

# **Dniester Pump Storage Plant: project risks**

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# 1 INTRODUCTION

Ukraine is an independent state which is dynamically developing and gradually increasing the strength of its economic and political positions. Currently the development of its power sector is vitally important for the economy of the country.

In March 2006 the Cabinet of Ministers of Ukraine approved the “Energy Strategy of Ukraine up to the year 2030”. The Strategy foresees the growth of electric power generation mainly by the development of Ukraine’s power engineering due to the priority usage of nuclear energy. As nuclear power plants (NPPs) do not represent loads shifting generating capacities, there is a problem with loads shifting in the network. For this purpose the Strategy foresees the installation of loads shifting capacities – or pump storage plants (PSPs) – the construction of which has already started (Tashlyk, Kaniv and Dniester PSPs).

The completion of the Dniester PSP is an unlikely solution to the problems of the Ukrainian power sector and will have a number of negative impacts, especially:

- doubts about the reality of the strategy of development of the power engineering, a part of which is PSP;
- the utter uncertainty about the development of the economy and the electric power sector;
- violation of procedures of decision-making specified by the laws of Ukraine;
- violation of the Espoo Convention;
- the high risks of man-made accidents;
- the negative impacts on the people living in the area of the construction and in the low-flows of the Dniester;
- the negative impact on the water balance;
- the possible negative impact on the environment.

The project involves contradictions with the recommendations with regard to the development of the power sector worked out by the experts of the World Bank. The World Bank has to focus its efforts on the development of the power industry of Ukraine in compliance with today’s European norms and pay special attention to the independence of Ukrainian power engineering. This refers, first of all, to the reduction of the power intensity of the economy, and the World Bank has to play a leading role in this project.

## 2 History of the Dniester PSP Project

### *2.1 A history of long lasting construction*

The Dniester Hydro Power Complex (DHPC) project was developed in the 1970s and comprised a number of hydro power facilities – hydro power plants HPP-1 and HPP-2, a pump storage plant (PSP) and a nuclear power plant (NPP), and service and ancillary buildings. In the course of time the NPP construction was suspended for a number of reasons and the project of NPP construction was withdrawn from the plan of the hydro power complex. The open Joint-Stock Company Ukrhydroproekt was the general designer of the Dniester PSP.

In 1983 the construction of the main dam of the Dniester HPP (HPP-1) was completed; it is located at a distance of eight kilometres from the PSP construction site.

Between 1985 and 1988 the project of construction of Dniester PSP was approved by all interested republican ministries and departments, and in 1988 the title for the construction was opened and construction of the main buildings of the PSP began. The financing of the construction of Dniester PSP began in 1984-1985, after the first approval of the project.

Construction was suspended in 1991 after the dissolution of the Soviet Union because of a lack of budgetary funds and investors, and it was resumed only in 2000-2001. In 1993 the project was re-approved by the Ministry of Power Engineering and Electrification of Ukraine. Unsystematic state financing for the maintenance of already built structures was insufficient to maintain the construction site in a proper state and to pay salaries to the staff. During the period of time when construction was not financed, the administration of PSP fulfilled their duties focusing on the safety of the construction. Fully-fledged budgetary financing of PSP completion was resumed only at the beginning of 2005. Considerable sums have been spent for the reconstruction of the already built (in 1984-1991) hydro constructions - galleries, dams, pits of hydro units, and so on, which lost their initial technical characteristics during the period of time when the construction works were suspended at the PSP.

In the autumn of 2004 the share of state property in the charter fund of Open Joint-Stock Company Dniester PSP made up 87.4%, and it was in the charter fund of National Joint-Stock Company Energy Company of Ukraine; 11.48% of PSP shares were under the control of the affiliated entity National Joint-Stock Company ECU – Open Joint-Stock Company Ukrhydroenergo, which make up together 98.88%. At the end of 2005 the Council of shareholders of the Open Joint-Stock Company Dniester PSP took the decision on its liquidation and transfer of its assets in favour of Open Joint-Stock Company Ukrhydroenergo, with a view to speeding up the completion of the Dniester PSP and improving the system of management of the construction. Novodniestrovsk Branch of Open Joint-Stock Company Ukrhydroenergo was established in the town of Novodniestrovsk in place of the liquidated Open Joint-Stock Company Dniester PSP.

Since 1999, in compliance with the Decree of the Cabinet of Ministers of Ukraine, one kopeck has been added to the value of one kWh (to the tariff of Dniesterhydroenergo) to raise money for the completion of Dniester PSP. In 2006 this extra charge was raised up to two kopecks. Further, the money accumulated in the special fund of the budget is used to avoid extra charges on the tariffs of electric power generated by other companies.

## **2.2 Status report**

Dniester PSP is currently under construction. According to the latest official information the construction is 67% complete. In the opinion of public organisations, which have carried out a field study of the construction, the percentage complete is much lower.

As of May 10, 2006, UAH 40,903,456 had been allocated to the construction of Dniester PSP and was used, of which UAH 2,600,000 are budgetary funds, while targeted allowances make up UAH 14,903,456. We have not been able to receive information about the up-to-date status of the PSP from the management of the Open Joint-Stock Company Ukrhydroenergo.

It was planned to invest in the construction UAH 150 and 207.047 million from the special fund in 2005 and 2006 only. According to the project documentation UAH 5.6 billion should be spent additionally before 2007 for the completion of the Dniester PSP and for putting the starting complex into operation, as well as all three hydro units in time.

## **2.3 Completion plans**

It is planned that the first unit of the plant will be put into operation in December 2007, the second in September 2009 and the third in September 2010. The planned generation capacity is 2,268 MW (seven blocks with nominal capacity of 324 MW each).

Currently the construction of the PSP is suffering due to a lack of human resources and highly-qualified specialists, especially taking into consideration the confirmed dates of putting the starting complex into operation in 2007. Hydro technicians, power engineering specialists and builders from Tashlyk PSP have been already recruited and will be recruited in the future.

## **2.4 Applying for World Bank credits**

Negotiations with the World Bank about the possibility of financing the completion of Dniester PSP have been in process for a few years already, but only lately have they begun to take a concrete form. There is information on the website of the Cabinet of Ministers of Ukraine that on November 2, 2005, the Ministry of Fuel and Power Engineering, represented by the First Deputy Minister of the Ministry of Fuel and Power Engineering (Mr Yuriy Prodan) started to negotiate with the World Bank prospects and crediting about the completion of the Dniester PSP in 2006. Then the Ministry of Power Engineering of Ukraine asked the World Bank to support the Dniester PSP completion project by granting a credit of USD 200-250 million. The Bank suggested that the ministry should submit a corresponding application and expects to receive project documentation by the end of 2006. In spite of the fact that the project obviously has considerable potential impact on the environment the customer believes that the project should be regarded as a category "B" one, meaning one that does not require the process of consultations with the public. Thus, the Ukrainian public will not be able to exert their influence on the decision-making process.

Meanwhile, on December 7, 2005, at a closed meeting the Council of the shareholders of the Open Joint-Stock Company Dniester PSP took the decision about its liquidation and transfer of its assets to the Open Joint-Stock Company Ukrhydroenergo. This decision was motivated by the necessity to improve the financial schemes and the structure of the management of the Dniester PSP completion.

Resting hopes on the fact that the decision made by the Bank on the Dniester PSP would follow the same scenario as other Ukrhydroenergo projects with the less environmental impact, Ukrhydroenergo organised public hearings on September 2, 2006. Given the practical absence of an announcement, and the inconvenient timing and location of the hearings, interested public organisations refused to participate in the consultations, and sent their observers who could only confirm the unacceptability of the procedure of organisation and conducting of the hearings. The decisions and other materials of the hearings, in spite of numerous letters of inquiry sent by public organisations to the Open Joint-Stock Company Ukrhydroenergo, have not been made public yet. In particular, the aim of the hearings remained unknown to the public organisations: were they merely considerations of the Project or discussions about the prospects of credit granting?

In 2005 Open Joint-Stock Company Ukrhydroenergo received from the World Bank a credit in the amount of USD 106 million for the implementation of Hydroelectric Power Plants Rehabilitation Project, which envisages the renovation of nine hydro power plants, including the reinforcement of seven dams (six on the Dnieper river and one on the Dniester river), and a number of measures of technical and administrative modernisation aimed at the reform of the

wholesale electric power market. The aim of these measures, in addition to the rehabilitation, is the creation of conditions for the formation of an electric power market in Ukraine. The initiators of the project also expect to receive an additional USD 5.5 million for a reduction in emissions of greenhouse gases.

Now another USD 300 million project is being considered by the World Bank; the project provides for the construction of power lines to connect to Dniester PSP.

## **2.5 What is a PSP and why are they needed?**

### **2.6.1 Peak loads in the network**

The demand for electric power is not stable; it varies over 24 hours and according to the seasons of the year. The generation of electric power should also vary according to the consumption schedule.

The rapid and periodical change of power generation capacity by electric power plants complicates the generation, and is not applicable to NPPs. Therefore, there is a need to have enough loads shifting capacities or to take measures directed at demand regulation. Loads shifting capacities such as HPPs or gas-burning thermoelectric power plants can quickly change the mode of generation according to the change of volume of demand. Specialists assert that the volumes of these loads shifting capacities should make up to 16-17% of the entire power supply system, taking into consideration the variation of demand over 24 hours and over one year, if no measures are taken for demand regulation. The share of loads shifting capacities decreased in Ukraine due to the growth in the share of NPPs and is now about 10%.

The peak loads problem can be solved in various ways. First, it is possible and necessary to control demand, in other words to create conditions when the variation of demand over 24 hours is very low. Second, it is possible to use electric power plants with technical facilities which allow quick changes in the volume of the generation of electric power and the consumption of raw materials correspondingly. But, according to Ukraine's power strategy, this problem is planned to be solved in a third way: by the construction of a number of PSPs by 2030 – these work as accumulators.

### **2.6.2 How PSPs operate**

A PSP is not an independent energy source; it is an accumulator which stores the energy generated by other sources. In times of low demand a PSP pumps water into the upper reservoir located at a certain height, creating a reserve of potential energy. When there is higher demand, water is released back into the lower reservoir through a turbine, generating electricity as happens at a standard HPP. But for all that a PSP consumes more electric power to pump water to the reservoir than it generates by releasing water back into the reservoir.

Using electric power from an integrated power system, PSP technology foresees losses at the level of 25-30% of electric energy, and approximately 70-75% of the received electrical energy can be regained. The planned generation capacity of the Dniester PSP is 2,268 MW (turbine mode) and 2,947 MW (pump mode).

Specialists try to substantiate the economic expediency of the PSP by the difference between night and day tariffs for electric power, the result of the decrease in demand at night time. In

addition to supply, The peak loads of demand in the power system PSP are used as an emergency reserve.

## **2.6 PSP within the context of the energy strategy of Ukraine**

### **2.6.1 The energy strategy of Ukraine**

In March 2006, the Cabinet of Ministers of Ukraine approved the “Energy Strategy of Ukraine up to the year 2030”. The strategy plans an increase of electric power generation by 2.22 times on the basis of the forecast of growth of gross domestic product by almost three times. The construction of 22 new NPP blocks by 2030 is envisaged.

Experts of the “Concept of “non-nuclear” way of development of power engineering in Ukraine”, worked out by a number of non-governmental organisations, say that no studies were carried out in the course of working out the new strategy with a view to determine the real volume of the losses of power resources in different sectors of the national economy; therefore this index does not represent the real potential of energy-saving in the country.

As NPPs are the least load shifting generating capacities, and the portion of electric power which they will generate is planned to remain at the level of about 52 %, there is a problem related to the regulation of peak loads in the network. For this purpose the strategy foresees the installation of loads shifting capacities (PSPs), the construction of which started during Soviet times: namely Tashlyk, Kaniv and Dniester PSPs. It is expected that there will be “putting into operation of hydroelectric capacities at Tashlyk and Dniester PSP during 2007-2010 and at Kaniv PSP during 2020-2030”. There are also out-of-date projects dating from the 1970s that envisage the construction of several PSPs in the area of Upper Dniester and on the River Dnieper. In 2005 the volumes of generation of electric power by PSP amounted to 0.2 billion kWh. In theory they will generate 2.2 billion of kWh in 2010, 3.2 billion of kWh in 2015, 3.9 billion of kWh in 2020, and 4.5 billion of kWh in 2030” (“Energy Strategy of Ukraine up to the year 2030”).

### **2.6.2 Weak points of the energy strategy of Ukraine up to the year 2030**

Analysis of the basic indices of the strategy shows that all of them are interconnected and are governed by the principle idea of the document: the development of power engineering in Ukraine via the priority use of nuclear energy and coal-burning thermo-electric power plants. The designers of the strategy proceeded from the current task to decrease drastically the use of gas, underestimating other risks related to the presented plan.

The strategy does not envisage a substantial increase in the power efficiency of the Ukrainian economy. Today unfortunately Ukraine is one of the world leaders in the use of energy per one unit of GDP – it has extraordinary potential to reduce its needs in power resources. For example, neighbouring Poland has already reached the level of power efficiency that Ukraine will have in 2030 as provided for in the new strategy.

The strategy does not consider the problems associated with nuclear power: in particular, the complete dependence on Russia regarding fuel and equipment, the considerable risk of accidents and terrorist attacks, the contamination of the environment during the extraction of uranium, and the unsolved problem of nuclear waste disposal. The main problem consists of the extraordinarily large investments which are needed.

The strategy envisages the doubling of coal production by the year 2030. It is difficult to assess the possibilities of such growth in coal production in Ukraine. However, it is even more difficult to understand the logic of the strategy's authors who expect that, at such levels of growth of demand and necessity to work more coal under complicated conditions, the price of coal would fall.

The authors try to justify the excessive production capacities for electric power generation laid down in the strategy by shifting from gas to electricity for heating purposes. We are concerned that large capital investments are required in the electric power transportation system, to say nothing about the fact that such measures have nothing in common with energy saving, because they imply considerable increases in the loss of electric power (a portion of which will be generated from gas in any case). The efficacy of such investments is especially doubtful taking into consideration the rather developed gas supply system.

A number of non-governmental organisations and independent experts elaborated the concept of a "non-nuclear" way of development of Ukraine as a reaction to the approval of "Energy Strategy of Ukraine for the Period up to the year 2030". According to this concept there is an alternative to the nuclear scenario of development for Ukraine's power complex. It is based on the implementation of energy-saving and energy efficient technologies, and the real use of potential non-conventional, recoverable and off-balance sheet power sources, though it also foresees the revision of the scenario of fast reduction of the consumption of natural gas.

Analysis of the existing structure of consumption of raw resources as forecasted by the official strategy shows that the share of non-conventional, recoverable and off balance sheet power sources in the total consumption of raw energy carriers in Ukraine not only fails to increase but even slightly decreases in 2030 in comparison with the year 2005. The concept also substantiates that the forecast of the consumption of fuel and energy resources (**FFER**) in 2030 was **overestimated by 213.1 million tons of standard coal; this one fact proves the low quality of the strategy and provides grounds for doubts about all other data and conclusions found in the strategy.**

The authors of the strategy insist on PSP application as an instrument for the regulation of peak loads resulting from the specifics of NPP operations. In other words, rather than turn down the source of the problem, the authors propose a doubtful technical solution to this problem. This corresponds to Ukrainian traditions, where old doors are propped up with a rake rather than having their door hinges replaced.

Especially strange is the need to put into operation considerable PSP capacities given the assertions of Energoatom management that new reactors in Ukraine will represent loads shifting capacities. It is also possible that there will be the use of coal-burning thermal power plants as loads shifting capacities on the condition of technical re-equipment. What is the object of generating electric power by burning limited fuel resources and then storing it at PSPs, thus losing its considerable portion, if this excessive electric power should simply not be generated?

We are surprised at the assertion that the operations of the new PSPs will contribute to the united power systems of Ukraine and Russia, will create conditions for the integration of a united power system into the European Union, and will allow the increased export of electric power at the account of critical "peak" capacity because it is just enough to install "lines of short communication", or lines of direct current with country-importers, in order to increase export and avoid losses during transmissions.

**Moreover, both the development of nuclear power engineering (22 new power-generating water-cooled units in particular) and the proposed for Ukraine technology of solution of**

**problems of peak loads – PSPs – require considerable volumes of additional excess water resources, which Ukraine simply does not have.**

## ***2.7 Ineffective organisation of Ukraine's energy system***

The approach to the development of the power industry inherited from Soviet times is the most serious problem of the energy system in Ukraine. It involves centralisation according to the principles of production cycles and attention to large-scale and low-effective projects.

The ineffective structure of the Ukrainian power sector leads to its fragmentation and division on account of its belonging to certain production cycles, which results in the absence of necessary contacts, joint consumers and joint dispatch control. Moreover, the out-of-date methods of management are compounded by the corruption in the industry. NPPs, which generate about 50% of electric power and represent the worst loads shifting capacities, enjoy priority access to the electric power network; and the remainder operate in the chaotic mode depending ultimately on personal contacts. This causes variations of loads in the network and requires additional measures directed to the regulation of loads.

## **3 Problematic issues connected to the Dniester PSP project**

In this section we will analyse a number of problems related to the prospect of the completion of the Dniester PSP, involving: the energy efficiency of PSP technology; economics; the state of power engineering; adherence to legal requirements and international conventions; man-made, hydrological, geological and seismic risks; impacts on the environment and; social consequences of the project.

### ***3.1 Low efficiency of PSP technology***

Ukraine is one of the most power consuming countries in the world (even Russia consumes less energy per unit of GDP, being more rich in energy resources), and its power efficiency is three times lower on average in comparison with industrially developed countries. At the same time PSP technology involves considerable losses of electric power: about one third of electric power received by a PSP from the united power system with a view to accumulate it (pump the water) is lost; PSP returns to the united power system approximately 70-75% of electric power and 25-30% is used for its own needs.

The fully planned production capacity of the Dniester PSP is 2268 MW in turbine mode and 2947 MW in pump mode. In other words, the PSP will consume more electric power to pump water to the reservoir than it will generate in the event of absence of excess electric power. The effectiveness of the PSP will be even less if we take into account the electricity transmission losses. As there is quite a distance from the Dniester PSP to the main non-loads shifting power generating capacities, it can be expected that these losses will be large.

We would like to emphasise that given the expected balance of the power generation a portion of the electricity used for water pumping will be generated from fossil fuels (coal and gas). The application of PSP technology entails considerable losses of energy and, thus, an extremely ineffective use of this fuel.

### **3.2 Economic aspect**

Open Joint-Stock Company Ukrhydroenergo is a customer of the Dniester PSP construction. This structure unites only hydro power enterprises which have loads shifting capacities themselves, and does not require additional regulation. In other words, Ukrhydroenergo is not a motivated customer of loads shifting within the system by means of pump storage technology.

Today, however, generating capacities are divided between various structures, none of which can act as a motivated customer. Perhaps this is the reason why in-depth economic and energy calculations regarding the plant's effectiveness were not made for the Dniester PSP Project. In the meantime the motivated customer choosing regulation capacity project should have made calculations about the effectiveness of the existing power system and an analysis of the energy and economic efficiency of numerous alternatives to the project on the basis of these calculations. In this particular case the Dniester PSP seems to be a far-fetched project without any justification and aimed only at gaining funds.

The economic estimate of the advantages of Dniester PSP from the point of view of Ukrhydroenergo is based on the fact that Dniester PSP would buy cheap electric power during decreases of consumption and sell it during peaks of consumption when the price is higher. However, night and day tariffs exist now which do not always reflect correctly the real demand.

Moreover, the Dniester PSP is located at some distance from the main non-loads shifting capacities (Rivne, Khmelnytsk and South-Ukrainian NPPs). Thus, the cost price of the project should include the construction of additional power lines. Losses for transmission should be taken into consideration during the calculation of the Dniester PSP's revenues. However, it is very clear that such calculations are absent.

Given the unpredictability of the situation in Ukraine's power industry, the development of the electricity market, and the orientation towards integration to UCTE, the prices for electric power can change radically, which will undermine the economic basis of the Dniester PSP operation.

The economic risks concerning the project also increase due to the long payback period for the Dniester PSP, and there is one more important question in connection with the prevailing tendency to privatise the enterprises of the Ukrainian hydro energy complex.

A decree of the Cabinet of Ministers of Ukraine, dated April 2006, recommended the National Energy Regulatory Commission (NERC) to revise the tariffs on the electricity sold by the Open Joint-Stock Company Ukrhydroenergo, taking into account the investment component of two kopecks for 1 kWh, and accumulate these funds in a special Dniester PSP financing fund with the aim of speeding up the completion of the first line of the Dniester PSP.

It is beyond our understanding why consumers have to pay for the unfinished Dniester PSP while the costs of the construction should have been reimbursed from the future proceeds of the plant. At the same time, current studies (International Energy Agency, "Ukraine: Energy Policy Review", 2006) show that Ukraine has enormous potential increase energy efficiency which is more advantageous from the economic and energy point of view.

### **3.3 Financial non-transparency**

In 2006 the Clearing House audited the analysis of formation and use of resources of the special state budgetary fund envisaged by the Ministry of Fuel and Power Engineering of Ukraine for the construction of Dniester PSP, **but we have not been able to obtain the results of this audit.**

As early as 2003, the inspection of the Regional State Auditing and Inspection Service confirmed in the documents that such “gainful” construction could last not less than the construction of the Great Wall of China. According to Ivan Drebot, Head of the Regional State Auditing and Inspection Service, the last audit of the financial activities of the enterprise revealed the overstating of the volume of work performed by 14 contractors by the sum of approximately UAH 321 thousand (Yuriy Chorney, Chernivtsi, **BukNews, 07.09.2006**).

Currently there neither exist or they have not been made public complete complex economic calculations relating to the advantages of the Dniester PSP and the funding required for its completion, taking into account the partial reconstruction of hydraulic structures, natural resources lost due to the construction, an assessment of the role of Dniester PSP within the united energy system of Ukraine and in the social and economic development of the region. Such issues as the ownership of the Dniester hydro energy complex and some of its structures, the influence of the local authorities on the processes pertaining to the completion of Dniester PSP, the distribution of the revenues (if they are really expected) after putting the plant into operation, and its connection to the interconnected energy system of Ukraine require additional consideration.

### **3.4 Legal aspect**

#### **3.4.1 Manipulation of procedures and legal requirements**

Since 1997 the Dniester PSP completion project has been the subject of permanent attention from public environment protection organisations in Ukraine. The construction of the Dniester PSP had started and had been carried out long before the Environmental Impact Assessment (EIA) documentation was drafted and a complex state expertise of the project was performed as per current official requirements. The first environmental expertise of the Dniester PSP Project was carried out in 1984 in Soviet times and it does not meet the requirements of the currently applicable laws of Ukraine.

In 1996, Open Joint-Stock Company Ukrhydroproekt prepared additional studies and EIA materials, which in fact are basic. In 1997 the Ministry of Environment of Ukraine drafted and signed the Final report of the State ecological expertise No 10-3/2-3-877, dated 15.11.97, in the text of which 17 substantial deficiencies were discovered on various aspects of the project. In spring 2005 the Dniester PSP Project was re-approved at the initiative of the Government of Ukraine, and another state ecological expertise was carried out in compliance with the requirements of the new State building regulations (SBR A.2.2-1-2003 “Composition and content of EIA materials in the course of designing and constructing enterprises, buildings and structures”). After re-approval of the project the Final report of the state ecological expertise No 10-3/2-3-877, dated 15.11.97, is considered to be invalid.

An emergency initiation of the development of the new Final report of the state environmental expertise took place with the aim being to speed up the financing of the Dniester PSP completion. For this purpose an order was placed at the Institute of Geochemistry of Environment under the National Academy of Sciences of Ukraine to work out a Scientific and Expert Assessment of the project, in which the majority of the most important deficiencies pertaining to the project were eliminated. At the same time public hearings were imitated in Novodniestrovsk on 21 November, 2005 and soon after that, referring to the favourable Scientific and Expert Assessment and resolution of public hearings, a favourable Final report of the state ecological expertise was signed without objections (No 307, dated 23.11.2005).

Up to now there has been no Report of the state ecological expertise regarding the main dam of the Dniester HPP (HPP 1) and buffer dam (HPP 2). At the same time, according to Article 7 of the Law of Ukraine “On Ecological Expertise” (1995) and paragraph 15 of the “List of types of activity and objects which represent increased environmental danger”, approved by the Decree No 554 of the Cabinet of Ministers of Ukraine, dated July 27, 1995, which identifies hydraulic engineering constructions as environmentally dangerous, these constructions are subject to obligatory state expertise.

A favourable one-page Final report of the state ecological expertise No 307 was signed by A. Gritsenko, Deputy Minister of Environment Protection of Ukraine, on 23.11.2005, three days after the receipt of all necessary documents and contained no remarks. No mentioning of previous comments on the project, in particular as to its man-made safety issues, were not reflected in the text of the Final report. It took only 20 days (from November 3 until November 23) to work out the Final report of state ecological expertise No 307. During this period of time the authorities of Novodniestrovsk, the people’s deputies representing Bukovyna, the Chairman of the Supreme Council of Ukraine, the Prime Minister of Ukraine, the Institute of Geochemistry under the National Academy of Sciences of Ukraine, and the Ministry of Environment had time to exchange by official letters and corresponding materials concerning this issue as well as by corresponding instructions. The peak of correspondence was between November 16 and November 23.

One half of this Final report is dedicated to the so-called “public hearings”, held on November 21, 2005 in the town of Novodniestrovsk. Neither representatives of regional public councils nor members of all-Ukrainian public organisations and local environment protection public unions (about 50 people), whose activity extends over the basin of the River Dniester, were properly invited to these hearings. The administration of the Dniester PSP passed over the information and documents with regards to the “hearings” to the Ministry of Environment via a letter, dated 23.11.2005, and on the same day the favourable Final report of the state expertise was signed. The possibility to accomplish this work without the preliminary agreement of the participants of the process provokes doubts if we take into consideration bureaucratic procedures.

### **3.4.2 Inconsistency in the Final report of the state ecological expertise**

The conclusions of the expertise of 1997 (more than 30 pages) contain comments which are not consistent with the final part, as an opinion is expressed that the construction of the plant is permitted, though the construction is not allowed without the consideration of 17 substantial deficiencies discovered in the text. First of all, an appropriate geological expertise was not carried out. It is impossible to understand, on the basis of the text of the Scientific and Expert Evaluation made by the experts of the Institute of Geochemistry under the National Academy of Sciences of Ukraine and Ministry of Environment, why the most substantial comments about the project were eliminated.

### 3.4.3 Consultations with the public

The public was not properly encouraged to participate in the discussions about the project at any stage until November 2005. Something resembling “public hearings” took place on November 21; the Administration of the Dniester PSP reported on it in a letter, dated November 23, 2005, which was sent to the Ministry of Environment, and the favourable Final report was signed on the same day. The possibility of accomplishing this work without the preliminary agreement of the participants to the process is doubtful if we take into consideration bureaucratic procedures.

On February 16, 2006, members of the Public Council sent to the Minister of Environment a letter with the requirement to recall the Final report No 307 because its development was not transparent. The letter also touched on the problem of further procedures pertaining to the agreement of the Dniester PSP completion project, and a procedure related to the new public hearings in particular. However, members of the Public Council did not receive a proper answer to this letter, and the interested public does not have access to the EIA materials up to now because only hard copies are available and they are available only in the town of Novodniestrovsk. The final report No 307 was not recalled by the Ministry under the pretence that the grounds and corresponding official application in written form to Ukrinvestexpertise are absent. The public was not duly attracted to the discussion about the procedure of the new public hearings planned to be held on September 2, 2006.

Members of the Public Council under the Ministry of Environment were notified by e-mail on August 3, 2006, about new public hearings on September 1, 2006 dedicated to the Dniester PSP completion, in other words, eight months after the signing of the favourable Final report of the state ecological expertise. No other information about the public hearings either in written form or by e-mail, including invitations in writing, was received by the representatives of the Public Council, interested public organisations and unions, and by independent experts. The host party was unable to or did not want to make a substantial list of interested public organisations and independent experts. The majority of interested public organisations found out about the postponement of the public hearings from the 1<sup>st</sup> to the 2<sup>nd</sup> of September, 2006 only on August 30-31, and only via word of mouth. They never received invitations in written form or materials to be discussed at the hearings.

Preliminary discussion with the public on the subject and procedure of the hearings and agreement of organisational issues did not take place in spite of the position of the Public Council under the Ministry of Environment (from a letter, dated February 16, 2006), like it was during the preparation of the previous hearings. The hearings were arranged during the summer holidays and scientific expeditions, and once again not in Kiev or in Chernivtsi but in Novodniestrovsk, which is a difficult place to get to. The venue and program of the hearings were not made public, and the organisers of the hearings did not distribute the relevant materials beforehand. In the views of interested public organisations and independent experts all of this limited the possibilities for the public to participate in the hearings, and made the management of Dniester PSP feel awkward once again in front of the experts from the World Bank.

Taking into account that the problems associated with the completion of Dniester PSP apply to the inhabitants of the entire basin of the Dniester (mostly the residents of the Vinnitsa, Chernivtsi, Odessa, Ternopil and Khmel'nitskiy regions of Ukraine, the Republic of Moldova and the Republic of Pridniestrovye), and taking into consideration the necessity of the previous acquaintance with information materials of hearings, a number of non-governmental organisations sent letters to the Ministry of Environment and Ministry of Fuel and Power Engineering with the request to provide additional information about the hearings. No answer was received. On August 18, 2006, National Environmental Center of Ukraine sent a letter (No 125-1/78) to Open Joint-Stock Company Ukrhydroenergo and to the Dniester PSP

Administration with the request to change the date of the hearings, in order to make it more convenient for the representatives of the interested public and to change the place of the hearings. No answer was received.

The resolution of the public hearings has not been given yet in spite of repeated requests of the Public Council under the Ministry of Environment and some non-governmental organisations. Establishments and organisations which were involved with the arrangement of the hearings avoided contact with interested non-governmental organisations throughout the last two months.

We have witnessed an illogical sequence of procedures performed in 2005 through 2006 during the decision-making over the completion of the Dniester PSP and consultations with the public. Such a sequence contradicts the requirements of the applicable laws of Ukraine and the provisions of the Convention regarding access to information, public participation in the decision-making process and access to justice in environmental matters (Aarhus Convention), the Law of Ukraine “On Environmental Expertise”, the Decree of the Cabinet of Ministers of Ukraine No 1378, dated October 15, 2004. The provisions of Laws of Ukraine “On Information” and “On Applications of Citizens” were repeatedly infringed during the interactions between the authorities and the public with respect to the Dniester PSP.

In light of this we consider informing the public that the hearings and the process of their preparation were extremely unsatisfactory.

#### **3.4.4 Violation of the provisions of the Espoo Convention on Environmental Impact Assessment in a Transboundary Context**

The Government of Ukraine does not recognise the transboundary nature of the project. Thus, the Dniester PSP completion Project is not recognised as being under the jurisdiction of the Convention on Environmental Impact Assessment (EIA) in a Transboundary Context and the Protocol on Strategic Environmental Assessment (SEA).

In spite of the undoubted transboundary nature of the project, Ukraine has not officially provided Moldova with information about the planned potentially dangerous activity; therefore public hearings on this matter were not carried out in Moldova, the public was not duly attracted to the processes of decision-making, and informing about the processes of the Dniester PSP completion both in Ukraine and in Moldova was not done properly.

This is a violation of the Espoo Convention on EIA in a Transboundary Context as well as the Protocol on SEA which provides for public participation in the ecological evaluation of projects which have such impacts.

According to our information, the Government of the Republic of Moldova has not considered at the official level the problem of the transboundary environmental impacts of the Dniester PSP and has not initiated any consultations with the public to address the Dniester PSP subject.

### **3.5 Political risks**

In the area of the Dniester hydro complex the national border between Ukraine and Moldova has not yet been determined. A part of the buffer reserve of Dniester HPP (HPP-2) is on the territory

of the right bank of the River Dniester. This territory was given by the government of the Moldavian Soviet Socialist Republic free of charge, without time limit, for the construction of Dniester PSP as long ago as 1981 (Decree of the Council of Ministers of the Moldavian SSR No 372, dated September 22, 1981 and State Act No 000347 issued on its basis). On August 3, 1990, the same energy complex was given to the subordination of Ukraine. Since 1990 the plant has been fully under the control of Ukraine (including the construction, financing, and so on). But in 2000 the authorities of Moldova notified by memorandum that the Act of Allocation of Land issued by the Government of Moldavian SSR is null and void. On July 17, 2003, without consultations with the Ukrainian party, Moldova set up a frontier post on the territory of the safe zone of the Dniester PSP. A Ukrainian frontier post was set up at HPP-2 as a response to the actions of the border guards of Moldova.

Further financing of the Dniester hydro facilities, its ecological and man-made impact on the section of the River Dniester located in the low flows was not considered at the intergovernmental level, and the Moldavian party has not initiated such a consideration. At the same time Moldova does not recognise the importance of the present-day (since 1991) contribution of Ukraine to the construction of the Dniester hydro energy complex and is planning to claim 20% of the electric power which is to be generated by this complex. Compensation measures for the Moldova part are not envisaged, and this issue has not been discussed at the intergovernmental level. The Moldavian party explains its actions and aspirations by the fact that the construction of the Dniester hydro facilities started at the expense of the USSR rather than Ukraine.

This situation puts obstacles in the way of the normal operation of the plant and does not allow for the provision of reliably guarding against possible terrorist acts and acts of sabotage. According to the management of the Dniester hydro energy complex the claims of Moldova to the hydro facilities of Ukraine (HPP-2 and a part of the buffer reservoir of the Dniester PSP) is of a long-term character and inadmissible uncertainty as there has not been timely and decisive interference on the part of the President of Ukraine and the Ministry of Foreign Affairs of Ukraine. According to the management of the Dniester PSP, an intergovernmental subject commission was set up to consider these problems but its work is not effective.

The Dniester PSP Project (with seven hydro turbines) implies the exploitation of 9.6 hectares of land on the territory of the Republic of Moldova. But this question has not been discussed and agreed at the necessary governmental level. The project builders say that this issue is not urgent for the establishment of the complex of the Dniester PSP; therefore trying to find a solution has been temporarily postponed.

The conflict concerning the planned evacuation of water at HPP-2 is a separate problem. The volumes of water which are discharged can amount to 3 million m<sup>3</sup>. In the opinion of the power engineering workers such water evacuations are important for the normal operation of the Dubossary HPP (Moldova). At the same time, the local authorities of Moldova are demanding that the power engineering specialists reduce the volume to 1,6 million m<sup>3</sup> because of the processes of flooding of overbuilt-up flood-lands of the River Dniester in the area below HPP-2 and down to Dubossary HPP.

### **3.6 Man-made risks**

The construction and operation of large-scale hydraulic complexes always involves certain man-made risks: construction, hydrodynamic, geological and seismic sometimes. Unfortunately all of these factors apply to the Dniester PSP complex as well.

From the point of view of man-made safety, regardless of the conclusions and recommendations of seven additional studies presented for the consideration, which were carried out from 2004 through 2006 by specialized scientific establishments in Lviv, Kiev, Kharkiv and Moscow, the following principal problems exist and are the cause of alarm for the public:

### **3.6.1 Seismic, geological and construction risks**

The Dniester PSP Project envisages 150 metres of water level difference between the upper and lower storage reservoirs with the volume of the upper reservoir being 32.7 million m<sup>3</sup>. The upper PSP reservoir is located in an area of active karst where the bottom rock is limestone. The engineering and geological conditions of the construction site are extremely complicated; the bottom of the upper technical reservoir is located in caverns where the processes of cavern formation (of karst type caves) are ongoing. The safety margin of the walls and the bottom of the reservoir, according to the Final report of the State commission for environment in 1997, is not too high but their ability to filtrate water is high. According to local geologist Mr. V. Korzhik (Western-Ukrainian Regional Union of Horizontal Speleology), one of the tectonic-karst caverns leads under the pit and he has personally described two karst cavities there.

A number of years ago the preliminary concreting of the bed of the upper reservoir was made with the aim to isolate the influence of the water on the bed rocks. In order to increase the reliability of the construction the construction of a clay-film screen for its bed and pedestal is planned. However, the reliability of these technologies as well as the effectiveness of the reconstruction of hydro structures built in the 1980s and through the 1990s – and damaged in the process of time – are the cause of some concern.

The high natural and induced seismic activity (with a magnitude of 6-8 on the Richter scale) in the area of construction can result in the destruction of external and underground hydraulic structures, the displacement of water conduits, the destruction of the bed of the upper technical reservoir of the Dniester PSP, and so on.

The service of geo-seismological support is permanently working at the Dniester PSP Administration. It carries out monitoring of the inspection of galleries and the upper reservoir every six months. There is a plan to set up a permanently operating system of the automated monitoring of the state of the hydraulic structures and the units of the Dniester PSP.

According to the project documentation and in the opinion of all the managers of the Dniester PSP, including engineering services, no accident – even the most dreadful man-made accident – at the Dniester PSP (the destruction of underground and surface hydraulic structures as a result of an earthquake, the obsolescence of materials or acts of sabotage, dislocations of the upper layers of earth, erosion, the collapse of karst caverns under the bed of the upper technical reservoir, and so on) will not affect the bed of the Dniester river below HPP-2 and adjacent territories. The after effects of a man-made accident will be alleviated due to the considerable volume of water in the buffer storage reservoir of the Dniester PSP and its considerable length, and also due to the reliability of the HPP-2 dam. An accident or discharge of water (filtration) from the upper technical reservoir through the karst caverns, according to the specialists and managers of the Dniester PSP, will neither affect the valley of Sokiryanka because in accordance with the calculations all discharged water masses will be directed to the buffer storage reservoir.

Such statements cause doubts, especially if we take into account the experience with the operation of the Tashlyk PSP where it was impossible to avoid the flooding of adjacent territories, in particular wells which were the sources of drinking water for local people in spite of a much more reliable soil and granite platform.

An inspection of the reliability of the bed and the pedestal of the upper reservoir of the Dniester PSP, and also the effectiveness of the construction of the clay-film screen, is planned to combine with the putting into operation of the first hydraulic unit of the Dniester PSP. The upper reservoir will be temporarily dammed. The volume of water in the reservoir near water intake will be sufficient for the operation of the starting complex. At the same time, careful inspections of the bottom will be performed immediately after the filling of the dammed part of the upper reservoir with the water. The Dniester PSP will be shut down, the bed will be dried out and a new reconstruction of the upper reservoir will be made in the event of intensive filtration, the destruction of the clay-film screen, and so on.

Such a place is not an appropriate place for the construction of a complex of this scale as a whole. The project represents mostly man-made danger.

### **3.6.2 Hydrodynamic risks**

Any attempts to regulate the hydrodynamics of large reservoirs imply risks of catastrophic and unforeseeable processes. The hydrodynamics of flows, in particular, the conduct of the water in canals and the interaction of water with the walls and bottom of the storage reservoirs and dams represent very complicated processes in complicated systems, which present-day mathematicians are not able to calculate reliably due to their complexity. There are a lot of unstudied problems and phenomena in this area such as the self-organisation of processes (waves and flows) or so-called “memory of water”, which means the capacity of the water for the independent reproduction of processes which were caused artificially some time ago.

## **3.7 Risks for the environment**

### **3.7.1 Impact on the water balance**

According to the UN classification, Ukraine belongs to those countries which are not sufficiently provided for with water resources; moreover, these resources are distributed unevenly. Large hydraulic structures imply the construction of storage reservoirs, which change the hydrological regime of the river basin due to the artificial regulation of the water level and the additional evaporation of water from the reservoir surface; and the situation with waters resources is becoming even worse.

The River Dniester, the major part of whose water flow is formed by tributaries streaming down from the slopes of the Carpathians, was until recently deemed to be a river of clean water. Its water resources supply water to large industrial and agrarian territories, cities, including the city of Odessa with a total population of one million, generate electricity, dispose of fish resources and spawning areas, and create natural preserves of international importance.

But during the last few years the conditions of the River Dniester and the quality of water have been considerably impaired because of chemical contamination and the artificial regulation of the water, which does not coincide with natural cycles.

According to the experts of the State Committee for Water Resources and Aqua Economy, one can already observe the significant negative impacts of the hydroelectric complex of the Dniester storage reservoir on the environment of the lower flows of the Dniester; and these will increase once the Dniester PSP is put into operation:

- Intensive sedimentation of the bed of the Dniester storage reservoir in its upper section in the area of the River Khotyna and the operating of the water intake (of open or surface type), which considerably (by 3-4 times) exceeds the planned figures. For this reason and because of the considerable water level variations here, bogs (places of mass reproduction of bloodsuckers) will appear soon on the territory of one of the main recreation tourist centres of Podniestrovya. As a result the banks of reservoir and reservoir itself will lose their recreation and economic importance.
- Sharp variations in the water level as a result of water discharging or usage of water storage. Numerous facts about the drying off and destruction of large quantities of caviar are regularly recorded in spite of annual attempts to arrange environmental water discharges to the lower Dniester. This negatively affects the species variety of fish fauna and its stock.
- The deformation of the flood rhythm in the lower flow of the Dniester: unsynchronised with the climatic conditions and biological rhythms sanitary discharges of the water from the Dniester reservoir negatively affect spawning processes and the hydrochemical regime of the estuary.
- An accumulation of floating garbage in the river and scrap-heaps on the banks.
- Activation of karst on the banks and in the heart of Prut-Dniester country between two rivers caused by the underground outlet from the reservoir to the bed of the Prut river.
- Regulation of flow of the River Dniester also caused changes of hydrological and temperature conditions in the ecological systems of the River Dniester below the Dniester HPP dam that negatively affects the wetlands system in the lower flow of the River Dniester, which are of international importance according to the criteria of the Ramsaar Convention.

Though the complex has already existed for twenty years we could not find operation instructions for the existing Dniester HPP and this is despite the fact that a shortage of water at the delta of the River Dniester is observed regularly. After the construction of the Dniester PSP the situation will be even worse. The anticipated unsanctioned diversions of the water by the Moldavians for the irrigation of agricultural lands, which are suffering from a shortage of irrigation water, will further reduce the water level in the lower flows of the River Dniester.

### **3.7.2 Impact on the biological variety in the lower flows of the River Dniester**

Catastrophic environmental phenomena such as the extinction of species and the drastic reduction of such resources as water, fish and game can take place during “low water” years which happen once every 12 years. The drying up of the delta of the River Dniester is a result of the construction of the Dniester HPP in 1986; it led to cyanobacteria blooming in all reservoirs of the delta, including the Dniester Estuary and internal lakes, and entailed mass extinction of molluscs and other species. Apart from the above, the intensive invasion of sea-water to the delta of the river took place that has had a catastrophic impact on the ecological system.

The continuity of the hydro ecological system will disappear in this area of the Dniester once the Dniester PSP is put into operation (in buffer storage reservoir whose length is 20 km). After the completion of the Dniester PSP the high death rate of hydrocoles will be observed due to the circulation of considerable volumes of water through the PSP hydraulic structures, and a complete changing of the hydro-biological terms with a corresponding change in the hydro-ecological system type will take place. The daily difference of the water level in the buffer reservoir will be 7.2 m. The quality of the water and the condition of the hydro-ecological

system in this area will be indefinite. At the same time, because of the turbulent processes, water turbidity in the buffer storage reservoir will increase. A special 1996 EIA volume confirms the expected negative impacts on the river-bed hydro ecological system, but it implies in a non-comprehensible manner its compensation by additional water airing and improvement of the temperature condition.

In compliance with the Law of Ukraine “On the Implementation of the State Program of Formation of the National Ecological Network in 2000-2015”, the National wildlife park “Nizhniodniestrovskiy” will be founded at the River Dniester and will include the delta of the River Dniester, a key territory of this ecological network of national and international importance, and will join the Dniester international ecological corridor within the framework of the formation of the all-European ecological network. It is impossible to understand how the construction of the complex and the foundation of the park will be combined from the legal and environmental point of view. What impact will the Dniester hydro power complex and the Dniester PSP make on the created wildlife park? EIA and project expertise do not take this problem into account in any way because the corresponding documents were worked out long before the decision-making about the creation of the park. In other words, nobody has studied this impact.

### **3.7.3 Impact on fish fauna**

The impact of the hydraulic power complex on fish fauna in the area of the PSP has not been studied by experts, but the existence of fish fauna both in the PSP storage reservoir and in the buffer storage reservoir is problematic enough due to the almost complete destruction of forage reserve because plankton is exterminated by 99% as a result of PSP operation.

The expertise of the project foresees total damage of 61 tons caused to the fish industry by the construction of the Dniester PSP. A reimbursement budget for the Project provides for a share holding in the reconstruction of the trout farm “Lopushno” and the construction of Chernivci fish-farm for the reproduction of salmon species.

According to Dniester PSP’s directors, the construction site was chosen with the aim of eliminating the faintest technical chance to provide uninterrupted transportation of water (and hydrocoles, respectfully), isolated from the impact of Dniester PSP through the hydro power complex (from the area upstream of HPP-1 to the area downstream of HPP-2). It is possible to design and build by channel or a pipe; however nobody took care of it. If these additional measures are taken, the cost of construction will drastically increase.

### **3.7.4 Social consequences**

The Dniester PSP Project entails the resettlement of several villages and settlements located in the area affected by the Dniester PSP. In the area affected by the Dniester PSP are located villages and settlements of the Vinnitsa and Chernivtsi regions: Ozhevo, Vasylivtsi, Voloshkovo, Bernashivka and Kozlov. Altogether 271 homesteads are subject to resettlement due to the construction of the Dniester PSP facilities. In any case it is planned to build new houses because of the depreciation of existing constructions. Thus 191 houses will be built by the workers of the Dniester PSP and 80 families will build the houses themselves with the following correspondent compensation.

Nobody will know the exact number of the people who incur losses due to the construction of transmission facilities connected to the Dniester PSP (private and state land owners and tenant

farmers) until the completion of the engineering project. 280 persons can incur losses if we suggest that the construction of one power transmission pole inflicts losses to one owner (81 m<sup>2</sup> for stretching poles and 52 m<sup>2</sup> for intermediate poles).

Bogs (places where there will be mass reproduction of bloodsuckers) will appear in one of the recreation and tourist centres of Podniestorvya as a result of the silting of the bed of the Dniester water storage reservoir and the drastic changes of the water level; the banks of the reservoir and reservoir itself will completely lose their recreation and economic importance and worsen the general sanitary and epidemiological conditions in the region.

Due to the artificial decrease of the water level in the lower flows of the River Dniester, the sea-water can reach the level of Odessa water supply point, and this will worsen problems with drinking water which are faced not only in the city of Odessa with an overall population of one million but all over this region.

A lot of published materials in favour of the Dniester PSP focus on full the dependence of Novodniestrovsk on the construction of the plant. In fact due to the construction of the Dniester complex the town population expects the creation of jobs and growth in the town's budget. However, such growth takes place at the expense of the state and the growth of electricity tariffs, in other words, at the expense of other citizens of Ukraine. Even direct funding of the town would be cheaper for other citizens of Ukraine than the creation of jobs at the expense of the construction of a plant whose economic expediency is doubtful.

## **4 RECOMMENDATIONS**

### ***4.1 To drop the Dniester PSP Project***

In 2006 the government of Ukraine began system work for the sake of development of efficient and maximally independent power industry of the country. Unfortunately, approved Energy Strategy of the development of power engineering till 2030 contains a number of principle deficiencies. The Strategy ignores dependence on Russia in nuclear industry, economic aspects of coal production in Ukraine, impact on environment and risks of the accidents. And the most important is biased assessment of financial possibilities of the industry.

The World Bank should have given critical assessment of the plans of the government, before actively undertake to implement the strategy starting with one of the most doubtful projects. Ukrainian power engineering requires considerable investments in organisation and structural restructuring (the Bank believes that these are its main tasks). Apart from the above, there is an urgent task of re-equipment of thermal power plants to increase their efficiency in connection with expected used of the coal.

State expertise of the Dniester PSP project considered, as an alternative, construction of new TPP and came to the conclusion that such alternative is economically non-expedient. We do not understand why the expertise ignored a lot of already existing TPP which stand idle as well as the possibility to modernize TPP for the improvement of their dynamic characteristics.

Now TPP amount to 60% of existing power capacities of Ukraine. TPP are able to operate in load shifting mode, but only 20% of them are in the operation supplying peak loads, and 80% stand idle. This is explained by the excess of generating capacities in Ukraine on the one hand,

and by the foul competition for the access to the network on the part of NPP. Experts also say that corruption in the industry is one of the main reasons for this critical situation.

If TPP operate at full fledged level they, due to their load shifting capacities, will be able to regulate load in electric power network. Although TPP hold better a basic load in comparison with other types of the plants, if we built at the turbine exhaust so-called peak devices connected at the time of peak loads, the plants will generate additional 30% of electricity.

## **4.2 Solution of the problem of peak loads**

### **3.7.5 Reforming of power sector**

According to independent experts the problem of peak loads in the network can be solved by reforming of power industry in Ukraine, which necessity reached the crisis point due to many reasons. Even elementary up-to-date automation of regulation of power systems on the basis of present-day principles can completely eliminate the problem of peak loads. Efficient organisation of power companies envisages unification of the entire cycle of generation, sale, calculations and management, whereas the existing system does not possess necessary contacts, joint customers and joint dispatch control.

Electric power sector of Ukraine enjoys considerable advantage, which permits to provide its stability: this is existence of interconnected power network which unites all back-bone networks of power lines, including main, distributive and local lines, built in such a way that they allowed to have interconnected power system which provides stable operation of electric power systems. This system was built at the times of the Soviet Union, when the main concern was not a customer but the maintenance of the system which should reliably transmit electric power for long distances. This system could function properly on condition of existence of automated dispatch control whereas now dispatch control system is rather of monitoring character and is not able to respond to the changes in the network because of the absence of executive devices.

The situation regarding the limited chaotic schedule of access of TPP to the interconnected power network requires changes. On account of their load shifting capacities, TPPs alone can perform the regulation functions for the peak loads in the network.

### **3.7.6 Economic instruments**

One effective economic instrument which can help to solve the problem of peak loads, and which has had results already in Western countries, is restricted hour tariff of electric power, when during peak loads tariffs are higher than during the period of falling consumption. Thus, for the consumer sector it is better to level differences in the schedule of consumption of electric power which reduces the need for measures directed to the regulation of peak loads in the network.

### **3.7.7 The sale of electric power abroad**

The sale of excess electric power abroad during drops in domestic consumption can perform regulatory functions. The possibility to export electric power is usually related to the synchronisation of electric power systems.

However, export and import transactions with neighboring countries are possible through so-called “lines of direct current”, which allow to perform the exchange of electric power at any time without synchronisation and with minimum losses. Line of direct communication or line of direct current is a system that unites power lines; the device, which is at the entrance of power lines, converts alternating current into direct current for transmission through power lines, and a converter at the other end of the power lines converts direct current into alternating current with the frequency of the consumer’s power system.

These systems suffer fewer losses because of the specific character of direct current; apart from the above, power lines with the same specifications have higher carrying capacity and, moreover, power lines of direct current do not need to be synchronised with the power system of the country in which the power exchange takes place. There is a unified line of direct current in Ukraine Volgograd – Mikhailovskoye (800 kWh) but it has never been utilised since Soviet times.

In October 2006, Ukraine and Russia agreed about the renewal of the export of Ukrainian electric power to the interconnected power systems of Russia regarding the joint export of Ukrainian electric power to Moldova and transit from a Moldavian HPP to Russia through Ukraine. A decision was taken regarding the prolongation of work directed to the unification of the power systems of CIS countries and Baltic countries with European UCTE.

### **4.3 Energy-saving**

Taking into consideration the large potential of the Ukrainian economy it should focus on energy-saving instead of the construction of new capacities for power generation. Growth in energy efficiency is declared to be among the priorities of the development of power engineering in Ukraine, but it is not confirmed by the actions of the government, which can be explained by the starkly different plans which are suggested by the Ministry of Power Engineering under the influence of the operators of the power plants.

### **4.4 Decentralisation**

Small power-plants, irrespective of their type, have larger loads shifting potential; they are more reliable, environmentally safe and cheaper. In particular, the possibility to place production capacities close to the places of the consumption of electric power allows for the opportunity to give up the practice of transmission of electric power at large distances which results in losses of up to 20% of electric power.

If we develop small and loads shifting generating capacities, employ and reconstruct already existing TPPs, and reduce at this account a share of large-scale and non-loads shifting capacities, the load in the network will be regulated directly at the power plants and there will be no need to build additional storage plants.

## **5 Conclusions**

The need to solve the problem of the generation of electric power during peak loads is the main argument for the construction of the Dniester PSP. However, the authors of the “Strategy of development of the power industry of Ukraine up to the year 2030” are not trying to solve the

problem in principle; they are proposing only an expensive engineering solution for its alleviation.

The Strategy suggests the preservation of the existing ineffective balance of sources of electricity, which took shape under the very specific circumstances of the transition of the Ukrainian economy to an independent economy, under extremely favourable conditions for nuclear power engineering. The authors of the Strategy appear to be unable to assess the present-day tendencies in the development of power engineering, instead suggesting approaches and methods worked out during Soviet times.

Consideration of the Dniester PSP Project, its economic, ecological, social, legal and political aspects, has revealed a number of its negative consequences. In particular, the Project is based on an inefficient technology; therefore there are doubts about its economic expediency and its ability to reap returns sufficient for the repayment of credit. Besides, the Project involves several man-made risks, the gravest of which is the high seismicity in the area of construction, quick soils as well as construction and hydrological risks.

As to ecological consequences, the Project threatens to dry up the lower flows of the River Dniester – this will have catastrophic consequences for the ecology of the region, in particular for the wetlands system of the Dniester protected by the Ramsaar Convention. It will also cause problems with the drinking-water in the region which could trigger epidemics.

Finally, the Project does not meet the requirements of the legislation of Ukraine, violates the Espoo Convention as well as the Protocol on Strategic Environmental Assessment.

The experience of the international financial institutions in financing projects in the power sector of Ukraine, in which the state acts as a guarantor, requires thorough analysis, because it shows the ineffectiveness of financial investments which become a burden on the state foreign debt.

The financing of the Dniester PSP completion project is not an effective investment for the Ukrainian power sector, because it supports the wrong direction in its development. The World Bank should instead be making efforts to reform the Ukrainian power sector, to create a relevant system of management for the electricity market, and to support projects aimed at increasing energy efficiency in the Ukrainian economy.