

Network for Nuclear Innovation

2016 WNU Summer Institute



More information could be found on:

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World Nuclear University 2016 Summer Institute

The WNU Summer Institute is an intensive six-week programme for future nuclear leaders held annually in different locations. The Summer Institute offers a comprehensive programme of lectures, tutorials, field trips to nuclear and industrial facilities, and team projects led by some of the world's foremost authorities. These cover the global environment and sustainable development, nuclear-related technology innovation, nuclear diplomacy and nuclear operations. The programme also includes cultural and social events.

Each WNU Summer Institute involves some 80 participants, called Fellows, selected from promising nuclear professionals who have demonstrated strong leadership potential. WNU Fellows become part of an expanding global network of future leaders in the nuclear profession. Since the Summer Institute's inception in 2005, a total of some 988 Fellows from 81 countries have successfully completed the WNU Summer Institute.

Covered:

- Global setting, including energy supply and demand, climate change, nuclear technology in sustainable development, new build and key political issues and trends;
- International regimes, nuclear law and 3S, including the international legal framework, safety, security and safeguards, implementation aspects and oversights;
- Nuclear industry and applications, including the nuclear fuel cycle, production of nuclear energy, operational excellence, technology innovations, transport, waste management, economics, and a brief summary of the newest applications of ionizing radiation;
- Leadership, project management, knowledge management, and effective communications.

The network for nuclear innovations is a group project, where fellows approach current nuclear topics with a new and innovative approach, combining their diverse experience and research undertaken and the Summer Institute under the guidance of a mentor.

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Network for Nuclear Innovations?

Lectures

Workshops

Technical Tours

Group Projects

Development of a Regulator Framework for Congo

August 2016
DRAFT

The aim of the Network for Nuclear Innovations is to enable fellows to participate in detailed discussion of important global nuclear issues and bring new light to it. This module takes place at the end of the Summer Institute and it is a project, where the fellows present an innovative approach to an issue. Each topic is guided by a mentor, but the mentor will observe and only make small interventions if needed.

Each group is given the task to create a piece of high-quality work in their chosen forms. For example, this could be an article to be sent to publication, a paper to be presented in an International Conference, a video to be posted, well founded recommendations for nuclear research, or an idea for a start-up company.



project QUALITY

CHECK!



How am I MANAGING a quality project? Is this enough? I would like to know if the criteria to measure my project... OH HERE IT IS! Tear the below sideways following the lines, and if your answer is YES, fold the paper. If your answer is NO, leave unfolded.

Tell stories about yourself? YES / NO

Can you understand the contents at a glance? YES / NO

Are you passionate? Does it come across? YES / NO

Can you see yourself in the description you have written?

YES / NO

Does your plan take more than 30 minutes to understand? YES / NO

Did you do your homework regularly? YES / NO

Tear this part

How many folds did you get?

6 YOU ARE A SUPERB PROJECT EXECUTER

Good work! Keep it up **5**

4 STILL GOOD, BUT YOUR WORKS COULD BE IMPROVED A LOT BY ADOPTING A FEW THINGS

Average 3

2 Congratulations! You have many chances to go up to the next level

I encourage you to work a bit harder **1**

OH NO.. **0**

Share your story with 2016 WNU SI fellows,



And win the chances of being congratulated by one of our WNU staff!

TIPS

1) Tell us about yourselves. What we're most interested in hearing about is you. Tell us about you and your co-founders upfront. Don't leave this till the last slide, convince us you have the skills, the commitment and the vision to make this a success.

2) Keep it simple. Try to present your venture in a clear and concise way. Tell in laymen's terms how it works, how will have an impact and how it will grow and be successful. If part of your description is not understandable, it will ruin the flow of your presentation.

3) Show the passion for what you're doing. If you're not excited by the opportunity, the chances are we won't be either. Grab our attention, take us on a journey explaining and emphasis the need for the product/ project and why it will succeed and exist far into the future.

4) Make it believable. You need to show

the upside to the opportunity, but it needs to be believable. If you tell us you have absolutely no competition, or in five years you will be making £1bn, we won't believe you and you will lose credibility.

5) Keep it short. Studies show the average concentration span is 20 minutes. Keep your pitch within this. This will ensure you both hold our attention and importantly it will leave us with enough time to ask questions and really understand you and your business.

6) Do your homework. Know what the investor is looking for from an investment and tailor their pitch. As an impact investor we prioritize social impact, so we look for compelling pitches that convince us not only that an entrepreneur can create a thriving business, but also that they can address major social challenges and have a lasting impact on people's lives.

Ref.: Katie Mountain. Foolproof pitching tips from an impact investor. 4th December 2013. <https://www.pioneerspost.com/comment/20131204/foolproof-pitching-tips-impact-investor>

NNI 1 The possible solutions for the technical and economic challenges of the integration of nuclear and renewables in low carbon grid

BACKGROUND

Contemporary challenges to nuclear power in OECD countries include; A) sustainability of nuclear power in deregulated electricity market (with unbundling of power company's cooperate structure to power generation, transmission and delivery), and B) deep penetration of renewables into the grid, especially solar and wind. Although nuclear power is an important option as a low carbon energy source, its capital-intensive characteristics are making new nuclear build very difficult when power companies are separated. Increased share of renewables supported by FIT give rise to a situation of dominance of supply-contingent renewables in the market and even negative price, which can lead to nuclear power plants facing premature shutdown.

TASK

- a) To discuss what are the targets for sustainable development in the energy industry and how nuclear can contribute to them
- b) To analyze the major issues that can arise from complete deregulation and deep penetration of renewables, and their impact on nuclear power
- c) To come up with an innovative proposal for humankind to continue to benefit from nuclear power in deregulated electricity markets by co-existing alongside renewables
- d) To assess effectiveness of the said proposal. Such a proposal would include both technological and institutional options.

References:

- 1) 'Transforming our world; The 2030 Agenda for Sustainable Development', UN, 2015
- 2) Griggs et al, 'Sustainable development goals for people and planet', *Nature*, 21 March 2013
- 3) Joint MIT-Japan White Paper, 'Compatibility of Nuclear and Renewables with Grid Stability, Economics and Deregulation', 1 April 2016 (<http://web.mit.edu/nse/research/canes.html>)
- 4) *The Future of Solar Energy*, MIT, 2015

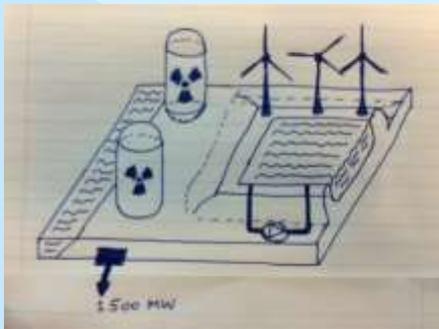


thoughts

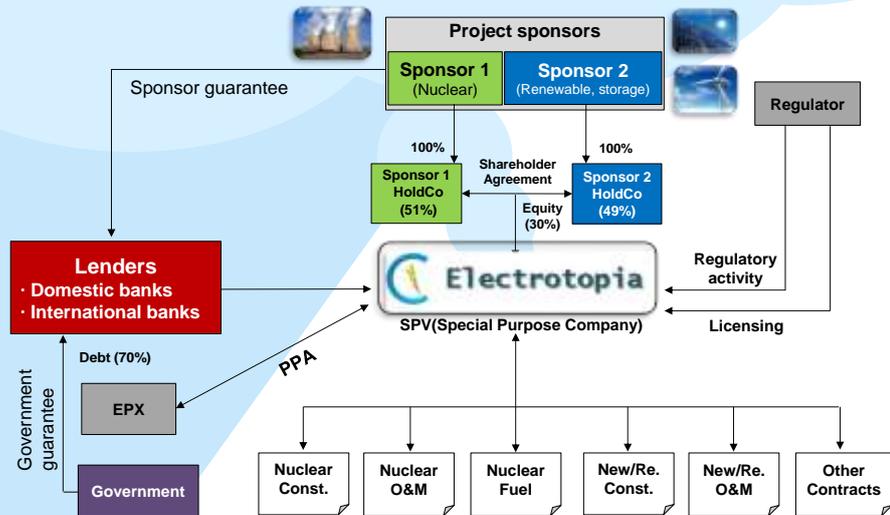
Economic and technical solutions to a low carbon grid should be..

- Affordable,
- Reliable,
- Environmentally sustainable

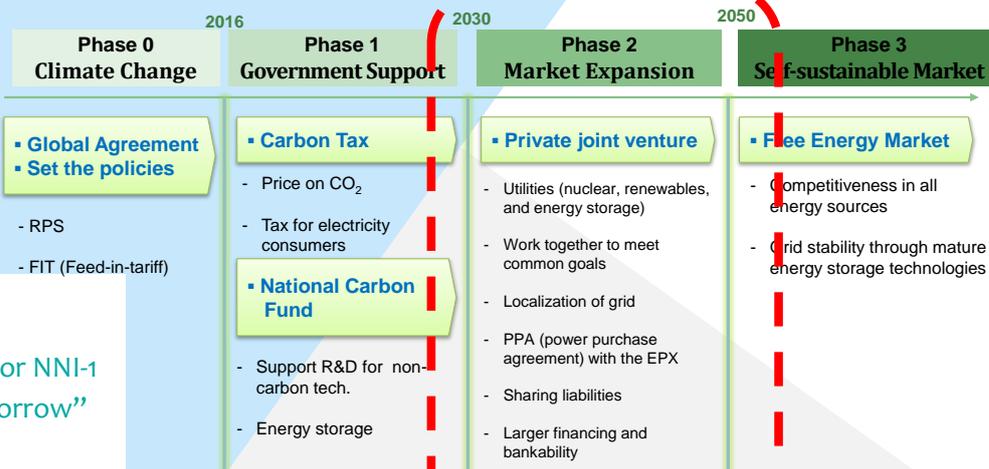
blueprints



structure



plans



“DJ Jin preparing for NNI-1 presentation tomorrow”

Transition to a Low Carbon Grid



NNI 2. The 4Rs - reduction, reuse, recycling and recovery – A case study in the nuclear industry

BACKGROUND

For nuclear power to expand, it must overcome a number of challenges, including material recovery and waste management. Below are examples of specific nuclear fuel cycle issues which need to be addressed to improve resource utilization and reduce environmental impact:

1. Most liquid high-level nuclear waste in the world is being converted to a solid form as a borosilicate glass, which is highly durable, but not very efficient. Is it possible to increase radioactivity concentrations and thus decrease the total waste mass and volume? Are there any alternatives to vitrification?
2. Minor actinides (mostly Pu and Am) dominate repository radiotoxicity and heat load in the 300–3000 year time frame. Can we separate or transmute minor actinides from the bulk of the waste?
3. A significant amount of plutonium has been accumulated in the world. Some was produced during the Cold War as a result of weapon programs; some has been generated by the nuclear power industry. Can we reuse plutonium and thus reduce the non-proliferation concerns?

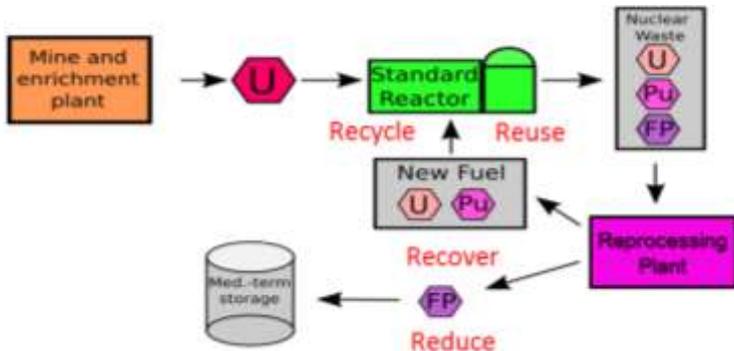
TASK

The fellows will do a thorough bibliography search and identify a number of 4R challenges (see examples above) which stymie the further development of the nuclear fuel cycle. They will apply the scientific method to their research on possible solutions and prepare a paper to be published in a peer review magazine.

REFERENCES

1. John D. Vienna, 'Nuclear Waste Vitrification in the United States: Recent Developments and Future Options', (2010) *International Journal of Applied Glass Science* 1(3):309 - 321
2. IAEA-SM-358/38. REACTOR-BASED PLUTONIUM DISPOSITION: OPPORTUNITIES, OPTIONS, AND ISSUES.
3. World Nuclear Association Information Library: <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/plutonium.aspx>

4Rs – Reduce, Reuse, Recycle, Recover



OVERALL

The theme of NNI 2 is the 4Rs - Reduction, Reuse, Recycling and Recovery – A Case Study in the Nuclear Industry. Our project title is “Spent Nuclear Fuel – Waste or Treasure?”

Our aim is to explore possible innovative approaches (e.g. Fast Breeder Reactors and Accelerator Driven Systems) to close the fuel cycle with fuel breeding, partitioning, and transmutation; focusing specifically on managing spent nuclear fuel.

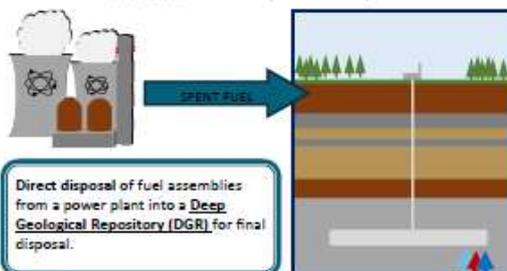
In the process, we will identify the possible challenges, the solutions, and explain our findings through a final power point presentation and info-graphic hand-out.

SPENT FUEL—WASTE OR TREASURE?

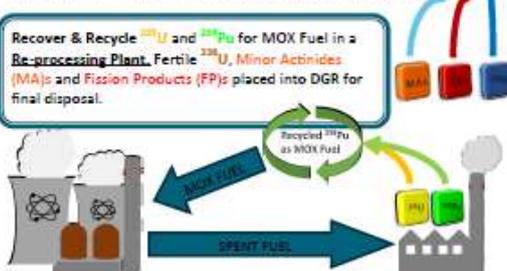


Application of the 4Rs (Reduce, Reuse, Recycle, and Recovery) to the nuclear fuel cycle, considering fuel breeding via fast reactors, and Partitioning & Transmutation via Accelerator Driven Systems.

OPTION 1—The Open Fuel Cycle



OPTION 2—The Traditional Closed Fuel Cycle

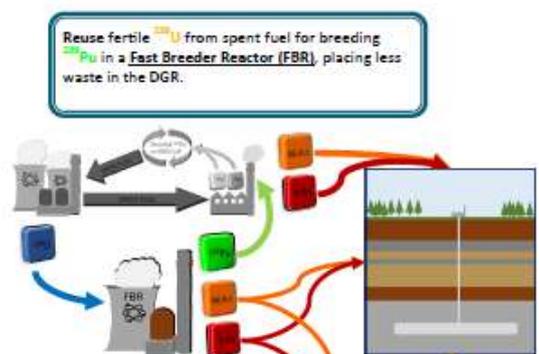


SPENT FUEL—WASTE OR TREASURE?

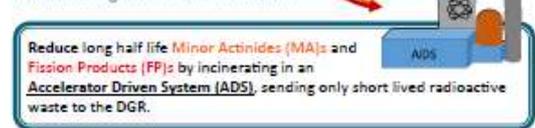


Application of the 4Rs (Reduce, Reuse, Recycle, and Recovery) to the nuclear fuel cycle, considering fuel breeding via fast reactors, and Partitioning & Transmutation via Accelerator Driven Systems.

OPTION 3—Closed Fuel Cycle with Fuel Breeding



OPTION 4—Closed Cycle with Fuel Breeding, Partitioning and Transmutation



infographic

NNI 3. Initiating or expanding the use of nuclear energy

BACKGROUND

The use of nuclear power is very likely to expand in the future. Nations that currently do not have nuclear power plants (NPPs) will be considering whether and how best to build them. In addition, other countries with operating NPPs have little or no recent experience constructing and commissioning new plants. These countries will need the capability to project manage, construct and operate a new fleet of plants either for the first time or against the background of the loss of much of their indigenous nuclear power knowledge and experience due to an aging workforce. In addition these countries will face similar challenges in establishing capabilities within Safety Authorities, Technical Support Organisations (TSOs), Universities and Research Institutes.

TASK

You should seek to identify and discuss the major issues that will face countries considering the introduction of nuclear power for the first time and the issues they would need to address before doing so (IAEA, 2015). In parallel, you should consider and identify the major issues that should be considered by companies and countries that have little or no experience of recent new build. In both cases, particular attention should be paid to the timescales and funding likely to be involved in implementing the requirements you identify.

REFERENCES

Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1 rev 1, IAEA (2015).



RISE Energy Consultants

RISE Energy Consultants (REC) is a regulatory and engineering consulting firm which has provided a broad spectrum of technical services to a number of commercial nuclear power plants in the world. REC internal and external consultants make up the team that is always ready to take on the challenges that others have struggled to solve.

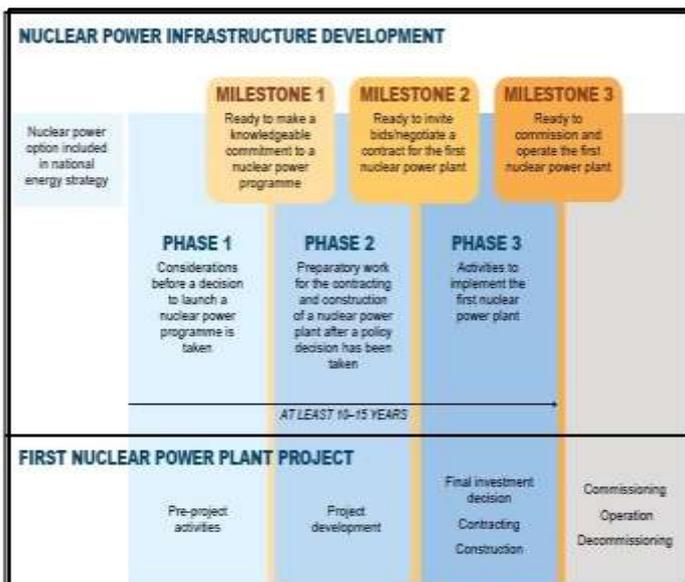
Our Motto: "In support of excellence, safety first and quality foremost"

Vision: To provide integrated energy solutions for our customers and partners

Objectives: Advising on the implementation and promotion of nuclear power plant program in new comer countries



Milestones



19 Infrastructure Issues



Key Organizations

- The government
- The owner/operator of the nuclear power plant
- The regulatory body

NNI 4. Nuclear safety regulators effectiveness

BACKGROUND

The overall safety record of the nuclear industry has been very good – in comparison to any other large-scale source of energy, despite public perception.

Nevertheless, as Chernobyl and Fukushima have shown, nuclear accidents may lead to social disruption by destroying local communities and by necessitating huge investments for remedial actions. As technology develops and operational experiences accumulate, nuclear energy will be safer. Advent of probabilistic risk assessment (PRA) enables identification of vulnerabilities with which owner/operator will tackle. Stress tests required by nuclear regulatory bodies will enable them to identify where the cliff edge is, beyond which a serious accident may happen, and how to increase the distance to cliff edge. However, most important might be human factors, since it is people who make decisions utilizing information obtained from operational experiences, best practices, risk information from PRA or stress test etc. This leads to the issues around the organizational and individual's safety culture, and enhanced safety and security by design for fault-tolerant safety.

Furthermore, the Fukushima accident has had significant implications on methodology in safety assessment such as human reliability analysis in harsh environments, accidents by multi-hazards, in multi-unit, with multi-radioactivity sources. Traditional safety goals were also challenged. Whereas, in the past, safety goals had mostly focused on potential health risks caused by radiation, there are other risks such as psychological effects due to fears to radiation, damage to company's reputation and even power replacement costs, which are not usually taken into account. All these indicate that existing safety goal needs to be revisited.

In order to keep nuclear energy viable from the point of view of economics, safety and public acceptance, it is necessary to harmonize regulatory processes using internationally-accepted safety codes and standards, enhance standardization and improve efficiency of the licensing process of current and new technology.

TASK

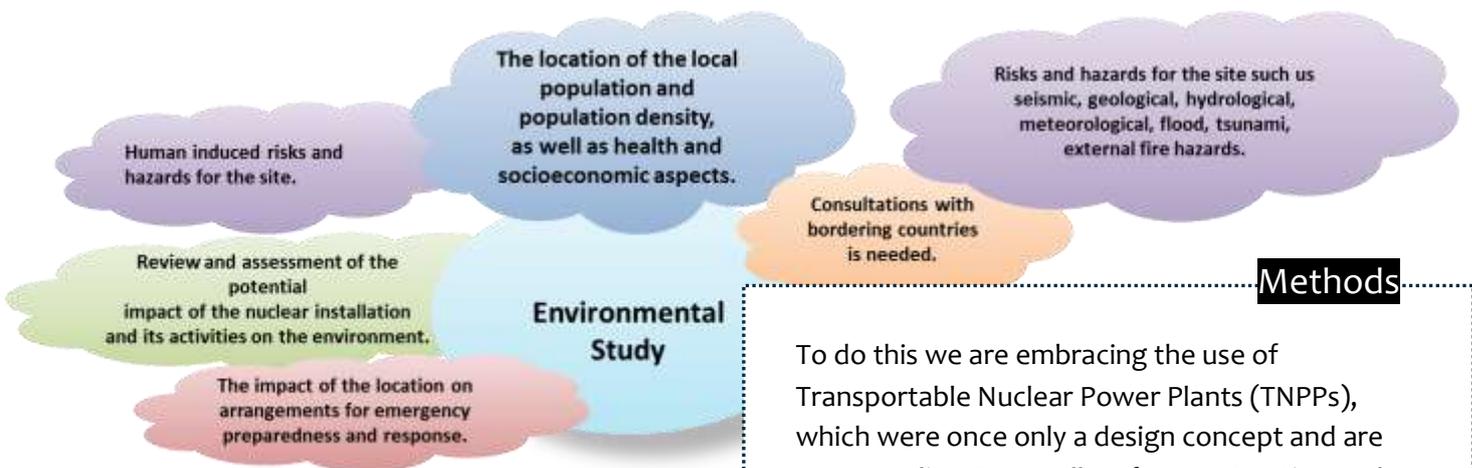
As leaders in the nuclear community, either now or in the future, it is your responsibility to establish a regulatory framework that creates a stable and predictable licensing process, which will promote the conditions to ensure a culture of safety, new paradigms for safety goals and the development of innovative designs.



Team members

Saulo Ribeiro, Diego de Hijes, Roberto Lopez, Celia Caveda Ramos, Takuya Toriyama, Akio Hori, Gaspard Liyoko, Lucia Pastuchova, John Thelen, and Josip Zic.

The goal of our group project is to establish a regulatory framework for the Republic of Congo that creates a stable and predictable licensing process, which will promote the conditions to ensure a culture of safety, safety goals, and the implementation of innovative designs.



Methods

To do this we are embracing the use of Transportable Nuclear Power Plants (TNPPs), which were once only a design concept and are now a reality. TNPPs allow for construction and decommissioning to occur elsewhere by a supplier that has experience in nuclear design and waste management. While the remainder of the nuclear life cycle is being overlooked in the current scope of this project, it is understood that there will be necessary required changes to this regulatory framework in order to advance these other aspects of nuclear in the future.

Focus

The focus of developing this regulatory framework is to meet Congo's current legislation and regulatory needs to address aspects of uranium mining, medical and industrial needs, and of course electricity generation.

Afterwards...



John Thelen

3 August at 14:41

I suggest we all meet on the 24th at 6pm (BYOB, snacks) to celebrate the end of today's NNI presentations. 😊

👍 Like

💬 Comment



Judd Lapp, Dermot O'Loughlin and 7 others

✓ Seen by 54

NNI 5. Contributing to the Harmony programme

BACKGROUND

Electricity needs are growing with a strong development of nuclear in the world (e.g. China). Energy independence was the motivator for countries, which today are the best low carbon emitters (e.g Brazil). It is possible to change the situation rapidly and sustainably. Sweden and France in past years have had a rapid increase in electricity produced by nuclear energy.

The Harmony goal is for 1000 GW of new nuclear capacity to be built by 2050, which means that nuclear will deliver 25% of global electricity by 2050. To get there, 3 main areas need to be developed:

1. Level playing field –Establish a level playing field for all low-carbon technologies, valuing not only environmental qualities, but also reliability and grid system costs.
2. Effective safety paradigm: Ensure global nuclear safety, confidence in management of nuclear technology and operations, stakeholder trust and place risks in perspective. Nuclear energy can deliver reliable, affordable and clean electricity
3. Harmonised regulatory processes: Enhance standardisation, harmonise and update global codes and standards.

TASK

The fellows would consider the harmony goals, do some research and consultations with several international organisations and stakeholders, clarify which problems are impacting the nuclear energy expansion, and look at solutions to these problems and draft a “position paper”.

The final presentation could be the debate of the position paper with the decision makers to promote and increase the awareness.

"The realisation that swift action is needed to reduce greenhouse gas emissions and air pollution from fossil-based generation has highlighted again the potential of nuclear power to help meet these challenges"

Global demand for electricity expected to grow to 35,000TWhrs by 2035

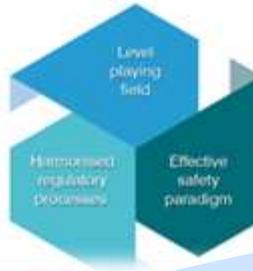
Harmony Goals

By 2050

- ▶ 25% of global electricity to be generated by nuclear power
- ▶ 1000GW of nuclear generating capacity to be added

Challenge for the global nuclear industry:

- ▶ identify barriers
- ▶ engage in dialog
- ▶ develop key actions



Harmony Roadmap

Baseline Current Designs and Map Future Innovations

Global Standardization

- Review Existing Organizations
- Safety and Licensing Philosophy

Political and Public Support

Sharing of experience across whole industry

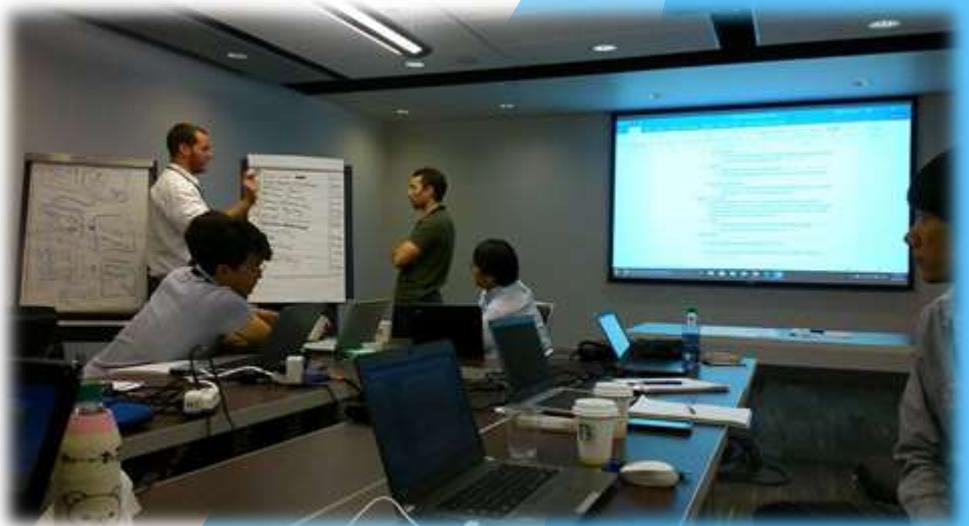
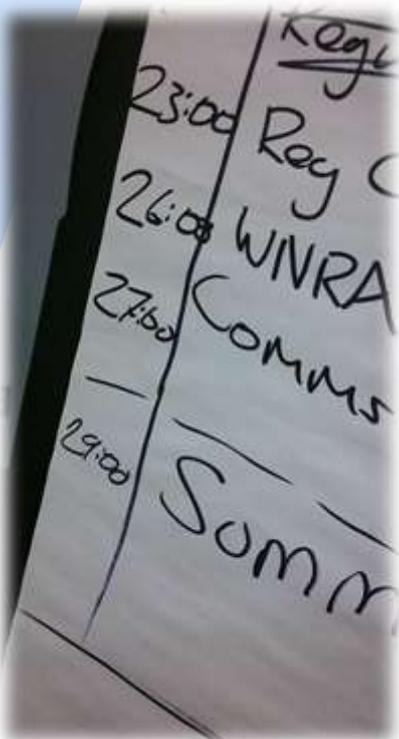
Short Term Wins

Learning from 1984

Communication Strategy



Work done! Ready for tomorrow's presentation ☺



NNI 6. Leadership and employee development

BACKGROUND

Excellence in leadership and employee development are essential aspects in the nuclear field. In fact, any group or organization that aspires to achieve a high level of performance needs to have talented and well trained employees who are passionate about fulfilling their roles; great teamwork; and strong leadership. The key question is how to create and execute a model that supports this objective for the long term. Reference 1 provides information regarding important considerations for human resources in the nuclear field. Reference 2 builds upon these considerations, through addressing a workforce planning model for new nuclear power programmes.

TASK

Identify the key features of an effective model to select talent, train personnel, create high performance teams, and establish the requisite levels of responsibility and accountability commensurate with achieving nuclear excellence. Include consideration of recruitment, culture, economics, education, dependence on contractors and temporary workers, and other barriers, as applicable, that may impede effective implementation of the proposed model and how to deal with these barriers. Also, how nuclear professionals can be good decision-makers on complex and multi-disciplinary issues with uncertainties and having safety implications.

REFERENCES

1. Managing Human Resources in the Field of Nuclear Energy, IAEA Nuclear Energy Series No. NG-G-2.1, 2009.
2. Workforce Planning for New Nuclear Power Programmes, IAEA Nuclear Energy Series No. NG-T-3.10, 2011

“Over 90 percent of CEOs are already planning to increase investment in leadership development because they see it as the single most important human-capital issue their organizations face.”

As a sample of the next generation of leaders in the nuclear industry, our experiences demonstrate that there are still challenges that exist despite leadership development efforts. Our intent is not to provide a new theory on leadership but to provoke thought in upcoming leaders and current senior management in any industry, including nuclear. We would like to share our stories and have you consider how they may apply to you and your organization.

Imagine that you have been tasked with working to provide innovative leadership insight. What can be said about leadership that is not already in a training program, on the internet or in a book? Now imagine that you are working with thirteen other people from eight other countries with varying culture and their own unique perspectives.

We are one of the working groups from the 2016 World Nuclear University Summer Institute (WNU SI). The WNU SI is a six week long intensive program that aims to develop future leaders in the nuclear industry. This program hosts young leaders from all over the world – 31 countries in 2016. Our working group is comprised of both technical and business professionals representing companies of varying scale and size.

Current global headlines indicate that the nuclear industry has been facing challenges. We believe that leadership has a vital role in both the challenges and the solution.

We have compiled personal short stories to reflect our own individual experiences to try to capture both best practices and challenges within the current working environment.

“Over 90 percent of CEOs are already planning to increase investment in leadership development because they see it as the single most important human-capital issue their organizations face.”¹ As evidenced by our and other WNU fellows’ experiences, there are still challenges that exist despite development efforts. Our intent is not to provide a new theory on leadership but to provoke thought in upcoming leaders and current senior management.

These are our stories.

¹Developing leadership: What really matters –McKinsey & Company, January 2015



NNI 7. An effective international verification system

BACKGROUND

Since 1956 the International Atomic Energy Agency (IAEA) has been responsible for verifying that states are complying with their commitments to use nuclear energy for peaceful purposes. To that end, the IAEA developed a verification system and continues to evolve the system and its implementation. Credible assurance that states are using nuclear energy for peaceful purposes is an essential element for governmental and public support of the nuclear industry. However, currently the IAEA is faced with a static level of resources to fulfil its verification mandate and an increasing amount of nuclear material and facilities to verify. This exercise will focus on the elaboration of some fundamental principles and objectives of nuclear verification and suggest how they might apply under different scenarios. This does not require an in depth knowledge of the current verification approaches and techniques used by the IAEA (although the references below will provide some background). Rather, the exercise presents an opportunity for unencumbered thought on what participants think should be the primary principles and objectives of an international verification system and the amount of effort that should be expended in specific circumstances. The project would comprise of two parts: (i) identifying the basic principles and objectives that could constitute an effective verification regime; and (ii) applying those principles and objectives to specific fictional case studies to demonstrate how this new approach could work.

This project provides an opportunity for original thinking not influenced by previous or current practices. As such, it could contribute to the ongoing debate on where and how the IAEA should allocate its limited verification resources in an effective and efficient manner.

TASK

To elaborate some fundamental principles and key objectives relevant to an effective international verification system that could provide credible assurances on the peaceful use of nuclear energy and to indicate how such a system could be implemented under different scenarios.

REFERENCES

IAEA Safeguards Serving Nuclear Non-Proliferation

https://www.iaea.org/cites/default/files/safeguards_web_june_2015_1.pdf

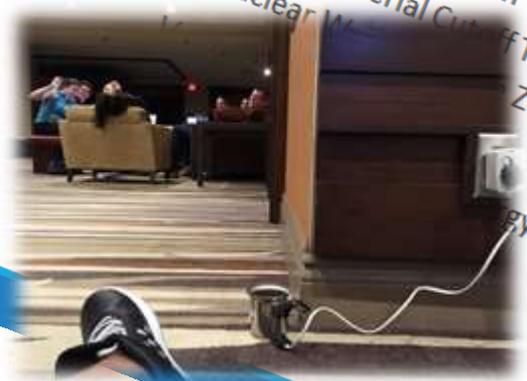
IAEA Safeguards General Information (Browse as you will)

https://www.iaea.org/safeguards/basics_of_iaea_safeguards

Nuclear Non-Proliferation Regime

- Treaties
 - Nuclear Non-Proliferation Treaty (NPT)
 - Nuclear Non-Proliferation Treaty (CBTB)
 - Cooperative Test Ban Treaty (FMCT)
 - Fissile Material Cutoff Treaty (FMCT)
 - Nuclear Weapon-Free Zones (NWFZ)
 - Nuclear Energy Agency (IAEA)

- Multilateral Agreements/Arrangements
 - Zangger Committee, Nuclear Suppliers Group
- Bilateral Agreements
 - Nuclear Cooperation Agreements
- National Policies



“Making Armenian coffee to keep ourselves awake”

... and presentation begins



After presentation ->



description

To elaborate some fundamental principles and key objectives relevant to an effective international verification system that could provide credible assurances on the peaceful use of nuclear energy and to indicate how such a system could be implemented. This will be accomplished through discussions on the current safeguards regime, the ideal implementation of the legal framework to meet the objectives, as well as challenges or gaps that were noted as a group of non-experts. The final product is in the form of a verbal presentation with additional uploaded notes that captured the discussions that took place.

Zoom in to SJ Programme:

Team-building and Leadership development

In the afternoons Fellows break into working groups composed of around ten people. A Fellow is likely to be assigned to three of these groups during the WNU SI, allowing him/her to work closely with a large number of people. Each group is overseen by a Mentor, one of a number of experienced academic or industry leaders that participate throughout the WNU SI.

During working group sessions, Fellows engage in Working Group discussions:

- Reviewing of the morning's presentations;
- Preparing responses to challenging case studies assigned by faculty during the morning lectures;
- Presenting information about themselves, and nuclear programmes in their countries;
- Preparation of an in-depth presentation on a topic key to the future of the nuclear industry. Topics covered may include: setting up new NPP, waste repositories, non-proliferation.

The final project of every group will be presented to the rest of the group before changing the groups.

As an integral part of the WNU SI leadership development programme, the Summer Institute includes presentations from "Invited Leaders" who have made notable contributions to the nuclear industry. As an adjunct to the established curriculum, Invited Leaders choose their message and are likely to discuss:

- Their organization's current and future work
- Major challenges they see unfolding in their area of interest and in the industry as a whole
- What particular characteristics future leaders should possess and how those traits can be developed.



Complete output for each NNI group can be found on

<http://www.world-nuclear-university.org>

e **W** hope this project is a step forward in producing more publications with information on nuclear areas. The intended audiences are people whom are engaged in the nuclear field - especially those who have an interest in joining WNU Summer Institute- and the wider public. We aim to provide a bridge that is easy to access for people from all walks of life. We hope you have enjoyed it, and should you have any enquiries, please do not hesitate to contact us.

Thank you,



