uses and users of the water within or abstracted from the river channel, river bank stability and public safety, particularly around the margins of the buffer reservoir. The project could also affect the riparian rights of Moldova. Initial contacts between Moldova and Ukraine have been established regarding riparian rights. The Governments of both countries have been informed of the Bank's policy in this regard.

XXX. The DHPSP required some earlier resettlement of local residents. Although DnHE indicated that the resettlement was designed with the participation of the resettled population, the success of this resettlement will need to be checked during project preparation.

XXXI. Preparation of the project clearly falls under the guidance of the Bank's Operational Directives OD 4.01 (revised as OP 4.01)- environmental assessment, OD 4.30- involuntary resettlement, and OD 7.50- transboundary waters, and requires that the project be given an "A" classification.

Program Objective Categories

XXXII. Environmentally sustainable development: The project makes use of the existing water resources of the Dniester River, and electricity price differentials between peak and off-peak power that

reflect the power generation profile of the Ukraine power system. Sustainability of the project is dependent on the available resource, ecological requirements to maintain, and hopefully enhance, the existing aquatic and flood plain ecology of the Dniester River, and existing and potential future beneficial uses of the resource downstream. The project preparation will determine whether the project can be undertaken in harmony with nature and other potentially competing users of the resource (see the Environmental Data Sheet).

XXXVIII. Finally, the project adds to further enhancement of the Ukrainian Power System's ability to better balance supply and demand, and improves frequency regulation, which have significant nuclear safety benefits.

1/ The original project, as envisaged before the breakup of the FSU, included a provision to supply irrigation water from the upper reservoir to Moldova. Cost of supply of irrigation water to Moldova was not a significant consideration when these plans were prepared. Now that Moldova and Ukraine are separate republics the cost of water is consideration. Discussions held with the Ukrainian Government during the Project Identification Mission suggests that this component of the original project is in doubt, particularly given that Moldova would have to pay full cost for the water supplied to its irrigation system. The proposed completion of 3 units of the DHPSP project would require a "coffer" dam to be built across the upper reservoir to impound the portion of the reservoir needed for the operation of three turbines. Irrigation would therefore not be physically possible under the current project. The DNHE will be discussing the possible viability of supplying water to Moldova from the upper reservoir, including the option of dropping the irrigation proposal entirely unless a firm commitment is made by Moldova to purchase water.

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Note: This is information on an evolving project. Certain components may not necessarily be included in the final project.

ENVIRONMENTAL DATA SHEET FOR PROJECTS
in the IBRD/IDA Lending Program

Country	UKRAINE
Project Name	Hydropower 2 Project
Appraisal Date	October, 1996
Board Date	April 30, 1997
Managing Division	EC4IN

Lending Instruments IBRD
Date (est) for receipt of EA by
Bank October, 1996
EA Category (A/B/C) A
Project ID No UAPA40565
Total Project Cost US\$ 350 million
Task Manager Bill Lane
Sector Energy
Status \
Date Assigned \
Date Sheet Prepared/Updated September 6, 1995

(Please do not leave any items blank: use "N/A" or "To be developed"
when appropriate)

Major Project Components: (presents description of project components)

The Hydropower 2 Project would, as the next phase of improving the mix of generation capacity, include the following components (although these components may change depending on the results of the feasibility study and environmental assessment to be completed as part of project preparation);

- Completion of three units of the Dniester Hydropower Pump Storage Project (capable of supplying about 1000 MW of peak power;
- Completion of the after-bay (buffer) hydropower plant at the lower dam of the DHPSP;
- Strengthening of the transmission system to a degree necessary to link DHPSP to the transmission network, and to control system voltages;
- Further priority upgrades of the dispatch control and communications systems, needed to improve (a) control of system frequency, system voltages, power interchange and power dispatch; (b) functioning of the electricity market;
- Technical assistance for project preparation and implementation.

Major Environmental Issues: (describes major environmental issues identified or suspected in project)

Environmental issues are mainly associated with operation of the Dniester River Hydropower Pump

Storage Project (DHPSP) and construction of new high voltage power transmission lines between the DHPSP and the national transmission network. While it is unlikely that a significant volume of water will be lost to the Dniester River as a result of the operation of the DHPSP, the completion of 3 of 7 units of the scheme will affect the discharge regime of the river. This could have impacts on instream and river floodplain ecology, existing and potential downstream uses of the water within or abstracted from the river channel, river bank stability and public safety particularly around the margins of the buffer reservoir, and could affect the riparian rights of Moldova.

The proposed transmission line will probably be less than 20 km in length. However, acquisition of a route will need to take into account location of local residents, ecologically sensitive areas, and public health and safety.

Other Environmental Issues: (describes environmental issues of lesser scope associated with project)

The DHPSP has required some resettlement of local residents and the success of this resettlement will need to be checked during project preparation. One local village has been protected from inundation by the buffer dam reservoir through construction of a dike. The technical specifications and likely impact of the dike should also be reviewed during the impact assessment.

Proposed Actions: (describes actions proposed to mitigate environmental issues described in project)

Of particular interest is the impact on the pump storage project on the Dniester River. The DHPSP and operation of the associated buffer dam will affect the discharge regime of the Dniester River in an unknown way. The need to understand this impact is increased by the international waterway status of the Dniester River. A water resource study is proposed as part of updated environmental assessment, and will include work in both Moldova and Ukraine. Grant finance is being sought for this water resource work.

Justification/Rationale for Environmental Category: (reasons for Environmental category selected & explanation of any changes from initial classification)

Preparation of the project clearly falls under the guidance of the Bank's Operational Directives OD 4.01 (revised as OP 4.01)- environmental assessment, OD 4.30- involuntary resettlement, and OD 7.50. The project contains potentially significant environmental issues related to water resource allocation and water management between competing uses and users in two countries, and therefore requires that the project be given an "A" classification.

Status of Category A Environmental Assessment: (presents EA start-up date, EA first draft, and current status)

An environmental impact assessment of the DHPSP was done when it was first proposed. However, this assessment is now more than 5 years old and is to

be updated under the joint direction of Minenergo and the Ministry of Environment (the environmental department of the Power Design Institute, Ukgidroproject, will be the consultant).

Remarks: (gives status of any other environmental studies, lists local groups and local NGOs consulted, tells whether borrower has given permission to release EA, etc)

Signed by:

Dominique Lallement, Chief, EC4IN

Signed by:

Seth (EMTEN), Regional Environment
Division Chief December 28, 1995