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The ANS Globe

...e-news from the ANS International Committee

From the editor

The ANS Globe is the Bulletin of the American Nuclear Society's International Committee (IC). *The ANS Globe* has as its mandate the dissemination of news of international interest to International Committee members and to others.

We would like to keep *The ANS Globe* current and relevant. Please send your letters, articles, news and/or comments for consideration towards the next issue.



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From the Chair and Vice Chair

As we look at the global nuclear energy industry, we see some heartening trends in Asia, Africa, Canada and even the U.S. And we are inspired by the internationalist outlook of incoming ANS President John Kelly.



First, the trends. According to the World Nuclear Association, the past three years have seen a surge in new builds. Fifteen new reactors with a combined capacity of 25 GWe are now supplying electricity. And over the next two years, 33 GWe are expected to come on line. Taken together, these total a 15 percent increase in global nuclear energy capacity in just five years. Thirty reactors in ten countries, including two newcomer nations. Not bad.

We see interest in nuclear energy growing at a fast pace in the Middle East and Africa. The U.S. Energy Information Administration estimates that nuclear energy capacity in the Middle East will grow from 3.6 GWe today to 14.1 GWe in 2028. The United Arab Emirates and Saudi Arabia have major programs in various stages of development, construction is underway on Turkey's first plant, Egypt has awarded contracts, and Jordan is laying the groundwork for a program. South Africa's nuclear energy program has strong government for its existing two reactors and the prospects of new builds. Many nations in sub-Saharan Africa have real interest in building nuclear energy programs, but they are focused on infrastructure and regulatory requirements. Nigeria, Kenya and Ghana are interested in new builds, and likely will find SMR technologies to be attractive.

Asia is a nuclear energy powerhouse with 131 reactors in operation, 35 under construction and 76 planned, along with 36 research reactors. The vast majority of these reactors are in China and India whose programs are large and growing quickly but nascent programs are emerging in Indonesia, Malaysia and Bangladesh.

In the U.S., nuclear power has been under siege by market factors, but recently the Trump Administration has moved to protect the U.S. nuclear power fleet by declaring them critical to the nation's national security. In Europe, the situation is, at best, stalled as the role for nuclear energy being heavily debated in many 'energy transition' discussions while newbuild-programs are progressing slowly overall. A replacement market of fossil-based and nuclear baseload comes increasingly nearby, i.e., around the 2030s, and thus adds to the overall discussion what role and what kind of nuclear energy we'll need and accept in future sustainable energy mixes. Russian nuclear industry is, on the other hand, steaming full force ahead both domestically and in partnering internationally and announcing various new newbuild-projects worldwide.

The recent Ministerial Clean Energy Meeting on Copenhagen again embraced nuclear energy as part of the solution in the past as tomorrow to tackle the decarbonization challenge. The "Nuclear Innovation: Clean Energy Future" (NICE) initiative was launched and already subscribed by 6 major nuclear countries and new-build-program countries while the list of members being extended continuously. Other initiatives are taking the

momentum as well, not least by the SMR-community but also by philanthropic-sponsored initiatives as ... crucially important ... by our younger generation which is increasingly more vocal and represented to prepare their sustainable energy future ... including nuclear energy for many.

Not to forget that nuclear applications are helping to feed the world next to providing the necessary decarbonised energies. A regional IAEA technical cooperation project in Africa has used these applications to develop better crops. Varieties of rice which are drought-tolerant and blast-disease-resistant have been developed in Egypt, while Namibia has developed higher-yielding cowpea and sorghum, which are also drought-resistant. Zimbabwe released an improved cowpea variety in 2017. And, of course, nuclear medicine is key to effective diagnoses and therapies to a spectrum of diseases.

We see all of these trends as opportunities to lead ANS into more international collaborations with other nuclear societies, and to reach out and establish international sections of the ANS in nuclear newcomer nations. We look forward to growing ANS's international profile, and through these collaborations, the value that ANS delivers to its members. The IC and thus you being instrumental in this.

Mimi Holland Limbach, ANS International Committee Chair
Luc van den Durpel, ANS International Committee Vice Chair

The ANS International Committee's Web Page

Visit the enhanced ANS International Committee's Section on the ANS website, located at <http://www.ans.org/const/international>. It includes:

- Background information about the ANS International Committee
- Connections to ANS International Local Sections
- An overview of Society alliances with international organizations (INEA, INSC, and PNC), along with contact information
- Connections to 30 ANS Agreement Societies/Organizations, and
- Current/back issues of *The ANS Globe*, which features ANS International Committee activities and related items.

Non-US ANS Board Members

Non-US Board Candidates in 2018 ANS National Election

Congratulations to [Prof. Akio Yamamoto](#) [Department of Material, Physics and Energy Engineering, Graduate School of Engineering, Nagoya University, AESJ (Japan)] who was elected as the Non-US ANS Board member in the 2018 elections.

Thanks are also due to [Prof. Lyndon Edwards](#) [Head, Institute of Materials and Engineering Science, ANSTO (Australia)] for agreeing to be in the running!

The IC must now turn its attention to the important task of nominating IC members to run for the Non-US Board position in the 2019 ANS election.

News from Sister Societies and International News

- Canada, Canadian Nuclear Society (CNS) (<http://www.cns-snc.ca>)

The CNS is pleased to announce that its new President, as of June 3, will be Prof. John Luxat of McMaster University. Many IC members probably know Dr. Luxat well from his extensive activity within ANS Divisions. He is also the current Chair of the International Nuclear Energy Academy (INEA).

By the time of distribution of this *ANS Globe*, the 38th Annual Conference of the CNS, together with the 42nd CNS/CNA Student Conference, will have been held in Saskatoon, Saskatchewan, 2018 June 3-6. This conference was quite successful. And it featured an embedded component in Small Modular Reactors, a topic which elicits much enthusiasm these days.

The CNS now looks forward to the many events it will be holding in the next 12 months or so

- 8th International Conference on Simulation Methods in Nuclear Science and Engineering (8ICSMNSE). Ottawa, Ontario, Canada, 2018 October 9-11 (<https://www.cns-snc.ca/events/8icsmnse/>)
- Nuclear-101 Course, Ottawa, Ontario, Canada, 2018 October 10-11 (<https://www.cns-snc.ca/events/nuclear-101-2018/>)
- 1st International Conference on Generation IV and Small Reactors (G4SR-1), Ottawa, Ontario, Canada, 2018 November 7-8 (<http://www.g4sr.org/>)
- 9th International Symposium on Supercritical-Water-Cooled Reactors (ISSCWR-9), Vancouver, British Columbia, Canada (<https://www.cns-snc.ca/events/isscwr9/>)
- 39th Annual Conference of the CNS and 43rd CNS/CNA Conference, Ottawa, Ontario, Canada, 2019 June 23-26 (www.cns-snc.ca)
- 14th International Conference on CANDU Fuel, Mississauga, Ontario, Canada, 2019 July 21-24 (www.cns-snc.ca)
- 4th Canadian Nuclear Waste Management, Decommissioning and Environmental Restoration Conference (NWMDER-2019), Ottawa, Ontario, Canada, 2019 Sept. 8-11 (www.cns-snc.ca)
- Fire Safety & Emergency Preparedness for the Nuclear Industry 2019 (FSEP-2019), Ottawa, Ontario, Canada, 2019 October 27-30 (www.cns-snc.ca)



- Japan

Kiyoshi Yamauchi, ANS Japan Local Section and IC member, sent the following report from Japan, which I have edited:

1. **Energy Policy and Activities of Ministry of Economy, Trade and Industry (METI)**

The current “Energy Basic Plan”, approved by the Cabinet on April 11, 2014,

emphasized that nuclear energy would be one of the important base load power and the desirable “power best mix” in 2,030 as electric power base. METI decided, in July 2015, that nuclear should be reduced down to 20-22 % from 30 % before “the Great earthquake disaster” in 2011. The “Round Table for Studying Energy Situations” was established by MITI in August 2017, aiming to hold discussion on future directions of long-term energy policies based on the forecast for the circumstances surrounding energy in 2050. This Round Table made a suggestion in April 2018 that renewable energy should be pursued to be a major electric-power source as non-carbon and every optional power source for non-carbon also should be pursued. Concerning nuclear, whereas it is recognized as a non-carbon option, dependency should be reduced and social reliability should be regained and technology development and resource enforcement should be pursued. The Energy Basic Plan is expected to be revised in this summer.

2. Nuclear Regulation

Nuclear Regulatory Authority

Chairman Toyoshi Fuketa, was assigned on September 22, 2017, for a 5-year term.

Fracture-Zone Issue

Fracture-zone issues at Tsuruga-site, Higashidori-site and Shika-site, which were judged as active faults by the Sub-Committee, have been under discussion in the plant re-start application review and final decision has not been made.

Monju (Prototype FBR) Issue

Based on the Government decision to decommission the Monju reactor, whereas the promotion of fuel cycle and development of fast reactors be pursued, on Dec.21, 2016, JAEA applied the decommissioning plan to the NRA in December 2017 and the NRA approved this plan on March 28, 2018. The whole project is expected to take around 30 years and fuel removal from the core will be started this summer.

Review of Current Inspection System

Nuclear Reactor Regulation Law was revised to incorporate the concept of “Reactor Oversight Process (ROP)” and was issued on April 14, 2017. Total enforcement is expected in April 2020 and trial operation is expected in October 2018. Discussion on making detailed rules has been started and detailed rules and guides for trial use will be issued before the start of the trial use.

3. Status of LWRs Restart & Plant Life Extension

Applications of restart for NRA review on conformity with new safety regulation, enforced in July 2013, were started. Applications as of April 2018 are still 26 reactors at 16 sites (16 PWR, 4ABWR, 6 BWR).

Most recently, 2 ABWRs, Kashiwazaki-Kariwa 6&7 granted approval of restart in December 2017 and total number of approved plants are 13, namely 11 PWRs and 2 ABWRs. Kashiwazaki-Kariwa 6&7 are the first plants approved as BWRs. 2 PWRs, namely Ohi 3 and Genkai 3, were just restarted in March 2018. Consequently, 7 plants among 13 have already been restarted.

Concerning the NRA review of installation plan of Special Mitigating Means for Specific Major Events such as airplane crash, Takahama 3&4 and Sendai 1&2 already granted approval, and Ikata 3 will grant approval soon.

After plant life extension approval was granted for Takahama 1&2 and Mihama-3, JAPC applied for Tokai unit-2 in November 2017.

Applicant	NPP	Type	Commercial Operation start	Application
Hokkaido	Tomari 1 Tomari 2 Tomari 3	PWR PWR PWR	1989 1991 2009	July, 2013
Kansai	Ohi 3	PWR	1991	Restarted (March 2018)
	Ohi 4	PWR	1993	Approval Obtained (May, 2017)
	Mihama 3	PWR	1976	March, 2015 (Life Extension Approved, November 2016)
	Takahama 1 Takahama 2	PWR PWR	1974 1975	Approval Obtained (June, 2016) (Life Extension Approved, June 2016)
	Takahama 3	PWR	1985	Restarted (July, 2017)
	Takahama 4	PWR	1985	Restarted (June, 2017)
Shikoku	Ikata 3	PWR	1994	Restarted* (September, 2016)
Kyushu	Sendai 1	PWR	1984	Restarted (September, 2015)
	Sendai 2	PWR	1985	Restarted (November, 2015)
	Genkai 3	PWR	1994	Restarted (March, 2018)
	Genkai 4	PWR	1997	Approval Obtained (January, 2017)
Tokyo	Kashiwazaki-Kariwa 6 Kashiwazaki-Kariwa 7	ABWR ABWR	1996 1997	Approval Obtained (December, 2017)
Chugoku	Shimane 2	BWR	1989	Dec. 2013
Tohoku	Onagawa 2 Higashidori 1	BWR BWR	1995 2005	Dec. 2013 June 2014
Chubu	Hamaoka 3 Hamaoka 4	BWR BWR	1987 1993	June 2015 Feb. 2014
Hokuriku	Shika 2	ABWR	2006	Aug. 2014
JAPC	Tokai 2 Tsuruga 2	BWR PWR	1978 1987	May 2014 Nov 2015
EPDC	Ohma (Full Mox)	ABWR	Not yet	Dec. 2014

- Although Ikata Unit 3 was restarted in September 2016, the Hiroshima High Court issued the provisional injunction to prohibit the restart on December 13, 2017, cancelling the decision of the Hiroshima District Court, which rejected the injunction request by anti-nuclear group. Consequently, Ikata Unit-3 cannot continue to be operated.

4. Activities of Atomic Energy Society of Japan (AESJ) (<http://www.aesj.or.jp/en/>)

ANS and Atomic Energy Society of Japan (AESJ) have established a bilateral agreement in 1999 to provide a mutual cooperation and since then AESJ is one of the so-called sister-societies” of ANS.

(1) Annual Conference

2018 Spring Annual Meeting was held at Osaka University, on March 26-28, 2018, where many special plenaries and sessions, such as restart of nuclear plants regarding post-Fukushima, experimental training and utilization of research nuclear reactors, and so on were organized and implemented successfully under cooperation with the Local Section of AESJ and a local organising committee. Also, the presentation ceremonies for AESJ Awards, Excellent Student Awards, and recognition of long-term members were conducted as well. More than 1,400 people attended, including many students.



(2) Fukushima Daiichi Accident Related Activity

“Fukushima Decommissioning Committee“ of AESJ continues a scientific advice activity for the decommissioning of the Fukushima Daiichi plant and a follow-up activity suggested in “AESJ Fukushima Daiichi Nuclear Accident Report“. This Committee held a symposium on Fukushima Daiichi Decommissioning on March 18, 2018 in Tokyo on what the current subjects or problems to face with and what or how AESJ could cope with.

The current subjects or problems pointed out are absence of the following:

- Total project management and suitable operation scheme
 - Milestones with key date and responsibility
 - Safety target and risk evaluation of whole decommissioning activities
- Criteria and evaluation method of building structures integrity, experienced of earthquake loads, tsunami flooding, salt damage in long term duration.
- Back cast study from the end state options

AESJ strongly stated that they would like to proceed activities to cope with these.

7. Activities of ANS Japan Section (<http://aesj.or.jp/kaigai/en/index.html>)

ANS Japan Section is managed by the International Nuclear Information Network (ININ) of the Atomic Energy Society of Japan (AESJ). The members are about 180, and among them the number of ANS national members are about 20. There are ten officers in the Executive Committee.

Major activities in 2017 are as follows:

- (1) Semi-annual Members General Meeting was held twice in Spring and Autumn at the AESJ semi-annual conferences, at Sapporo city and Osaka city, respectively.
- (2) Executive Committee Meeting was held five times per year.
- (3) Workshops by the invited speakers were held four times.
 - “Nuclear Knowledge Management, Challenges and Opportunities”, by Mr. Huang Wei, Director, Division of Planning, Information and knowledge Management in Department of Nuclear Energy (NEPIK), IAEA, on July 18, 2017
 - “Current Energy Policy in the United States and Nuclear Power”, by Mr. Ross Matzkin-Bridger, Director, Department of Energy (DOE) Japan Office, on September 14, 2017
 - “International Cooperation on the Nuclear Infrastructure Development toward New Nuclear Power Countries” by Mr. Akio Toba, Director, JAIF International Cooperation Center (JICC), on December 8, 2018
 - “World Trends in Electric Power Market and Nuclear Power”, by Mr. Yuji Kuroda, Senior Researcher, Japan Electric Power Information Center, Inc. (JEPIC), on March 27, 2018.
- (4) Communication opportunities to the section members through e-mail, Web and annual Newsletter have been utilized.
- (5) This year, we continued a plan to invite the President of ANS to the Japan Local Section and AESJ, where original invitation plan was jointly developed with the ANS Taiwan section in 2016. But unfortunately, schedule did not match to realize it. We

continue to make efforts to realize a plan to welcome a visit of the ANS President to Japan at the next opportunity.

The officers for the ININ of AESJ, as well as ANS Local section 2018, were voted in in March 2018. Mr. Yukio Tachibana of the Japan Atomic Energy Agency (JAEA) becomes the new Chair of the Executive Committee from April 2018 to March 2019, and started activities for 2018.

8.Recent Status of Fukushima Daiichi NPP Restoration

(1) Road Map and Technical Strategic Plan

“The Intermediate and Long Term Road Map for Fukushima Decommissioning and Contaminated Water Removal”, originally issued in December 2011, has been revised every other year and the latest revision was issued in September 2017, reflecting recent finding and activities, especially the decision of debris removal approach as “access from the lateral direction in the air“. “The Technical Strategic Plan“, originally issued in April 2015 by NDF, has been revised every year and the latest revision was issued in August 2017.

(2) Means for Contaminated Water Treatment

Contaminated water has been generated due to underground water flow into the reactor building where fuel debris exists. Total efforts of extracting underground water, installation of water shielding wall at the sea side and starting of partial freezing operation of water shielding wall at the mountain side has been effective to reduce the amount of contaminated water in the reactor building.

(3) Fuel Removal from Spent Fuel Pit

As for Unit 1, the work to install the new cover of reactor building for spent-fuel removal has been started.

(4) Investigation inside the containment vessel (PCV)

Investigation by camera inside the PCV of Unit 2 and Unit 1 were conducted in February 2017 and in March 2017 respectively. These were the first trials of taking pictures by camera inside the PCV. Investigation by underwater camera inside the PCV of Unit 3 was conducted in July 2017. This was the first trial of taking pictures of the lower head of reactor vessel. Multiple structures were destroyed and some of the support bracket were lost. Concerning Unit 2, investigation by movie camera was conducted in this January 2018. This information could be important to investigate the detailed method to take out the fuel debris.

(5) Research and Development

“International Research Institute for Nuclear Decommissioning“ (IRID) together with reactor vendors and Japan Atomic Energy Association (JAEA) has been continuing to work for R&D of decommissioning of Fukushima Daiichi using the METI fund in accordance with the Road Map and Technical Strategic Plan already issued. Major areas are as follows;

- Investigation technology inside PCV and RPV including development of devices and access route
- Monitoring inside PCV and RPV to investigate the spread of fuel debris

- Technology and engineering method of fuel debris removal including device development
 - Study of possibility of occurrence of re-criticality and recommendation how to avoid this during debris removal
 - Integrity of structures such as reactor building and reactor support structures (pedestal), and so on.
- **[OECD Nuclear Energy Agency \(http://www.nea.fr\)](http://www.nea.fr)**

The following articles are gleaned from OECD NEA monthly reports.

Australia Accedes to the GIF Framework Agreement

On 14 September 2017, Australia deposited its instrument of accession to the Generation IV International Forum (GIF) Framework Agreement for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems. A ceremony was held in Paris which included His Excellency Mr Brian Pontifex, Ambassador and Permanent Representative of Australia to the OECD, and Dr Adrian (Adi) Paterson, CEO of the Australian Nuclear Science and Technology Organisation (ANSTO). The GIF is a co-operative international endeavour which was established to carry out the research and development needed to establish the feasibility and performance capabilities of the next generation of nuclear energy systems. Australia became the 14th member of the GIF on 22 June 2016 when it signed the GIF Charter. Acceding to the Framework Agreement will allow Australia to become actively engaged in R&D projects related to Generation IV systems, particularly in R&D projects on advanced materials.

International Cooperation on the Future of Nuclear Energy



Over 600 participants from 67 countries and five international organisations came together in Abu Dhabi, United Arab Emirates, to discuss the future of nuclear energy at the International Ministerial Conference on Nuclear Power in the 21st Century from 30 October to 1 November 2017. The event was organised by the International Atomic Energy Agency (IAEA), in co-operation with the NEA, and hosted by the Government of the United Arab Emirates through the Ministry of Energy and the Federal Authority for Nuclear Regulation. During **his remarks at the opening session**, NEA Director-General Mr. William D. Magwood, IV, noted that the world will need to use as many tools at its disposal as possible to stabilise the future global energy framework and that nuclear energy is one of these tools able to address climate change, air pollution and energy supply security.

Happy Birthday to Marie Skłodowska Curie

Marie Skłodowska Curie was born this month 150 years ago. She was the first woman to win a Nobel Prize, as well as the first person to be awarded the Nobel Prize twice, in physics in 1903 and in chemistry in 1911, in relation to her pioneering research on radioactivity and discovery of polonium and radium. She was not only a brilliant scientific pioneer who had ground-breaking discoveries, but also a humanitarian. During World War I, she developed mobile radiology units, and organised and participated in their use for diagnostic and therapeutic purposes near the battlefield. She founded the Curie Institutes in Europe, which remain major centres of oncology research today. Her legacy still continues to resonate to this day through advances in engineering, technology and medicine. The NEA is proud to have had the opportunity to name one of the two main meeting rooms in its current building after Marie Skłodowska Curie and her daughter Irène Joliot-Curie.



NEA High-Level Visit to China



From 25 February to 1 March, NEA Director-General Magwood led a high-level visit to China. Bilateral meetings were held with the Ministry of Environmental Protection (MEP), the National Nuclear Safety Administration (NNSA), the China Atomic Energy Authority (CAEA), the National Energy Administration (C/NEA) and the China National Nuclear Corporation (CNNC). Technical visits were made to the Qinshan Nuclear Power Plant and the Fuqing Nuclear Power Plant, where China is building the first Hualong One nuclear power reactor. The NEA delegation also visited some of the country's leading research centres, including the Shanghai Institute of Applied Physics (SINAP), which is leading China's development and demonstration of molten salt reactor technology; the Shanghai Nuclear Engineering Research and Design Institute (SNERDI) and the Chinese Academy of Sciences (CAS). On 28 February, Director-General Magwood delivered a lecture on NEA work and activities to nuclear science and engineering students at Shanghai Jiaotong University (SJTU). The visit, which was very informative and constructive, exemplified the valuable exchange of information and ideas from which China and the NEA can both benefit. Highlighting the growing relationship between the NEA and China, the Agency will welcome in March a Chinese radioactive waste expert on secondment to work at the NEA in Paris for the next two years. She will be the first Chinese expert to join the NEA's main secretariat staff.

The Vital Role of Women in Energy

The NEA participated in the Women in Energy Conference organised by the Bosphorus Energy Club in Istanbul, Turkey, on 27 March 2018. Dr. Tatiana Ivanova, Head of the NEA Division of Nuclear Science, was a featured speaker at the panel sessions on "Barriers



to women in energy: How to overcome them?" and "Bettering options for women empowerment", during which she presented the **NEA International Mentoring Workshop in Science and Engineering** and highlighted the NEA support for enhancing women's role in energy. The NEA encourages its membership to explore ways of attracting, recruiting and retaining women in science and technology.

NEA Celebrates its 60-Year Anniversary

Nearly 200 senior leaders in the international nuclear sector from 31 countries came together in Paris on 19 April 2018 to celebrate the 60th anniversary of the NEA and to discuss the current state and future prospects for nuclear energy. To mark the occasion, the NEA organised a special high-level session for senior leaders in the nuclear sector. "There have been many successes and accomplishments over the last 60 years. While we take this opportunity to recognise the tremendous contributions of the men and women who have served with the NEA over the decades, we are excited by the road before us, the challenges ahead and the as yet unknown priorities of tomorrow," said NEA Director-General William D. Magwood, IV during his opening remarks at the session. "The work of the NEA is always just beginning."

- **Spain**



IC Member **Santiago San Antonio** contributed the following article on "Evolving Knowledge Transfer" and a report on activities of the Sociedad Nuclear Española.

1. EVOLVING KNOWLEDGE TRANSFER TO 4.0

Authors: Francisco Ruiz (fjruiz@tecnatom.es), José Luis Delgado (jldelgado@tecnatom.es), & Francisco J. Sánchez (fsanchez@tecnatom.es)

Introduction

This article describes the Tecnatom knowledge transfer experience in the last 35 years; including the process of transformation of training tools, methodologies and society itself. We now reach a radical change in the model (learning vs. teaching), which projects a vision of a very different future from the one we know today.

Tecnatom, www.tecnatom.es, a Corporate Member of the Spanish Nuclear Society, is a leading Spanish engineering company specializing in guaranteeing the operation and maintenance of nuclear power plants to the highest levels of safety. The company's main activities center on the rendering of component inspection and structural integrity services, the training of personnel in advanced training settings and the plant operating assistance engineering.

Post TMI training. Systematic Approach to Training (SAT)

As in many other processes, TMI necessitated a strategic change in training. In the years after the accident, the Systematic Approach to Training (SAT) methodology became standard throughout the nuclear industry and the concept of Training for Performance Improvement became popular.

Based on SAT methodology, specific Control Room Full Scope Simulators, Workshops and Mockups were developed and rigorous methods of design, development and implementation of training in these settings were applied towards the principle that "we work like we train, and we train like we work".

The key practice to achieve this objective is the establishment of Training Committees at different levels within the organization, where some of the incumbents, instructors, training specialists, training program owners, training managers and high-level managers of the organization play different roles in a structured and coordinated manner to manage the training process.

The tools applied in the theoretical parts of the programs also evolved from the old blackboards to transparencies with head projectors. A large amount of documentation was generated and maintained, such as the student texts, instructor books and the transparencies themselves. The volume of paper and paperwork was considerable and consequently, became a key aspect of training center management.

The Kirkpatrick methodology of assessing training processes was developed to measure the efficacy of training activities depending on their nature and importance.

Regarding learning theories, Bloom's Taxonomy is globally recognized, establishing the cognitive, psychomotor and affective domains, and to determine and assess the training objectives as the basis of training program content.

New Century. Moving into digital and organization networking

Coinciding with the beginning of the new century, the evolution of computers has had an important impact in the training process, both for simulation tools and for the use of IT in the theoretical parts of the program.

"Zero paper" objectives have been set in Training Centers. Massive use of PowerPoint in classrooms is firmly established everywhere and remains until today.

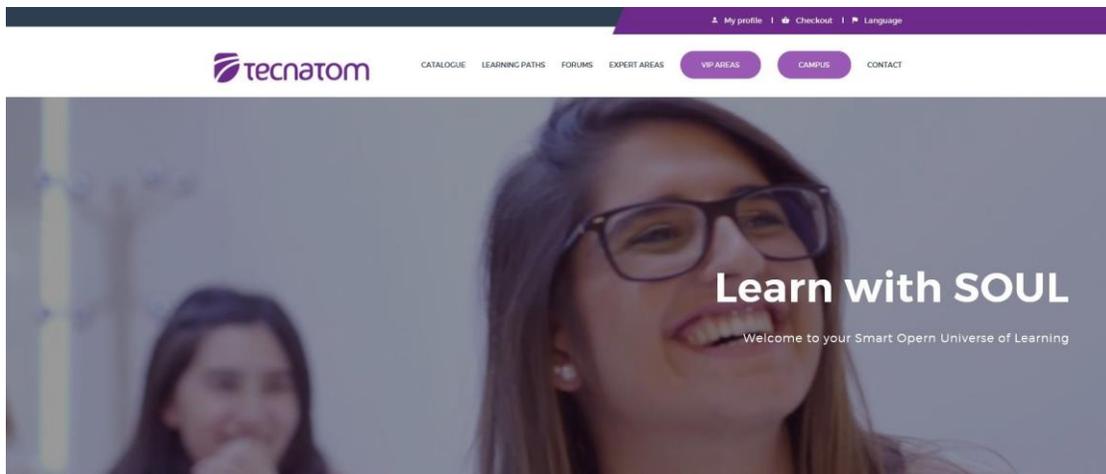
Portable training tools and digital materials were developed and new tools found their place in the training process thanks to their ease of use for instructors and students as well their effectiveness in training results. Some examples of these new tools are Learning Simulator concepts and different approaches to Computer Based Training (CBT) Activities.

Now. Learning with SOUL

The 21st century is a time that presents challenges without parallel in the previous century. These challenges are linked to the rapid evolution of technology. The so-called fourth revolution or revolution 4.0, opens new development horizons for which, new and different competences are required, as well as continuous retraining and updating of the knowledge and skills acquired.

This revolution cannot be based on traditional methods of teaching and learning but the process of innovation and change has already begun.

We are moving into a new type of society in which the acquisition of knowledge is not confined to the training center, nor is it limited to initial training. Education is now an active process, focused on the learner, extending throughout life and beyond formal learning by supporting the development of a knowledge economy.



Welcome to **SOUL**, **Smart Open Universe of Learning**, a new concept in the learning process, developed by Tecnatom. More than a simple learning management tool, it is an integrated knowledge management system, which takes advantage of digital transformation, expert knowledge and social and collaborative learning.

As a learning system, it was conceived to be centered on the learner, around which all elements of the system are developed.

The proposed learning system is a **Smart** platform, where learning analytics allow gathering the necessary information to guide the student, step by step, in an increasingly personalized way.

SOUL guides the student actively through their learning path, through access to existing digital resources and interaction with new intelligent systems. It provides guidance, support tools and suggestions for learning in the right place, at the right time and in the right way. In a contextualized way, collecting and recording learning analytics to develop smart personalized support.

Open at SOUL means: connected with other systems of the organization (Strategic Planning, Operating Experience, Knowledge Management Systems ...). It is open to interact with innovative new technologies, such as virtual reality, holograms, and, of course, it is seamless: flexible, ubiquitous to be use anywhere, at any moment, from any device (computer, mobile phone, tablet...), integrating formal and tacit learning processes.



SOUL can offer training solutions that are integrated into the job environment and that minimize the need for workers to be absent from their positions to participate in training activities.

The new platform offers a **Universe** of knowledge transfer services, not only through the formal "Learning Paths" offered in the certification, but also through the Subject Matter Experts (SME) Space, where senior experts can share articles, videos, links, organize webinars, moderate forums or offer on-demand consultant services and coaching.

This SME Space is an important tacit knowledge generator that later can be organized in Wikis and constitutes a relevant knowledge asset to be transferred during generational change.

The social and organizational learning included in SOUL allows students to share knowledge by participating in forums, case studies and problem solving or collaborative projects. Students learn together and help each other, even by solving each other's problems. Those students who obtain five stars from their classmates and teachers will be recognized in their results.

Another important aspect of organizational learning is Operating Experience. Learning from in-house experience or industry events using OE Story Telling techniques is very useful for continuing improvement and avoiding error repetition. It is also highly recommended to share good practices using videos or other media.

Finally, QuizBot technology allows Intelligent Cumulative Mobile Learning follow-up. The system sends a daily question to the student's mobile phone, from the previously studied subjects in a cumulative way and, from the analysis of the answers, it can detect areas that the student must review to remember important concepts.

The advanced tools kit included in SOUL offer a new engaging **Learning EXPERIENCE**, emphasizing the practical nature of learning, guiding students in a setting as real as possible to the job. SOUL tool kit includes:

- Video Channel, 360° videos and 3Ds equipment descriptions
- Animated control wire diagrams, electrical schemes and flow diagrams
- Experimentation and on-line simulation
- Serious games
- Augmented Reality practices...



Future perspective.

Intelligent Learning and virtual assisted working blurring



However, neither technology nor society will slow down in their evolution towards more democratic ways to understand knowledge, progress and development. Nor does SOUL.

The SOUL project is not only a static tool designed to face current challenges. It is born as an adaptive space to keep pace with organizations' demands. Furthermore, it is important to notice that technology and development are two elements for a binomial. In such a duality, both push and pull each other simultaneously: theoretical models and organizations look to technology asking for answers just to find that, very often, technological advances offer solutions to questions that were never asked.

In this sense, there is a blurring frontier between intelligent learning and virtual assistance. A fact that forces us to work with *agile methodologies* to prototype strides towards the upgrading of Virtual Reality and Mixed Reality. A good example is the use of holographic conformations.

At the same time, it seems clear that technologies such as BIM (Building Information Modeling) and Wearable Devices are already pointing at new courses on skills acquisition and not-yet-designed training methods; easier to predict and adapt to trainees needs and strengths.

Big data and Machine Learning will be, very likely, the tools to explore that path. Thus, it will be possible that decision-making is based on pure data analysis, to an extent that has been never been seen before. The integration of AI (Artificial Intelligence) into learning processes along with the Internet of things will maintain the SOUL project as a cutting-edge tool.

However, it will be important to bear in mind the following two critical factors:

- Cyber security, an extremely sensitive topic under strict and variable law regulation and a sempiternal public focus.
- Ethical implications, surrounding the massive collection and treatment of personal information,

SOUL may be the acronym of Smart Open Universe of Learning, but it also refers to the capacity to feel and think freely for the benefit of human beings.

Incidentally, here is a follow-up on the above article:

The project “Learning with Soul Tecnom” received the Atomexpo Prometheus Award following its nomination on the Atomexpo International Forum “Human Capital Development”. Tecnom implements with this project a new concept of the educational process comprising digital transformation, expert knowledge and collective learning. The Atomexpo Award is a professional international award for a company’s outstanding merit in the global industry and its significant contribution to the development of the nuclear industry.” The photo below was taken on the occasion of the award. On the right side is F. Naredo, Secretary General of the European Nuclear Society.



2. SPANISH NUCLEAR SOCIETY ACTIVITIES

“Spanish Nuclear Power Plants in 2017; Experiences and Prospects”

A new edition of the Conference “*Nuclear Power Plant in 2017. Experiences and Perspectives*” was held at the School of Industrial Engineers of the Polytechnic University of Madrid. More than 200 delegates from the Spanish nuclear industry dealt with relevant issues of the operation of nuclear power plants in the last year and the future of the nuclear sector. The conference was also attended by teachers and students of the masters of nuclear energy programmed in the country.





The “Nuclear España 2017” awards were given out. The prize for the best article of the magazine published by Nuclear Spanish Society was awarded to César Serrano Santamaría, Montserrat González Sisternas and Vicente Zuriaga Rodríguez for their article “Implantation of passive autocatalytic recombiners in the Central Nuclear of Cofrentes”. The best Nuclear España 2017 issue was awarded to “New Reactors”.

The SNE award for the best doctoral thesis in 2017 was given out to Silvia Espinosa Gútiérrez (student of Massachusetts Institute of Technology) for her work “Theoretical explanations of I-mode impurity removal and H-mode poloidal pedestal asymmetries”. More than twenty papers from twelve different universities were submitted.

The SNE award to the best nuclear master project 2017 was given out to Sara Costa, student of Polytechnic University of Valencia, for her work “Design and implementation of an electronic circuit in FPGA for the calculation of the location of the double beta decay in the NEXT particle physics experiment (Cancfranc)”.



Finally, the Board of Directors of the SNE honored Nuclenor and all its professionals who have contributed to the formidable trajectory of the Santa María de Garoña nuclear power plant. José Ramón Torralbo, President of Nuclenor, thanked the nuclear sector for the support received during the last years and place value on the excellent standards of the Spanish nuclear power plants.





44th ANNUAL MEETING • SPANISH NUCLEAR SOCIETY
September 26 - 28, 2018

44th SNE ANNUAL MEETING



NUCLEAR
a smart choice

The 44th Annual Meeting of the Spanish Nuclear Society will take place on September 26, 27 and 28, 2018 in the city of Ávila, in the Community of Castilla y León, with the motto “Nuclear, a smart choice”. Iberdrola will be the host company of the meeting. Two plenary sessions have been scheduled, as well as several workshops and monographic, oral and poster sessions. More than 600 delegates are expected to attend the Meeting. All the information about SNE Annual Meeting can be found on the website (www.reunionanualsne.es/en).

ONE-DAY TECHNICAL MEETING ON “RADIOACTIVE WASTE MANAGEMENT”

The SNE One-Day Technical Meeting was on May 10 at the headquarters of University of Cordoba. It counted with the important participation of 60 professionals from the nuclear sector. The session was held on the subject "Radioactive waste management", the working day has been structured to provide an overview of waste management, as well as to deal with the most important aspects of it.



HISTORIOGRAPHIC PUBLICATIONS PLAN OF SNE

The Spanish Nuclear Society continues with its Historiographic Publications Plan on the Spanish nuclear development and its protagonists. The fourth book of the series “The beginning of nuclear science in Spain”, by Pablo Soler, was presented at the 43rd Annual Meeting of the SNE that was held in October 2017 in the city of Malaga. The next publication will deal with first generation of nuclear power plants in Spain.

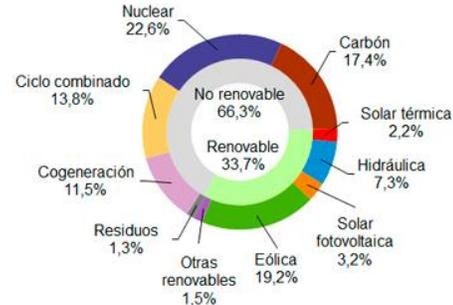


SNE POSITION PAPERS

The Spanish Nuclear Society has published a new position paper on topical issues in the nuclear sector in Spain. The third position paper deals about “Safety in nuclear power plants”, following the previous documents on “The useful life of a nuclear power plant” and “The management of radioactive waste”. These documents are more accessible than other technical publications of the Society.

SPANISH NUCLEAR SECTOR NEWS **SPANISH NUCLEAR GENERATION IN 2017**

The contribution of Spanish nuclear power plants in 2017 to the production of electric energy was equivalent to 22.6% of the country's total consumption. Nuclear generation was in fact the top-ranking energy source in Spain, followed by wind 19.2 %; coal 17.4%; gas combined cycle 13.8%; cogeneration 11.5% and hydraulic 7.3%.



- [United Kingdom](#)

IC Member [Dr. Fiona Rayment](#), OBE, and Executive Director Nuclear Innovation and Research Office, (**National Nuclear Laboratory**) and **Chair of the Nuclear Skills Strategy Group**, UK, contributed the following articles.

1. Nuclear Skills Strategy Group Has Joined Forces with Women in Nuclear UK

The United Kingdom's nuclear industry faces a significant challenge ahead. Its nuclear new build renaissance means it will need to see a significant increase in the number of highly skilled people to build and operate the new nuclear fleet, as well as a skilled workforce to run the existing power stations, decommission the older ones, safely process nuclear waste and maintain the defence programme.

Indeed the NSSG's Nuclear Workforce Assessment (NWA)¹ shows that construction of five sites for 16 – 18 GWe new generation capacity, causes total nuclear workforce demand to rise from 87,560 in 2017 to 100,619 in 2021. Women today are working as nuclear engineers, project managers, chemists, nuclear inspectors, senior managers and in many other roles across the Sector.

But currently only 23% of these skilled nuclear roles are occupied by females. The NSSG recognises that this is hampering its skills ambition, and its Strategic Plan to ensure our talent pipeline is robust, includes a target of 40% women in nuclear. It also embraces broader diversity and inclusivity challenges so that the nuclear workforce more closely matches the diversity of the UK population in terms of the Black, Asian and Minority Ethnic (BAME) population.

Not only will this support the Sector in closing the skills gap, we now know that diversity is correlated with both profitability and value creation. More diverse thinking breeds new ideas, new ideas breeds innovation and innovation breeds business growth.

The NSSG, working with WiN, has now established a task force on Diversity and

Inclusion: taking action means spreading best practice, disseminating the tools to implement diversity and an amplification of what works well.

As a first step, working with the NSSG, WiN is generating a map of what already exists, and engaging with employers on how to apply existing tools and best practice. Examples include an Industry Charter, mentoring programmes and A Guidance Toolkit. Women in Nuclear have recently produced a powerful video which demonstrates the power of diversity. The benefits of a broadly diverse organisation are also shown in the video through real statistics and the gap that remains to reach a greater level of diversity in the workforce including gender balance. For example companies in the top quartile for gender diversity are 15% more likely to have financial returns higher than their competitors. And inclusive companies have 22% lower turnover rates due to increased morale.

There is no doubt – diversity builds better business!

2. **The Nuclear Institute and Nuclear Professionalism**

All people working in the nuclear sector, irrespective of their level or grade of employment, can be characterised as nuclear professionals. All require specialist education and training to develop the skills and expertise needed to perform their jobs safely, securely and effectively in a nuclear context.

In addition to role-specific technical skills, all nuclear professionals demonstrate something extra – what we call in the United Kingdom the **Nuclear Delta®**. This is the understanding of nuclear specific standards and requirements, especially the importance of nuclear **safety** culture, nuclear **security** culture and nuclear **technology**.

Nuclear professionals demonstrate an ongoing commitment to personal behavioural standards and apply their skills and knowledge effectively in a nuclear context.

Employer Responsibility

Promoting nuclear professionalism brings together the responsibilities of the employee and the employer to create an environment and culture in which nuclear professional practice is highly valued and expected as the norm.

While the primary responsibility for professional conduct and development rests with the individual, the employer contributes to and supports the maintenance and development of nuclear professionalism. The employer directly benefits from nuclear professionalism, which underpins critical safety and security arrangements and supports business and CSR objectives.

Continuous Professional Development

In most professional disciplines it is normal practice for individuals to maintain and record their professional status independently of their employment through the appropriate professional body. Professional status is maintained by reporting continuing professional development, accumulated experience and on-going commitment to uphold the

profession's standards and codes of conduct.

As the UK's professional membership body, The Nuclear Institute has developed the Nuclear Delta® to support professionals in meeting and maintaining the specific attitudinal, competence and behavioural requirements of the nuclear industry.

Achieving the requirements of the Nuclear Delta® is central to professional membership and accreditation by the Nuclear Institute. To find out more about how to join the Nuclear Institute visit **Nuclearinst.com**

Faces of Professionalism

Catherine Bush CSci MNucl has a clear view on what it means to be a nuclear professional and member of the Nuclear Institute. "From the earliest days of my career at Golder Associates, working onsite at Sellafield and other nuclear licensed sites, I was made aware of the Nuclear Delta and the importance of safety within a nuclear context", says the Integrated Project Team Leader who now works within the Core Design and Manufacture business of Rolls-Royce.



Technical Validation

Catherine achieved her professional member status with the NI in 2012. She is also a Chartered Scientist, which she also gained through the NI. Achieving both of these were important to recognise her professionalism as well as provide technical validation within the industry. Catherine recalls a positive and enjoyable experience of the assessment process. "It [the Assessment Panel] allowed me to draw on both my environmental background in contaminated land investigations and my experience as a Safety Engineer. It was clear to me the NI membership route was the best fit for my career", she says.

Catherine graduated with an MSci in Geology from the University of Birmingham and started her career with environmental consultants, Golder Associates. Golder provided her induction into the high standards of the nuclear and safety culture. She joined Rolls-Royce several years later as a Safety Engineer, holding this role within the Safety Team writing Nuclear Reactor Plant safety case documents for five years, before joining the Integration Team.

Following a period of maternity leave, she then joined the Operations Team where she became Senior Engineer.

"It was clear that being an NI member was the best route for my career..."

Volunteer Value

Achieving professional status was a key part of Catherine's career progression. She also

greatly values participating as a volunteer on the Nuclear Institute Membership Committee and the regular volunteer day, VForum. “It’s a great way to observe and learn how people approach a problem, and get different perspectives to that of my engineering viewpoint”, she says.

Overall, Catherine recognises how both chartered status and membership of a professional institution enables individuals to progress to higher grades, and notes the benefit of many employers being prepared to reimburse application fees and annual subscription costs.

Read more real-life examples of nuclear professionalism in action. Go to www.nuclearinst.com/Faces-of-Professionalism

This article was originally published in the Nuclear Institute’s technical journal, *Nuclear Future*.



3. Nuclear Skills Strategy Group Unites Sector on Skills

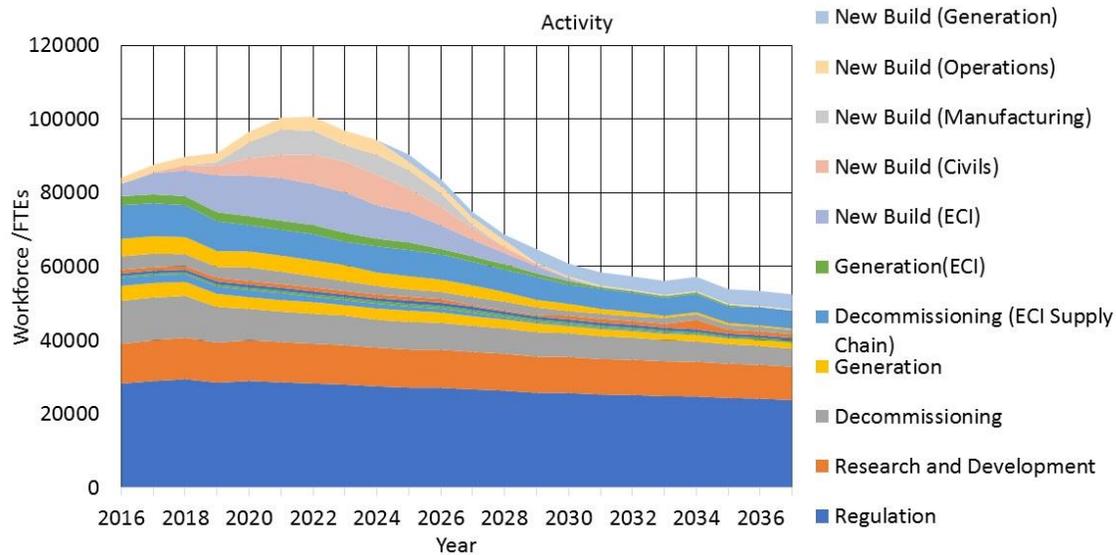
The United Kingdom’s nuclear new build renaissance means it will need to see a significant increase in the number of highly skilled people to build and operate the new nuclear fleet, as well as a skilled workforce to continue to run the existing power stations, decommission the older ones, safely process nuclear waste and maintain the defence programme.

In order to tackle this UK-wide skills challenge, the leading employer forum for sector skills – the Nuclear Skills Strategy Group (NSSG) – is applying national leadership to this key strategic sector of the economy.

The NSSG comprises:

- Major nuclear employers who have the plans and the expenditure to drive the key developments in the UK nuclear sector
- UK government departments responsible for nuclear development and skills leadership
- a representative of the trade unions in the nuclear industries

The NSSG’s work is underpinned by a comprehensive UK Nuclear Workforce Assessment (NWA)¹ which shows that construction of five sites for 16 – 18 GWe new generation capacity, has a significant impact on total nuclear workforce demand in the UK, causing it to rise from 87,560 in 2017 to 100,619 in 2021.



In order to address this significant skills challenge the NSSG has developed a Nuclear Skills Strategic Plan to address the key risks to skills and resources facing the industry, as it approaches a time of unparalleled growth, it is underpinned by a number of key themes:

Strategic Themes

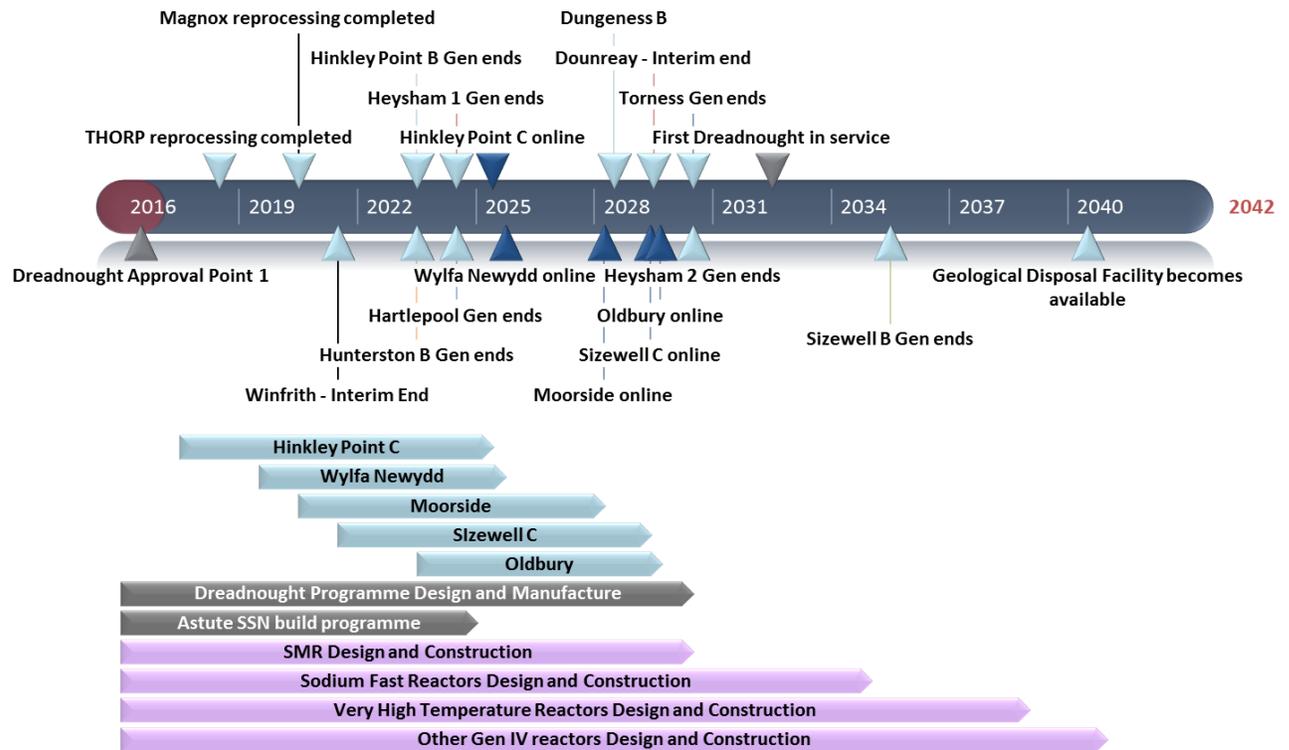
- Meeting the Demand
- Training Infrastructure and Provision
- Training Standards and Qualifications

Enabling Themes

- A clearly defined skills delivery model
- An agreed nuclear timeline (see below)

In turn the NSSG has produced a more detailed Delivery Plan which includes a range of programmes - from Group Training Arrangements for apprentices and a new online Skills Matching platform³ to share talent across related sectors such as Oil and Gas, through to a clear national curriculum.

UK Nuclear Activity Timeline



The work of the NSSG will not stand still. It is constantly seeking to plan for the future, regularly refreshing its Nuclear Workforce Assessment to map out likely future needs – including gathering data on the supply of skills into the sector – and developing ongoing skills strategies and interventions to address emerging employer skills requirements.

This will ensure the UK is positioned to deliver the sector’s future increase in workload, that it has a powerful nuclear skills capability and that it continues to develop a diverse talent pipeline to meet the needs of a UK sector that has a very ambitious programme in the coming decades.

1. http://www.cogentskills.com/media/76523/nwa2017_public.pdf
2. <http://www.cogentskills.com/media/76258/national-nuclear-skills-strategic-plan.pdf>
3. <https://www.nucleargateway.co.uk/>

Presentation at Previous IC Meeting: Patricia Paviet on GEN-IV Webinars

At the 2017 October meeting of the IC in Washington, DC, IC Member [Dr. Patricia Paviet](#) made a presentation on the subject of GEN-IV webinars. The presentation is attached here in [Appendix A](#).

Societies with Collaboration Agreements with ANS

The following is a list of nuclear societies with collaboration agreements with the ANS, along with the corresponding website addresses. The Table contains also a few other entries of interest to ANS International Committee members.

Society	Website or E-Mail Address
Asociación Argentina de Tecnología Nuclear	www.aatn.org.ar
Associação Brasileira de Energia Nuclear	www.aben.com.br
Association des Ingénieurs en génie atomique du Maroc	-
Atomic Energy Society of Japan	wwwsoc.nii.ac.jp/aesj/index-e.html
Australian Nuclear Association	www.nuclearaustralia.org.au
Bangladesh Nuclear Society	-
Bulgarian Nuclear Society	www.bgns.bg
Canadian Nuclear Society	www.cns-snc.ca
Chinese Nuclear Society	www.ns.org.cn
Croatian Nuclear Society	www.nuklearno-drustvo.hr/en/home.html
Czech Nuclear Society	www.csvts.cz/cns
European Nuclear Society	www.euronuclear.org
Hungarian Nuclear Society	www.kfki.hu/~hnucsoc/hns.htm
Indian Nuclear Society	www.indian-nuclear-society.org.in
Israel Nuclear Society	meins@tx.technion.ac.il
Korean Nuclear Society	www.nuclear.or.kr/e_introduce.php
Lithuanian Energy Institute	www.lei.lt
Malaysian Nuclear Society	www.nuklearmalaysia.org/index.php?id=18mnu=1
Nuclear Energy Society of Kazakhstan	www.nuclear.kz
Nuclear Energy Society of Russia	ns@kia.ru
Nuclear Energy Society of Slovenia	www.drustvo-js.si
Nuclear Energy Society of Thailand	www.nst.or.th
OECD/Nuclear Energy Agency	www.nea.fr
Polish Nuclear Society	www.ptn.nuclear.pl
Romanian Nuclear Energy Association	www.aren.ro
Romanian Society for Radiological Protection	www.srrp.ro
Slovak Nuclear Society	www.snus.sk
Sociedad Nuclear Española (SNE)	www.sne.es
Sociedad Nuclear Mexicana	www.sociedadnuclear.org.mx
Ukrainian Nuclear Society	www.ukrns.odessa.net
United Kingdom Nuclear Institute	www.nuclearinst.com/ibis/Nuclear%20Institute/Home
Women in Nuclear – Global	www.win-global.org

Affiliated National Societies	Website or E-Mail Address
Belgian Nuclear Society	www.bns-org.be
Associated Nuclear Organizations	Website or E-Mail Address
International Nuclear Societies Council	http://insc.ans.org
Pacific Nuclear Council	http://www.pacificnuclearcouncil.org
Non-U.S. Local Sections	Website or E-Mail Address
Austrian Section	
French Section	http://local.ans.org/france/
India Section	http://local.ans.org/india/
Italian Section	
Japanese Section	
Latin American Section	www.las-ans.org.br
Korean Section	
Swiss Section	
Taiwan Section	u805301@taipower.com.tw

Calendar of Events

Some Upcoming International Conferences on Nuclear and Related Topics
(Please send us information about your upcoming conferences, for inclusion in this space.)

Legend:

☀ **ANS Event**

□ **Non-ANS event co-sponsored by ANS**

○ **For all other conferences, ANS is NOT a sponsor, nor are these conferences endorsed by ANS.**

2018

- 9-14 September: 21st International Conference on Water Chemistry in Nuclear Reactor Systems, San Francisco, CA, USA
- 23-27 September: Is the LNT Obsolete? The Linear Non-Threshold Question, Pasco, WA, USA – <http://www.ans.org/meetings> ☀
- 30 September-4 October: TopFuel 2018, Prague, Czech Republic, <http://www.topfuel2018.org>
- 30 September – 5 October: Pacific Basin Nuclear Conference 2018 (PBNC-2018), San Francisco, CA, USA – <http://www.ans.org/meetings>

- 9-12 October: 8th International Conference on Simulation Methods in Nuclear Science and Engineering (8ICSMNSE). Ottawa, Ontario, Canada (<https://www.cns-snc.ca/events/8icsmnse/>)



- 10-11 October: CNS Nuclear-101 Course, Ottawa, Ontario, Canada (<https://www.cns-snc.ca/events/nuclear-101-2018/>)
- 14-18 October: NUTHOS-12, Qingdao, China
- 6-8 November: 1st International Conference on Generation-IV and Small Reactors, Ottawa, Ontario, Canada (<https://www.cns-snc.ca/events/g4sr1/>)
- 11-15 November: ANS Winter Meeting, Orlando, FL, USA – <http://www.ans.org/meetings> ☀

2019

- 5-7 February: Conference on Nuclear Training and Education (CONTE-19), St. Augustine, FL, USA (<http://conte.ans.org>) ☀
- 9-14 February: 11th Conference on Nuclear Plant Instrumentation, Control and Human Machine Interface Technologies (NPIC-HMIT 2019), Orlando, FL, USA (<http://npic-hmit.ans.org>) ☀
- 25-27 February: Nuclear and Emerging Technologies for Space (NETS) 2019, Richland, WA, USA (www.ans.org) ☀
- 10-14 March: 9th International Symposium on Supercritical-Water-Cooled Reactors (ISSCWR-9), Vancouver, British Columbia, Canada, 2019 March 10-14 (<https://www.cns-snc.ca/events/isscwr9/>)
- 14-18 April: International High-Level Radioactive Waste Management 2019 (IHLRWM 2019), Knoxville, TN, USA (www.cans.org) ☀
- 15-19 April: 2019 International Congress on Advances in Nuclear Power Plants (ICAPP '19), Juan les Pins (French Riviera)
- 9-13 June: ANS Annual Meeting, Minneapolis, MN, USA – <http://www.ans.org/meetings> ☀

- 23-26 June: 39th Annual Conference of the Canadian Nuclear Society and 43rd CNS/CNA Conference, Ottawa, Ontario, Canada (www.cns-snc.ca)
- 21-24 July: 14th International Conference on CANDU Fuel, Mississauga, Ontario, Canada, 2019 July 21-24 (www.cns-snc.ca)
- 18-22 August: 18th International Topical Meeting on Reactor Thermal Hydraulics, Portland, OR, USA (www.ans.org)
- 18-22 August: 19th International Conference on Environmental Degradation of Materials in Nuclear Power Systems - Water Reactors, Boston, MA, USA (www.ans.org)
- 25-29 August: Topical Meeting on Mathematics and Computation, Portland, OR, USA (www.ans.org)
- 8-11 September: 4th Canadian Nuclear Waste Management, Decommissioning and Environmental Restoration Conference (NWMDER-2019), Ottawa, Ontario, Canada (www.cns-snc.ca)
- 22-27 September: Global/TopFuel 2019, Seattle, WA, USA (www.ans.org)
- 6-11 October: Materials in Nuclear Energy Systems (MiNES), Baltimore, MD, USA (www.ans.org)
- 27-30 October: Fire Safety & Emergency Preparedness for the Nuclear Industry 2019 (FSEP-2019), Ottawa, Ontario, Canada (www.cns-snc.ca)
- 17-21 November: ANS Winter Meeting, Washington, DC, USA (www.ans.org)



2020

- 7-11 June: ANS Annual Meeting, Phoenix, AZ, USA (www.ans.org)

2021

- 13-17 June: ANS Annual Meeting, Providence, RI, USA (www.ans.org)

→ Contact ANS International Committee Members by E-mail:

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*Editor of the *ANS Globe*

Appendix A

GEN-IV Education and Training Webinars: A Useful Resource for All Nuclear Engineers

by

Dr. Patricia Paviet

**Director of the Office of Systems Engineering and Evaluation
Department of Energy, Office of Nuclear Energy**



GEN IV Education and Training Webinars: A Useful Resource for all Nuclear Engineers

Dr. Patricia Paviet

Members (14) in alphabetical order:

- Alekseev, Pavel
- Fazio, Concetta
- Fratoni, Massimiliano
- Gagne Kayla
- Hwang Il Soon
- Jun Sun
- Liu Xiaojing
- Mihara, Takatsugu
- Mikityuk, Konstantin
- Mpoza, Nolitha
- Nam, Youngmi
- Paviet, Patricia
- Pynn Grace
- Renault, Claude





1

Members



- The GIF-ETTF members
 - Basically nominated by Policy Group members
 - 14 Members from 9 countries + EU



Paviet, Patricia (chair)





Mikityuk, Konstantin (Co-chair)



 Alekseev, Pavel 	 Fazio, Concetta 	 Fratoni, Massimiliano 	 Hwang, Il Soon 	 Liu, Xiaojing 	 Mihara, Takatsugu 
 Gagne, Kayla 	 Mpoza, Nolitha 	 Nam, Youngmi 	 Pynn, Grace 	 Renault, Claude 	 Sun, Jun 

2



GIF Education and Training Task Force

- Established in 2015 to respond to the challenge of maintaining a well-educated advanced reactor systems workforce and to meet the projected growth in this field.
- Serves as a platform to enhance open education and training as well as communication and networking in support of GIF.



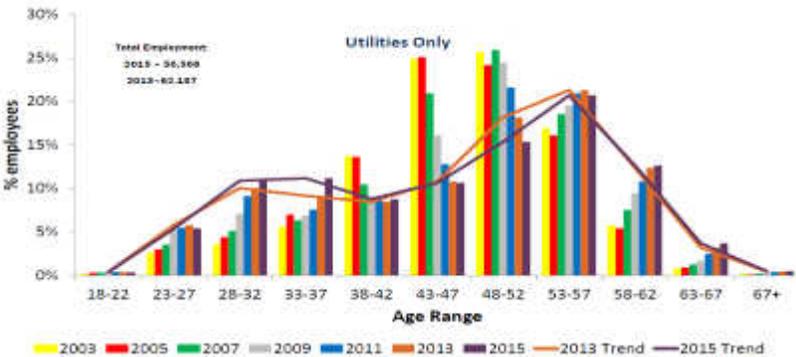
EDUCATION AND TRAINING TASK FORCE

- **The principal objective is focused on promoting education and training by:**
 - Identifying and advertising current training courses,
 - Identifying and engaging collaboration with other international E&T organizations,
 - Developing a webinar series dedicated to Gen IV systems and related cross-cutting topics and advertising these at the national and international level
 - Creating and maintaining a modern social medium platform to exchange information and ideas on Gen IV R&D topics as well as related GIF education and training activities.

3



Motivation



Total Employment:
2015 - 56,368
2012 - 62,187

Utilities Only

% employees

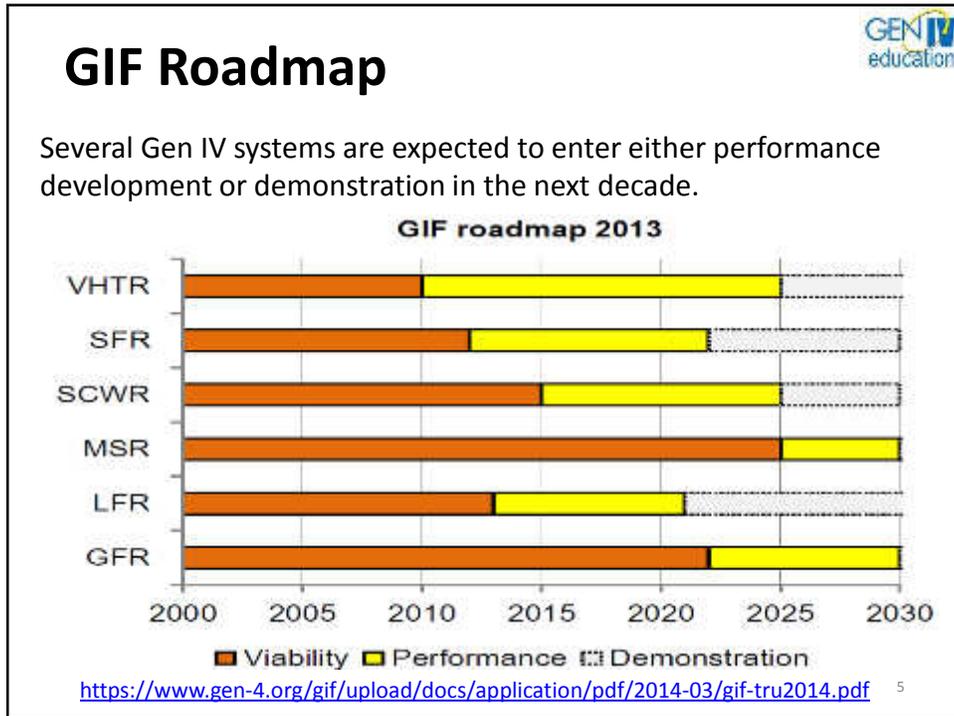
Age Range

Legend: 2003 (yellow), 2005 (red), 2007 (green), 2009 (grey), 2011 (blue), 2013 (orange), 2015 (purple), 2013 Trend (light orange line), 2015 Trend (purple line)

Given that the current nuclear energy workforce is approaching the age for retirement, and that a limited number of universities in the world provides advanced reactor systems curriculum, we are faced with a growing demand for the training and education in the Gen IV system arena.

<http://www.nei.org/Master-Document-Folder/Backgrounders/Presentations/NEI-s-2015-Nuclear-Workforce-Survey>

4



Social Network Linked



LinkedIn group of GIF-ETTF created on October 13, 2017 (194 members), Platform for Gen-IV information and discussions. <https://www.linkedin.com/groups/8416234>



Generation IV Education and Training Task Force

Free GIF webinar on "Estimating Costs of GenIV Systems";
 25 OCT 2017, 8:30 am (EDT)

To view a presentation on the Estimating Costs of GenIV Systems, please access the GenIV Training Website at www.gen-4.org and click on the "GenIV Training" link in the top navigation bar. For more information, please contact the GenIV Training Task Force at geniv@gen-4.org.



ABOUT THIS GROUP

The Generation IV International Forum (GIF) is a cooperative international endeavor which was set up to carry out the research and development needed to establish the feasibility and performance capabilities of the next generation nuclear energy system.

[Show more](#)

MEMBERS 189 members

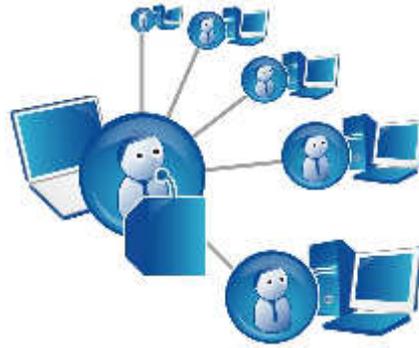


Series of Gen-IV webinars



A series of Generation-IV webinars has been launched in September 2016 and is currently proposed.

- based on the large experience of Patricia Paviet (DOE) and her team on organizing and conducting the radiochemistry webinars; use the same platform and support;
- 1 h online lecture on one GIF system or cross-cutting topic from top-level experts;
- frequency of approximately once a month;



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Series of Gen-IV Webinars



A series of Generation-IV webinars devoted to GIF system and cross-cutting topics has been organized

- 1st webinar launched on 29 September 2016
- A total of 28 webinars planned until December 2018
- All webinars are archived and accessible from the GIF website

www.gen-4.org



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Series #1 of Gen-IV Webinars
Sep. 2016 to Sep. 2017

September 29, 2016 Atoms for peace - The Next Generation Dr. John Kelly, Department of Energy, USA		
October 19, 2016 Closing the Fuel Cycle Prof. Myung Seung Yang Youngsan University, South Korea	February 22, 2017 Gas Cooled Fast Reactor Dr. Alfredo Vasile CEA, France	June 12, 2017 Lead Fast Reactor (LFR) Prof. Craig Smith US Naval Graduate School, USA
November 22, 2016 Introduction to nuclear reactor design Dr. Claude Renault CEA, France	March 28, 2017 Supercritical Water Reactors (SCWR) Dr. Laurence Leung CNL, Canada	July 12, 2017 Thorium fuel cycle Franco Michel-Sendis NEA/OECD
December 15, 2016 Sodium Cooled Fast Reactors Dr. Bob Hill ANL, USA	April 27, 2017 Fluoride-Cooled High-Temperature reactors (FHR) Prof. Per Peterson UC Berkeley, USA	August 22, 2017 Nuclear Fuel and Materials Dr. Steven Hayes INL, USA
January 25, 2017 Very High Temperature Reactors Dr. Carl Sink DOE, USA	May 23, 2017 Molten Salt Reactors (MSR) Dr. Elsa Merle CEA, France	September 21, 2017 Energy Conversion Dr. Richard Stainsby NNL, UK

Series #2 of Gen-IV Webinars: Oct. 2017 to Dec. 2018



Title of Webinar	Tentative date for Webinar presentation	Title of Webinar	Tentative date for Webinar presentation
Economics of the Nuclear Fuel Cycle	October 25, 2017	Proliferation resistance of Gen IV reactor systems	May 23, 2018
Feedback Phenix and SuperPhenix	November 29, 2017	The Russian MOSART fast spectrum molten salt reactor concept	June 2018
Sustainability of Gen-IV Nuclear Energy Systems	December 14, 2017	Astrid SFR- Lessons learned	July 2018
Design, Safety Features and Progress of the HTR-PM	January 24, 2018	BREST-300 Lead Cooled Fast Reactor	August 2018
GEN IV reactor's material and their challenges	February 14, 2018	Safety of Gen IV reactors	September 2018
SCK•CEN's R&D on MYRRHA	March 21, 2018	Current status and challenges of MSR technologies	October 2018
Russia BN 600 and BN 800	April 25, 2018	Advanced Lead Fast Reactor European Demonstrator – ALFRED project	November 2018
		The ALLEGRO Experimental Gas Cooled Fast Reactor Project	December 2018

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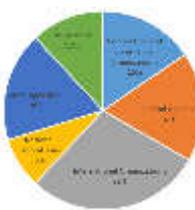
Statistics of the Gas Cooled Fast Reactor (GFR) Webinar by Dr. Alfredo Vasile (CEA) – February 22, 2017



Research centers and international organizations (29%)

- Bruce Power
- Canadian Nuclear Laboratories
- Centre for Environment, Fisheries and Aquaculture Science
- Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
- Electrical Power Research Institute (EPRI)
- Joint Research Centre' (JRC)
- National Centre for Nuclear Research (NCBJ)
- Partnership for Global Security
- Research Centre Rez
- SC Training and Consulting
- SCK•CEN
- UJV Rez, a. s.
- VUJE a.s.

U.S. state agencies (18%)
from AR, ME, NJ, NM, OH, PA, TN, and TX



Federal agencies (18%)

- U.S. Department of Energy
- Department of Homeland Security
- National Institute of Standards and Technology
- Nuclear Regulatory Commission
- U.S. Environmental Protection Agency
- US ARMY
- US Army Corps of Engineers

Universities (12%)

- Budapest University of Technology and Economics
- Florida International University
- Naval Postgraduate School
- Queen's University Reactor Materials Testing Lab
- University of Manchester
- University of Nevada
- University of Virginia
- University of Wisconsin-Madison
- Virginia Commonwealth University

U.S. National Laboratories (8%)

- Argonne National Laboratory
- Brookhaven National Laboratory
- Los Alamos National Laboratory
- Savannah River National Laboratory

Several contractors and commercial organizations (15%)

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Statistics of the Metallic Fuels for Fast Reactors Webinar by Steven L. Hayes, 22 August 2017



Research centers and international organizations (39%)

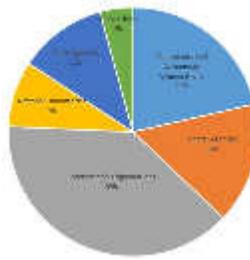
- Canadian Nuclear Laboratories
- China Institute of Atomic Energy
- Commissariat à l'énergie atomique et aux énergies alternatives
- De Dietrich Process Systems
- European Atomic Energy Community
- European Commission's Joint Research Center
- Institute for Physics and Power Engineering (IPPE)
- Japan Atomic Energy Agency
- KEPCO Nuclear Fuel Co., Ltd. (KNF)
- Korea Atomic Energy Research Institute (KAERI)
- Korea Hydro & Nuclear Power
- Korea Institute of Nuclear Safety (KINS)
- National Research Center Kurchatov Institute (NRCKI)
- Nuclear Facilities of Serbia
- Nuclear Safety Institute (IBRAE)
- Organisation for Economic Co-operation and Development/ Nuclear Energy Agency (OECD/NEA)
- Paul Scherrer Institute
- Radiation Protection Service, Ministry of Labour
- South African Nuclear Energy Corporation SOC Limited (Necsa)
- Tractebel

Universities (4%)

- Politecnico di Milano
- University of Miami
- University of Ontario Institute of Technology

U.S. National Laboratories (9%)

- Brookhaven National Laboratory
- Idaho National Laboratory
- Los Alamos National Laboratory
- Oak Ridge National Laboratory



U.S. state agencies (12%)

from NM, PA, and TN

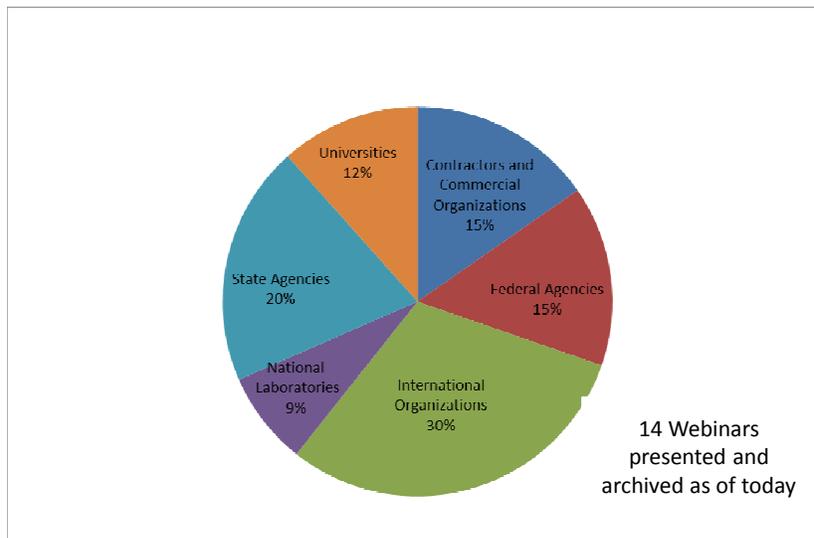
Federal agencies (16%)

- Centers for Disease Control and Prevention
- Department of Homeland Security
- Food and Drug Administration
- U.S. Army
- U.S. Army Corps of Engineers
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- U.S. Nuclear Regulatory Commission

Several contractors and commercial organizations (22%)

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GIF Webinar Attendance Distribution over 12 webinars (September 2016 to August 2017)



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GEN IV education

Join us on September 23, 2015 for the next GEN IV webinar

ATOMS FOR PEACE
The Next Generation

This webinar provides a historical perspective on the Atoms for Peace program, and a look at the development of nuclear power among the globe, and discusses the current outlook for the development and deployment of the next generation of nuclear power (Generation IV).

Free webinar!
Thursday, September 23, 2015 at 8:00 am EDT (UTC-4)
Register NOW! <https://www.linkedin.com/groups/8416234>

Who should attend? Nuclear energy managers, regulators, industry professionals.

Meet the Presenters—
Dr. John E. Kelly, Director, Division Secretary for Nuclear Reactor Technologies in the Office of Nuclear Energy, U.S. Department of Energy. He is responsible for the U.S. nuclear reactor research, development, and deployment portfolio, which includes programs on Advanced Nuclear Reactors, Light Water Reactor Sustainability, and Generation IV reactors.

The Generation IV International Forum invites you to attend and share the latest perspectives of nuclear energy experts and enhance working contacts. Don't miss this opportunity to meet experts and leading scientists in the nuclear energy world for these most important issues.

Keynote Address:
September 28, 2015: **Chairman Bill Cook, Prof. Sheng Sheng Tang**
November 10, 2015: **Secretary of Energy Ernest Moniz, Dr. Charles Beaudoin**
November 13, 2015: **Secretary of Defense Paul Brown, Dr. Ray Kinsler**

For more information, please contact gen4@gen4.gov or go to www.gen4.org for more information or visit us on www.linkedin.com/groups/8416234

Webinar announcement

LinkedIn group of Generation-IV Education and Training Task Force was created on October 06, 2015. <https://www.linkedin.com/groups/8416234>

Education and Training Task Force Members and their own network, US national labs, industry, academia

Posted on the GIF website

Posted by the Department of Homeland Security to the Interagency Network

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Webinar announcement supported by GIF website

www.gen-4.org

GEN IV education

GEN IV International Forum

Webinars

The GEN IV International Forum is pleased to announce the next webinar in the series, "Atoms for Peace: The Next Generation". This webinar provides a historical perspective on the Atoms for Peace program, and a look at the development of nuclear power among the globe, and discusses the current outlook for the development and deployment of the next generation of nuclear power (Generation IV).

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One day prior to the live webinar...



One day prior to the presentation of the live webinar, each participant who registered, receives a reminder via email:

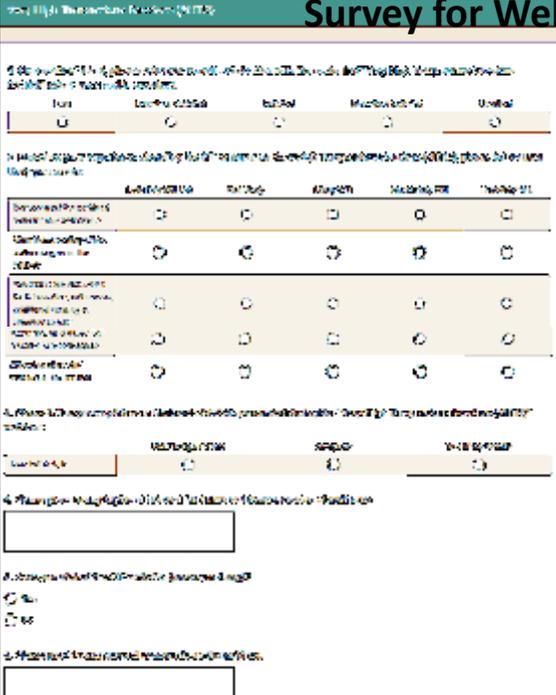


One day after the presentation



One day after the presentation, each participant who registered, receives via email a thank you note and an invitation to take the survey





Survey for Webinars

Creation of survey for the GIF webinar

<https://www.surveymonkey.com/r/WGPKNQ9>

Link is posted in a notes pod for access during the presentation.



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Certificate of Attendance



Certificate of Attendance

Awarded to
John Kelly

Molten Salt Fast Reactor (MSFR)

Presented by Prof. Elsa Merle

5/23/2017



Elsa Merle, Ph.D.
Chief of Education and Training Task Force



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Interaction with regional education networks



Possibility of cooperation with regional education networks was analyzed. Five regional nuclear educational networks identified



ENEN (European Nuclear Education Network, Europe) has mission of the preservation and further development of expertise in the nuclear field by higher education and training.



ANENT (Asian Network for Education in Nuclear Technology, Asia) focused on cooperation, and sharing of information and knowledge for nuclear capacity building through E&T by utilization of e-Learning platform in Asia and the Pacific region.



LANENT (Latin American Network for Education in Nuclear Technology, Latin America) aims to facilitate and improve cooperation in education, training and outreach in nuclear technology in the Latin American and Caribbean region.



AFRA-NEST (African Network for Education in Science and Technology) aims to facilitate operation and networking in higher education, training and related research in nuclear science and technology in the African Region.



STAR-NET (Eurasia) aims to facilitate cooperation in education and professional training in the nuclear sector and related research and outreach in nuclear technology. Present members are 30 universities. It has a unique legal entity registered in Austria as a non-profit organization and sponsored by membership fee and contribution.

An international training course supported by GIF ETTF



The course is targeting scientists already involved in Gen IV systems activities or planning to work in such areas. The course covers the 6 systems, and cross-cutting aspects (energy conversion, materials, safety, and fuel cycle). It offers lectures by renowned subject matter experts in the various areas, as well as tutorials (how to "design" a fast neutron reactor using simple calculations).

Generation 4, Nuclear reactor systems for the future
June 18-22, 2018
INSTN/CEA-Saclay, France



CONTACT
 Claude RENAULT (CEA/INSTN, France)
claudio.renault@cea.fr

The Generation IV International Forum (GIF) and 4th generation systems

- General context, evaluation criteria, the six concepts selected
- Increased performance for energy conversion: innovative cycles
- Materials issues and development of advanced components
- Safety aspects of 4th generation reactor concepts

Sodium-cooled Fast reactors (SFR)

- Principles, past and existing reactors, and background knowledge
- SFR core design, performance and safety
- The choice of sodium coolant: impact on design and operation
- The ASTRID prototype reactor

High Temperature and Very High Temperature Reactors (HTR and VHTR)

- Historical development of HTRs
- HTR core physics

Gas-cooled Fast Reactors (GFR)

- GFR core and system design, preliminary safety evaluation
- The ALLEGRO demonstration reactor

Lead-cooled Fast Reactors (LFR)

- Status of LFR development

Supercritical Water Reactors (SCWR)

- SCWR principles, characteristics and challenges

Molten Salt Reactors (MSR)

- Physics of MSR in the thorium fuel cycle

Fuel cycle of 4th generation systems

- Closed nuclear fuel cycle and transmutation

INSTN is Collaborating Centre of IAEA

Summary



- 14 members representing active GIF members (9 countries + Euratom).
- A social medium platform maintained (<https://www.linkedin.com/groups/8416234>)
- GIF-ETTF webpage on the GIF portal contains all info (archive of recorded lectures, link to registration for the next webinar, the whole program)
- 14 webinars presented and archived (www.gen-4.org) and 14 webinars planned until December 2018



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“Because of the passion and grass root efforts from Professionals and Educators, the GIF-ETTF’s goal of creating an archive of online Gen IV systems webinar series becomes a reality”



Thank you for your attention

Questions?

www.gen-4.org

<https://www.linkedin.com/groups/8416234>

Patricia.Paviet@nuclear.energy.gov

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