

Human Resource Development for Nuclear Power Programmes

Meeting Challenges to Ensure the
Future Nuclear Workforce Capability

Proceedings of an International Conference
Gyeongju, Republic of Korea, 28–31 May 2018



IAEA

International Atomic Energy Agency

HUMAN RESOURCE DEVELOPMENT
FOR NUCLEAR POWER PROGRAMMES

The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

PROCEEDINGS SERIES

HUMAN RESOURCE DEVELOPMENT FOR NUCLEAR POWER PROGRAMMES

MEETING CHALLENGES TO ENSURE THE FUTURE
NUCLEAR WORKFORCE CAPABILITY

PROCEEDINGS OF AN INTERNATIONAL CONFERENCE ORGANIZED BY THE
INTERNATIONAL ATOMIC ENERGY AGENCY,
IN COOPERATION WITH THE
KOREA HYDRO & NUCLEAR POWER COMPANY
AND HELD IN GYEONGJU, 28–31 MAY 2018

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2019

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Marketing and Sales Unit, Publishing Section
International Atomic Energy Agency
Vienna International Centre
PO Box 100
1400 Vienna, Austria
fax: +43 1 26007 22529
tel.: +43 1 2600 22417
email: sales.publications@iaea.org
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FOREWORD

The IAEA held its first international conference on human resource development in the nuclear industry in Abu Dhabi in 2010. Focusing on the theme of introducing and expanding nuclear power programmes, this first conference highlighted the importance of human resources and of providing the necessary support in this area for countries embarking on a new nuclear power programme. The IAEA's second conference on this subject, held in 2014 in Vienna, concentrated on capacity building, human resource development, attracting the next generation of nuclear professionals, education and training, nuclear knowledge management and knowledge networks. Both conferences were well attended and supported by a broad range of participants and experts across the nuclear sector.

The IAEA's third conference in this area, held in 2018 in Gyeongju, Republic of Korea, reviewed the current state of nuclear human resource development (including nuclear education and training) and addressed issues such as the availability of opportunities for sharing of relevant infrastructure. The conference was directed at a broad range of experts in the areas of capacity building, human resource development, education and training, knowledge management and knowledge networks for nuclear power programmes.

These Proceedings highlight the key findings and recommendations of the meeting, as well as the conclusions of the conference president. The papers presented and discussed during the meeting are included on the attached CD-ROM.

The IAEA is grateful to all of the conference participants — particularly the Programme Committee, the session lead chairs and co-chairs, and the conference rapporteurs, D. Palmer (United Kingdom) and C. Goodnight (United States of America) — for their contributions. Special thanks and appreciation go to the conference president, Y. Brechet (France). The IAEA also acknowledges the generous support of the Korea Hydro & Nuclear Power (KHNP) Company and expresses its appreciation to the KHNP staff. The IAEA officers responsible for this publication were M. Van Sickle and D. Drury of the Division of Nuclear Power and the Division of Planning, Information and Knowledge Management, respectively, and S. Mallick of the Office of Safety and Security Coordination.

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CONTENTS

HUMAN RESOURCE DEVELOPMENT FOR NUCLEAR POWER PROGRAMMES: MEETING CHALLENGES TO ENSURE THE FUTURE NUCLEAR WORKFORCE CAPABILITY.....	2
FOREWORD	3
1. SUMMARY.....	1
1.1. INTRODUCTION.....	1
1.2. OBJECTIVES.....	1
1.3. FORMAT AND TOPICS	2
2. OPENING SESSION.....	3
2.1. KOREA HYDRO & NUCLEAR POWER	3
2.2. INTERNATIONAL ATOMIC ENERGY AGENCY	5
2.3. CONFERENCE PRESIDENT	8
3. SUMMARY OF SESSIONS	11
3.1. SESSION 1: ATTRACT, RECRUIT AND RETAIN A HIGH QUALITY NUCLEAR WORKFORCE	11
3.2. SESSION 2: EDUCATION, TRAINING AND QUALIFICATION OF A NUCLEAR WORKFORCE	12
3.3. SESSION 3: DEVELOPMENT OF INDIVIDUALS AND TEAMS WITHIN THE ORGANIZATIONS	13
3.4. SESSION 4: ORGANIZATIONAL CULTURE AND ITS IMPACT ON THE WORKFORCE	14
3.5. KEY ISSUES AND LESSONS LEARNED	15
4. SUMMARY OF INTERNATIONAL NUCLEAR MANAGEMENT ACADEMY (INMA) FORUM.....	16
5. SUMMARY OF INTERNATIONAL STUDENT COMPETITION.....	17
5.1. INTRODUCTION.....	17
5.2. SELECTION CRITERIA	17
5.3. FINALIST SELECTION.....	17
5.4. PROJECTS OF FINALISTS	18
5.5. WINNER SELECTION	18
6. CLOSING SESSION.....	19
6.1. CONFERENCE PRESIDENT	19
6.2. INTERNATIONAL ATOMIC ENERGY AGENCY	23
7. CONFERENCE STATISTICS	25
8. PARTICIPANT FEEDBACK	26
9. CONFERENCE SECRETARIAT AND PROGRAMME COMMITTEE.....	29
CONFERENCE PRESIDENT.....	29
CONFERENCE VICE PRESIDENT	29

SCIENTIFIC SECRETARIES OF THE CONFERENCE:	29
ADMINISTRATION AND ORGANIZATION:.....	30
SESSION CHAIRPERSONS	30
PROGRAMME COMMITTEE.....	31
RAPPORTEURS	31
10. CONTENTS OF ATTACHED CD-ROM.....	33

1. SUMMARY

1.1. INTRODUCTION

The Third International Conference on Human Resource Development for Nuclear Power Programmes: Meeting Challenges to Ensure the Future Nuclear Workforce Capability was conducted 28 to 31 May 2018 in Gyeongju, Republic of Korea. The conference was directed at a broad range of experts in the area of capacity building, human resource development, workforce planning, education and training, knowledge management and knowledge networks for nuclear power programmes.

In 2010, the International Atomic Energy Agency (IAEA) held its first international conference on human resource development in the nuclear industry in Abu Dhabi, United Arab Emirates. Focusing on the theme of “Introducing and Expanding Nuclear Power Programmes”, this first conference highlighted the importance of human resources and of providing the necessary support in this area for countries embarking on new nuclear power programmes. The IAEA’s second conference on this subject, held in 2014 in Vienna, Austria, concentrated on capacity building, human resource development, attracting the next generation, education and training, nuclear knowledge management and knowledge networks. Both conferences were very well attended and supported by a broad range of participants and experts across the nuclear sector. The IAEA has continued to receive requests for further support, guidance and advice from embarking countries, countries moving through the phases of construction and commissioning, as well as from mature countries seeking to extend the working life of their existing nuclear power plants. This is clear evidence that human resource development continues to be a key consideration of the IAEA’s Member States.

The IAEA’s third conference on this area held in May 2018 in Gyeongju, Republic of Korea, reviewed the current state of nuclear human resource development (including nuclear education and training) and addressed issues such as availability and opportunities for sharing of relevant infrastructure. With keynote speakers and interactive presentations that shared state-of-the-art knowledge on the subject, the conference engaged participating experts in detailed discussions on important aspects of human resource development for emerging nuclear power programmes.

1.2. OBJECTIVES

The objectives of the conference were to:

- Review developments in the global situation relating to human resource development (HRD) since the second IAEA conference on this subject (2014);
- Provide the participants with practical solutions that they can use at the organizational, national and international level to develop and maintain the human resources needed to support the safe and sustainable operation of nuclear power programmes;
- Emphasize the role of human resources and capacity building programmes at the national and organizational level for achieving safe, secure and sustainable nuclear power programmes;
- Provide a forum for information exchange on national, as well as international, policies and practices;
- Share key elements and best practices related to the experience of Member States that are introducing, operating or expanding nuclear power programmes;
- Highlight the practices and issues regarding HRD at the organizational and national level;
- Consider education and training programmes and practices;

- Emphasize the role of nuclear knowledge management for knowledge transfer and HRD;
- Elaborate on the role and scope of various knowledge networks; and
- Discuss practical considerations in the field of organizational culture and leadership in the nuclear sector.

1.3. FORMAT AND TOPICS

To meet the conference objectives, each topical session had the following format:

- Presentations by invited keynote speakers;
- A set of presentations that supplemented specific areas within the topical sessions and stimulated discussion among conference participants; and
- A set of interactive presentations that presented current information and knowledge in the subject area.

Four topics constituted the programme of the conference and were considered from both the operator and regulatory perspective. The four topical themes were detailed as follows:

- Attract, Recruit and Retain a High Quality Nuclear Workforce
- Education, Training and Qualification of a Nuclear Workforce
- Development of Individuals and Teams within the Organizations
- Organizational Culture and Its Impact on the Workforce

All presentations as well as the conference programme are included in the attached CD-ROM.

2. OPENING SESSION

2.1. KOREA HYDRO & NUCLEAR POWER

Mr. J. H. Chung, the President and CEO of Korea Hydro & Nuclear Power Co. provided the following opening remarks:

Good morning, ladies and gentlemen.

I extend my sincere appreciation for your attendance, despite your busy schedules.

I would like to express my warmest welcome to the participants from over 60 countries who have travelled a long way to be here.

Ladies and gentlemen.

Nuclear power plants are constructed using state-of-the-art technology with multiple safety functions. However, the most important aspect of nuclear safety would be individuals.

Even with the most reliable safety systems and technologies, safety can collapse in an instant when regulations and procedures are not followed. Therefore, human resource development is tremendously important.

With recruitment of qualified individuals and developing their skills through training and education, the safety of nuclear power plants will be improved to a higher level.

KHNP has been making efforts to secure nuclear power safety by utilizing technology of the fourth industrial revolution. This also requires a highly qualified workforce.

In that sense, the Third International Conference on Human Resource Development beginning today is very significant.

The conference will bring nuclear industries from around the world to share and discuss ways to secure and develop experts for our future.

Valued guests,

It gives me extreme joy that this International Conference is hosted here in Gyeongju.

Along with Abu Dhabi and Vienna where the first and second conferences were held, Gyeongju is a beautiful city that preserves an outstanding treasure and history.

It is an honor for this meaningful conference to be held in this city, home of KHNP's head office (headquarter).

In regards, I would like to take this opportunity to thank the IAEA for their extensive efforts toward global nuclear safety and development.

Ladies and gentlemen,

The theme of this conference is, "Meeting Challenges to Ensure the Future Nuclear Workforce Capability."

In Korea, there is a common proverb that goes, “If you are planning for a year, sow rice. If you are planning for a decade, plant trees. If you are planning for a lifetime, educate people.” This means, for a bright future, there is nothing more valuable than to develop qualified individuals and staffs.

We are now constructing 4 units of the APR1400 reactors in the UAE.

As the first commercial GEN-3 reactor, the APR1400 is currently being evaluated by the US NRC for design certification. And, we believe to receive the Design Certificate (DC) soon.

Moreover, the EU-APR, a customized model for European market acquired EUR certification in 2017.

These achievements cannot be met without exceptional manpower. That is why KHNP is increasing its efforts to develop our employees.

We must secure capable individuals and develop their potential to successfully implement various issues facing our industry.

New technologies such as decommissioning, treatment of high level radioactive waste and safer operation and construction of nuclear power plants are required nowadays.

These valuable knowledges continuously request a workforce development, a cooperation with other countries by sharing its technology and an expertise accumulated through years of experience.

Distinguished guests.

Starting today, an outstanding knowledge will be prepared for you from various presentations and panel discussions.

Through active discussions and knowledge exchange, I hope that this conference will provide a platform to share best practices and gather inspirations.

Also, please take time to visit the exhibition, as well as the technical tours to Saeul Nuclear Power Site on Friday. I would like to express my sincere gratitude once again for your participation, as well as my deepest regard for your good health and happiness.

Thank you.

2.2. INTERNATIONAL ATOMIC ENERGY AGENCY

Mr. M. Chudakov, Deputy Director General and Head of the Department of Nuclear Energy delivered the following statement:

On behalf of the International Atomic Energy Agency, I welcome you all to this beautiful city of Gyeongju, and to our Third International Conference on Human Resource Development for Nuclear Power Programmes.

The IAEA holds major events every year, focussing on various aspects of nuclear power. But I believe the conference we are starting today is quite special. It focuses on the human aspect, the people, you and me. Is there anything more crucial for the future of nuclear power?

Let me start with a few facts:

- Nuclear power provides about 11% of the world's electricity.
- But, this is about a third of the world's low carbon electricity.
- As of today, we have 450 nuclear power reactors in operation in 30 countries.
- 59 nuclear power reactors are under construction in 17 countries, 4 of which are newcomers.

So let's put these facts on one side and let's look into the future:

- Yes, we indeed see a growing interest in nuclear power, especially in developing countries, as part of the future energy mix. But at the same time, our low projections for installed nuclear capacity show a decline through 2030 and 2040, before rebounding to current levels by 2050.
- However, if the Member States want to meet their sustainable developments goals by 2030 and fulfil their climate change commitments by 2050 and beyond, even our high projections are not enough.
- In fact, the current situation is very grim: Today, 70% of the global electricity comes from fossil fuels. If we are to meet the 2°C scenario, we need a radical shift and produce 80% of the world's electricity from low carbon sources. And nuclear, without a doubt, is one such source.
- The current reactor fleet is getting old. There are successful long term operation and ageing management programmes implemented for an increasing number of nuclear power plants... But in the years to come, considerable decommissioning work around the world on power reactors, research reactors, critical assemblies and other fuel cycle facilities is expected... By the way, not only the reactors, but also the workforce is ageing and retiring!
- And add to this, the responsibility of safe and efficient management of radioactive waste!

Now, all these factors, point to a need for special attention to carefully thought, well planned management of the workforce.

No matter how high-tech, automatized and digitized machinery you may have, in the end, you need people to run them. Good people. Skilled people. People who have absorbed the safety culture in their hearts and minds.

As we all know, amidst the stiff competition between high-tech sectors, attracting, and retaining a high quality nuclear workforce is becoming challenging.

So what do we do? The IAEA is world's hub for information exchange of peaceful nuclear technologies.

We support Member States in the development and qualification of the workforce needed for all stages of nuclear power development. Using our human resources planning tools, countries that are embarking on nuclear power programmes, can better estimate the number of skilled students and individuals needed to enter into their future national nuclear workforce. At the same time, we help countries with operating nuclear power plants improve and optimize their training and evaluation schemes. Under our technical cooperation programme, we provide specialized capacity building initiatives, to help foster and develop the future nuclear workforce.

We organize theoretical and hands-on training sessions across the world. We offer review services to help Member States better capture the knowledge and experience of retiring workforce, and transfer it to the next generation. We use research reactors and nuclear power reactor simulators in training future nuclear workforce. We organize schools for entry and mid-level career professionals, as well as for managers, that cover the whole fuel cycle. We coordinate among universities in providing a high level masters degree in nuclear management. Our regional networks, our communities of practice, our distance learning programmes supports the nuclear community worldwide.

Ladies and Gentlemen,

Looking to the future, the IAEA's work will continuously evolve to keep up with developments in the nuclear industry. We are aware of the challenges in training and qualifying nuclear workers. We need to work together with the industry and other international organizations to find innovative ways to deliver performance improvements at a lower cost. These solutions must keep nuclear safety as the top priority.

And at the same time, we need to continue engaging future generations in science, technology, engineering and math. We must make these STEM subjects "cool". As part of our efforts in this area, we have held an international student competition. We asked students from 14 to 18 years of age to present a project that promotes discussion and raises awareness on how nuclear science and technology impact their lives.

We have received 188 entries from 31 countries! Considering that each team had to have at least three members, about 1,000 students have participated in the competition. So interest is there! The finalists are among us, and we will hear from these bright minds later this week.

Dear Participants,

Each day of this conference has a specific theme:

- The theme of day 1 is "Attract, Recruit and Retain a High Quality Nuclear Workforce";
- Day 2 will focus on "Education, Training and Qualification of a Nuclear Workforce";
- Day 3 is dedicated to the "Development of Individuals and Teams within the Organisations";
- and Day 4 will zoom in on "Organisational Culture and the Impact on the Workforce".

We have done this on purpose so that we, the almost 600 participants here, can focus our discussions – because what we need to hear from you are practical solutions to the challenges that we see in maintaining the current, and securing the future nuclear workforce. We will hear from both regulators and operators, as well as newcomers and operating countries – each with unique challenges. But I expect that common ideas will emerge, and these should be shared across our Member States.

Your active participation, ideas, and engagement will help nuclear power to continue to play its role in a healthy energy mix.

I wish you all success during the conference and I would like to thank all of you for your important contributions.

But before closing, I would like express our sincere thanks to the Government of the Republic of the Korea, and to the Korea Hydro and Nuclear Power Company, for hosting this important event in this beautiful city.

Thank you.

2.3. CONFERENCE PRESIDENT

Mr. Y. Brechet, the High Commissioner for Atomic Energy and the conference president then delivered the following opening address:

Dear Colleagues

It is my great pleasure and honour to give the opening address for this conference, and to thank beforehand our Korean hosts and the organising committee for the outstanding work done preparing this conference, and which will, no doubt, materialise in an interesting and productive conference, and hopefully, in new actions and cooperation between the participants.

Beside the pleasure of learning which never decreases within a true scientist or engineer, academic or industry related, I have several specific reasons to consider that this conference is both important and timely. They will be appear as comments on the wording of the title of the conference “Future”, “International”, “Challenges”, “Human resources”.

First, in spite of what some people would like to instil into public perception, Nuclear power is more and more relevant, and when balance between pro’s and con’s is analysed rationally, Nuclear power will most certainly be part of the future energy mix if one takes seriously the issues raised by the problem of global warming. Among the concentrated sources of energy it shares with hydroelectricity, the privilege to be almost totally de-carbonated. Due to the high energy density in nuclear fuel, which is a direct consequence of the magnitude of nucleon-nucleon interaction, the amount of matter needed to produce a kwh is much smaller than most other energy sources. In addition, the reserves of fuel can be expanded by several technologies such as fast neutron reactors. Nuclear power is an important component for the future, as a carbon free energy source, and as a technology using matter in a parsimonious way. Future Nuclear Power is a component of the solutions for a sustainable growth.

Second, in spite of fierce competitions between the various industrial actors, in spite of the variety of commitments of the state in various countries, the future of nuclear energy has to be dealt with at an international level. It is not simply because of the risks of nuclear proliferation, it is because any problem in a nuclear installation at some point of the planet influences the policy and drives industrial evolutions and safety management in all the other places. It is also because the problems of waste management spreads on such large time scales that their treatment in the long term is a question for the planet. It is finally because the studies on nuclear power plants durability, on their efficiency, are expensive, they sometime requires experimental installations that rationality urges to share rather than duplicate. Long term commitment of our economies in Nuclear Power will require enhanced international collaborations, in the academic research as well as in the precompetitive programs.

The word “Challenges” is also important. Nuclear energy is a mature field, with a lot of feedback from many hours of operations. But safety, sustainability, efficiency ,economical relevance, systemic approach for fuel generation, reactor operation and waste management still offer possibilities for improvement, all the more important that the requirements on these systems are steadily increasing. But beside these challenges, in a way “internal to atomic energy”, new challenges appear with the increased penetration of renewable energies on the market. Consequences on economic models are obvious, but technical questions such as manoeuvrability, fuel cladding interactions, cyber security, are as well relevant. Acceptability by the public, for which a prerequisite is an undoubtable integrity, is also a challenge of another style. Indeed the future nuclear will have new challenges to face.

And that brings me to the last word I wanted to attract your attention upon “Human resources”. There will be no future for nuclear energy, and I dare to say, no sustainable growth for the planet if our leaders underestimate the key importance of human resources, if our academics are not strongly committed to train these human resources, if our industries are not convinced that human resources is not a mere list of expertise, but is also a real strategy to have them working together. If you allow a metallurgist of phase transformations to make the parallel, Energy need is the driving force for nuclear power development, Human resources are the kinetic path which make the transformation possible.

Four conference themes will structure the coming days

- Attract, Recruit and Retain a high quality nuclear workforce;
- Education, Training and Qualification of a nuclear workforce;
- Development of Individuals and Teams within the Organisations;
- Organisational Culture & the Impact on the Workforce.

The underlying goal is obvious: Attracting and integrating the next generation of nuclear experts into the industry, and possibly attract the best ones. Promoting a culture of team working at every level is essential.

But in order to recruit, one has to train, and to train individuals both for their rapid efficiency, and their adaptation ability. That requires a careful analysis of the relationship between government and industry to ensure the availability of a qualified workforce. But that requires also a rethinking of relations between academia and industry, and of the role of international cooperation (bilateral and multilateral) in fostering human resource development. These are

These are obvious questions, and of course there are no obvious answers – if there were some, the need for an international conference on the topic would be less clear. But there are a number of ideas, of experience, of difficulties encountered that we are here to share.

In addition, there are other questions which, I think, have to be addressed, if not during the sessions of this conference, but perhaps during the most important period of “coffee breaks”, after sessions discussions, in all the space left by a busy schedule for non-formal discussions. Among the many issues related to human resource development, that could fit this “free space for discussion” several appear of particular importance to me, in spite of the difficulty to formulate them. Let us have a try to a few of them.

As a prerequisite to public acceptability and to political deciders commitment , we have to bring back in a world polluted by “communication laziness” a focus on rationality and action, what I call “Active rationality”: be able to understand in order to decide and act appropriately. How to develop this capacity among young children as well as adults? Most people who press a button and get light have no idea of what it takes to get this result. The issue is “how to give children, through education, the tools necessary to make them become adults who can act as informed citizens able to take rational decisions”. They will be able to escape from intoxication by the media. Trust relies on understanding, not on knowledge, on integrity not on communication. This is the very meaning of the competition organized this year among high school students from all countries.

Education is to be developed as the basis for lifelong learning, not solely aiming at being immediately operational. The present focus of education and training is to make immediately operational, job-ready professionals. Since the world is changing fast and jobs are evolving accordingly, it is also necessary to prepare students to life-long learning. How to combine both objectives?

These two questions are more general than nuclear energy industry. Some other “meta questions” are more specific to human resources in nuclear energy.

Since nuclear safety is a global issue which has to be dealt at the local level, we clearly should aim at harmonizing qualifications and skills training, particularly in the field of safety. Depending on the country, safety files or operations critical to nuclear safety may be handled differently. How to harmonize training on these questions on the basis of best practice sharing?

Security and Safeguard have joined the list of new challenges. There is a growing concern about security and cyber security. Taking into account the fact that this field is the prerogative of each member state, what are or what should be the IAEA's education and training initiatives?

Innovation is becoming a buzzword, which is the worst possible fate for a respectable word. Nevertheless future nuclear energy will need innovation. Research plays an important role in nuclear education and training, particularly for future experts. The number of nuclear facilities such as research reactors, hot labs, large test loops, is limited. The ICERR initiative by DOE in the United States allows sharing of these large facilities for training and research. How can we spread this idea at the international level?

I claim that one of the problems of nuclear energy in its relation with society is the times scales involved in any decision process. Entering into the "nuclear family", or leaving it, or changing of global strategy for fuel and waste management implies decisions spreading decades of action, far beyond the usual time scale of political responsibility, far longer than the activity period of the actors. By nature nuclear commitment is trans-generation. Some projects in nuclear industry are even more extended over time. For instance the nuclear waste storage projects. These long-term projects and very long term operations present considerable challenges in terms of Knowledge Management beyond the century.

I hope you will forgive me for this rather long opening address, first commenting the title, then the explicit content of the program, and finally suggesting questions which are not explicit in the program.

I wish you a fruitful conference, vivid discussions, and a productive week.

3. SUMMARY OF SESSIONS

3.1. SESSION 1: ATTRACT, RECRUIT AND RETAIN A HIGH QUALITY NUCLEAR WORKFORCE

This session covered the following topics:

- 1) Workforce planning techniques, models and practices, including case studies of best practices and lessons learned in workforce planning for new build, operations and decommissioning;
- 2) Methods of attracting high quality personnel to careers in the nuclear industry, including examples of successes and challenges that have been overcome, instruments to support 'pipeline feeders' and next generation links;
- 3) Recruitment and selection strategies, techniques and processes to help overcome the challenges in the current recruitment climates; and
- 4) Accessing the global nuclear talent pool and multinational workforce challenges, retention strategy, techniques and practices, including use of different employment contract models and flexible contracts that attract part-time workers and nuclear industry retirees.

Key points from this session included:

- The critical challenge is getting the right people at the right place at the right time.
- The nuclear workforce is evolving with the industry – workforce ageing and retiring, plant ageing, more mobile, technologies changing, people learning in different ways.
- People are learning in new ways and the industry must embrace these new learning models.
- Education, research and innovation should be more closely integrated.
- Individuals should have knowledge, skills and abilities needed to perform their duties. This includes both qualifications and competence.
- Onboarding and induction training is an important component of individual development.
- As we live in a more and more connected society, we should take advantage of today's networks and communications systems to help young people gain a better appreciation of the positive contribution of nuclear energy.
- Attracting the next generation of the nuclear workforce will require the industry to "win the hearts and minds" of the youth population.
- Ensure continuation of science, technology, engineering and math programmes in grade schools to foster interest in nuclear technology and related fields.
- Public perceptions of nuclear energy are not improving, and actions are needed now to educate, attract, and retain the next generation of nuclear workers.
- Identify opportunities and tools to engage young people, down to the primary school level, and educate them about the societal, environmental, and technological aspects and benefits of nuclear energy.

- Government support for human resource development is critical, and active intervention may be required.
- Leadership development programmes are important to support individual development and career progression.
- Diversity of the nuclear workforce should be strengthened, especially in the area of gender.
- Silos in the nuclear power industry exist, in some cases for good reasons, but should be further examined for spanning opportunities and enhanced education approaches.
- HRD for regulatory bodies requires the same level of focus and development as nuclear operating organizations.
- Self-assessments may lead to learnings which are not expected, but may prove very useful.
- Benchmarking opportunities for HRD for regulatory bodies should be considered, where appropriate.

3.2. SESSION 2: EDUCATION, TRAINING AND QUALIFICATION OF A NUCLEAR WORKFORCE

This session covered the following topics:

- 1) The importance of educational courses to develop and support the nuclear workforce;
- 2) Modern developments, including ‘co-operation’ in initial and continuing training and qualification programmes for a nuclear workforce;
- 3) The role of future innovation and technology in nuclear education and training — opportunities and challenges;
- 4) Authorization, licensing and accreditation requirements for the future nuclear workforce;
- 5) Role of knowledge management and transfer across the HRD life cycle and understanding the challenges of task based vs knowledge based worker programmes;
- 6) Effectiveness of the training programmes in driving performance improvements and the question of ‘return on investment’; and
- 7) The role of the nuclear instructor and trainer — models and activities.

Key points from this session included:

- There is a need to consider the changing landscape of nuclear with consideration to education and knowledge management.
- Training programmes should be established early and may need to be adapted for use by the operating organization.
- Education is about preparing people for a generic role e.g. nuclear engineer – but training prepares individuals for specific roles.
- It is important to have a common language for communication, especially early in the development of training programmes.

- Training practices should be periodically reviewed for improvement opportunities.
- Secondary school students appear to enjoy hands-on learning experiences with radiation science, and this creates an opportunity to develop new approaches to capacity building.
- Education and training programs for regulatory bodies must keep up with developing technologies, both for 1) applications that are being deployed by the operating organizations and 2) for training and educational tools.
- Human performance has generally been improving, but complete error-prevention has not yet occurred. Consider opportunities and methods to further improve human performance.
- Qualifications are important, but should be linked to competence.
- e-Learning approaches to education may be a cost effective approach to delivering high quality education content using international instructors at lower costs.
- Nuclear security education is a global issue, and the IAEA has a charter to continue to enhance and support education in this field.
- IT security training is unique, and impacts almost all staff at regulatory bodies and other nuclear energy organizations, and must be considered a key part of any educational and training program.

3.3. SESSION 3: DEVELOPMENT OF INDIVIDUALS AND TEAMS WITHIN THE ORGANIZATIONS

This session covered the following topics:

- 1) Managing employee engagement, recognising and rewarding individuals or teams;
- 2) Ensuring effective teamwork, both internal to the organization and with suppliers and contractors;
- 3) Developing leaders to provide positive coaching when setting and communicating organizational values, ethics and standards; and
- 4) Effective career development for a nuclear worker life cycle.

Key points from this session included:

- The Systematic Approach to Training is still universally recognised as one of the best models for training in the industry.
- While each organisation is unique journey, there are many HR factors that are similar e.g. workforce planning, knowledge management and individual and team development.
- It is important to develop strong partnerships between schools and universities to create interest in science, technology, engineering and mathematic subjects and nuclear careers.
- Language differences can create barriers to learning and development, and unique solutions must be sought.
- Career development paths are important to show individuals how they can progress through the organisation.

- It is necessary that people understand the leadership development options available to support them during their career choices.
- It is important that individuals understand how their colleagues are different in terms of their behavioural traits and how they can adapt their own behaviours accordingly.
- Existing standards and training approaches are subject to review and potential improvement.
- Continue to develop the Nuclear Energy Capacity Building Hub and seek feedback from users and Member States for potential improvements.
- Some Member States' educational programs are still limited in terms of available resources for capacity building for nuclear energy programs, including some with operating NPPs.
- Recognize that Agency tools may be applied in innovative ways, and this should be encouraged and supported wherever possible.
- Member States' continue to need support from more advanced countries relative to Safeguards and the Agency needs to frequently monitor these conditions.

3.4. SESSION 4: ORGANIZATIONAL CULTURE AND ITS IMPACT ON THE WORKFORCE

This session covered the following topics:

- 1) Establishing a learning culture within organizations;
- 2) Workforce performance and monitoring for performance improvement, identifying performance gaps and their underlying causes;
- 3) Anticipating future staffing, competence and performance needs for the right organizational culture;
- 4) Fitness for duty — requirements for a nuclear workforce;
- 5) Leadership and culture for the nuclear sector
- 6) Organizational culture that sustains operational safety and security; and
- 7) Human performance tools and techniques.

Key points from this session included:

- A newcomer organization should begin defining and focusing on organizational culture from the very beginning, starting as soon as the organization is formed.
- Organizational culture subsumes nuclear safety culture, and the construction organization must also focus on nuclear safety culture – and it is not separate from the requirements of nuclear safety culture.
- The construction organization must ensure that all work is done according to specification and in accordance with quality standards to ensure that the operating organization can safely operate the NPP.

- The assessment of an organization's culture requires a methodology that uses a combination of tools (confidential surveys, confidential interviews, observations, etc.) to ensure that a holistic view is achieved.
- Organisations benefit from a questioning attitude to ensure a strong safety culture.
- The effectiveness of the overall training program is assessed through the training committees- there is an assessment at each level of training, as well as a suite of key performance indicators.
- In order to optimize knowledge transfer, people are recruited early enough so they can shadow experienced workers and also capture experienced workers doing specific tasks on video with narration.

3.5. KEY ISSUES AND LESSONS LEARNED

- An integrated approach to education is needed to ensure we understand priorities, and allocate resources accordingly. The approach should also be integrated with workforce planning and other key HR activities and requires a long-term planning horizon.
- Recognise the important role of knowledge management but also need to understand that this is cyclical in terms of generational movements.
- Use of a common language is very important for standardisation, as well as to ensure effective, efficient communication.
- Early establishment of training programmes is important, including nuclear familiarisation programmes.
- Centralized storage and dissemination of important information helps to foster international cooperation and Member States' development.
- Recent technological advances are rapidly being used to develop innovative approaches to education and training (e.g., social media and eLearning), and should always be under consideration for use by IAEA to support to its Member States.
- Raising awareness of regional and international major projects which are ongoing, so countries can work together and not independently.
- There is a need to ensure that the quality of the nuclear supply chain is consistent with the standards required by the industry.
- IAEA should consider disseminating international approaches to HR development in regulatory bodies to share with Member States embarking on new nuclear power programmes.
- IAEA should consider working with Member States to identify educational needs and coordinate support for the next generation of the nuclear workforce.

4. SUMMARY OF INTERNATIONAL NUCLEAR MANAGEMENT ACADEMY (INMA) FORUM

Facilitated by the IAEA, INMA provides a framework to support the establishment and delivery of Master's courses in the newly defined discipline of nuclear technology management (NTM), which can provide the spectrum of competencies required for managerial roles in the nuclear industry. The competencies have been categorized into four Aspect Groups of external environment, technology, management and leadership with guidelines given for the required number of hours of study for each Aspect Group in an INMA endorsed NTM programme.

Introduced and chaired by Mr. J. Roberts from the University of Manchester, UK, the forum showcased the courses that have already been established and gave further information on how universities can develop their own NTM programme and the endorsement process that is required for full member status of INMA. Summarising their own university's programme and including more details on how the competencies in each of the Aspect Groups are taught were:

- Alyona Solovyova and Daria Iurshina from the Moscow Engineering Physics Institute, Russia;
- Joe-Nimique Cilliers from the University of the Witwatersrand, South Africa;
- Robert Zedric from Texas A&M University, USA;
- Shota Ueda from the University of Tokyo; and,
- Chang Liu from Harbin Engineering University, China.

After the presentations, there was a question-and-answer session to discuss further aspects of INMA and NTM programmes. Universities that are interested in establishing an NTM Master's programme and joining INMA are encouraged to contact the Nuclear Knowledge Management section of the IAEA.

5. SUMMARY OF INTERNATIONAL STUDENT COMPETITION

5.1. INTRODUCTION

One of the challenges of the lifecycle of the human resource in the nuclear field is attracting and recruiting talented individuals. To foster the younger generation's interest in nuclear science and technology, the IAEA organized an international student competition held in conjunction with the conference.

Students (aged 14-18 and currently enrolled in secondary schools) were invited to present a project that promoted discussion and raised awareness of current or future impacts and applications of nuclear science and technology in their lives.

5.2. SELECTION CRITERIA

Approximately 200 teams submitted project abstracts, which were evaluated against the following criteria:

- *Accuracy and completeness* – does the abstract contain complete and accurate information on nuclear science and technology?
- *Innovativeness* – does the project introduced in the abstract contain innovative, original ideas?
- *Relevance* – does the project idea meet the objectives of the competition, which is to “promote and increase awareness of nuclear science and technology in their local communities?”
- *Potential impact* – is the project anticipated to have a significant impact in local communities in promoting discussion and/or increasing awareness around nuclear science and technology?

In the end, 25% of those projects that met the outlined criteria best were selected for the next round of the competition.

5.3. FINALIST SELECTION

Short-listed teams submitted videos (or digital media presentations) of the project implementation. Using the following criteria, the IAEA and the conference committee selected five finalist teams to present their project at the conference in Gyeongju:

- *Accuracy* – does the project demonstrate technically accurate information on nuclear science and technology?
- *Innovativeness* – is the project implemented in an innovative manner? Does it use social media and/or new ways of learning to support its implementation? Does the project use original content?
- *Clarity* – does the project communicate the benefits of nuclear science and technology in a clear manner?
- *Impact* – did the project impact the community as demonstrated through verbal testimonials or evaluations?
- *Sustainability* – is the project something that could be sustained by the community or implemented again in the future?

5.4. PROJECTS OF FINALISTS

The five finalist teams included:

1. Generation Z for Nuclear Development (Hungary)
2. Fukushima High School (Japan)
3. KuBest Smart Innovation Team (Malaysia)
4. Team Pareto (Republic of Korea)
5. Alliance Dr. Olga Mohan High School (United States of America)

The final video presentations of the projects are included on the attached CD-ROM.

5.5. WINNER SELECTION

The finalists presented their projects at the Third International Conference on Human Resource Development for Nuclear Power Programmes on Tuesday 29 May in Gyeongju, Republic of Korea. Each team had ten minutes to introduce their project and present video. In addition to this, a jury of experts was invited to ask questions to each team about the work carried out during the project implementation. The team KuBest Smart Innovation Team (Malaysia) was awarded first prize in the competition and Team Pareto (Republic of Korea) was awarded runner up.

6. CLOSING SESSION

6.1. CONFERENCE PRESIDENT

At the final plenary session, Mr. Y. Brechet, the High Commissioner for Atomic Energy and the conference president then delivered the following closing statement:

Before I get into my closing remarks I would like to take this opportunity to thank the government of the Republic of Korea and the Korea Hydro and Nuclear Power Company for the hosting of this conference, all of the conference organisers and support staff, all of the speakers and you as participants and the young students for ensuring such a successful conference.

First, I would like to stress the quality of the conference, both in the presentations, and in the round tables and the questions and answer sessions. In such a topic as “human resources” (but indeed in any topic treated with the aim of understanding) one benefits from the presentation of the success, but also from sharing our difficulties. It is the only way to make progress. It is the way which was infusing most of the conference.

The very first key issue to be made to the IAEA Member States, unambiguously, is that, indeed, the nuclear industry is a mature field and that any rational approach to possible reduction of greenhouse gases has a non-negligible contribution of nuclear energy in the electric mix. In addition, since electrification of economy is certainly one of the most promising strategies, the previous statement becomes even more relevant. And finally, if electrification of the economy is a driving force, and if greenhouse gas reduction is a goal that we take seriously, not only we will have nuclear energy, but we will have a massive need for nuclear energy which will require technologies to make better use of natural resources, more sites to implement plants which will require a renewal in the public acceptance, a coherent view on fuel cycle, reactors, waste management and storage. The future nuclear will have to be safe, secure, competitive, innovative and accepted.

You may wonder why I start my concluding remarks by this vibrant plea for nuclear energy as a necessary contribution to a strategy for sustainable development. First, because it is true, and because this truth has been steadily undermined in recent years with no respect whatsoever for what science teaches us. That has led to a negative attitude which is the worst enemy of public interest in this field. Facing the dangers of climate change is more important than “looking cool” in mundane dinners.

The very first recommendation to attract young engineers to nuclear industry is that nuclear industry has to be both proud of its achievements, and humble in front of a technology which is not forgiving. Governments should listen to what they have to know rather than to what they are willing to dream, and act in a responsible manner. It is perfectly clear that Nuclear will be needed, but in order to be creative and safe it needs to attract talented young professionals. That will be the case only if there is an explicit and shared strategy, expressed at the highest level by the governments, the industry and able to motivate the academies to train the best students.

The time for ambiguity is over, we can no longer afford procrastination. The need to attract a new, enthusiastic generation is clear, and the existence of a long-term commitment of authorities and of large projects from industry is a prerequisite to have a proactive “human resources” policy. Nuclear energy cannot afford to attract second rank professionals: it needs the best ones, it needs to give them a sense of duty, a feeling of pride, and a culture of humility.

Beside this preliminary statement, each of the underlying requirements has a counterpart in education and training.

The increasing acceptance of the general public requires education of the general public and raises the question of a scientific education for everybody.

Increasing efficiency and safety will mobilize a new generation of engineers, perhaps more familiar with computer simulation and data analysis, and able to be both nourished by experience and reactive to new challenges.

Developing innovation will request to bring back to this engineering science, via long-term projects, academics from many different fields. Decommissioning and safety and security are a necessity, but they can't be the only highlights to trigger innovation and scientific research.

From primary school to PhD, all levels of education will have to be involved in preparing the future of nuclear energy. Let us consider the three levels of involvement required.

First, attracting children to science as a path toward public understanding.

Nuclear energy is not unique in this respect: the attractivity of science and technology to children is no longer a self-evident truth. Technology is taken for granted, and for children who like to be involved in action, it seems that gadgets are more attractive than large industrial objects. We do have to interest them, and not simply to entertain them, we have to give them the taste for "knowledge for knowledge" and for "knowledge for action", for science and for technology, and that requires a direct contact with people active in the field. The member states and nuclear industry should be involved, together with other "classical industries", in "hands on experiments" to reinstall the feeling I had while reading Jules Verne: "I myself can be an engineer". It is an involvement of any worker in nuclear energy industries to contribute to the interest of the children, to the information of their professors. When a child enters a "turbine room" of a nuclear power plant, his smile and twinkling eyes tell you that the flame of technical curiosity is not over. When professors talk with true engineers, they understand what journalists are unable to understand: trust can come from competence. The presence on web social networks can help fighting disinformation by its own weapons, but it is a counter-fire, and if "reaction" may shake the construction of lies, it does not built trust. Trust is a matter of people face to face, eyes in eyes meetings. My second recommendation will be: bring back trust in nuclear energy for the general public is not a mere communication issue, it is a direct human contact between children and future citizens, and responsible engineers and technicians which will reconstruct it. And again it is a question of education. The student competition we have witnessed in this conference was a very efficient strategy to induce "nuclear awareness" to the high school students. Such experience should be made available by IAEA on a website and on social networks.

From qualification to competence

Nuclear energy will have to be safe, secure, competitive, and trustworthy. That requires excellent engineers and technicians, and that requires training them and training them all along their life.

It is all the more necessary that the current professionals are ageing, that both engineering and science are in rapid evolution, and that the general pattern of energy policies is evolving bringing new challenges for nuclear energy.

That means that we will have to trains engineers to designs the devices, engineers, and technicians to operate the device, engineers and technicians for decommissioning and waste management, and finally, regulators and experts which have to be competent in all the three issues above.

Training should be carried out for the main industries and regulation authorities, but also for all the supply chain. Training should rely on a strong foundation in basic engineering sciences: designing a nuclear plan can't be "quick and dirty", this technology is not forgiving. Regulation can't rely on authority only: one can apply efficiently only the regulations one understands at depth. It would be appropriate, among all the various existing networks, and respecting their specificities, that the member states agree on harmonizing the "non-negotiable technical skills" for a given level or responsibility, both in the plant designers, in the plant operators and in the regulators.

A very important point was made about the road from qualification (i.e. the diploma) toward competence. Competence takes time. The managerial evolution in a career should not be the “ultimate Grail” for young engineers. They should be proposed an attractive career path in which they could be encouraged to widen their technical skills rather than to forget them in upper spheres. As far as competence is concerned, depth and breadth are not incompatible, but competence and hastiness are.

Nuclear energy is becoming more and more an international business. Any successes benefit to the image of the community, any failure, being technical, economical, or accidental, damages everybody. This “sharing of consequences” is a continuing challenge for this industry. We have to live both in a very competitive world and be aware that everybody’s situation will be influenced by everybody’s success or failure.

I am not sure all the consequences of this new situation have been fully integrated in the minds of the community. We have to be responsible to the world: because nuclear energy is necessary for sustainable development, the sharing of best practice at the international level is absolutely necessary, within the constraints of competition between industries, respecting independence of regulation authorities, and sovereignty of each state.

We have to think of practical ways to develop this sharing of best practice, via student training periods, by professionals meetings or joint projects. It is not an “irenic” thinking in my mind, it is a prerequisite for a long-term development of nuclear energy: we, as a community of responsible scientists, engineers and citizens, can’t avoid the fact that we will succeed together or fail together. I think the IAEA has an important role to play enabling setting up harmonized competence frameworks and creative route to international collaboration.

From competence to innovation

I started my opening remarks outlining a number of innovations necessary if nuclear energy wants to fulfill its historical mission: a better use of resources, a better management of the wastes, a more efficient method to reach innovative design. Of course innovation can come from a close interaction between industry and academia and that should be supported and valued in a career. And certainly the IAEA should continue to encourage large research projects to maintain and develop the core competences underlying innovation.

But I would like to stress also the role to be expected for new emerging technologies.

Science and technology moves on. Nuclear energy was for a long time at the forefront of technical and scientific innovation. It is no longer the case.

The reason is two-fold: since this technology is unforgiving, evolution is necessarily slow; since any decision commits a community on many decades, it should take time to implement it.

This specific timescale has led nuclear energy to develop somewhat in isolation, the information flux being more from nuclear energy toward other fields, rather than incorporating in nuclear energy progresses in industrial culture or technical innovation from other fields.

On the opposite, new technologies are rapidly evolving: new sensors, mass data mining, High Power Computing. That will be my third line of recommendation. Nuclear energy should be more open to other industrial fields. The competences coming from new technologies such as Artificial intelligence, new manufacturing technologies, computer simulation of ageing processes, should be developed in close relation with academia which are already involved with other industrial fields. That is also part of the general plan of “making nuclear attractive and trustworthy”.

While keeping in mind the specificities of the nuclear field, we have to prove that we can be innovative and benefit from emerging technologies. And we have to prove once again the seriousness of our field by keeping away from buzzwords, and having a real commitment for well-defined goals.

General comments: toward a nuclear culture

I would like to make a last point which is appearing underlying the whole conference: at its best, and in spite of some of its failures, nuclear energy has a deep engineering culture: team working, responsibility, and rush aversion. This may be obvious to you, but it is not obvious to the world.

We live in a world always in a hurry. Taking the necessary time is felt to be a sign of conservatism. “Rush aversion” is not an excuse for project which take forever to be completed, it doesn’t mean that this industry is averse to being competitive, it simply means that we don’t have the right to make an ill constructed decision, we don’t have the right to disregard competence, we don’t have the right to sacrifice engineering ethics to the need to arrive first. Nuclear energy needs time because it feels strongly its responsibility, and because the decisions we are taking now will involve the life of our children and grandchildren. Rather than apologizing for this, we should state to the world, and to the new generation to come, that this respect for the time necessary to do thing properly is part of our culture, and an essential one.

We live in a world which is thoroughly egotistic and centered on the individual. Bill Gates is the embodiment of computer mass production, Steve Jobs is the embodiment of “cool information technology” and Zuckerberg is social networks. I would like you to think over this “tycoon centered” view on technology. Could any of you name the inventor of the plane, of the train, of the car? No. For the simple reason that there are none. Or rather, they are many. Each of these major industrial adventures were the results of some remarkable individuals, but above all the result of a long and productive team work, of positive competition between these teams.

Nuclear energy is a teamwork and should be presented for that: it is consubstantial to the complexity of the topic and to the responsibility we have to society. And in spite of the propaganda for the “individual who saves the world” of which the “Maskmania” is a symptom, Nuclear industry should claim teamwork as one of these assets.

These are my thoughts after a very interesting conference. As you may have guessed, I have enjoyed it thoroughly. I think building human resources in a responsible manner will contribute greatly to a feeling much more important than “public acceptance”: it will bring “public understanding”. And to increase the chances for success, it is crucial to understand than “Human resources” is not simply a resource, it is an investment.

6.2. INTERNATIONAL ATOMIC ENERGY AGENCY

On behalf of the IAEA, Mr. S. Mallick provided the following closing remarks:

Ladies and gentlemen,

An intensive week is about to end. As Juan Carlos Lentijo, the IAEA Deputy Director General and Head of the Department of Safety and Security, cannot be here today, I have been tasked with delivering closing remarks on his behalf. He extends his greetings to you, and he looks forward to hearing about the ideas and practical solutions discussed to meet the human resource development challenge generated at the conference.

I will not attempt to describe what we have achieved during the conference. It is too early to summarise our achievements, as we need time to digest and reflect to distil the true impact of this conference.

After all, a speech that captures a conference with more than 500 participants from 62 countries and six international organizations taking part in 12 plenary sessions, four panel discussions and many interesting side events would be far too long for even the most enthusiastic of audiences.

Remarks that are brief cannot give justice to the new contacts that have been established, the many exchanges of ideas that have taken place not only inside our meeting halls, as well as in the hallways, over meals or over coffee.

Ladies and gentlemen,

I would like to highlight just a few of the useful ideas that have been raised during our meeting.

- We have heard that good measures to attract, recruit and retain a high quality nuclear workforce include engaging with educational establishments such as schools, colleges and universities. Partnerships that encourage children at the earliest possible age to take an interest in science, technology, engineering and mathematics – subjects often referred to as STEM – also are beneficial.
- When it comes to education, training and qualification: many countries and organisations have established frameworks and programs - each country is undertaking its own journey. Still, there are networks to share ideas that can help Member States tackle the challenge of maintaining high standards as they develop the next generation of engineers and scientists.
- To develop individuals and teams within organisations, we heard about the important role that managers and leaders play in developing projects that encourage their teams to work together. We also heard about the importance of communication and its role in building positive team cultures and improving team effectiveness.
- Organisational culture was emphasised as important for safety, security and performance, and in this regard, leadership is key. Having a strong safety culture also contributes to effective communication and management. It was noted that diverse teams perform better.

There are many more examples that I will not list now, that I am sure you observed throughout the week.

I would like to congratulate Malaysia and the Republic of Korea, the winners of the international student competition. I was much impressed by their entries, as I was by all the finalists. Their enthusiasm and vigour make me optimistic for our collective future.

Ladies and gentlemen,

This conference and its predecessors highlight that international cooperation – as fostered by the IAEA – is key in our field. We tackle challenges more easily together. Though countries have different contexts and challenges, international cooperation helps everyone.

This conference has been an excellent cooperation opportunity.

I would like to thank the conference President for his guidance throughout the conference and for his excellent and passionate summary.

I would also like to extend the IAEA's warmest thanks to the Government of the Republic of Korea and the Korea Hydro & Nuclear Power Company for their excellent hosting of this meeting.

I would like to note our sincere appreciation to the following individuals from KHNP:

Moo Hwan Seo; Ryan Kim; Younghee Ko; Sebin Cheon; Syngryong Lee; Youngmi Oh; Dongmin Park; William Ham, as well as all of the staff of the professional conference organizer, UNI-ONE.

I thank all of the speakers for helping to making the conference such a success. I also would like to thank the organizers and sponsors for the side event, exhibitions and conference breaks. I would especially like to offer our collective thanks and gratitude to our Conference Service Staff – Martina Neuhold and Martina Khaless for their outstanding professionalism and organization, the entire Conference Committee and our rapporteur, David Palmer.

And finally, I would like to thank all of the participants. Your active engagement during the conference made it a dynamic event that will help improve global efforts to solve the human resource development challenge now and in the future. I wish you a safe journey as you return home.

Thank you.

7. CONFERENCE STATISTICS

The Third International Conference on Human Resource Development for Nuclear Power Programmes held in Gyeongju, the Republic of Korea, from 28 to 31 May 2018, brought together experts to share ideas and new approaches to recruiting, attracting, and training workforce for the needs of nuclear energy programmes all over the world.

In total 528 participants from 62 Member States and six organizations participated in the conference. Out of them, seven participants were keynote speakers with presentations in the plenary sessions, 48 participants were speakers in the main sessions, and 65 participants gave short interactive presentations. Additionally, 13 companies participated in the exhibition of the conference.

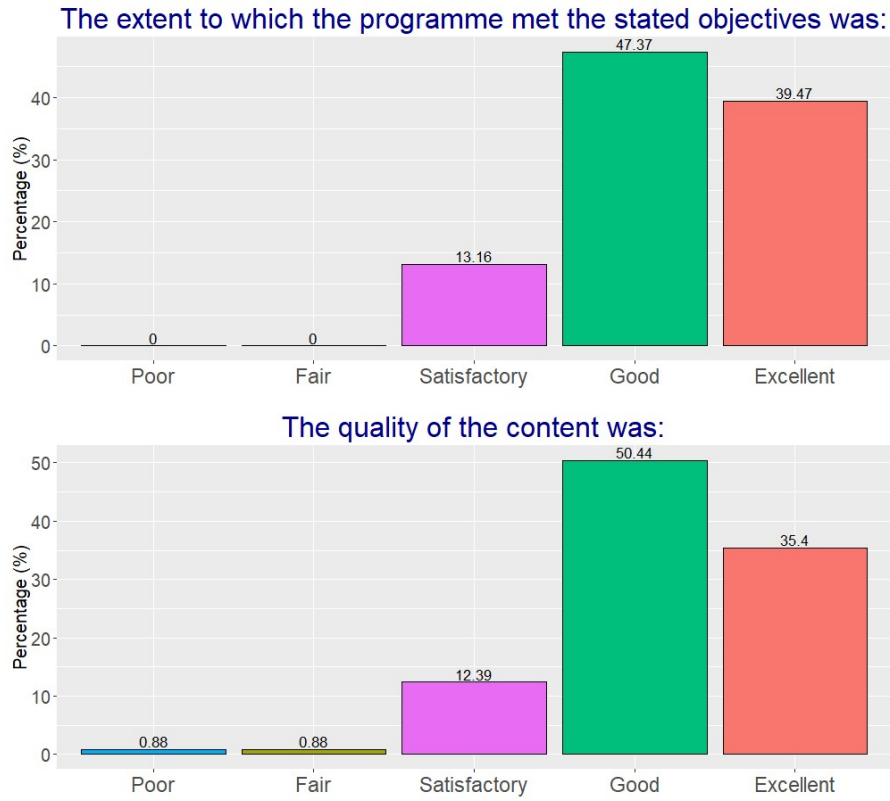
180 speakers gave presentations in three keynote plenaries, 12 main sessions, eight interactive presentation sessions (IAP), and three plenary panel discussions. Notably, 40% of all speakers and presenters were female, providing a good gender balance to the conference, which was an objective of the IAEA's organizing committee. The main sessions considered the key challenges of human resource development for nuclear power programmes from the perspective of both regulator and operator. In addition to this, four side events covering topics such as strategies of nuclear workforce planning, engagement of youth with nuclear, and national experiences in the human capacity building for nuclear power programmes were organized to extend the main conference programme. Moreover, the programme was also supplemented by two special events, namely, International Student Competition and International Nuclear Management Academy (INMA) Forum.

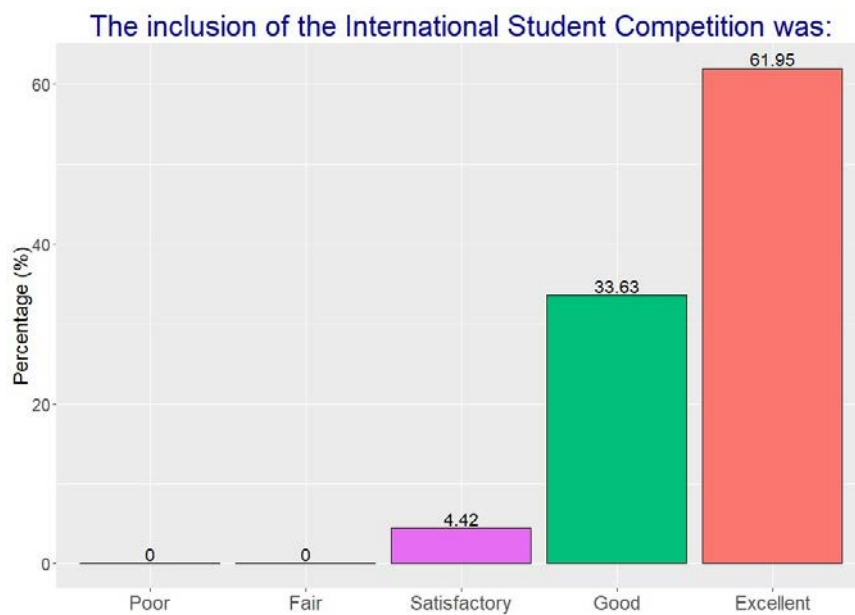
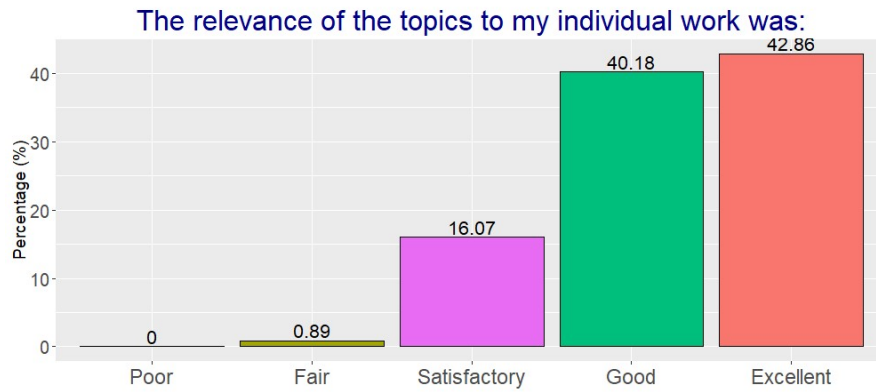
Finally, approximately 100 participants took part in one of two technical tours, either a visit to Saeul Nuclear Power Site (Shinkori 4) or Doosan Heavy Industry on June 1.

8. PARTICIPANT FEEDBACK

After the conference, participants were asked to fill out a survey to provide feedback on the conference organization, programme, presentations, etc. According to the survey data, the participants evaluated the conference positively, and also provided valuable comments for future conferences.

The feedback is presented below:





Finally, the participants included considerations for future conferences. The key proposals for the future work include the following:

- to organize a session with the focus on the newcomer countries;
- to highlight innovative practices in HR for nuclear power programmes;
- to re-emphasize the organizational culture concept at the next conference;
- to extend the time for the IAPs;

- to continue supporting the youth initiatives and encourage their engagement with the nuclear science through such activities as International Student Competition, INMA Forum, etc.

9. CONFERENCE SECRETARIAT AND PROGRAMME COMMITTEE

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