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INPRO – Moving into a Third Decade of Innovation Relevant to Nuclear Materials Handling

Brian Boyer, Francesco Ganda, Maxim Gladyshev, Hussam Khartabil, Andriy Korinny, Vladimir Kuznetsov, International Atomic Energy Agency

ABSTRACT

The International Atomic Energy Agency (IAEA) established the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) in 2000 to contribute to creating sustainable nuclear energy to meet the energy needs of the 21st century. Now INPRO is entering its third decade of existence with the goal of adapting its mission to future nuclear industry and global outlooks on environment, energy, and technical progress. The primary objective of INPRO is to support Member States in their long-term planning for deploying sustainable nuclear energy systems. The project provides direct support related to advanced and innovative nuclear energy system (NES) scenario modelling, analysis and sustainability assessment applying the INPRO methodology. INPRO assists its members in decision-making and capacity building on innovations and long-range planning for NES in view of the decades long commitments and obligations involved. INPRO services and collaborative projects are contributing to Member States' long-term planning for deploying sustainable nuclear energy. The INPRO global scenarios task provides scenario modelling, comparative evaluation of energy system and scenario alternatives, economic analysis, and road mapping through various INPRO tools available for use by IAEA Member States. These have been validated on various cases already that include large reactors deployed in typical electric grids. INPRO now will be working to take these tools and provide them for analysis with the deployment of SMRs in the grid including analyzing SMRs in hybrid energy systems, co-generation, and non-electric power uses such as process heat to produce hydrogen. INPRO also sponsors Dialogue Forums for experts to share ideas on developing sustainable nuclear power and is building educational networks and opportunities with governments and universities around the world to bring INPRO tools into the hands of nuclear technology holders and nuclear power and technology users in emerging nuclear power lands. INPRO is finishing revising its evaluation INPRO Methodology accounting for experience in the first two decades of INPRO. INPRO's work in support of the above tasks includes initiatives in proliferation resistance, transportable nuclear power plants, fuel cycle assessment, cooperation on the backend of current and advanced the fuel cycles for advanced reactors, and involvement with Safeguards by Design and the GIF Proliferation Resistance and Physical Protection Working Group. These initiatives show that part of INPRO's work is a cross-cutting nuclear material management effort.

INTRODUCTION

The International Atomic Energy Agency (IAEA) established the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) in 2000 to help ensure that nuclear energy can sustainably meet the energy needs of the 21st century [1]. At present, 42 IAEA Member States and the European Commission are members of INPRO with Ghana becoming the newest INPRO member in 2021. It should be noted that the INPRO Member States represent over three quarters of the world´s population and GDP as well as 90% of the global nuclear electrical capacity. INPRO brings together this spectrum of nuclear technology holders and users as the foremost cross-cutting and forward-looking activity in the IAEA evolving and adapting to the changes in the nuclear industry and global energy milieu which can be seen in the changes in its programmes in the last two years.

INPRO endeavours to look at important sustainability areas and focus on these issues for new nuclear reactor designs and the entire nuclear fuel cycle needed to provide new fuels envisioned for future reactors, as well as handling wastes from the innovative reactors with recycling or direct disposal and integrating these designs into the present technological base. Some of the future reactor designs such as advanced light water reactors and liquid metal fast reactors including mixed-oxide (MOX) uraniumplutonium fuels have extensive databases for design and operation and existing infrastructure that make extrapolating these advanced designs into a nuclear energy system a simpler exercise. However, others such as molten salt reactors, fuel cycles based on uranium-233/thorium and advanced pyroprocessing recycling as well as using light water reactors in transportable nuclear power plants explore concepts with less operational experience, a need for intense research development and demonstration (RD&D) as well as having a lack of fuel cycle infrastructure already in place, and institutional regulations and structures needed for making these nuclear energy systems workable. INPRO's challenge has been to create studies and tools to look at the range of nuclear energy systems proposed and pinpoint sustainability issues early on to provide planners and designers some guidance to create and choose the optimal system for their needs.

The Member States look to INPRO to provide guidance to build sustainability into their nuclear programmes. Since its inception, INPRO focused on sustainability. From the United Nations Brundtland Commission Report (1987) [2], "Our Common Future", INPRO embraced the Brundtland Commission definition of sustainable development: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition contains within it two key concepts:

1. The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
2. The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

This definition of sustainable development advocates a three-part test of any approach to sustainability and sustainable development: 1) current development should be fit to the purpose of meeting current needs with minimized environmental impacts and acceptable economics, 2) current RD&D programmes should establish and maintain trends that lead to technological and institutional developments that serve as a platform for future generations to meet their needs, and 3) the approach to meeting current needs should not compromise the ability of future generations to meet their needs. The Brundtland Commission felt that nuclear power had seven key sustainability issues:

1. Proliferation risks
2. Economics
3. Health and environment risks
4. Nuclear accident risks
5. Radioactive waste disposal
6. Sufficiency of national and international institutions (with particular emphasis on intergenerational and transnational responsibilities)
7. Public acceptability

Furthermore, INPRO over the past 20 years shifted its programmes to the changes in the energy outlook, economics of power generation and focus on sustainable clean energy that have brought us to 2021. The present INPRO programme strives to link its efforts in nuclear energy sustainability into the 17 United Nations (UN) global Sustainable Development Goals (SDG) adopted by all UN Member States in 2015 [3], shown in Figure 1. INPRO believes that affordable and clean energy (#7), industry, innovation, and infrastructure (#9) and climate action (#13) can be inseparable pieces for a sustainable nuclear power system. There is support for innovation in reactor types, fuel cycles, institutional approaches to nuclear power, sustainable development, national strategic and long-term planning and development and provision of tools and services. From the early days of INPRO a holistic approach created a coherent sustainability evaluation methodology. INPRO assesses the six areas of environment [4,5], safety [6], proliferation resistance [7], waste management [8], infrastructure [9], and economics [10]. This six-point INPRO methodology, shown in Figure 2, reflects the Brundtland Commission goals and the UN SDGs in many aspects. The IAEA created the INPRO methodology using broad philosophical outlines of the concept of sustainable development as the tool for assessing the sustainability and sustainable development of a nuclear energy system. The INPRO methodology starts with basic principles and user requirements to develop evaluation criteria with indicators and acceptance limits.

Figure 1. UN Sustainability goals

Figure 2. INPRO Assessment Areas

This paper intends to show the six INPRO assessment areas not only matured over the first 20 years but have in the last few years expanded the innovative and creative reach of INPRO. A key part of this maturation of the INPRO methodology is the focus on providing tools and outreach in global scenarios and innovations to integrate with the needs of the Member States to analyze a Nuclear Energy System (NES), the missions of the rest of the IAEA, and other power sources such as renewables and fossil fuels in the energy grid and in non-electric power uses such as district heating, hydrogen production, desalinization, and energy storage. The present INPRO structure consists of four tasks and a special project:

- Task 1 – Global Scenarios
- Task 2 – Innovations
- Task 3 – Sustainability Assessments and Strategies
- Task 4 – Dialogue and Outreach
- Special Task: FRAMES

These tasks build tools, guidance, updated INPRO methods and collaborative relations and outreach for use by the INPRO Member States and beyond. INPRO receives strong input from INPRO's Steering Committee of the Member States which provides both extrabudgetary funds to allow INPRO to provide workshops, meetings and services, and Cost-Free Experts and interns who bring a diverse spread of expertise to INPRO and the above four key tasks and the special task. This paper will describe how these tasks are moving INPRO forward.

TASK 1 – GLOBAL SCENARIOS

The Task 1 – Global Scenarios has as its key goal developing global and regional nuclear energy scenarios with the use of developed scientific-technical analysis tools. INPRO provides a global vision of sustainable nuclear energy development in the current century and beyond through Task 1. INPRO forged collaboration (nuclear trade) among countries and new partnerships to enable sustainable nuclear energy systems in both technology holder and user communities, supported by workshops and the tools developed to analyze nuclear energy systems and nuclear energy evolution scenarios (Figure 3).

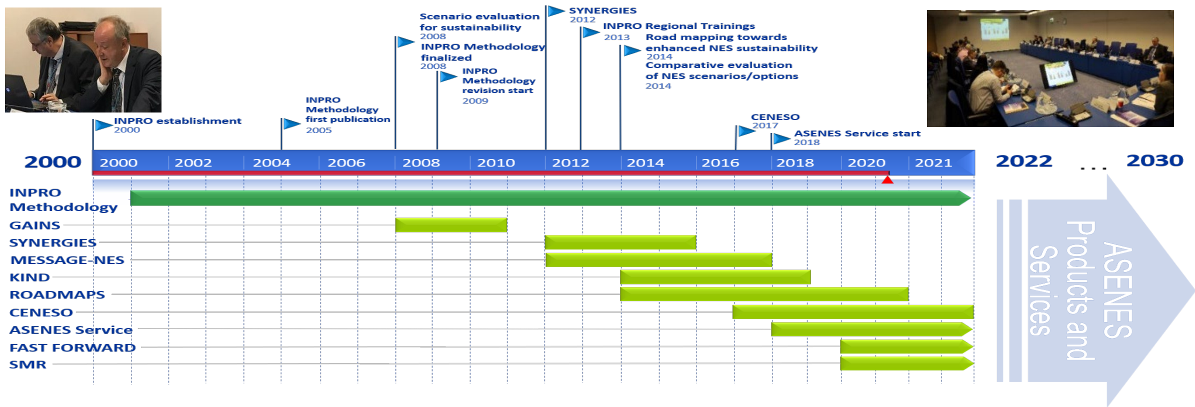

Figure 3. INPRO task 1 "Global Scenarios" development versus time.

In the last few years in collaborative projects INPRO working with experts from several IAEA Member States developed a set of tools for analysis and comparative evaluation of their nuclear energy options. INPRO has worked with the IAEA's Planning and Economic Studies Section (PESS) who assists Member States in capacity building in national and regional energy system analysis and planning, the evaluation of long-range energy strategies and the potential role of nuclear energy in a country's future energy mix. PESS developed the analytical tool Model for Energy Supply Strategy Alternatives and their General Environmental Impacts (MESSAGE) which INPRO adapted to complex nuclear energy systems involving different fuel cycles and nuclear trade options in each stage of the nuclear fuel cycle front end and back end. This was used in modelling nuclear fuel cycles in Argentina, China, Romania, Russia, and Ukraine [11]. INPRO's Nuclear Economic Support Tool (NEST) allows Member States to perform analyses to see if energy and related products and services from NESs shall be affordable and available. Argentina and Belarus were the first NEST user countries and conducted NESA studies. China, India, Indonesia, Romania, Russia, and Ukraine used NEST to look at sustainability of their existing or planned nuclear energy systems. Other countries have had access to NEST including possible nuclear newcomer countries Ghana and Kenya who are considering nuclear power. INPRO's GAINS project [12] has examined possible architectures of global NESs in a heterogeneous world model and concluded that achieving sustainability of a global NES would require collaboration (nuclear trade) not only in reactors but in the nuclear fuel cycle. The follow-up collaborative project SYNERGIES [13], which involved more than 90 experts from 35 IAEA Member States, has developed an explicit classification of options to enhance nuclear energy sustainability through both, innovations in technology and increased collaboration (nuclear trade) among countries. This project analyzed in-depth how collaboration among countries could facilitate a synergistic situation when combined NESs of two or more countries achieve more in terms of sustainability than any individual national NES within such a combination can achieve. INPRO's Key Indicators for Innovative Nuclear Energy Systems (KIND) was part of a 16 Member State effort to do five national and two global case studies designed to help countries to consider the status, prospects, benefits, and risks of developing innovative nuclear technologies [14]. The outcome of this effort is, however, applicable to a variety of comparative evaluation problems, including those of interest to technology user and newcomer countries, i.e., cover the domain of evolutionary nuclear energy technologies and non-nuclear energy options. The present KIND-ET tool software is an Excel application that helps identify advantages and disadvantages of various NES options/scenarios with various options under different circumstances. It is being broadly applied by Member States in the on-going collaborative project on comparative evaluation of nuclear energy system options (CENESO) [15] with 17 national case studies covering evolutionary and innovative NESs and scenarios and non-nuclear energy options. Another INPRO collaborative effort is 'Roadmaps for a transition to globally sustainable nuclear energy systems' or ROADMAPS. Armenia, Belarus, Romania, Russia, and Ukraine utilized the newly developed ROADMAPS-ET tool [16] on a trial basis to develop, compare and present examples of national plans and projections for long-term development of nuclear energy. ROADMAPS-ET is not a computational code but an Excel based analytical decision support tool for structuring and unifying data on issues related to NES sustainability enhancement. The methods and tools developed within the INPRO task "Global scenarios" were integrated into a new INPRO service to Member States designated "Analysis support for enhanced nuclear energy sustainability" (ASENES). Figure 4 shows the building blocks of ASENES analysis philosophy. As will be explained in Task 3, Task 1 emphasizes analysis while Task 3 emphasizes assessment.

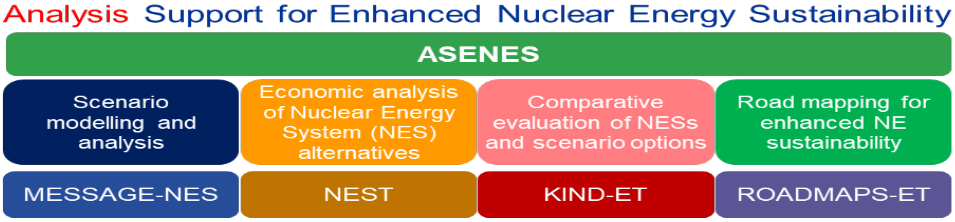

Figure 4. INPRO task 1 "Global Scenarios" development versus time.

The ASENES tools, as seen in Figure 4, will now be used in new collaborative projects by INPRO such as the "Sustainable deployment scenarios for small modular reactors" ASENES-SMR started in 2020 and the planned STEP FORWARD looking at integrated nuclear energy systems comprising evolutionary and innovative nuclear installations to achieve a notable reduction of spent nuclear fuel inventory and expansion of fissile resources through multi-recycling of fuel.

TASK 2 – INNOVATIONS

The Task 2 – Innovations looks at innovative approaches to a nuclear energy system including integrating the front and back ends of the fuel cycle into the entire nuclear energy system with advanced reactor technology. Task 2 looks at true cross cutting issues such as regulation, safety, security, safeguards, nuclear material transport, operations, and overarching legal issues on the national and international levels with the desire to locate gaps for designers, policy makers and operators to work to close. A the ongoing INPRO collaborative study on a transportable nuclear power plant (TNPP) is a relevant study of a type of NES which is presently deployed technology with the operation of the Floating NPP (FNPP) Akademik Lomonosov in Russia as a source of electricity and district heating [17]. This TNPP is a factory fuelled and factory-manufactured that is a transportable and relocatable nuclear power plant.

Introducing a TNPP may require fewer financial and human resources from the host State. However, the deployment of such reactors will face new legal issues in the international context which need to be resolved to enable the deployment of such reactors in countries other than the country of origin. INPRO with its Member States and integrated efforts across IAEA departments such as the Departments of Nuclear Energy, Safeguards, and Nuclear Safety and Security, and including the Office of Legal Affairs is an ideal candidate to examine these issues and provide some international consensus on a path forward to deployments around the globe especially in the case of the FNPP [18].

Task 2 also is looking at how to handle waste arisings from innovative reactors and fuel cycles in the Waste from Innovative Types of Reactors and Fuel Cycles (WIRAF) project and also all back end fuel cycle activities that GEN IV reactors and fuel cycles are proposing [19]. INPRO's goal here is to research the possible waste forms and materials and back end activities including recycling and repository storage to see what gaps in institutional approaches, knowledge and technology as well as policy need to be filled. In 2021 Task 2 increased it activities on the back end of the fuel cycle with a push to finish up WIRAF and Cooperative Approaches to the Back End of the Nuclear Fuel Cycle (BACK END) project documentation and restart and complete the collaborative project Review of Innovative Reactor Concepts for Prevention of Severe Accidents and Mitigation of their Consequences (RISC) looking at issues of nuclear safety in advanced reactors.

TASK 3 – SUSTAINABILITY ASSESSMENTS AND STRATEGIES

INPRO Task 3 - Sustainability Assessments and Strategies integrates all INPRO activities directly related to the INPRO Methodology for Sustainability Assessment of Nuclear Energy Systems including creation of tools and NESAs These activities involve the development, revision, and update of the

INPRO methodology, application of the INPRO methodology in different national and international assessment studies and a series of supportive activities aimed on methodology related issues. First editions of the INPRO methodology were published in 2003 and 2004, and later revised and expanded in 2008. These INPRO manuals have been applied to different national and international nuclear energy systems providing valuable feedback which has been used in the latest update of the methodology started in 2012. Seven of the nine INPRO manuals have been updated and published as the IAEA Nuclear Series Reports or IAEA TECDOC series reports. These manuals have undergone thorough revision and update including significant simplification and restructuring.

It should be noted that in Task 3 SMR NESAs focus on performing NESAs with the operative word being "assessment" on planned designs to *assess* "design sustainability" under the INPRO methodology and capturing gaps for evaluation by the design team to improve robustness and sustainability of design for deployment. The ASENES SMR project mentioned earlier in Task 1 "Global scenarios" focuses on performing case studies to *evaluate* deployment scenarios for SMRs such that a strategy for development of designs, marketing, and infrastructure can coalesce to find "energy planning sustainability" using ASENES tools for a State or a group of collaborating states (Figure 5).

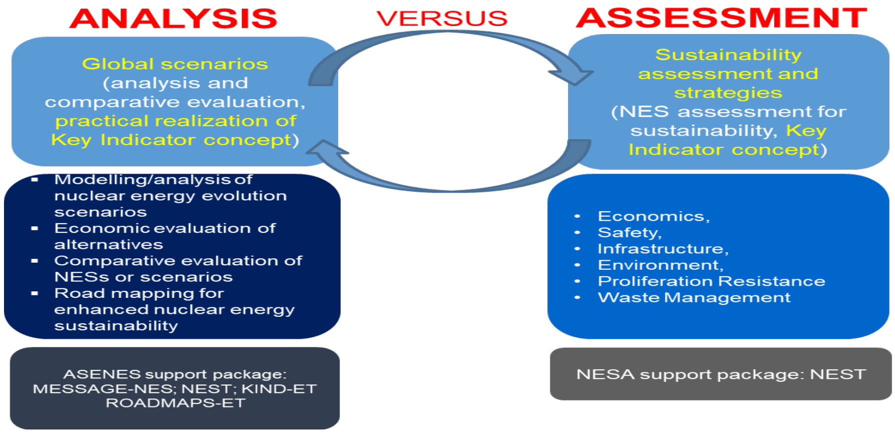

Figure 5. INPRO Task 3 Assessment Tools Versus Task 1 Analysis Tools

Each INPRO methodology manual examines a key issue of nuclear energy system sustainable development for assessment. Based on the definition of sustainable development the INPRO project proposes a three-part test of any approach to sustainability and sustainable development that included 1) current development should be fit for the purpose of meeting current needs with minimized environmental impacts and acceptable economics, 2) current RD&D programmes should establish and maintain trends that lead to technological and institutional developments that serve as a platform for future generations to meet their needs, and 3) the approach to meeting current needs should not compromise the ability of future generations to meet their needs. As the key final piece of the update, a streamlined and useful revision of the Proliferation Resistance Manual is part of a series of consultancies convened in 2020 with progress towards consensus understanding of the term "proliferation resistance" and the path to revision taken by INPRO.

Specific sustainable development issues considered in the INPRO methodology may involve complicated research and coordination efforts tied up in the tools and the use of the tools. These efforts fall under several cooperative projects aimed at the advising INPRO methodology improvements. For example, ENV (Environmental Impact Benchmarking Applicable for a Nuclear Energy System under Normal Operation) and ENV-PE (Case Study on Assessment of Radiological Environmental Impact from Potential Exposure) [20] provided advice on the goals and assessment method in the INPRO areas of Reactor Safety and Environmental Stressors. INPRO cooperative projects PRADA (Proliferation Resistance: Acquisition/Diversion Pathway Analysis) and PROSA (Proliferation Resistance and Safeguardability Assessment Tools) [21] provided advice on the assessment method in the INPRO area of proliferation resistance. INPRO's strong ties to the Generation IV International Forum (GIF) proliferation resistance and physical protection working group (PR&PPWG) provide an excellent base for continuing the work done in PRADA and PROSA. A key goal of INPRO in this year, as noted above, is to update the proliferation resistance methodology and provide a clear and robust definition of proliferation resistance which is needed within the nuclear community by working in a collaborative fashion integrating with colleagues in the IAEA Member States and across departmental boundaries in the IAEA.

NESAs are now a key Task 3 endeavour. INPRO and Russia completed a limited scope sustainability assessment of planned nuclear energy systems based on the large BN-1200 fast reactor [22]. With the growing number of SMR designs that include advanced reactors with advanced fuel cycles, INPRO recognized the need to create a collaborative project on SMR NESAs. In 2020 INPRO inaugurated the task to assess the potential assessment of SMR designs, scope of assessment and cooperation among reactor developers, potential reactor users, and the use of the INPRO methodology for assessment. The meeting began the process in 2021 with individual kick-off meetings to be separate for every developer including briefings on the INPRO assessment of SMRs. So far INPRO has met with the developers of the CAREM reactor of Argentina, the RITM-200M of Russia in May 2021 with the SMART reactor of South Korea and the Holtec SMR-160 of the United States (Figure 6). The desire is to create more SMR NESAs with the developers in the coming years.

Figure 6. INPRO Task 3 First Four SMR NESAs and Completed BN-1200 NESA

TASK 4 – DIALOGUE AND OUTREACH

INPRO Task 4 - Dialogue and Outreach works closely with the other three INPRO tasks. A key part of Task 4 starting in 2020 is the INPRO school. INPRO schools aim to provide national managers and decision makers, as well as experts working in nuclear energy departments, energy ministries, research and development institutions and technical universities with the opportunity to learn about the concepts, methodology, tools, and services developed by INPRO. Participants in the schools can enhance their skills in data analysis, modelling nuclear energy systems, including developing and evaluating NES option, scenarios, and their results. Equipped with analytical tools and competence in systematic analysis, they will be able to contribute more effectively to national decisions on the planning and development of nuclear energy in their countries. Despite COVID-19, INPRO was finally able to roll out its first INPRO school in April 2021 organized jointly with the Regional Network for Education and Training in Nuclear Technology (STAR-NET), focused on "training the trainers" with 30 participants from universities and nuclear organizations in five countries in Eastern Europe and Central Asia. They learned about INPRO methods for strategically planning for the long-term development of nuclear energy systems, including economics, infrastructure, waste management, environment, proliferation resistance and safety. The participants found the course useful and are eager for more interactions with INPRO.

INPRO in parallel with the INPRO schools is building relationships with higher educational institutions around the world. The main objective of this activity is to foster a better understanding of sustainable nuclear energy system development and deployment and to increase the awareness of INPRO among nuclear universities and university networks. It is essential that information on INPRO activities, services and tools will be delivered to young professionals, lecturers and students of technical universities, who will further be engaged in development and deployment of sustainable solutions for nuclear systems in the IAEA Member States. Along with STAR-NET, the Rosatom Technical Academy, and the National Research Nuclear University MEPhI in Russia, INPRO is building relationships in the United States through the Nuclear Engineering Department Heads Organization. (NEDHO) and Canada through the University Network of Excellence in Nuclear Engineering (UNENE). UNENE and NEDHO shall join INPRO in the virtual Regional School to Train the Trainers on Nuclear Energy System Modelling and Assessment Using the INPRO Methodology in September 2021. This year INPRO hopes also to run the Joint Russia-IAEA INPRO School for managers and decision-makers in the nuclear sector and government in Russia in September 2021 and a Regional Training Course on IAEA INPRO School on Methodology, Tools and Analysis for Enhanced Nuclear Energy Sustainability in Bangkok, Thailand in November 2021.

Another cornerstone of Task 4 are the dialogue forums that foster opportunities to discuss relevant topics amongst the Member States and push for building new collaborations to foster growth and maturity in new NESs. The last dialogue forum was the 18th Dialogue Forum (May 2021) entitled "Partnerships for Nuclear Development and Deployment" that took place virtually. Partnerships and developing new relationships for sustainable nuclear futures are a key INPRO goal as well as fitting firmly into "partnerships for the goals" (#17) of the UN SDGs. This Dialogue Forum provided some new possibilities in Latin America and beyond for building the framework for providing INPRO schools and there was significant interest in our systems modelling under development in the Special Task FRAMES.

SPECIAL TASK: FRAMES

The new IAEA **FRA**mework for **M**odelling **E**lectricity **S**ystems (FRAMES) capability is under development to study the optimal integration of nuclear and renewables (Figure 7) in an effort lead by INPRO working with PESS and Nuclear Power Technology Development Section (NPTDS). Recent expansions in capabilities include non-electric applications of nuclear energy, with a focus on hydrogen production. Hence, FRAMES includes the capability to analyze the contribution of nuclear energy in the path to net zero, to understand the benefits and implications of using hydrogen as an energy carrier and to understand the synergies between hydrogen, nuclear power, and renewables. IAEA efforts in showing how nuclear and renewables can work together to build a clean energy future got a huge lift during the International Conference on Climate Change and the Role of Nuclear Power at the IAEA in October 2019 which the IAEA and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), INPRO began to build the FRAMES capabilities around this time and found a strong endorsement from the INPRO Steering Committee in 2019 and 2020. Recently, the IAEA and URENCO began to look at nuclear and renewables in the production of hydrogen in a joint effort with results to be presented at COP26 in late 2021 in Glasgow. FRAMES became a key tool for this being a key effort supported at the highest levels of the IAEA. With interest from ASENES SMR and the 18th Dialogue Forum participants as well as the Director General of the IAEA, FRAMES can be a key tool for the future of INPRO as an innovation in being able to sustain energy production in a clean and economic fashion point by integrating some form of nuclear capability into an energy production system and grid.

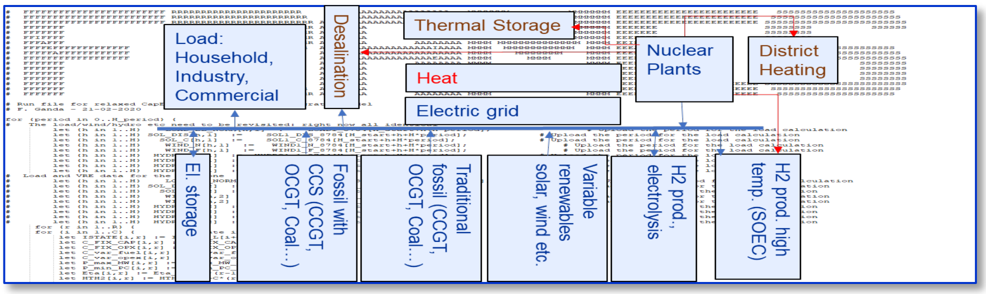

Figure 7. FRAMES Structure for Scenario Modelling and Analysis

CONCLUSIONS

INPRO is adapting to the changes in the nuclear power industry and the needs of the globe for energy sources moving into its third decade. While in 2000 the nuclear industry was looking forward to a new generation of large power reactors, today the industry is filled with a group of new and innovative developers of new SMRs and microreactors for use in newcomer States with small electric grids and for remote locations where nuclear power can deliver a steady stream of electricity in a more sustainable and robust fashion than fossil fuels or renewables can under arctic conditions or other rugged environments. INPRO launched efforts such as ASENES SMR and SMR NESAs to analyze and assess, respectively, the issues of sustainability and the gaps needed to be filled by SMR developers and technology users to make SMRs be a successful next step in nuclear power. INPRO created studies on TNPPs and planned NESAs for new smaller reactors such as SMRs and microreactors and is constantly looking to move in the direction where the industry might evolve especially in looking at back end plans and solutions for spent fuel and wastes. The effort in revising the proliferation resistance piece of the INPRO methodology is defining the topic and streamlining and updating the methodology with strong expert input and broad consensus. INPRO is also developing tools to model electric grids and integrated power systems with the objective of providing Member States with quantitative analyses on the potential of nuclear power to address climate change, on the role that nuclear energy can play in sustainable present and future electricity systems and on non-electric application of nuclear energy such as hybrid energy systems, co-generation, etc. These tasks are the key future efforts and directions for INPRO and the IAEA.

Hence, INPRO is continually studying international and national actions that would result in the required innovations in nuclear reactors, fuel cycles or institutional approaches. In addition, INPRO has an important and unique role in helping its Members better understand the national, regional, and global implications of future nuclear energy system development by being a cross cutting and forward-looking activity integrating with all parts of the IAEA and with other international organizations such as the Nuclear Energy Agency in Paris and GIF PRPPWG. To support that development, INPRO looks decades ahead and plays a key role in fostering innovation in technologies and institutional infrastructure. INPRO has played a role in providing for the needs a of a planet looking to have sustainable energy sources that are environmentally beneficial and sustainable. INPRO has and will be ever innovative in the areas of reactors, fuel cycles, institutional approaches to nuclear power, sustainable development, national strategic and long-term planning and development, collaboration and nuclear trade among countries, and provision of tools and services. It looks always to be a key mediator in integrating innovative developments in the nuclear field around the globe. These developments will include many key technological, policy and economic issues relevant to nuclear material handling.

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