



SUMMER INSTITUTE  
2019

# Networks for Nuclear Innovation



A Magazine containing the results achieved in the Network for Nuclear Innovation projects during the WNU Summer Institute 2019



The work described in this Magazine was prepared during the final two weeks of the World Nuclear University Summer Institute 2019. It does not represent the position or the official views of World Nuclear Association, World Nuclear University or any of the companies to which the participants are affiliated with.

## FROM WORLD NUCLEAR UNIVERSITY PRESIDENT



Nuclear electricity generation is growing globally, but it needs to grow faster if the world is to meet future energy demand and mitigate the effects of climate change. The major goal that we have set to achieve by 2050 is to generate 25% of global electricity with nuclear power. Challenges in the technological, regulatory, economic, and social levels of our industry must all be addressed to achieve this growth. In such an international industry, this requires strong international collaboration. Networking is a vital component of international collaboration, and I am delighted to see the central role the Networks for Nuclear Innovation has played in this year's Summer Institute.

Fellows are selected to participate in the Summer Institute in part due to their ambition and enthusiasm for the future of nuclear. The Networks for Nuclear Innovation groups this year produced high quality reports with serious recommendations for diverse aspects of the nuclear future. Information does not respect national boundaries, and I anticipate that the innovative ideas generated during the NNI will be carried forward by the Fellows into their 39 countries. I support the endeavours of these future leaders, and fully believe in their future successes.

Agneta Rising  
President  
World Nuclear University

## ACKNOWLEDGEMENTS

The first edition of the Networks for Nuclear Innovations (NNI) magazine was completed at the Summer Institute 2016. The main concept is to compile the ideas that emerge from the Fellows collaborative work in a publication that could inspire future innovations and serve as reference for the continuous development of important topics in the nuclear area.

We are extremely impressed by the efforts the Fellows and Mentors dedicated to finalize the text within the Summer Institute timeframe, at the same time they were preparing their impactful oral presentation.

We are grateful for the NNI Magazine Editor, Alina Constantin, who made sure all the pieces were correct and in place for its timely publication. The digital version of the NNI magazines can be found at: [www.world-nuclear-university.org](http://www.world-nuclear-university.org)

Patricia Wieland  
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## FOREWORD

This year the Summer Institute attracted 82 Fellows representing 39 countries. They bonded in Romania and then gathered in Switzerland, under the close guidance of their mentors, to intensively work on the dedicated projects of the programme – the Networks for Nuclear Innovation. The thematic chosen reflects actual aspects of nuclear industry, which are or have to be driven even more by innovation, to cope with the global context of climate change and accelerated digitalization.

The Fellows developed ideas, concepts and practical solutions to promote innovation in their area chosen while addressing the Sustainable Development Goals. The presentation of their results achieved, during the closing day of the Summer Institute, called for reflection, adaptability and international cooperation. Institutional changes needed, short term, mid-term and long term perspectives, economical aspects and implementation ways were carefully studied by the teams. Some of the messages derived are captured in this brief introduction, being in the same time an invitation for the reader to carefully consider each of the projects described, engage in dialogue and disseminate the most feasible proposals.

Innovative nuclear reactors, the Gen IV and the small modular reactors can be the ingredients of a nuclear renaissance, having increased safety capabilities and ability to target specific customer needs.

In order to encourage the development of Gen IV reactors, it is needed to collaborate at international to consolidate the fundamental features of Gen IV design and simplify the process of validation.

When communicated nuclear energy outside the industry, the Fellows highlighted how important is to come from the same shared values to the social and ethical level in order to be understood and build solid partnerships based on trust. This is key in gaining more acceptance for nuclear and going towards the goals of the Harmony programme.

Different aspects and criteria have to be considered when assessing the feasibility of a nuclear project, this being the base of creating openness and support, as every country has its own particularities. A forum for providing technical advice on feasibility studies and sharing of information has been proposed by one of the teams.

People are a company's most important resource. Even with the most expensive and safest equipment and systems, high-performing organizations shall invest in their people and culture to truly achieve their vision and mission. In order to maintain a proper organizational environment, favourable to development and progress, periodical checks and assessments of the organizational health and state of the culture in the organization have to be performed.

Another message strongly reinforced was that creating and maintaining a valuable and well prepared human capital is crucial for nuclear but has also to keep the pace with the technology infusing now all aspects of people's life. Organizations have to be aware and prepared to allocate the needed resources while having a sound and adaptive strategy. Governments, academia, and nuclear industry stakeholders can join efforts to create an internationally connected nuclear industry network where individuals possessing qualifications needed are much easier identified, as well as shortages or surpluses of particular skills.

We hope that the reader will enjoy the content and find value in it.

Yours sincerely,  
Alina Constantin  
Editor-in-Chief

## BUILDING PARTNERSHIPS OF TRUST

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### Abstract

The nuclear industry often relies on facts and figures to make the case for nuclear energy. However, the public remains wary of nuclear energy. Deliberate stakeholder engagement and two-way communication are needed to overcome this. In this project, three different types of nuclear facilities are analyzed to identify the values of these facilities and find stakeholders that share these values. Ideas for building partnerships of trust between the nuclear facilities and the stakeholders are then presented, concluding that the industry can think outside of the box in order to find valuable and long-lasting partnerships to improve the societal acceptance of nuclear energy.

## 1. Introduction

Negative public perception of nuclear energy remains a difficult challenge to overcome because of the “dread” that the technology evokes. A recent study in the US showed that there would be 40% more nuclear power plants if nuclear were fairly compared to other energy sources based on factual merits. Deliberate stakeholder engagement and two-way communication with the public are needed to overcome the public scepticism of nuclear energy [1].

The goal of the Harmony Programme, which is a global initiative led by the World Nuclear Association, is to provide at least 25% of electricity from nuclear by 2050 as part of a clean and reliable low-carbon mix [2]. Jeremy Gordon, the mentor for this project, says that, “*the industry has to reduce the remoteness of nuclear energy from people’s lives. Continuous transparent engagement based on aligned human values is key to building understanding and trust.*”

Science communication models mainly fall into two categories to explain the gaps between scientists and the public: (1) the information deficit model, which assumes the gaps are a result of a lack of information or knowledge; and (2) the engagement or dialogue model, which assumes the gaps are a result of lack of trust. Public understanding of science by itself does not increase sympathy for new technologies. Rather, genuine dialogue and engagement build support for new technologies through a sense of public ownership and by developing trust in scientists and tech developers [3].

*“Decisions always involve both facts and values, whereas most science communication focuses only on facts. If science communication is intended to inform decisions, it must be competent with regard to both facts and values. Public participation inevitably involves both facts and values. Research on public participation suggests that linking scientific analysis to public deliberation in an iterative process can help decision making deal effectively with both facts and values.” — Thomas Dietz, Michigan State University [4].*

Effective public engagement is built on trust through common values. Values are ideas that reflect a sense of right and wrong, principles and concepts that guide action in different situations and help set priorities. They form the basis of the character of an organisation. Nuclear facilities can find

common values with other groups of people in order to build partnerships of trust outside of the industry.

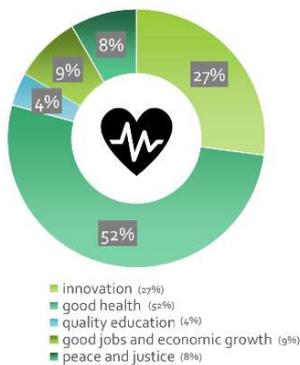
An excellent example comes from the Netherlands, where radioactive waste is stored above ground at the Centrale Organisatie Voor Radioactief Afval (COVRA) for at least a hundred years. While looking for suitable storage space for artefacts that are not exhibited, museums and COVRA found each other. The favourable climate-conditioned COVRA storage buildings for radioactive waste have enough unused space to securely store the museums' artefacts. The storage space has been offered for free to the museums by means of a contract for a hundred years, forming a long-lasting partnership between the waste facility and the museums [5].

*“How can we explain the long-term aspect of radioactive waste management in a way that people can relate to? Ask people how long we should preserve our cultural heritage such as the paintings of Rembrandt or Van Gogh. The answer is generally: “forever.” The link between the long-term preservation of art and the management of radioactive waste helps people to visualise and trust the concept of long-term management.” - Hans Codée and Ewoud Verhoef of COVRA, The Netherlands [5].*

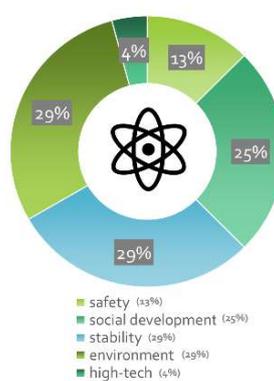
## 2. Survey

For this project, three different types of facilities have been selected to represent different parts of the nuclear fuel cycle and technology: medical centre with research reactor, nuclear power plant (NPP), and deep geological repository (DGR). A survey was conducted of World Nuclear University (WNU) participants. The goal was to better understand the values that leaders in the nuclear industry see that their facilities bring to society, and to collect ideas on what other organizations share these values. 48 WNU participants from 26 countries took part in the survey, with results presented in Figure 1. It is interesting to see that industry leaders share a variety of values around nuclear facilities, many of which align with the United Nations Sustainable Development Goals.

**Medical Centre with Research Reactor Values**



**Nuclear Power Plant Values**



**Deep Geological Repository Values**

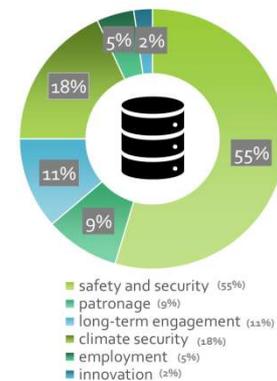


FIG. 1. Results of WNU survey on values for various nuclear facilities.

## 3. Case studies

The proposed approach is intended to implement a methodology for building trusting relationship links outside the nuclear industry's usual ecosystem of stakeholders. From the selection of three types of nuclear facilities and typical values that can be linked directly or indirectly with the activities there, this project identifies potential partners with whom to build partnerships of trust. For selected values, two to three case studies are presented per facility.

### 3.1. Medical Centre with Research Reactor

Medical centres with research reactors provide much value to society, which is often unseen, due to unfamiliarity with radiation technology. Some values (high-tech, innovation, health, accuracy, excellence, knowledge, education) and associated stakeholders are shown in Figure 2.

#### 3.1.1. Value of Health

A medical centre with a research reactor is fully focused on producing radioisotopes, providing early diagnostics and targeted therapy in the field of oncology, cardiology and neurology. Hence, health is one of the major values, bringing advanced nuclear technologies also into the women's healthcare sector. The value of women's well-being is globally shared by women's health clinics, non-governmental organisations (NGOs), social media, social media influencers and mobile apps – just to mention some of them.

There is a lack of information in the public about early diagnostics and existing benefits of nuclear medicine. The topic of oncology is quite sensitive and is rarely discussed in the public space. Modern methods of nuclear medicine can diagnose cancer at the earliest stage and increase the patient's chances of survival. Moreover, the existing methods of nuclear medicine are some of the most effective in the treatment of cancer. In this case, it is important to choose the right channels for communication.

Some key relevant channels of communication with women in society are, for instance: apps, social networks, NGOs, and magazines. In partnerships with media platforms that share the values and ideals of women's health, content that will unobtrusively promote how important it is to pay attention to your health, including undergoing early diagnosis using nuclear medicine methods, could be prepared. The results of this activity should be to increase women's awareness of nuclear medicine methods, the need for timely diagnosis and the possibility to receive effective treatment of cancer. Partnerships of trust are furthermore created through common values of health between women's health organisations and nuclear medicine.

#### 3.1.2. Value of Knowledge

As a way to preserve the workforce in nuclear medicine, a medical centre with research reactor is interested in educational activities. While disseminating knowledge across different layers of the educational system, the firm focus of the centre is/should be forming trustworthy relationships with the key stakeholders such as secondary schools and key supporting universities which share the same value of being a knowledge-spreading organization.

There are at least three strong communication channels in the educational community: teachers, fellows or classmates and informal or semi-formal organizations. All these channels are simultaneously social groups with at least one common feature: the desire to receive and share



FIG.2. Values and stakeholders for a medical centre with research reactor.

knowledge both within their group and between groups. Any activities aimed at these groups should be consistent with the core value and make a contribution to the ongoing process of knowledge spreading, not just on nuclear science, but on science in general.

In partnership with educational institutions (schools and universities), as well as organizations, associations, camp organizers, training programmes can be developed aimed at raising awareness in the subject area. For example, it may be possible to develop a teachers' programme aimed at raising awareness about the current situation in the medical scientific sector. Another example would be organizing camps for students who have decided to go into medicine and science.

Co-organizing educational programmes with other organizations that are also strongly committed to knowledge would build important partnerships within and trust among the broader science and education community.

### 3.2. Nuclear Power Plant

Nuclear power has many different values to different people; from stability and responsibility to teamwork and bravery. Some of these values, and matching stakeholders, are shown in Figure 3. Here we will examine how nuclear power plants can build partnerships of trust with organisations that share the values of happiness, innovation, and sustainability.

#### 3.2.1. Value of Happiness

Theme parks, such as Walt Disney World and Universal Studios, have been attractive to people for a very long time. Especially in the emerging markets, they are popular and profitable [6]. Some challenges that they face include the rising cost of land and finding unique types of entertainment. It appears that, on one hand, the land surrounding an NPP is cheaper and less entertaining [7], and on the other hand, entertainment industries are looking for new opportunities to invest and evolve.

More importantly, they both share some mutual values. NPPs are committed to providing clean energy to make the world a better and happier place for human beings. Entertainment industries bring happiness to people as their main goal. Some of them are pursuing education in a fun way, as well. Both types of facilities are also committed to the safety of their visitors and the public.

Therefore, a cooperation between a NPP in the emerging market and an international entertainment firm could be established to build a nuclear power theme park jointly. There would be different themed zones, such as "adventures on a nuclear island," and educational movies and interactive museums. This could build the partnership of trust between the entertainment industry and nuclear power by commercial innovation and shared values to make a happier life for everyone.



FIG. 3. Values and stakeholders for NPPs.

### 3.2.2. Value of Innovation

The definition of innovation is “the introduction of something new”, whether a new idea, method or device. Although introduced in the 1960s, nuclear energy is still considered an innovative energy source. The nuclear industry is constantly working on innovative new ways to produce reliable and sustainable electricity. Innovation is also a key value for artists and designers, amongst others. The drive to create something new connects these two otherwise unrelated groups. Both groups could profit from a cooperation. Artists, designers or even architects could gain a huge canvas using the surface of the cooling tower or the whole NPP area. It would be a way to showcase their talents for the artists. By inviting creative people in and presenting them with the opportunity, the NPP could build a network with the creative community whilst also improving the looks of the otherwise quite bleak concrete buildings.

### 3.2.3. Value of Sustainability

Sustainability is something most organisations and companies strive for these days. In particular in Europe recycling, reusing and upcycling are more than mere concepts. By building trust within the growing community of sustainable organisations and companies, by exchanging ideas and cooperating also offsite the facility the sustainability of NPPs could be communicated to a broader audience.

For instance both Belgian NPPs are registered with the Eco-Management and Audit Scheme (EMAS) which is a European environmental management scheme and thus prove “that they work with an environmental management system that aims to continuously improve their environmental performance” [8]. EMAS registered organisations and other EMAS stakeholders can connect in an EMAS Club through a common interest for environmental best practices. EMAS Clubs are voluntary bottom-up initiatives. The participation in, and contribution to, such clubs by NPPs could lead to a valuable exchange of ideas and in connecting over the common value of sustainability [9].

## 3.3. Deep Geological Repository

A fundamental set of values that every DGR follows are long-term engagement and responsibility towards the public and future generations. Interestingly, many fields and organisations share these same values, two of which are analysed here. More values and stakeholders are shown in Figure 4.



FIG. 4. Values and stakeholders for a deep geological repository.

### 3.3.1. Value of Social Responsibility

Seed collections need to be stored at constant low temperature and low moisture and to be guarded against loss of genetic resources in order to avoid loss of biodiversity during regional or global crises. Worldwide, many gene banks hold collections of food crops for safekeeping. Yet many of these are vulnerable, exposed not only to natural catastrophes and conflict, but also to avoidable disasters, such as lack of funding or poor management [10]. The loss of a crop variety can be irreversible for humankind. A global seed vault could be added in DGR projects. Seeds and crops could be brought by gene banks and safely stored in the DGRs. By doing so, a strong and trustful relationship between the nuclear facility and the gene banks can be established.

### 3.3.2. Value of Long-Term Engagement

People are commonly looking for ways to ensure the safe and secure deposition of their most valuable belongings and artefacts. In Switzerland a client can rent a deposit box of starting at 10 litres and as high as 20,000 litres for a yearly cost from \$60 up to \$10,000 [11] in a bank. Former Swiss military bunkers are transformed to storage sites for the safe and secure holding of valuable items and computer data [12]. A possible collaboration between DGRs, banks and private vault owners can be established in order to create a robust partnership of trust between these parties.

In both cases (i.e. gene/seed banks and bank vaults), DGRs offer a remote location with no visible entrance, in a geologically stable area with ideal and continuously monitored air conditions which serve as an additional barrier for the long term preservation of the deposits. They would be guarded, secured and protected via a series of barriers and the stored material wouldn't be damaged even under the most unfavourable natural or man-made disasters. Furthermore, the stored deposits can be retrieved by their owners without significant effort. Undoubtedly, the long-term partnership between DGRs and the proposed stakeholders spans centuries and represents the ultimate insurance policy for the world's food supply and heritage/wealth preservation.

## 4. Conclusion

In this work, a series of new collaboration channels between selected nuclear facilities and various stakeholders are proposed. The aim of this project was to explore possible long-lasting, strong and innovative relationships of trust between the nuclear sector and other organisations outside this industry in a meaningful and non-traditional way. By pooling knowledge, skills and political capital, a group of stakeholders could steer a decision in a way that a single group could not do alone. When an issue or opportunity arises, it is too late to build relationships, so they need to be built in advance. Women's organisations, NGOs, schools and universities, international entertainment firms, artists, banks and plant breeders are only a few examples of new partners which share key values and visions with the nuclear sector. Such a network of trust can work as a foundation for increasing the chances of achieving the Harmony Goal leading to a sustainable future.



#### **Seeking common values and unique stakeholders for the future of nuclear technology**

The members of the team are pictured here with an important personal value in their native language (from top left to bottom right): Rotem Daudee (*safety*), Sophie Missirian (*openness*), Christina Raith (*communication*), Lenka Kollar (*progress*), Isidro Amadeo Baschar (*teamwork*), Xiaoyu Guo (*responsibility*), Egor Kvyatkovskiy (*truth*), Andrei Tomescu (*engagement*), Jeremy Gordon (Mentor - *fair play*), Denis Kovalev (*health*), Irina Manina (*happiness*), and Dionysios Chionis (*humbleness*).

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