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# WHAT IS WRONG WITH KANIV PSP?

Kaniv Pumped Storage Plant: Project risks



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## 1. Introduction

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 Kaniv PSP is an unlikely solution to the problems of the Ukrainian power sector and will have a number of negative impacts. It is necessary to pay attention to the following factors:

- 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;
- 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 river; and
- the negative impacts on the environment.

However, the European Bank for Reconstruction and Development (EBRD) is considering the possibility to finance this project. The EBRD should rather 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 security of Ukrainian power engineering. This refers, first of all, to the reduction of the power intensity of the economy and demand management, and the EBRD has to play a leading role to make it happen.

## 2. History of the Kaniv PSP Project

### 2.1. A history of long lasting construction

The Kaniv Pumped Storage Plant (KPSP) Project was developed in 1985 by the Ukrhydroproekt Institute (city of Kharkiv, Ukraine) in compliance with the “Plan of placement of HPPs and PSPs on the territory of the European part of the USSR up to the year 1990”. The project substantiated the expedience of the construction of the PSPs at the time of the operation of the Interconnected Power System of the USSR. The project envisaged the construction of the PSP with a 24-hour and one-week loads regulation schedule for the 3600 thousand kW power system, which comprised 16 hydraulic units of 225 thousand kW and 250 thousand kW in generator and pumping modes respectively.

The construction of the Kaniv PSP, which began in 1984, was suspended during the economic crises of 1992. The moratorium on the construction of the Kaniv PSP was removed by the Resolution of the Cabinet of Ministers of Ukraine No 307, dated 19 April, 1999.

## 2.2. Status report

The planned Kaniv PSP is located in the Kaniv District of Charkassy Oblast. The construction site of the planned complex of Kaniv PSP structures is located on the right bank of the Dnipro, in the area regulated by the Kaniv reservoir, which includes free of construction riverside and the shore area of the reservoir's shore. The total area of the PSP site according to the original project documentation was 887 hectares<sup>1</sup>.

According to the latest information from the construction official in Kaniv, the project was significantly renewed with the number of new technical characteristics. Neither old project no this new one is available to the public.

The preparatory works were carried out and the infrastructure was created during the first stage of the construction. It resulted in an absolute interference in the natural environment (the taking down of the fertile layer and chopping down of the forests) on a scale which, according to the designer, considerably exceeded the scope of works specified in the Feasibility Study. According to the mass media, about USD 20 million was spent on the preparatory works<sup>2</sup>. According to the official press-release on Kaniv PSP from June 2006, the amount of money already spent is nearly 57 million Soviet Roubles (nearly 117 million Hryvnas or about USD 23 million)<sup>3</sup>.

We do not know in what condition the construction site was during the previous construction stage (1984-1992), but late in 2007 there were observed no signs of building activity on the site of the projected construction apart from dilapidated concrete flagged roads, solitary electricity transmission poles stripped of wire and some incomplete ancillary structures. Local residents say that nearly everything that was built in the 1980s that could be stolen was stolen long ago, including wire which disappeared from ETL, stone boulders which reinforced the concreted right bank of the Kaniv reservoir in the section from Buchak village and lower down the course, which were to protect it from the washing out by turbulent flows created by the PSP.

The only sign that bears a vague reference to the projected construction of the Kaniv PSP is a nameplate near the pit which is to be turned into the upper reservoir of the PSP. As of now no management of the PSP construction (formally the identified contractor) is based either in the town of Cherkassy or Kaniv. All processes are managed by the joint stock company

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<sup>1</sup> The scientific ecological and expert assessment «Kaniv PSP. Specifications of the Feasibility Study», developed by Geotechnology LLC, page 7.

<sup>2</sup> Ukrainian business weekly "Kontrakty" / No 31 of 01-08-2005 (<http://www.kontrakty.com.ua/show/ukr/article/34/3120055900.html>).

<sup>3</sup> Informational release on Kaniv PSP construction status as on the beginning of 2006; prepared by Kompanets A., the Head of the Construction Department at Kaniv HPP.



“Ukrhydroenergo” based in the town of Vyshgorod. The presence of the person in Kaniv who’s responsible for the project development – Mr Kompanets, the Head of Construction Department at Kaniv HPP, was concealed from the public and only recently this fact was discovered. But still, no project documentation is available neither from the management in Vyshgorod no from in Kaniv.

The administration of the Kaniv HPP has been tasked with the protection of the construction grounds of Kaniv PSP. In reality, however, no one knows for certain what are the boundaries of those grounds and what is to be protected apart from the sand, solitary sandstone rocks and pits overgrown with 20-25-year old trees.

The PSP's lower reservoir was built in the 1980s and represents a pit long since flooded with water, which opens into the lower water area of Kaniv reservoir. From the aesthetic aspect this water reservoir is rather picturesque and serves as a recreation zone for holiday makers from Cherkassy, Kiev, and so on. The slopes of the water reservoir are overgrown with trees and have suffered much from erosion. Irrespective of the magnitude of the work accomplished and money invested in the 1980s, energy experts decided to abandon the idea of using this reservoir as a lower buffer PSP reservoir and to build instead a new one which would be 1,2 km closer to Kiev HPP dam. Energy experts explain changes in the project by stronger substratum, the lower estimated cost of the work as well as the intention to preserve archeological monuments. The public is still not aware of the exact changes made in the project.

The local authorities of the towns of Cherkassy and Kaniv do not have a clear understanding of what is being built and what is the difference between the PSP and the existing Kaniv HPP, as proved by NGO’s representatives during the field trip in December 2006. The last field trip, held in October 2007, has also showed that local councils’ heads of the villages around the construction site do not have any official information on the project, and as the result, their understanding of both project’s risks and benefits is very narrow and in some cases inadequate. It remains doubtful that all land issues relevant to the Kaniv PSP project as well as land allocation were settled and done properly.

### **2.3. Construction plans**

Four power units with capacity totalling 1000 MW are to be built under the re-approved project. The basic structures will comprise of a water reservoir, water intake, pressure conduits, PSP construction inclusive of drop shafts and bypass channels. According to the project, the construction of the Kaniv PSP will take 10-12 years.

The Kaniv PSP site is situated on the Kaniv hills (Kaniv dislocations), which is a meridian surface strand 3-5 km in width with maximum altitude marks of 230-240 m above sea level, which are situated at 140-150 m above the level of the Kaniv water reservoir. The full volume of the upper reservoir will be 17,0

million m<sup>3</sup> with a conservation zone of 42,5 million m<sup>3</sup>. The upper dam with the crest mark of 204 m will be 10 m wide, 4000 m long and its height versus reservoir bowl will vary from 20 to 90 m<sup>3</sup>.

At present there is no official data about the cost of the re-approved Kaniv PSP project. Thus, according to a statement made by the Deputy Minister of power engineering the cost of the project will be no less than USD 500 million; but just recently the constructor representative estimate the total cost of the project as 8 billion Hryvnas, which is about USD 1,58 billion.

## **2.4. Applying for EBRD credits**

Negotiations with the EBRD about the possibility of financing the completion of Kaniv PSP went unnoticed by interested Ukrainian public, which learned with surprise in December 2006 that the Ministry of Fuel and Power Engineering asked the EBRD to support the Kaniv PSP completion project via the granting of a loan of USD 250 million. All attempts to learn about the project failed since Ukrhydroenergo, the project owner, systematically ignores the formal requests of public organisations and refuses to make project information available. Meanwhile, EBRD officers, responsible for the project, keep saying that they do not yet have the documents of the project?

In 2005, OJSC Ukrhydroenergo already received from the World Bank a loan of USD 106 million for the HPPs rehabilitation project, which envisages the rehabilitation of nine HPPs, including the reinforcing of seven dams (six dams in the Dnipro River and one dam in the River Dniester) and a number of measures pertinent to the technical and administrative modernisation directed to the reformation of the wholesale energy market. Apart from the rehabilitation, the aim of these measures is the improvement of the conditions for the creation of the energy market in Ukraine. The authors and the sponsor of the project are also planning to receive an additional USD 5,5 million resulting from the reduction of greenhouse gases emissions.

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

### **3.1. 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.

But such loads shifting mode involved in the operation of power generating capacities complicates the generation of electric power and requires additional funding, and is not applicable to NPPs. Therefore, there is a need to have enough loads shifting capacities or to take measures directed towards the regulation of demand. Loads shifting capacities such as HPPs or gas-

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<sup>3</sup> The scientific ecological and expert assessment «Kaniv PSP. Specifications for the Feasibility Study», developed by Geotechnology LLC.

burning thermoelectric power plants can quickly change the mode of generation according to the change in demand.

Specialists assert that a share of these loads shifting capacities should make up 16-17 percent of the generating capacities, 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 has decreased in Ukraine due to the growth of the NPPs' share in the entire volume of the electric power generation and is now about 10 percent.

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 via a third way: by the construction of a number of PSPs by 2030, which are to be operated as accumulators.

### **3.2. 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 of the electric power at the level of 25-30 percent, and approximately 70-75 percent of the received electrical power can be regained.

Specialists try to justify the economic expediency of the PSP by the difference between night and day tariffs for the electric power. In addition to the supply of the peaks of demand in the power system, the PSPs are used as an emergency reserve.

## **4. PSP within the context of the energy strategy of Ukraine**

### **4.1. 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. By 2030, the construction of 20 new nuclear reactors is envisaged.



According to the experts of the “Concept of the non-nuclear way of development of the power engineering in Ukraine”, designed by a number of non-governmental organisations, no studies were carried out in the course of the development of the new strategy with a view to determine the real volume of losses of the power resources in different branches of the national economy; therefore, the expected demand for power does not correspond to the real potential of energy-saving in the country.

As nuclear power plants (NPPs) are unable to change their output in response to demand, and the electric power, which they will generate, is planned to remain at the level of about 52 percent, there is a problem related to the regulation of the peak loads in the network. For this purpose the Strategy foresees the use of the pump storage plants (PSPs), whose construction started during Soviet times, namely: Tashlyk, Kaniv and Dniester PSPs. It is expected that there will be “putting into operation of hydroelectric capacities at the Tashlyk and Dniester PSP from 2007 through 2010, and at the Kaniv PSP – from 2020 through 2030”. There are also technically obsolete projects dating back to the 1970s that envisage the construction of several PSPs in the area of the Upper Dniester and on the Dnipro River. In 2005, the volumes of generation of electric power by PSPs amounted to 0,2 billion kWh. In the long term 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<sup>4</sup>.

#### **4.2. Deficiencies 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 energy sector development of 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. Unfortunately, today Ukraine is one of the world leaders in the use of energy per one unit of GDP (energy intensity) – the country 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 comes down to the extraordinarily large investments which are needed.

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<sup>4</sup> Energy Strategy of Ukraine up to the year 2030.

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 authors of the strategy who expect that at such growth of demand and the need to work more coal under complicated conditions, the cost of coal would fall.

The authors try to justify excessive power generating capacities 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 a considerable increase of the loss of electric power (a certain amount of which will be generated in any case on account of gas). The merits of such investments are especially doubtful if we take 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 the development of Ukraine as a reaction to the approval of the “Energy Strategy of Ukraine up to the year 2030”. According to the concept there is an alternative to the nuclear scenario for the development of Ukraine’s power complex. It is based on the implementation of energy-saving and energy efficient technologies, and the practical use of potential non-conventional, renewable 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 and forecasted structure of consumption of the raw resources shows that a share of the non-conventional, renewable and off-balance sheet power sources in the entire consumption of the 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 (FFR) in 2030 was overestimated by 213,1 million toe. With this evidence we can talk about the low quality of the strategy and express our doubts about all of the other data and conclusions provided in the strategy.**

The authors of the strategy insist on the recognition of the PSPs as an instrument for the regulation of peak loads resulting from the specifics of NPPs’ 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 hanging properly.

Especially strange is the need to put into operation considerable PSP capacities given the assertions of Energoatom management that new reactors in Ukraine will themselves represent loads shifting capacities. Also likely is the application of coal-burning thermal power plants as loads shifting capacities on the condition of technical re-equipment.

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

Moreover, both the development of nuclear power (20 new VVER units and lifetime extension for another 12) and the proposed for Ukraine technology of solution of problems of peak loads (PSPs) require considerable volumes of additional excess water resources, which are just not available in Ukraine.

### **4.3. 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 corruption in the industry.

NPPs, which generate about half of the electric power and represent the worst loads shifting capacities, enjoy priority access to the electric power network; and the remainder operate in a chaotic mode depending ultimately on personal contacts between managers of the power generating companies. This causes variations of loads in the network and requires additional measures directed to the regulation of loads.

## **5. Problematic issues connected to the Kaniv PSP Project**

In this section we will analyse a number of problems related to the prospect of the completion of the Kaniv 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 the social consequences of the project.

### **5.1. Low efficiency of PSP technology**

Ukraine is one of the most power consuming countries in the world (even Russia consumes less, being richer 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 interconnected power systems, with a view to accumulate it (pump the water), is lost; PSP returns to the interconnected power system approximately 70-75 percent of electric power and 25-30 percent is lost.

In other words, a PSP, provided that excessive electricity is not available, consumes more electricity to pump water to the reservoir than it generates. PSP efficiency is even less if we add losses of electric power for energy transmission.

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.

## **5.2. Economic aspect**

PSP technology implies substantial capital investments in the construction phase. In Ukraine it is expected to come partly from the public funds. At the same time, the interested public is not aware of the correct calculations of PSP recoupment. We suspect that this information is not available as PSP is an unprofitable facility in the Ukrainian reality. The lifetime of one PSP is about 40-45 years. Power engineering specialists refer only to the recoupment and revenues of the entire integrated power system during 4-5 years if the PSP is put into operation within this integrated power system. If we take into consideration examples of the Tashlyk and Dniester PSPs, these calculations are either unknown to the public or cause doubts because of the defects of the calculation methods. Neither the harm caused to the environment, local residents, river basins, and so on is taken into account during the construction process and after putting the plant into operation.

Open Joint-Stock Company Ukrhydroenergo is a sponsor of the Kaniv 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 general economic and energy calculations regarding the plant's effectiveness were not made for the Kaniv 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 Kaniv PSP seems to be a far-fetched project without any justification and aimed only at gaining funds by the construction companies.

The economic estimate of the advantages of Kaniv PSP from the point of view of Ukrhydroenergo is based on the fact that Kaniv 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 which exist do not always reflect correctly the real demand. Besides, the cost of electric power, which remains low in Ukraine, does not allow the companies to get sufficient revenues. It still remains a question today how the tariffs will be changing.

Moreover, the Kaniv PSP is located at some distance from the main base 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 Kaniv PSP's revenues. However, it is very clear that such calculations are absent, because the customer does not incur these expenses.

Given the unpredictability of the situation in Ukraine's power industry, the development of the electricity market, and the orientation towards integration to USTE, the prices for electric power can change unpredictably, which will undermine the economic basis of the Kaniv PSP operation. The economic risks concerning the project will also increase due to the long payback period for the Kaniv PSP.

It is beyond our understanding why it is necessary to invest such big money for the implementation of such projects while current studies (namely the International Energy Agency's "Ukraine: Energy Policy Review", 2006) show that the Ukrainian government should focus on the implementation of a demand management policy.

### **5.3. Financial non-transparency**

Complete complex economic calculations relating to the advantages of the Kaniv PSP and the funding required for its completion either do not exist or has not been made public. Such an assessment should consider natural, recreational and other resources unalterably lost due to the construction, an assessment of the role of Kaniv PSP within the interconnected energy system of Ukraine and in the social and economic development of the region. It should cover such issues as the influence of the local authorities on the processes pertaining to the construction of Kaniv PSP, the distribution of revenues (should they occur) after putting the plant into operation, and its connection to the interconnected energy system of Ukraine.

An analysis of the engineering and economic indices provided in the description of the Kaniv PSP project on the website of OJSC Dniprohydroenergo<sup>5</sup> allows us to draw the conclusion that the amount of the net present value (NPV) of the project set at an amount of UAH 1 659 million

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<sup>5</sup> OJSC Dniprohydroenergo and OJSC Dniesterhydroenergo are liquidated to date, and their assets have been transferred to OJSC Ukrhydroenerho. // [http://www.dhe-ua.com/rus/project\\_kanev.html](http://www.dhe-ua.com/rus/project_kanev.html)



at 1997 prices (about USD 870 million at the UAH rate of 1997) has been overcharged. The NPV at current prices will be much lower even if we add the cost of the saved (at the expense of the power generated at the PSP) natural gas to the benefits of the project. According to the preliminary estimates, NPV will not exceed UAH 225 million, which is less than 6,5 percent of the project cost (determined to be UAH 3 491 million)<sup>6</sup>, if all the units will be put into operation simultaneously at the end of the construction (unfortunately, a schedule of the units' launching is not provided on the website of OJSC Dniprohydroenergo). There are also doubts about cost per unit for the construction of the PSP estimated on the website of OJSC Dniprohydroenergo to be 1 952 UAH / kW at 1997 prices, in other words at the level of 1000 USD / kW<sup>7</sup>.

Moreover, the authors of the PSP Project described on the website of "Dniprohydroenergo" envisage that set turbine operation capacity makes up 1 800 megawatt, and in the scientific, environmental and expert assessment of Kaniv PSP it is stated that its capacity will be 1000 megawatt. In the event of such a drop in the established capacity, the specific indices of the construction will be even worse because the cost of the construction of a reservoir, the outlet conduits, and so on, will reduce by a lesser extent than the cost of the basic equipment.

## **5.4. Legal aspect**

### **5.4.1. Manipulation of procedures of public hearings and access to information**

On the 7<sup>th</sup> of August 2006, National Ecological Center of Ukraine (NECU) received verbal information from Ivan Zayets, Deputy of the Parliament, about the unfreezing of the Kaniv PSP construction project and the holding of public hearings on the 18<sup>th</sup> of August in the town of Kaniv. We failed to find appropriate information on the Internet about the project and the hearings. We also failed to learn anything from OJSC Ukrhydroenergo by telephone. The host party did not notify interested public organisations in a timely manner about the date and procedure of the public hearings.

Only in the second half of August 15 was NECU informed by telephone by an outside organisation (All-Ukrainian Scientific and Technical Union of power engineering specialists and electricians) that the hearings would be held in Kaniv not on the 18<sup>th</sup> but on the 16<sup>th</sup> of August. In other words, if NECU was planning to participate in the hearings, its experts should arrive in Kaniv the next day before 10 a.m. As NECU and other public organisations did not receive the project documentation (Feasibility Study, scientific and

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<sup>6</sup> Scientific environmental and expert assessment "Kaniv PSP. Specifications for the Feasibility Study", developed by Geotechnology LLC.

<sup>7</sup> For comparison we would like to provide an example of the use of gas-turbine units to regulate peak loads, which is much more attractive both from the economic and ecological points of view. According to some estimates the specific costs for their construction comprise USD 350-400/kilowatt. Widespread application of these units requires certain changes in the power engineering management. This might be the reason why they are not supported by the top managers.

environmental assessment of the Feasibility Study and EIA, materials of hearings, official invitations to the hearings, and so on) in advance, they were not able to work out their comments and remarks to the project. None of the recognised environmental NGOs of Ukraine, which are working in the area of the Dnipro basin, were invited to the hearings.

As far as we know, the representatives of the state environmental institutions, in particular of the Ministry of Environment of Ukraine, the State Service for Nature Reserves, scientific and research establishments, who could oppose with their well-founded arguments the advocates of the construction, were absent at the hearings.

The representatives of local communities who were invited and took part in the hearings were not properly informed about the subject of the hearings and the Kaniv PSP Project; as a result they did not work out fully-fledged comments and remarks to the Project. They expressed their opinion that the hearings were arranged according to the well thought-out and planned scenario of the power industry specialists, the result of which had been determined beforehand.

With the aim to inform the public, the owner of the project published a Statement about the environmental consequences of the project only in the newspaper "*Dniprova zirka*", dated 23 June, 2006. In other words, for information dissemination to the public about a project affecting the basin of the largest river in Ukraine, the project owner chose a newspaper published only in one district and with a circulation of 3000 copies.

On the 12<sup>th</sup> of October 2006, NECU and the Ukrainian river network forwarded their written request to the OJSC Ukrhydroenergo asking for the ecological information pertinent to the materials and results of the public hearings held on 16 August, 2006 (letter No 125-1/84, dated 12.10.06), and requests about the hearings and the project (No 125-1/99, dated 15.12.06, No 125-1/8, dated 14.02.07). No answer has been provided by now. New attempts to get in touch with S.I. Potashnik, the chairman of the OJSC Ukrhydroenergo, or with other officials of the Company and to clarify the fate of the requests were unsuccessful. The request was also sent to the OJSC Ukrhydroproekt (No 125-1/28 of 24.04.07).

NECU sent one more request with regard to the EIA and expertise of the Kaniv PSP construction Project to the Minister of Environment (No.125-1/85 of 12.10.06). No answer was received and a formal reply was given to the repeated request (No 125-1/14 of 13.03.07), which contains no answers or documents concerning the essence of the request.

At the same time, on 1.11.2006, a similar request was sent by Cherkassy "Green World" to the State department for environment and natural resources in Chekassy Oblast. The reply with a copy of a favourable one-page report of the State ecological expertise No 413 (dated 06.01.07) was received on 23.11.06. As appears from the above, whereas interested public

organisations failed to receive answers to their requests regarding the State ecological expertise, the expertise was carried out without the public's knowledge and was accomplished on 6.11.2006.

We would like to emphasise that the same scheme was applied during public hearings dedicated to the Dniester PSP completion project on 21.11.2005 and 2.09.2006, arranged by the same OJSC Ukrhydroenergo. Up to now the materials of these hearings held on 2.09.2006 have also remained unavailable for ecological non-governmental organisations.

The Public Council of the All-Ukrainian environmental NGOs under the Ministry of Environment (20 organisations) considered the problem of the Kaniv PSP construction and the public hearings dedicated to this issue on December 14, 2006 and set up a special working group to study the project and procedures of its state ecological expertise.

However, the project documents and materials of the public hearings have not been given yet to the organisations and members of the working group in compliance with the applicable laws of Ukraine. NECU drafted a complaint to the General Prosecutor's Office concerning the infringement of the Law of Ukraine "On Information", and now this issue is being investigated.

The non-governmental environmental organisations believe that such actions from top-ranking officials and state-owned energy companies contradict the applicable laws of Ukraine and the provisions of a number of Conventions, ratified by Ukraine, namely the articles of the Law of Ukraine "On Information" and "On Appeals of Citizens", the Convention on access to information, public participation in the decision-making process and access to justice in environmental matters (Aarhus Convention), and the Decree of the Cabinet of Ministers of Ukraine No 1378, dated October 15, 2004 "On Certain Issues Providing for Public Participation in the Shaping and Realization of National Policy", dated October 15, 2004.

#### **5.4.2. Manipulations of EIA procedures**

While the public organisations were waiting for the reply to their requests, the Ministry of Environment of Ukraine and OJSC Ukrhydroenergo prepared the Conclusion of the state ecological expertise of the Project's feasibility study (FS). The favourable Conclusion is dated 6 November 2006, in other words almost one month after the date of the first NECU request. It seems that the Ministry of Environment and Ukrhydroenergo intentionally ignored the request with the aim to hide from the public the signed positive Conclusion and the fact that the project's expertise was carried out at the same time and was completed on November 6, 2006.

The Public Council of the All-Ukrainian ecological organisations under the Ministry of Environment of Ukraine discussed the matter of the Kaniv PSP on December 14, 2006, and gave its view on the expertise procedure to the representatives of the Ministry of Environment. However, the members of the

Public Council still have not officially received any documents pertinent to the project (Project FS, Environment Impact Assessment, Scientific environment assessment report, and so on), even the Conclusion No 413. In the letter of the Ministry of Environment to NCEU (No 3918-к/11-8, 11/M-232, dated April 10, 2007), the Ministry only recommended to turn to the general designer of the Project, OJSC Ukrhydroproekt "with the proposals regarding construction and operation of Kaniv PSP..., for their consideration in the process of adjustment of EIA documents at the next stage of design works".

Today the only document, which the public has managed to receive, is a scientific ecological and expert assessment "Kaniv PSP. Specifications for the Feasibility Study", developed by Geotechnology LLC (city of Kyiv)". However, this document was sent to NCEU by e-mail as an attachment, without any note or signature, from an unknown electronic address of an outside third party (most probably of the public organisation the "Ukrainian Association for Substantiate Development" or of the Institute for the Environment Geochemistry under the National Academy of Sciences of Ukraine - a state scientific establishment, which was not related to the preparation of the document).

The explanation is simple: only one person, Mr. Yuri Tyshchenko, uses this e-mail address and works at these three organisations. He is regarded as an expert on the Dniester PSP completion Project, which he analyzed using only EIA documents without visiting the construction site, and then arranged the public hearings and letters from unidentified public organisations to support the construction of the Dniester PSP. He was a person who signed the Scientific and environment assessment report "Kaniv PSP. Specifications for the Feasibility Study" in the capacity of executive performer of Geotechnology LLC.

In other words, the situation, when the same people act on behalf of the government institutions, commercial companies, and public organisations at different stages of the development of project documentation, state ecological assessment and provision of the public hearing with regards to large-scale and dangerous projects is presented as a norm in Ukraine.

### ***5.5. Neglecting the recommendations of the World Commission on Dams***

The Kaniv PSP Project is classified as a large dam project, according to the World Commission on Dams (WCD) because the size and capacity of the upper water reservoir's dam of the Kaniv PSP exceeds the parameters set forth in the definition of large dams. Due to the high potential danger of such projects, the WCD worked out a number of recommendations regarding their development in order to make the best of them.

However, in the process of the development of the Kaniv PSP Project, the project customer neglected almost all the recommendations of the WCD, including:

- Consent of the public

There were no public hearings or discussions with the stakeholders dedicated to the Kaniv PSP construction Project or the “Energy Strategy of Ukraine up to the year 2030”. Another factor preventing the involvement of wide public circles in the decision-making on Kaniv PSP Project was the unavailability of the project information. A lack of information about the project, discontent with the EIA procedure drafting and execution of the state ecological expertise of the project provoked criticism on the part of the public organisations and the Public Council under the Ministry of Environment of Ukraine. The public was not properly involved at the initial stage of the project's agreement.

- Comprehensive consideration of alternative projects

The complex assessment of all the scenarios of the development of the energy sector of Ukraine should include both the participation of wide circles of the public and consultations with interested parties, but, in fact, this fundamental procedure was neglected. The project had been worked out without any complex analysis of the population's needs in water and energy resources or the consideration of alternative scenarios to meet these needs. In particular, a possibility of raising the efficiency of the existing power-generating system was not studied prior to the assessment of new construction projects, and so on. There were no alternative projects considered from the economic, environmental or technological points of view (see paragraphs 3.1 and 3.2).

- Maintenance of ecological conditions of rivers and ensuring living conditions for people

At the previous stage of the construction, the residents of the adjacent village of Buchak were resettled by force. The residents of other adjacent villages will face problems because of the flooding of agricultural lands, houses, auxiliary buildings and wells with drinking water, as happened in the area of Tashlyk PSP construction site. The construction will drastically reduce the recreation potential of the area and its attractiveness for tourists.

There is a probability of radioactive impact on the people living downstream of the river, on drinking water (especially for the 28 000 inhabitant city of Kaniv) and its recreation zone. This will be an echo effect of the raising of radioactive silt accumulated on the bottom of Kaniv water reservoir after the Chernobyl disaster in 1986.

- Compliance with the legislative framework and distribution of the benefits

The project customer did not make any effort to assess in due manner and reimburse the damage which was caused or may be caused to local people and agricultural lands.



## 5.6. Man-made risks

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

From the point of view of safety, regardless of the conclusions and recommendations of the Scientific Environmental Assessment of the Kaniv PSP, the following principal problems exist and are the cause of alarm for the public: the location of Kaniv PSP construction site in the area of extremely dangerous exogenous geological processes, radiological and hydrological risks.

### 5.6.1. Seismic, geological and construction risks

#### 5.6.1.1. Exogenous geological processes

The highest man-made risk of Kaniv PSP Project arises from its location in the area of especially dangerous exogenous geological processes<sup>8</sup>. The only advantage of the chosen place is a great water level difference between the upper water basin of the Kaniv PSP and the Kaniv water reservoir.

In addition to the specific geological characteristics of the area, the Kaniv PSP Project has a rather high level of danger according to the classification of the WCD as a large dam project. A large volume of the upper storage pond (46,5 million m<sup>3</sup>) and its location at the height of 140-150 m above the level of Kaniv reservoir precondition the risks of the project.

The bottom and walls of the upper storage pond have a low margin of safety, high water filtration and landslide abilities. Water-bearing horizons are bedded and alternated with waterproof layers in a chaotic "mosaic" manner and require detailed study.

Compression of the surface by dynamic method to the depth of 6 metres and the placing of the waterproof protective screen are projected to ensure the water tightness of the bottom soils. However, the reliability of such construction is a source of doubt among independent experts. Similar screens are used in domestic waste plants, and experience shows that they fail to prevent a filtration process. At the same time, there are no turbulence effects in domestic waste plants, which do take place as a result of PSP operation.

In the event of water filtration from the upper storage reservoir the water-bearing horizons will be overfilled and the increased sliding processes will affect not only the surface but the deep layers of the rock as well.

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<sup>8</sup> See the Chart of the regional assessment of the spreading of dangerous exogenous geological processes on the territory of Ukraine in the Appendix.

### 5.6.1.2. Seismic activity

A background average statistical intensity of earthquakes on the territory of the PSP with a magnitude of 6-8 on the Richter scale is an additional factor of danger<sup>9</sup>.

### 5.6.1.3. Sliding of slopes

According to the Ministry of Environment of Ukraine<sup>10</sup>, special attention was paid to the three most risky zones, including the construction site of the Kaniv PSP, among 27 sliding slopes on the right bank of the Kaniv reservoir stretching for 8,7 km, where the experts studied re-forming processes of the banks of the reservoirs. The total length of the territory is about 1 km. The abrasion rate here was 0,2-2,46 m/year from 1998 through 2002, and the magnitude of shifts within the sliding territories is about 1-3 m/year.

The Kaniv PSP is partially situated on a sliding slope (up to 20-30 percent of the site territory), where there are two active plots of land which occupy a space of 3,5 hectares. The poles of the power lines and access roads (including an improved road section) have been destroyed as a result of sliding processes. The sliding speed was about 0,34-0,98 m/year, and the maximum values within the newly registered sliding made up 30-35 m/year<sup>11</sup>.

The situation is also complicated on the territories adjacent to Kaniv PSP. Thus, at the beginning of 2002, the most dangerous were the slides in the village of Mankivka, in the town of Monastyryshche, in the area of the Kaniv PSP construction site, within the territory of the Korsun-Shevchenkivsk Machine-Tool Plant, and near the villages of Rusalivka, Kyslyn and Hryhorivka. The slides, accompanied with deformations and partial destruction of buildings, constructions, access roads, and so on, were registered on the above-mentioned territories in 2000-2002.

Replacements of certain slides cause the partial destruction of the asphalt pavements, suffusion replacements provoke deformation and the destruction of houses and auxiliary buildings on the banks of the Dnipro; suffusion soil subsidence processes with the creation of suffusion holes and craters are periodically observed and their location is mainly associated with water-supply communications.

Due to the quite intensive destruction of other (not sliding) areas of the right bank of the Kaniv reservoir, the Ministry of Environment of Ukraine points out the need to carry out a complex study of the bank reforming processes including an annual examination of areas where there are registered landslides, slide-rocks, suffusion and erosive processes.

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<sup>9</sup> The Scientific Environment Assessment Report «*Kaniv PSP. Specifications of the Feasibility Study*», developed by Geotechnology LLC, p.8

<sup>10</sup> Regional state of environment reports. Cherkaska Oblast. // [http://mail.menr.gov.ua/publ/regobl02/dpsir/Cherkasska\\_2003/index.html](http://mail.menr.gov.ua/publ/regobl02/dpsir/Cherkasska_2003/index.html)

<sup>11</sup> Regional state of environment reports. Cherkaska Oblast. // [http://mail.menr.gov.ua/publ/regobl02/dpsir/Cherkasska\\_2003/index.html](http://mail.menr.gov.ua/publ/regobl02/dpsir/Cherkasska_2003/index.html)

According to independent experts, a detailed geological exploration of the construction site should have been carried out before the conclusion of the State ecological expertise of the Kaniv PSP project.

In other words, unstable soils in the area of Kaniv PSP construction, as well as the height and the volume of the upper reservoir, can provoke large-scale landslides and a break of the dam of the upper reservoir that may involve unpredictable catastrophic consequences not only for the neighbouring villages of Buchak, Ivankiv and Pshenychnyky, but could produce a wave in the lower section of Kaniv reservoir that could destroy the dam of Kaniv HPP, which is an integral part of the Dnipro dams' cascade.

This scenario is confirmed by the conclusion made by the experts of the scientific ecological and expert assessment of the Project<sup>12</sup>: *“From the hydraulic standpoint, the water outlet from the broken water-pressure reservoir can create high water wall, which will provoke a high wave after its discharging to the water area of Kaniv reservoir.”*

Now it remains a question whether the possibility of a hydraulic blow on the Kaniv HPP dam in the case of a catastrophic destruction of the structures of the upper reservoir of Kaniv PSP has ever been evaluated.

### **5.6.2. Soil underflooding**

Construction of the PSP upper reservoir can cause soil flooding, which is dangerous for drinking water wells, houses and outbuildings in the neighbouring villages of Ivankiv, Pshenychnyky, and Bobrytsia. Today, if the precipitations exceed an average rate, the level of underground waters rises even without water reservoir operation.

This threat is proved by the experience gathered during the completion and putting into operation of the Tashlyk PSP where the builders failed to avoid the flooding of the neighbouring territories, in particular the agricultural lands and wells with drinking water despite much more reliable soil and a granite platform.

Thus, the implementation of a PSP Project in the above-described region of the Dnipro, represents a man-made danger both in case of the designed operation and in case of the accident. According to independent geologists such construction is extremely risky.

### **5.6.3. 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

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<sup>12</sup> The Scientific Environment Assessment Report «Kaniv PSP. Specifications of the Feasibility Study», developed by Geotechnology LLC, p.16

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 ability of water for the independent reproduction of processes which were caused artificially some time ago.

Regular discharges of water from the upper reservoir of the Kaniv PSP may provoke destruction of the shore of the Kaniv water reservoir and the islands. The stream, as a result of large water flows, threatens to completely destruct the Zmiyini Islands, a part of the Kaniv Nature Reserve which are now eroded, and to damage the ‘Kaniv Ryba’ Fishery. Even without the PSP operation the local authorities incur large annual losses from the Kaniv HPP, although its operation is much more substantial and predictable than the effects of the PSP.

### **5.7. Sites of archaeological significance are under threat**

The construction site of the Kaniv PSP is part of the territory which is of unique archaeological significance not only for Ukraine but for the entire world. There have been found but still not thoroughly studied monuments of the Copper Age of the internationally known cultures: Tripilya culture (Copper Age, 4th - 3rd century B.C.), of Zarubenets culture (3rd – 2nd century B.C.) and Chernyakhiv culture (3rd – 4th century of our era), Scythian culture (5th -3rd century B.C.) monuments of Kiev Rus, Middle Ages, Kozak ages, and so on.

In the opinion of archaeologists, the construction of the Kaniv PSP will ruin the unique monuments of archaeology and unique (from the archaeological point of view) territory. The full extent of their archaeological significance is impossible to assess because systematic archaeological excavations have not been carried out in this area.

This is why we can only describe the results of the archaeological excavations near two villages (Bobrytsya and Buchak) which will be affected by the construction of the Kaniv PSP.

Archaeological monuments near to the village of Buchak and in the outskirts which are at risk of destruction because of the construction of the Kaniv PSP:

- A settlement of the times of Old Rus was located in the “Pid Ponyatovskiy” tract of land. Several houses and a pottery kiln which date back to the 11-12th centuries were excavated.
- A multi-layer monument on the Tuz mountain – a settlement of the Scythian (the 6th-4th centuries B.C.) and Early Slavonic (the 6th-7th centuries) periods; a large soil burial ground of the 11th-13th centuries. About 100 burial grounds were excavated over 20 years (1986-2005). Materials from these monuments studied by anthropologists are the most representative among all other village burial grounds of the South Rus period. They were the basis of the latest paleodemographic studies

of the medieval population of Ukraine. The major part of the burial ground has not been studied.

- A site of the Old Rus period settlement (12th-13th centuries) on the Tuz mountain.
- A multi-layer settlement in the Rozhana Krynytsya tract of land is one of the most complete monuments of that time found on the territory of the Middle Podniprovyie; it contains materials of the 6th-15th centuries including houses destroyed by fire and 8 pots of Luka-Raykovets culture (8th-9th centuries).
- A site of the Old Rus period settlement in the Gorodok tract: there are scarps and two lines of earthworks (ditches and walls of the 12th-13th centuries).
- A multi-layer monument on the Lisukha Mountain. The materials excavated in 1998-2004 were preliminarily dated back to the Sarmat (4th-2nd centuries B.C.), Zarubenets (3rd-2nd century B.C.) and Early Slavonic (4th-7th centuries) periods. Ceramic items of the Early Slavonic period are unique and we cannot find anything similar among well known cultural artefacts. Fortifications in the form of ditches and walls are partially preserved; they were of a sophisticated wooden construction which was destroyed by fire. The settlement had already suffered considerable damage during the first stage of the PSP construction in the 1980s.
- A settlement of the Scythian period (the 6th-4th centuries B.C.) on the Vikha Mountain. Its area is about 30 hectares. A fortification system in the form of ditches and walls has been preserved in good condition. They encircle the monument along its perimeter. The first explorations of the settlement took place in the 1990s.

Both monuments (on the Lisukha and Vikha Mountains) are unique with regard to the preservation of the fortifications and excavated artefacts, and undoubtedly must be preserved. Their complete archaeological exploration requires considerable investment, hundreds of workers, and will require decades:

- Didiv Shpil;
- Babyna Hora;
- the monuments were found during explorations in 2004 on the construction site of the future PSP.

In the opinion of archaeologists, the territories in Babyna Hora and Didiv Shpil tract near the village of Buchak should have the status of a preserved archaeological zone.

The archaeologists insist on the creation of an archeological conducted tour in this region. The Kaharlyk and Kaniv District Councils have already passed resolutions about the construction of facilities and the financing of such a tour in 2007 with the participation of the Buchak Village Council and the Kaniv District Administration. But we should note that the local authorities and administrations have not been informed about the PSP construction Project.



Archaeological monuments in the village of Bobrytsya and in the outskirts of the village which are at risk of destruction due to the construction of the Kaniv PSP:

- a burial ground of the Late Bronze Age;
- settlements and burial mounds of the Scythian period (the 5th-3rd centuries B.C.);
- a site of ancient settlement of the Kyiv Rus period;
- decorations of the Chernolis culture of the late period (in particular, a bronze bracelet);
- a burial mound of the Scythian period (up to 5 metres high) excavated by Ye.A. Znosko-Borovsky (6th century B.C.). It corresponds to the burial ceremony held for the representatives of the Scythian nobility on the territory of what is now Kyiv Oblast;
- burial mounds in which people were buried after a cremation ceremony (4th-3rd century B.C.);
- five sites of ancient settlements;
- two burial mounds and several stone crosses were found north-west of the village; and
- certain working tools were found.

Archaeologists propose the setting up of the Museum of history of the village with a model reconstruction of the burial mound of the Scythian times.

It is difficult to talk about Kaniv PSP impacts on geography in detail, because the public does not have access to the project documents, therefore we are not aware of the exact borders of the construction site, nor the location of the outbuildings and communications.

### **5.8. Risks for the environment and contradictions of the ecological expertise**

Once the plant becomes operational, a number of unavoidable system impacts are expected on the hydro ecosystem of the Dnipro in the area of the direct impact of Kaniv PSP and on the environment in the lower flows of the river:

- changes of temperature conditions of the various layers of the aquatic environment are provoked by the increase of the heating surface with the further water discharge to the water reservoir;
- considerable increase of frequency of water level variations in the reservoir;
- intensification and redistribution of the flows in the lower section of the reservoir;
- changes of the chemical, optic and other physical properties of the water in Kaniv and Kremenchug water reservoirs;
- changes of the location and accumulation character of the bottom sediments in the lower section of the Kaniv water reservoir;

- an increase of water turbidity in the lower section of the Kaniv and in the upper section of the Kremenchug water reservoirs;
- a violation of the environmental stability in biota colonies formed after filling the Kaniv reservoir with water after putting the PSP into operation;
- changes in the nature of the colonies, the intensification of succession processes, and so on.

Nobody can predict in advance the consequences of such changes but there is an unanimous opinion that there will be changes in the hydro environmental systems of the Kaniv and Kremenchug water reservoirs and in the riverside environmental systems and landscapes.

**At the same time, a scientific and environmental assessment “Kaniv PSP. Specifications for the Feasibility Study” made by experts of the Geotechnology LLC (which was the basis for signing a favourable Conclusion of the state ecological expertise of the Project) and the text of the Conclusion itself are beneath any criticism having a number of contradictions and non-compliances.**

For example, the section “Water ecological systems” of the expert assessment<sup>13</sup> of the Project reads: *“Active travel of the water masses along the right bank of the Kaniv water reservoir with the following water flow in its left-bank section will be observed if Kaniv PSP is operated in turbine mode while Kyiv HPP is in operation. Even a minor impact of the PSP operation on the level condition of the Kaniv water reservoir (0,05 m) will lead to the activation of the water circulation in the shallows with the positive environmental effect on the living conditions of hydrocoles”*.

This statement is not true because in the aquatic lake-type environmental systems (which are observed on the left bank of the water reservoir opposite the village of Buchak), the hydrocoles mainly represent tape species (which prefer smooth waters) which are not adapted to survive under the condition of the regular flows in the reservoir. The constant (regular) flows will depress the ordinary vital functions of the tape species. It will result in succession (a process accompanied by the change of the species composition and proportion of species in the colony), the consequences of which are difficult to anticipate.

However, there is no doubt that harm will be caused to the aquatic environmental systems of the left-bank shallows. We shall observe changes in the hydrocoles species composition and in the proportion of the species in the colonies which can lead to the deterioration of the self-purification capacity of the hydro ecosystem and the corresponding worsening of the water quality in the Dnipro River.

The process is getting even more complicated by the fact that the environmental conditions for the new stabilisation of the hydro ecosystem

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<sup>13</sup> The Scientific Environment Assessment Report «Kaniv PSP. Specifications of the Feasibility Study», developed by Geotechnology LLC, p.12

after putting the PSP into operation will not be unvarying due to the specific PSP operation mode.

Taking into account that *“The impact of the Kaniv PSP on the water shifting in the Kaniv reservoir will also provoke certain relocation of the bottom sediments in the area of 18 km<sup>2</sup>. About 2 million m<sup>3</sup> of the bottom sediments will be subject to the re-sedimentation, 20% of which will be carried away with the flow to the lower pool of Kaniv HPP”* – this will cause the following inevitable changes.

Bottom sediments relocation at a medium and profound depth in the water reservoir opposite the future PSP will cause serious harm and can entail extinction of the bottom colonies of mussels (*Dreissena* sp.) and other molluscs-filterers whose functioning are vital for enabling the processes of self-purification of the water reservoirs and prevent the intensive blooming of the water. Thus, not only basic mussels-eating fish species such as roach (*R. rutilus*) will be left without forage reserve but the water blooming processes will intensify which will undoubtedly lead to the deterioration of the water quality and the condition of the aquatic ecosystems on the whole.

Besides, there are many organic substances in the bottom silt sediments which will re-sediment and infiltrate into the water as a result of the PSP's operation. This will lead to the increase of the saprobe indices of the water (non-toxic pollution of the water with organic compounds) with the further worsening of gas conditions and clarity, to the decrease of a number of species sensitive to organic pollution and eruption of a number of saprotroph and relatively pathogenic bacteria (in fact it means the fouling of the water), and, finally, to the deterioration of the quality of drinking water and the destruction of aquatic ecosystems.

In the section “Flora. Protected areas” of the same document<sup>14</sup> it is stated that: *“The nearest to the planned construction site is the preserved territory of the Kaniv Wildlife Reserve located at the distance of 12 km. Any impacts of the future plant on the natural reserve fund territories are not envisaged”*.

However this is not true because the territory of the Trakhtymyriiv Regional Landscape Park is located only 1 km away from the construction site, and the Zmiyini (Snake) Islands, which are a part of the Kaniv Wildlife Reserve, are at a distance of 2 km from the future plant.

A direct flow of water which will be discharged from the PSP also threatens to wash out the banks until the complete disappearance of Zmiyini Islands where washing out processes are observed even now. Today, the well developed natural forests of the upland terrace in the Dnipro middle flow remain only on this plot of land.

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<sup>14</sup> The Scientific Environment Assessment Report «Kaniv PSP. Specifications of the Feasibility Study», developed by Geotechnology LLC, p.9

Taking into account the above considerations, **it is impossible to understand the issuing of a favourable Conclusion of the State environmental expertise of the Project** if even in the Conclusions of the State environmental and expert assessment of the Kaniv PSP feasibility study (which do not list all possible consequences) there is pointed out a need to improve the EIA and FS, and to carry out additional studies: “1. EIA documents: Specification of Kaniv PSP feasibility study by its content and completeness are not sufficient for substantial conclusions as to the environment impact assessment in compliance with the requirements of the applicable laws and rules in the area of environmental protection and safety... 3. The necessary condition for the further designing works before the beginning of the construction is the execution of a package of field observations and scientific and research works set forth in the section of FS “Monitoring of the aquatic environment, exogenous processes, flora and fauna, and radio-ecological situation”.<sup>15</sup>

## 5.9. Social consequences

At the previous stage of the construction local residents were resettled by force from the adjacent area without their consent and respective compensations. Besides, as a result of the implementation of the project, the remainder will have to change their routine life rhythm due to the flooding of agricultural lands, a change of the water level in wells and may face the danger of man-made catastrophe which are possible on account of the especially dangerous geological conditions of the construction area.

**Radioactive and toxic impacts** on people residing downstream, the drinking water and recreation zone of the town of Kaniv is another danger coming from the Kaniv PSP.

As it is established in the environmental and expert assessment<sup>16</sup>: “The PSP operation will affect the hydrodynamic conditions of the entire Kaniv water reservoir, which potentially can cause an intensive washing out of the bottom sediments in other places of the reservoir”.

There are quite a number of radioactive materials on the bottom of the Kaniv reservoir originating from the Chernobyl disaster in 1986, in particular strontium-90 accumulated by the shellfishes due to the substitution of strontium for calcium, and caesium-137. “Impact of the planned operation on the radio-ecological conditions of the aquatic environment of Kaniv reservoir and downstream of the Kaniv HPP dam which can suffer changes due to the re-sediments of the bottom sediments requires more in-depth substantiation. According to the Institute of Hydrobiology, about 2 million m<sup>3</sup> or 5,3 million

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<sup>15</sup> The Scientific Environment Assessment Report «Kaniv PSP. Specifications of the Feasibility Study», developed by Geotechnology LLC. Conclusions, pp. 21-22.

<sup>16</sup> The Scientific Environment Assessment Report «Kaniv PSP. Specifications of the Feasibility Study», developed by Geotechnology LLC. p.20.

*tons of sand and clay sediments with the maximum radio-activity of 529 Bq/kg (radioactive caesium) and 24,6 Bq/kg (strontium -90) will be re-distributed".<sup>17</sup>*

During pumping and discharging operations PSP water will be stirred up and small silt parts will migrate downstream. Re-sedimentation of the bottom sediments in the lower section of the Kaniv reservoir constitutes another threat, which was mentioned in the expertise report (though it was not an all-embracing wording): in the course of twenty one years radioactive nuclides in the bottom sediments got out from the biotic circulation and accumulated in silt. During pumping and discharging of the water from the upper PSP reservoir the radioactive nuclides will again return to the water as well as toxic compounds (heavy metals, chloric organic pesticides, and so on), the concentration of which in the silt sediments is usually much higher than in the water. This will deteriorate the radiological and toxic situation. Secondary pollution of the water of the lower section of Kaniv reservoir is inevitable during PSP operation. This will cause radioactive and toxic pollution of the drinking water, which constitutes a real danger for the 28 000 inhabitants of the city of Kaniv.

Taking into account that the PSP will be operating simultaneously with Kaniv HPP, the above-mentioned processes of the deterioration of radiological and toxicological conditions of the water reservoir will apply to the Kremenchug water reservoir as well. Particular concern relates to the fact that the recreation zone of the city of Kaniv which is just a few kilometres down the Kaniv HPP dam could be at risk. Moreover, not only the residents of Kaniv but numerous Ukrainian and foreign tourists, who every year visit the grave of Taras Shevchenko, spend their holidays on the territory of the above-mentioned recreation zone.

## **6. Recommendations**

### **6.1. To drop the Kaniv PSP Project**

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

The EBRD should have given a critical assessment of the plans of the government, before actively undertaking to implement the strategy starting with one of the most doubtful projects. Ukrainian power engineering requires considerable investments in organisation and structural restructuring. The development of the power engineering sector under the proposed scenario

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<sup>17</sup> The Scientific Environment Assessment Report «Kaniv PSP. Specifications of the Feasibility Study», developed by Geotechnology LLC. p.20.



preserves the existing scheme of centralised power generation, thus postponing the creation of the liberal decentralised power system for the distant future.

## **6.2. Solution of the problem of peak loads**

### **6.2.1. Reforming of power sector**

According to the opinion of experts, the problem of peak loads in the network can be solved by reforming the power industry in Ukraine, the necessity of which has reached a crisis point for many reasons. Even elementary up-to-date automation of the regulation of power systems on the basis of present-day principles can completely eliminate the problem of peak loads. The efficient organisation of power companies envisages the 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.

The electric power sector of Ukraine enjoys a considerable advantage, which allows for its stability: this is the existence of an interconnected power network which unites all the back-bone networks of power lines, including the main, distributive and local lines, built in such a way that they are allowed to have an interconnected power system to provide the stable operation of electric power systems. This system was built in Soviet times, when the main concern was not a customer but the maintenance of a system which should reliably transmit electric power over long distances. This system could function properly on condition of the existence of automated dispatch control whereas now the dispatch control system is rather of a 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.

### **6.2.2. 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 a restricted hour tariff for electric power, when during peak loads tariffs are higher than during the period of falling consumption. Thus, for customers 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.

### **6.2.3. Electricity export**

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 them to perform the exchange of electric power at any time without synchronisation and with minimum losses. A line of direct communication or a 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, 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 USTE.

### **6.3. Demand management and energy-saving**

Taking into consideration the large potential of the Ukrainian economy it should focus on demand management and 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 governments, 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.

### **6.4. 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 over large distances which results in losses of up to 20 percent of electric power.

## 7. 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 Kaniv PSP. However, the authors of the “Energy Strategy 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. The authors of the strategy appear to be unable to assess the present-day tendencies in the development of power systems, instead suggesting approaches and methods worked out during Soviet times of planned economy.

Consideration of the Kaniv 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. There are certain doubts pertinent even to the recoupment of the construction.

Besides, the project involves several man-made risks, the gravest of which is provoked by the location of the Kaniv PSP (the project implies construction of the reservoir of 46,5 million m<sup>3</sup> and the dam from 20 to 90 meters high, by 140-150 meters higher the level of the Kaniv water reservoir) **in an area of especially dangerous exogenous geologic processes**. The fact that the PSP will be operated in the Kaniv HPP affected zone provides grounds for unpredictable consequences with possible large-scale man-made catastrophe.

Hydrological risks in the construction area threaten to wash out the banks of Kaniv reservoir till the complete elimination of the Zmiyini Islands located at a distance of 2 km from the Kaniv PSP, which are a part of Kaniv Wildlife Reserve.

As to social and ecological consequences, the project threatens to change the routine lifestyle of the local people due to the flooding of the agricultural lands and water levels in the wells; the people will live under the threat of man-made catastrophe which is possible due to the especially dangerous geological conditions of the construction area.

A specific danger related to the putting into operation and further operation of the Kaniv PSP involves **radioactive and toxic impacts** on the population residing downstream of the River Dnipro, the situation with drinking water, and the recreation zone of the city of Kaniv, expected on account of the fact that the pumping and discharging of PSP water will cause the migration of radioactive matters (in particular strontium-90 and caesium-137) and toxic

compounds (heavy metals, chloric organic pesticides, and so on) accumulated on the bottom of the Kaniv reservoir after the Chernobyl disaster.

The construction site of the Kaniv PSP is a part of a territory of unique archaeological value which now is set to be destroyed.

Finally, the project designing procedures and the performance of the state ecological expertise do not meet the requirements of the legislation of Ukraine, namely, articles of the Laws of Ukraine "On Information" and "On Citizens' Requests" and "On the Ecological Expertise", provisions of the Convention on access to ecological information, public participation in decision-making and access to justice on environmental issues, and the Resolution of the Cabinet of Ministers of Ukraine No 1378 "On Certain Issues Providing for Public Participation in the Shaping and Realization of National Policy", dated 15 October 2004.

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's foreign debt.

The financing of the Kaniv PSP completion Project is not an effective investment in the Ukrainian power sector, because it supports the wrong direction in its development. The EBRD 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.





“Completion of the Kaniv PSP is not an effective investment in the Ukrainian power sector, as it will support the wrong direction of the energy sector development.”



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