

## **SUSTAINABILITY OF NUCLEAR**

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The plant is inspected regularly to monitor its safety conditions and verification of diversity of nuclear materials. It is not possible to build a bomb with radioactive material from a nuclear power plant. The plant itself cannot blow up like a bomb.

Spent fuel is highly radioactive and gives out considerable quantities of heat. It is therefore placed in water pool where it can be cooled for several years. After the period of cooling in pools at the reactor site the still highly radioactive fuel elements are conditioned and may be loaded onto shielded transport containers that meet the most stringent international recommendations and shipped to an interim storage facility. The interim storage facility is usually at the reactor site or at the reprocessing site.

Radioactive materials have been transported for many years. There have been no serious consequences as a result of radioactive nature of such material being involved in transport accidents. This excellent experience is a good illustration of the high level of safety or the low level of risk involved in the transport of radioactive material.

The emergency plans and drills are frequently updated and all the time there is a responsible for implementing the plan taking into consideration the approved procedures for evacuation and transportation, equipment and materials available to mitigate an eventual accident, medical resources trained to handle a contaminated person.

The PR Groups communicate all the time with public – trying to send the main message:

**NOBODY WANTS TO HIDE ANYTHING!  
WE ARE ALWAYS OPEN!**

**YOUR GOOD HEALTH MEANS WE CAN STILL PRODUCE NUCLEAR POWER!**



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### **Bohunice NPPs - part of the Slovak's economy (sustainable) development**

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Slovakia remains significantly dependent on imports of primary energy sources, which represent as much as 80% of the demand. Of the total consumption of electricity in Slovakia, 42% was generated in nuclear power plant units in 1999.

Slovakia operates 6 units with a VVER 440 nuclear reactors, 4 of them are at Bohunice site and 2 at Mochovce.

The first two units, known as Nuclear Power Plant Bohunice V-1 use first-generation pressurised water reactors model WVER 440/ V-230, unit 1 having been put into operation in 1978 and unit 2 in 1980. Units three and four, formed Nuclear Power Plant Bohunice V-2, work with second-generation reactors (model WVER 440/V-213). The units were put into operation in 1984 and 1985, respectively.

Slovakia's industry rapid development in the 50-th has required construction of new - large power stations. In that time as part of Czechoslovakia, Bohunice side was chosen for beginning of nuclear power utilisation. After the first NPP called A-1 with GCHWR /Gas Cooled Heavy Water moderated Reactor/ type was constructed, it was decided to construct one of the world-wide most used type of reactors - PWR /Pressurised Water Reactor/. Based on intergovernmental agreement it was WVER 440 design.

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The construction of Bohunice V-1 NPP has started on April 24, 1972 and 6, respectively 8 years later the commercial operation of the two Units has begun.

Since that time is each Unit with electric output of 440 MW supplying the national grid with some 5,5 TWh yearly. It has proved to be safe, reliable, environmental friendly and stable source of energy.

That amount of electricity was not enough and construction of another 2 WWER 440 Units, known as Bohunice V-2 NPP was started in 1976. Commercial operation of these Units is dated 1984, 1985 respectively. Similarly to V-1 NPP, with the same attributes the Units 3,4 are yearly supplying the Slovak's grid with about 5,5 TWh of electricity.

Moreover, since 1987 part of the heat produced in the reactors is used for heating purposes in the region. .  
What did it mean for the economy?

New - advanced technology of NPP construction, including civil construction, machinery, electric and electronic, as well as chemistry technology was developed and adopted, offering thousands of working places in numerous organisations. Science and education were following the development too.

Last, but not least, the character of the region was completely changed from mostly agricultural to industrial as well. The outlook of the nearby villages and towns was changed, high educated personnel was given an opportunity to realisation, what resulted in development of other sectors and general living standard of the people significant improvement.

It's time to turn from the history to the present time.

More than 10 years have passed since the political change happened in Slovakia, followed by change in all areas of our life. The best position for change was in Germany and you see, the process is not finished yet. Even harder is it for Slovakia, its economy and its inhabitants.

It can not be simply explained what does it mean such a change. To realise the change, it needs money and to act in new structure needs money again. Domain sources are not sufficient.

The restructuralisation of economy, having in mind influence to other areas, especially social welfare, needs from energy point of view again safe, reliable, stable and cheap energy supply.

To ensure development with higher priority - sustainable development - there is place for Bohunice NPPs again.

For comparison, I will focus on three main aspects:

1. economy
2. safety
3. ecology

### 1. *Economy*

Economy and costs are god of the time being.

Everything is calculated and effectiveness is priority Nr.1.

Slovakia is trying to approach the EU roles, we use „western“ codes for calculations too.

The results are showing that the original investments, which represented approx. 160, 320 billions of USD, had been paid back and the production costs are mostly represented by the fuel, other necessary materials, work force and renovation of equipment.

Investments to safety and technical reliability improvements, as well as by low prescribed regular sum of money for decommissioning fund are included Into the costs.

Bohunice NPPs costs are calculated within Slovenské elektrárne p.l.c., they are belonging to. There are Mochovce NPP, water and fossil Power Plants operated by the Utility.

Within these Plants, Bohunice NPPs are the second cheapest source. With the share of electricity production ( 44 % in 1999) they produce significant profit for the Utility. I would like to point out that Nuclear energy is mostly used in base load and from this angle, the comparison is even better for Bohunice NPPs.

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The result is clear for Slovak's economy - stable, economic, reliable electric energy for expected economy development.

### 2. Safety

Slovakia is the signatory of all important international agreements and conventions in the field of nuclear energy, and its legislation is in an advanced stage of approximation with European Union law.

This is a very important aspect, showing Slovakia's approach to the nuclear safety.

Although Nuclear Safety is not covered by common legislation within the EU and opinion varies from country to country, it seems to be area where Central and Eastern European Countries are strongly under pressure.

After the change of political system in former Czechoslovakia, one of many changes was also in openness in questions of Nuclear Safety. More intensive exchange with western countries started. Western experts visited our Units and didn't find the same technology as they were used on their Units. On the other hand our experts started to accommodate „western style / approach to work.

In 1992 the G-7 Summit in Munich with its statement /prepared by some experts, without deep analyses and maybe knowledge of the design - see the Foratom's statement of December 15-th, 1999: „...largely based on fears in the wake of the 1996 Chernobyl accident.“ / that NPPs with WWER 440 / V-230 and RBMK type of reactors are not safe enough and that it is not possible to improve them at reasonable costs meant difficulties for us up to date.

It is truth, that the design has some deficiencies, hardly exists some without them. Our experts are knowing the design throughout, but they know the benefits, which are not so often published.

Shortly the two sides of the coin are:

výhody

nevýhody

After analysis, calculations, recommendations of many international missions we have proposed to the Nuclear regulatory body, which behaves in accordance with International Atomic Energy Agency guidance and support of many countries Regulatory bodies, and we have realised two large modernisation programmes on older Bohunice V-1 NPP. They were so called „Small reconstruction“ and „Gradual upgrading“. We have the main deficiencies resolved by that and we have proved to do it in reasonable costs. In fact, the design is different to the original one.

Some modifications were realised on the Bohunice V-2 NPP too. Safety concept is prepared for realisation on this NPP in near future.

The Nuclear Regulatory Authority of SR is not the only regulatory body controlling our activity. Both - the system of nuclear activities regulation in Slovakia as well as the approach to Nuclear Safety enhancement of the operator were positively judged by IAEA and WENRA.

3. In 1993 -Slovakia has accepted the commitments of the UN Convention on Climate Changes, including a reduction of greenhouse gases to 1990 levels by the year 2000. Moreover, as an internal target Slovakia has set the reaching of the „Toronto Objective“, i.e. 20% reduction in CO<sub>x</sub> emissions through the year 2005 as compared to 1988.

Taking into account the actual situation as well as natural conditions for some renewable sources utilisation, the target won't be reached without nuclear energy.

The nuclear energy is free of emissions, does not burn oxygen, and with the share of production in Slovakia will remain significant contributor. To the environment protection it contributes also by replacing fossil heat plants with heat delivery for the region.

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It should be said something about the waste. In argumentation we shouldn't forget comparison from what amount of fuel what amount of energy is produced with production of what amount and what kind of emissions and wastes and in which way the emissions and wastes are handled. In case of radiological wastes the environment protection is ensured by very strict system of control, evidence, treatment and repository.

*To conclude, Bohunice NPPs were, are and will remain very important part of the Slovak's economy, creating conditions for its (sustainable) development.*



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### **Nuclear and sustainable development – a transdisciplinary approach**

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Never before in history has society been so thoroughly permeated by Science and Technology in all aspects of human life, ranging from economic progress to warfare, often resulting in huge environmental problems. Nuclear science can easily be seen as an exponent of this evolution. Numerous beneficial technologies for medicine and energy were developed, but mostly against the background of the Cold War culture of military secrecy – thus contaminating the public perception of nuclear technology as a whole from the early beginning. Moreover, these developments were accompanied by the threat of cancer risks.

Gradually, the contours of a new societal paradigm seem to materialise, driven by the often cited dynamics of social change : globalisation, the pace of technological change (notably biotechnology and information technology), changing social identities, mistrust in 'big science' and expert systems and often, an alienation from politics. In 'the age of risk', people feel insecure about the future. In this social context of uncertainty, a new concept for policy making at the global and local level has emerged : Sustainable Development. At present, the nuclear expert is struggling with society, and he paradoxically lacks a scientific approach and insight in complex human behaviour and societal interaction. The restoration of trust will require the integration of humanities and social sciences in a transdisciplinary problem solving approach, far beyond the technical dimension.

The Belgian Nuclear Research Centre SCK•CEN already built up experience with multidisciplinary projects (e.g. extending the research on nuclear complexity to economics and liability), but in 1998 the board of directors decided to integrate social sciences in a more co-ordinated way.

#### **Transdisciplinary reflection groups, defining research needs and actions**

An original transdisciplinary approach was set up. A horizontal program manager is co-ordinating 4 projects, joining 4 senior project leaders, 7 young scientists in social sciences and humanities, and interested SCK•CEN experts. University professors and experts from different disciplines and backgrounds accompany the projects.

All researchers involved meet monthly in 2 reflection groups, with active participation of SCK•CEN's top management. These working groups, extended with selected university experts, are discussing two broad items: *ethical choices in radiation protection* - focussing on ALARA and the precautionary principle within the context of new trends in low dose effects, such as genetic susceptibility - and *nuclear expert: role and culture* - analysing expert attitudes, behaviour and dilemmas in nuclear problem solving and communication.

The four projects are:

**Legal Aspects and Liability** – trying to bridge the gap between law and complex technology, paying attention to liability in nuclear medical applications and the interactions with product standards, QA and control principles in law;