

Renovation Of The Permanent Exhibition On Nuclear Technology

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ABSTRACT

An important activity of the Nuclear Training Centre ICJT is public information about energy and nuclear technology. It is composed of a short lecture, a demonstration of radioactivity experiments, and a visit to the permanent exhibition on nuclear technology. The first exhibition was set up in 1992, and around the year 2000, it was expanded and graphically redesigned. After two decades, we felt that it was time to improve the concept of the exhibition by extending the content with inclusion of comprehensive information on all kinds of energy sources and their impacts on electricity production and the environment.

The new exhibition was prepared in collaboration with professional designers, who made it more modern and attractive for the younger population, which are the majority of our visitors. In this context, the content is presented in an interactive manner as much as possible.

From February to May 2023, the new exhibition was visited by 4200 youngsters with their teachers and their response was very positive.

1 INTRODUCTION

Since the early days of the Nuclear Training Centre ICJT, public information about energy and nuclear technology has played a crucial role. An Information Centre at the ICJT was established in 1993, and since then there have been 4392 visits, resulting in more than 200,000 visitors. The majority of the visitors are youngsters aged between 13 and 16 years. Visit is composed of a short lecture, a demonstration of radioactivity experiments, and a visit to the permanent exhibition on nuclear technology.

Two decades after the last upgrade, the exhibition needed upgrade, to be more comprehensive and up-to-date. This led to a major renovation in collaboration with professional designers from Atelje BER.NARD. The new exhibition was designed to be more interactive, especially to engage younger visitors who make up the majority of the audience. The idea was

to use interactive elements to help people understand complex ideas more easily. They created an ambient atmosphere that, even without prior knowledge of the subject matter, immediately conveyed to visitors that they were entering an exhibition about energy, which could be best described by the radiant light of a blue colour. The overarching goal was to make each visitor feel like a particle traveling through the realm of energy itself.

The main focus of the updated exhibition is to present topics related to energy and nuclear technology. In the next chapters, we will systematically describe the different segments of the exhibition and present them in the order they are encountered when walking through the renovated layout.

2 WALK THROUGH THE EXHIBITION

2.1 Energy

The initial section of the exhibition is dedicated to energy. This part covers the basics, like power production and primary energy sources, and how they're turned into useful energy, considering the losses in between. It also talks about using energy efficiently and promotes energy savings.

An important exhibit in the energy section and a highlight of the whole exhibition is so-called human-powered power plant. It is a bike that the visitors can actually pedal and generate electric power, making the conversion process more understandable through hands-on experience.

Additionally, there's a new interactive exhibit that presents the concept of energy. It explains what energy is, the different types of energy, and how they are changed from one form to another. Different primary energy sources and historical data on energy consumption are also shown. This exhibit adjusts to what each visitor is interested in. It allows visitors to explore just the basics about energy while those who are more curious can look at things a little more in-depth.



Figure 1: Exhibition section on Energy (Photo by Marjan Verč)

2.2 Electricity

Moving on, the next section of the exhibition is dedicated to electricity. Here, an interactive exhibit awaits visitors, allowing them to control different power plants. By making informed decisions on how to operate these plants with the least possible costs, visitors are tasked with aligning the plant operations to match the daily electricity consumption in Slovenia. Additionally, this section features two more interactive displays.

The first interactive exhibit sheds light on electricity in a broader context. Visitors gain insights into what electricity is, and how it travels to our homes - from production through distribution to final consumers. They can explore the characteristics of various types of power plants, understand daily electricity consumption trends, and delve deeper into the field of energy storage options. This exhibit also presents notable scientists and their ground-breaking discoveries in the field.

The second interactive display presents power plants in Slovenia. Visitors can explore the different types of power plants in the country, their locations, and their respective contributions to overall electricity production. The exhibit offers images of these power plants along with essential information.

2.3 Climate change

Following this, the exhibition proceeds to a section dedicated to climate change. The mechanism of the greenhouse effect and its prominent contributors are shown. Information delves into human activities' impact on CO₂ emissions, along with an assessment of per capita emissions across different global regions. The display also highlights the consequences of global warming and introduces measures for reducing CO₂ emissions. Additionally, methods for carbon capture and sequestration are presented. Notably, the entire content is supported by engaging video content that improves understanding and engagement.



Figure 2: Exhibition section on Climate change (Photo by Marjan Verč)

2.4 Nuclear physics

As we continue our journey through the exhibition, we come to a section dedicated to nuclear physics. This part provides fundamental explanations about matter's composition,

radioactivity, and various forms of radiation. Additionally, it covers topics such as measuring radioactivity, nuclear reactions, and the chain reaction of nuclear fission.

Moreover, this segment delves into the effects of radiation on living organisms and the significance of radiation protection. It underscores the importance of safeguarding against radiation's potential impacts. An engaging feature within this part is the cloud chamber, where visitors can observe traces of natural radiation.

Furthermore, a personal contamination monitor demonstrates how contamination on hands, footwear, and clothing is monitored. This segment serves as a comprehensive insight into nuclear physics, radiation effects, and radiation protection.



Figure 3: Exhibition section on Nuclear physics (Photo by Marjan Verč)

2.5 Background radiation

Next to nuclear physics, a segment of the exhibition is focused on background radiation. This part explains where background radiation comes from and how much radiation we get. It also talks about radon's contribution to background dose and the average levels of radon in homes across different parts of Slovenia.

An exhibit called the Radiation Carousel turned out to be very attractive and informative for visitors. It shows how much radiation is emitted by everyday things such as welding electrodes, a piece of baking pan, a watch with glow-in-the-dark hands coated with radium, fertilizer (containing potassium), etc. In addition to the carousel, there is also a detector where visitors can check whether the things they have with them are emitting any radiation. These exhibits help visitors relate the idea of radiation to things they encounter in everyday life, making the concept more relatable.



Figure 4: Exhibition section on Background radiation (Photo by Marjan Verč)

2.6 Nuclear power plants

The central part of the exhibition is dedicated to nuclear power. Within this segment, visitors encounter detailed descriptions of various types of nuclear power plants, nuclear fuel, and the fuel cycle. Multiple screens display a range of multimedia content, including animations illustrating nuclear fission chain reaction, the functioning of steam turbines, and the step-by-step progress of the fuel cycle.

Using the example of the Krško nuclear power plant, the operation of the nuclear power plant is explained, how the outage is carried out, and how important the constant maintenance and modernization of the nuclear power plant is. A mock-up of the reactor vessel and steam generator helps visitors to visualize the primary system. The fuel element and a turbine blade are also presented. An important attraction is a simplified nuclear power plant simulator, where visitors can test themselves as operators of a nuclear power plant, at the same time, the simulator provides a better understanding and perception of the operation of the power plant.

Adjacent to this simplified start-up simulator, a scaled model of the Krško Nuclear Power Plant's control room offers a tangible connection to the plant's operational complexities. This exhibit provides a peek into the intricate coordination required to run a nuclear power facility.



Figure 5: Exhibition section on Nuclear power plants (Photo by Marjan Verč)

2.7 Nuclear safety and radioactive waste

As we progress toward the end of the exhibition, we encounter another highly significant theme: nuclear safety. In this section, we find explanations about what nuclear safety entails and how we ensure that a nuclear power plant operates safely. It covers the safety systems of the plant and emphasizes the importance of a safety culture. This segment also describes the major nuclear accidents (Three Mile Island, Chernobyl, and Fukushima), outlining the course of these accidents and their consequences.

Moving forward, the spotlight shifts to the topic of radioactive waste. Here, visitors can learn about the various types of waste generated and how it is stored and disposed. There is also a model of a planned low and medium level radwaste repository in Vrbinja. Additionally, there are two human-sized mannequins that depict basic and additional protective gear required for working with radioactive substances.

This part of the exhibition delves into crucial matters related to nuclear safety and waste management. It strives to impart an understanding of the measures in place to ensure the safe operation of nuclear facilities, as well as the protocols for handling radioactive materials and waste.



Figure 6: Exhibition section on Nuclear safety and radioactive waste (Photo by Marjan Verč)

2.8 Fusion

The very last section of the exhibition is dedicated to fusion, the energy of the future. Here, visitors are introduced to the concept of fusion and its significance. Different types of fusion reactors concepts are explained, giving an insight into potential technologies. Additionally, visitors can engage with a fusion reactor operation simulator, explore an animation illustrating the start-up of a fusion reactor, and observe a plasma globe that demonstrates some of the principles behind fusion.

As visitors make their way towards the exhibition exit, they have the opportunity to take part in a quiz. This quiz allows them to test the new knowledge they've acquired during their exploration of the exhibition.



Figure 7: Exhibition section on Fusion (Photo by Marjan Verč)

3 CONCLUSION

The exhibition at the ICJT Nuclear Training Centre offers a journey into the world of energy and nuclear technology. Since its inception in 1992, the exhibition has evolved into an engaging and interactive platform that is suitable for a diverse audience.

The exhibition covers a spectrum of interconnected themes. It begins by explaining the basics of energy and energy sources and encourages hands-on understanding through interactive displays such as a so-called human-powered power plant. The following sections deal with electricity generation, climate change, nuclear physics, natural radiation, nuclear power plants, safety, radioactive waste, and the potential of fusion energy.

The central focus of the exhibition on nuclear power plants provides a detailed insight into their mechanisms, processes, and modernization efforts. Safety protocols and waste management are also thoughtfully addressed, with an emphasis on commitment to responsible nuclear technology.

Ultimately, the exhibition provides a comprehensive insight into the world of energy and nuclear technology, based on scientific knowledge and is presented in an attractive way. It serves as a key educational tool that encourages visitors to think about the complexities of energy decisions and the evolving role of technology in shaping our future.