Dr. Volodymyr Tykhyy. Background.

Born in Eastern Ukraine, graduated from Moscow State University (applied nuclear physics) in 1975. Worked at the Institute of Nucler Research of the Academy of Science of Ukraine from 1975-1990. In 1986-1989 was involved in field investigations and modelling of radioactive contamination of the river Dnieper and watercourses in the 30-km exclusion Chernobyl zone.

In 1988 joined Ukrainian "green" movement, and in 1990 started working for "green" public organizations - Ukrainian association "Green World", Greenpeace Ukraine, Environmental Education and Information Center. In 1990-1992 - Director of the Independent Radiological and Toxicological Laboratory (a joint project of "Green World, Greanpeace International and International Renaissance Foundation).

In 1997 - 2001 - manager and participants of several projects funded by the British Council, CIDA, UNDP and US EPA, including a three-year Demonstration Environmental Impact Assessment Project.

As a consultant and trainer, worked on different environmental management and environmental awareness projects in many countries of the former Soviet Union, mainly in Central Asia. Since August, 2001 - senior reserch fellow at the Department of Environmental Modelling of the Institute of Problems of Mathematical Machines and Systems of the National Academy of Science of Ukraine.

Facts about Ukraine.

Kiev Rus - the first state on the territory of the present-day Ukraine - emerged in 9th century. It played an important role in Europe until Mongol invasion of the 13th century. After this, for centuries, different parts of Ukraine were under the rule of foreign powers (Golden Horde, Russia, Lithuania, Poland, Austria, Turkey). After a short period of independence in the middle of the 17th century Ukraine became a part of the Russian Empire, and after the Russian Revolution of 1917 - a part of the Soviet Union. During soviet period, Ukraine was an important part of soviet empire because of its high level of industrialization, coal and iron ore deposits, fertile land and literate population. Ukraine regained independence in 1991.

Terrytory of Ukraine is 603,700 sq. km, population estimated at about 50 mln. In recent years population is decreasing, becoming older and the birth rate dropped from 13.3 % in 1989 to 7.8 % in 1999. Major groups of population - Ukrainians (many of them are Russian-speakers) and Russians. There also other groups each of less than 1 % - Jews, Bielarussians, Crimean Tatars, Hungarians, Poles, Romanians.

Capital city Kyiv is located on the river Dnieper, population 2.7 million. In the end of the Soviet era, there were four other Ukrainian cities with population over 1 million, now they undergo depopulation due to the lasting economic crisis. It is estimated that since 1991 the average standard of living has declined by 50-70 percent.

Facts about Nuclear Energy Industry of Ukraine

Name of nuclear power plant (NPP)	Number of generating units	Years of putting units into operation	Number of units under construction	Number of units under decomissioning
Zaporizka	6	1984-1995		
Pivdenno-Ukrainska	3	1982-1989		
Rivnenska	3	1980-1986	1	
Khmelnytska	1	1987	3	
Chernobylska				3

Generation of energy by nuclear power plants in 1998: 75,2 billion kWh (43.5 % of total electricity generation in Ukraine)

Other sources of radiation danger: object "Shelter" at Chernobyl NPP; 30-km Chernobyl exclusion zone; uranium ore mining and processing enterprises in Dnipropetrovsk and Kirovograd regions; research reactors in Kyiv and Sevastopol; sources of ionizing radiation used in medicine, industry, science; storages of radioactive wastes in 6 cities.

Chernobyl: compensations, "Shelter" and some other problems

According to the Ministry of Ukraine on Emergency Situations, after 1991 Ukraine spent almost $5 bn to liquidate the consequences of Chernobyl catastrophe plus $3.5 bn on social protection of sufferers - benefits for "liquidators", compensations for lost health, medicines etc.

The burden of Chernobyl expenses is too heavy for the country: UAH 7.5 bn ($1.4 bn) is needed for the year 2000, while only UAH 1.8 bn ($340 m) has been allocated by the state budget. Some benefits for "liquidators" (reduced tariffs for electricity, heat, water supply) have been cancelled starting April, 2000.

As of 1 January, 2000, about 3.5 million Ukrainian citizens are regarded as "sufferers from Chernobyl catastrophe". Still rather bad is the situation with radioactive contamination of locally produced food in some regions of Kyiv, Zhytomyr, Volyn, Rivne and Chernigiv oblasts. The rate of thyroid cancer morbidity is very high, and during the last four years 1400 patients were operated. Most of these patients were children in 1986.

In December, 2000, before the final close-down of Chernobyl NPP that took place on **December 15, 2000**, Ukrainian Parliament held a hearing on the problems that would follow decommissionning of the power plant. Figuers revealed at the hearing really impress.

The debris of the reactor # 4 under the "Shelter" (sarcophagus) need permanent attention. To maintain and strengthen the existing construction and to convert it into environmentally safe system will require $758 million during next 8 years. And this will be just an interim solution without removal of radioactive fuel from sarcophagus. Permanent personal employed at the site will be between 800-900, plus 1200 more people will be used annually for additional construction works. Special international fund was establish to accumulate required financial resources. Ukraine contributed $50 million to this fund.

Estimated minimal cost of decomissioning of 3 remaining reactors is EURO793 million, and the cost of social programme for the city of Slavutich (where personnel of Chernobyl NPP and their families live) is UAH1.8 billion ($330 milllion).

Decomissioning will require infrastructure development at the NPP site. New facilities (we list only some of them) will be built with the financial and technical support from western donors:

- dry storage for waste fuel will cost EURO 66.1 million (funding managed by EBRD);
- facility for processing solid radioactive wastes EURO 40.8 million (TACIS);
- facility for processing liquid radioactive wastes EURO 19.7 m (EBRD), including Ukraine's share $11 million.

Serious dismissals of personnel of Chernobyl NPP will impoverish the city of Slavutich. Currently Chernobyl NPP employs 5,791 people. This number will be reduced to 4200 in 2001, and by the year 2008 to 1885 workers. It is anticipated that by that time the rate of unemployment in the city will soar to more than 50 % from current 5 %.

Chernobyl close up and compensation of generation capacities

In 1995, Ukraine and the G-7 countries signed a Memorandum of Understanding, which stated that G-7 countries are ready to support Ukraine with a complex investment programme in energy sector if Ukraine agrees to shut down the only one remaining Chernobyl reactor. This was a very serious decision for Ukraine, because according to Chernobyl NPP officials, it can still be operated generating profit of about $100 m/year.

Ukraine yielded an obvious pressure from the West and closed down Chernobyl reactor #3 on 15 December 2000, while 11 reactors of the same RBMK type (some older than Chernobyl one) are still in operation in Russia (four near St.Petersburg, three near Smolensk and four near Kursk). If Chernobyl reactor was shut down due to it's unsafety - why others are still in use? By the way, seven of them are located in a Dnieper river basin, which provides drinking water for 1/2 of Ukrainian population.

Western assistance to Ukraine was proposed in a form of $2.3 billion package of loans and grants to Ukrainian energy sector. Ukraine negotiated that one of the project should be a $1.7 bn project of completing reactors # 2 at Khmelnytsky NPP and reactor # 4 at Rivne NPP (K2/R4 project). These reactors were (according to Ukrainian nuclear industry officials) were 70-90 % ready when Ukrainian Parliament voted for Moratorium on building, completing or starting operations of any new neclear power unit in 1990. European Bank for Reconstruction and Development was assigned with a task to provide a loan for this project (the sum of the loan varied, as well as a cost of the project itself). Last figure of the loan from EBRD was around $200 million esclusively for safety measures at two power plants.

The project was extremely controversial both in Ukraine (where a strong opposition exists to the development of nuclear industry) and in Europe, where this project violated, for example, a German policy of gradual fasing out of nuclear energy.

In late fall of 2001 Ukraine announced that it does not need a loan from EBRD for this project and will complete the two units using state and private investments and loans.

Economy of Nuclear Energy Sector

"Every second kilowatt-hour of electricity in Ukraine is generated by nuclear power plants" – says the President of Ukrainian Energy-Generating Company "Energoatom" Yuriy Nedashkovsky. The company reports significant success in its operations. And the main one, beyond doubt, is the decision by the Government of Ukraine that from now on "Energoatom" company is an operator of all four Ukrainian NPPs (Zaporizka – 6 reactors, Pivdenno-Ukrainska – 4 reactors, Rivnenska – 3 reactors, Khmelnytska – 1 reactor), fully responsible for their management, safety and economic results. Before this, NPPs were operated on temporary licenses.

Energoatom works on improvement of nuclear safety of its power plants. With the assistance from IAEA and other donors, full-scale training centers have been put into operation at all Ukrainian NPPs, as well as systems of safety control.

The biggest problem for Ukrainian NPPs was low payments by consumers of energy. In 1998, monetary payments for electricity produced by NPPs comprised only 4.2-4.5 %, and about 52-53 % was covered by barter (supplies and goods delivered directly to NPPs). In 1998, the

Government of Ukraine issued a resolution which introduced a special tariff supplement, - money raised for a completion of reactors at Khmelnytska and Rivnenska NPPs. But, in 1998 only $8 mln was collected on the special account opened for this purpose. The total debt for consumed energy was over $1 billion in the end of 1998.

However, new Ukrainian Government introduced in the year 2000 much better regulations on Ukrainian energy market, and this allowed Energoatom to improve it's financial parameters significantly.

Ukrainian NPPs are now financially well doing, and "Energoatom" started several investment projects. Among these project the most important are:

(i) dry storage for used fuel at Zaporizka NPP (already put into experimental operation);
(ii) completion of Tashlyk hydro-accumulating power plant on Pivdenny Bug river (900 MW at full capacity, first two units 300 MW to be ready in two years);
(iii) completion of reactors #2 at Khmelnytsky NPP by 2003 and #4 at Rivne NPP by 2005.

Recently, a situation around K2/R4 has changed significantly. On 29 November, 2001, at the meeting of the Board of Directors of EBRD, representative of Ukraine Yuri Poluneev informed EBRD that Ukraine does not need any financial assistance from EBRD for K2/R4 Project. Of course this does not mean that Ukraine will not continue building two reactors – it probably means that other sources of financing are more attractive.

According to Mr. Nedashkovsky, Ukraine will need to build new NPPs to substitute those that will be decommissioned after 2010. For this, "Energoatom" already received offers from USA, France, Canada, Russia and other countries. And now Ukrainian nuclear energy industry has to decide what types of reactors and respectively what types of nuclear fuel it will need in future.

Public and nuclear energy: a K2/R4 story

Decades of Soviet (communist) rule in the former USSR (1917-1991) resulted not only in environmental damage and devastation of natural resources but also in a very weak and undeveloped civil society. Apparently this was true not only for the third (public, non-profit) sector, but also for the second sector (business) and the first sector (government). The national and local bureaucracy that consisted of former communist party functionaries was the first to consolidate its power. Second was business sectors, which merged with local and state bereaucracy and formed a rather unique structure that is characteristic to Russia, Ukraine and some other former Soviet countries.

The third sector, which was almost non-existent under communist rule, was doomed to lose in the early days of the race. Environmental groups appeared first during Gorbachev's perestroika period of 1985-1990 and were thus in a better situation during the first years of the post-communist period. Environmentalists were among first who spoke to all people and their message was clear.

In Ukraine, green movement was anti-nuclear from the very beginning. Greens protested against secrecy around Chernobyl catastrophe, against further development of nuclear industry. Under this presssure, in 1990 the Parliament temporarily banned development of nuclear sector. But, after the euphoria of the first years of independence was over, and the

country and people faced real economic problems, energy shortages, energy pressure from Russian companies, fuel and heat crises in cities, the ban was lifted and in 1995, unit # 6 at Zaporizka NPP was put into operation. It was a Russian design VVER-1000 reactor, same type as most other reactors in Ukraine. Since that time, new plans of development of nuclear sector started to appear.

Ukraine was considered as a good market for Western and Russian nuclear companies, because Ukrainian nuclear industry generated about 40 % of electricity, and it was hard to substitute this sector by other sources of fuel. And, besides turbines, there was no production of reactors and most other needed equipment in Ukraine - so, it was necessary to import all this from other countries. Ukraine is also a big consumer of nuclear fuel produced in Russia, and Russian nuclear industry would not want to lose such a market.

There were, of course, evidences of decrease in electricity demand (from 220 TWh in 1990 to 130 TWh in 1998), but there was also an obvious fact of aging generatinig capacities at Ukrainian nuclear and thermal power plants, and they needed substitution.

This was the background for the beginning of debates on completion of two reactors at Khmelnytska NPP and Rivnenska NPP in Western Ukraine. Of course, international support by G-7, provided via EBRD, was important for financial attractiveness of the project for nuclear sector, which badly needed "real" money.

EBRD and its Western partners started investigation of financial and economic viability of K2/R4 project. EBRD and Energoatom had serious problems with proving economic efficiency. Several different panels of experts came to opposit conclusions, some stating that K2/R4 project does not meet "least cost" criterion. Many experts suggested development of steam-gas power plants in Ukraine.

EBRD's involvement in the K2/R4 completion project inspired also public organizations. Bank's policy calls for extensive consultations with the public. NGOs considered this as a real opportunity to voice their concerns and get response to them from the government and nuclear industry. Ukrainian legislation on environmental impact assessment, as well as legislation on nuclear energy, provide opportunities for public involvement. These opportunities were specified by the Decree of the Cabinet of Ministers of 18 July1998 "Procedures of Public Hearings on Issues Concerning Atomic Energy".

Nevertheless, the project sponsor, National Nuclear Generating Company "Energoatom" was not willing to implement requirements of the EBRD with due diligence. "Energoatom" severely limited the level of public involvement. In addition, these consultations were regarded as having no binding influence on the decisions by Ukrainian authorities. So, environmental impact assessment for the project was conducted more in Ukrainian, then in western style.

Dissatisfied with the level of consultations undre EBRD procedures, Ukrainian NGOs started to initiate public hearings according to national legislation. In some regions local authorities refuse to support this initiative, in other regions NGOs were more successful.

Public hearings on K2/R4 project were conducted in 12 cities of Ukraine, in West and East, South and North. In big scities and samll towns, people almost unanimously voted against the project and against further development of nuclear energy sector in Ukraine.

From the resolution of public hearing in Nikopol of April 22, 1999:

"II. We consider the future development of nucler power in Ukraine inexpedient and erroneous, because the industry is dangerous for the environment and has no social and economic justification.

1. The Parliament has to ban construction of new reactors and completion of units at the Rivne and Khmelnytsky Nuclear Power plants. Chernobyl NPP must be closed down by the set date.

2. All efforts must be directed at the development of energy conservation, alternative energy sources, gradual closure of nuclear reactors in Ukraine (first of all Zaporizka NPP), and aid to the victims of Chernobyl catastrophe."

According to the results of a public opinion investigation conducted by SOCIS-Gallup International in April, 2000, only 14 % of respondents supported completion of K2/R4. Most people voted for better use of existing non-nuclear energy sources.