Nuclear Energy

Modelling the Contribution of Nuclear Energy to Energy Transitions towards Net Zero

Ongoing Project

THE RATIONALE

Nuclear energy's **potential to decarbonize beyond electricity** is not sufficiently recognized. The IAEA would like to initiate a multi-year initiative to better assess **the full potential of innovative nuclear technologies such as SMRs**, through **improved energy system modelling**. This will support more **robust net zero transition scenario studies** and **inform policymaking**.

OBJECTIVE

The project will focus on the development of **robust and credible net zero scenario studies** in which **nuclear's contribution** to the decarnonization of both the electricity and the hard-to-abate sectors **would be modelled**. Policy-makers are in general ill-informed about the potential of innovative nuclear technologies. The absence of modelling and quantification of emissions reductions that non-power applications of nuclear energy could represent, leads to the **absence of significant policy messages** and slows down the **needed multinational efforts to demonstrate and deploy advanced nuclear technologies** such as Small Modular Reactors. The proposed project would help address this gap.

PROJECT ACTIVITIES

The project would build on a **series of workshops** gathering expert organizations and energy modelling groups, as well as nuclear technology developers, utilities, industrial customers and experts from Member States.

National or regional case studies could be modelled, including macro-economic analysis to assess the economic benefits of investments in SMR programmes, in terms of growth and job creation.

While the project would be open to users and developers of various energy modelling tools and systems, the IAEA's MESSAGE tool, could be used by participating MS with the support of the Agency, to model different pathways to net zero.

In terms of deliverables:

- A **mid-term report**
- A **final report** to conclude the PUI project, including a **technical annex detailing the use of the IAEA MESSAGE energy modelling** tool for net zero energy transition modelling would also be developed, to help MS in future studies.

DURATION

3 years

BENEFICIARY COUNTRIES

MS from all continents, with a focus on developing countries that have expressed an interest in nuclear energy.

EXPECTED RESULTS

- More **awareness from policymakers** and generally Member States on the contribution that nuclear energy systems, including Small Modular Reactors, can make to the decarbonization of the energy systems.
- More **informed policymaking** thanks to energy transition scenarios that don't ignore the ability of nuclear power plants to produce, at scale, low-carbon heat and hydrogen – to help decarbonize hard-to-abate sectors.
- **Acceleration of demonstration and deployment of innovative reactors** so they can play contribute towards net zero goals by 2050.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	150 000
Year 2	200 000
Year 3	250 000
Year 4	additional budget could be allocated for follow up studies
Year 5	additional budget could be allocated for follow up studies
Total	**1 000 000 max.**

22-05033E

Ongoing project

Nuclear Energy

Support for capacity building on infrastructure development and e-tools to increase the efficiency and effectiveness of the INIR service

DURATION

3 years

BENEFICIARY COUNTRIES

Member States planning or constructing nuclear power plants

EXPECTED RESULTS

The expected result is an increase in the number of experts in Member States with an established level of understanding on the Milestones Approach for the development of a Nuclear Power Programme.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	56 000
Year 2	60 000
Year 3	50 000
Total	**175 000**

THE RATIONALE

More than 30 countries are considering, planning, or constructing their first nuclear power plant. The IAEA supports these countries to build their capacity using the *Milestones in the Development of a National Nuclear Power Programme* document, Integrated Nuclear Infrastructure Review (INIR) missions, as well as various resources on infrastructure development. The e-learning tools have proven to be an effective means to disseminate information to Member States and provide a first level of knowledge. Through the successful PUI project, the IAEA has developed a series of 21 e-learning modules. However, it has identified a gap in completing the set of these e-learning modules.

OBJECTIVE

This project aims to close the gap in the series of e-learning modules to be used by Member States that are considering, planning or constructing their first nuclear power plant.

PROJECT ACTIVITIES

- Design and development of new e-learning modules on:
  - Environmental protection infrastructure for a nuclear power programme
  - Preparation of Self-evaluation Report (SER) for review by the INIR missions
- • Review and revision of the exising e-learning modules based on the updated IAEA publications

23-01286E

Nuclear Energy

Capacity building supporting long-range sustainable nuclear energy system planning

Ongoing Project

THE RATIONALE

A key challenge in the 21st century, as countries expanding their nuclear programmes are joined by those embarking on new nuclear programmes, will be to ensure that the global nuclear energy system continues to progress towards sustainability.

OBJECTIVE

The path to sustainable global nuclear energy systems requires innovative approaches in institutional arrangements and nuclear technology. Such approaches will be based on national, regional and global scientific technical analysis and will use broadly recognized metrics of sustainability. They will be jointly developed by today's and tomorrow's nuclear energy users and technology developers.

Multiple resolutions of the IAEA General Conference and the direction of the International Project on Innovative Nuclear Reactors and Fuel Cycles Steering Committee are shaping the IAEA's response to this challenge. The primary objective is to continue assisting embarking and developing Member States in building capacity to conduct long-range nuclear energy system planning in a manner that promotes increasing nuclear sustainability.

PROJECT ACTIVITIES

- **International Project on Innovative Nuclear Reactors and Fuel Cycles Dialogue Forums.** These will be organized to help advance broad communication on innovations and topics related to global nuclear energy system sustainability.
- **Regional capacity building workshops and training.** These will be held regionally, by distance learning or in Vienna.
- **Distance learning.** To be provided to Member States' education and technical institutions at the request of the Member State.
- **Long term planning assistance.** Assistance will be provided to Member States in the application of the methodology assessment and analysis tools of the International Project on Innovative Nuclear Reactors and Fuel Cycles, to support long term planning efforts.
- **Publication.** A new edition of the International Project on Innovative Nuclear Reactors and Fuel Cycles methodology will be published.

DURATION

Five years

BENEFICIARY COUNTRIES

IAEA Member States embarking on or developing nuclear energy programmes

EXPECTED RESULTS

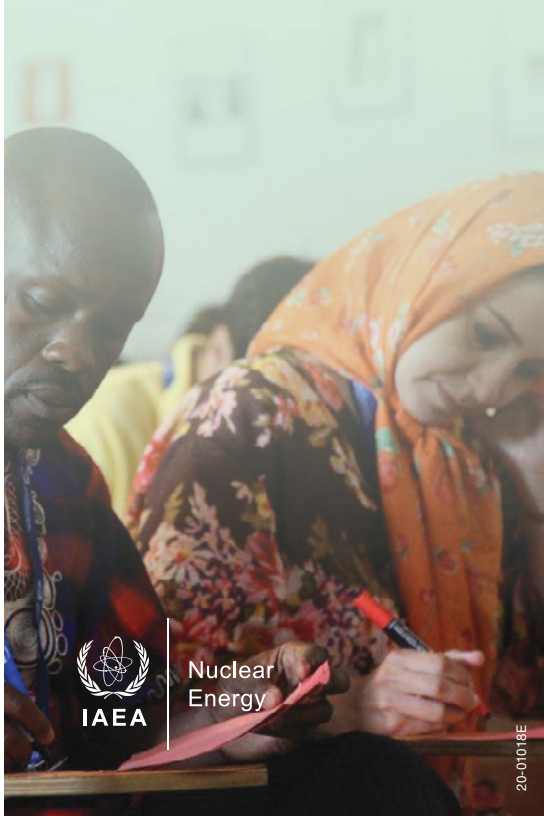
The project is expected to improve communication between experts from embarking and expanding nuclear countries and experienced counterparts from technology holding countries. It will also improve resources and capacity in energy system planning in embarking and expanding countries.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	489 000
Year 2	489 000
Year 3	489 000
Year 4	414 100
Year 5	344 500
Total	**2 225 600**

Remaining funding needs: €262 125.96



20-01018E

Concept Note

Nuclear Energy

Nuclear power plant life management in transition from operation to decommissioning

DURATION

Four years

BENEFICIARY COUNTRIES

Member States expected to transition from operation to decommissioning of nuclear power reactors in the near future

EXPECTED RESULTS

This project will raise Member States' awareness of good practices and lessons learned in the transition from operation to decommissioning.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	21 400
Year 2	107 000
Year 3	117 700
Year 4	53 500
Total	**299 600**

THE RATIONALE

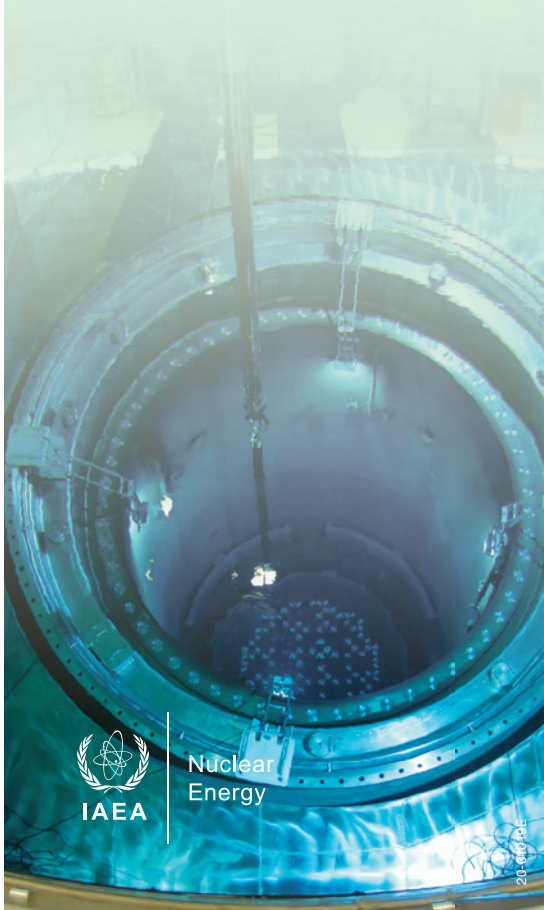
Nuclear power plant transitions from operation to decommissioning are critical. Plant systems, structures and components must continue to satisfy design functions and maintenance must be appropriately sustained. Meanwhile, the plant and organization must adapt to evolving objectives including eventual, permanent shutdown. Guidance for this transition period is needed, particularly in light of shorter transition times as seen from recent permanent shut downs before license expiration.

OBJECTIVE

Although various publications focus on management for the long-term operation of nuclear power plants, none deal specifically with the transition period from operation to decommissioning. This project aims to address that deficiency by highlighting the technical, management and organizational issues arising during transition and providing guidance to ensure reliability while effectively managing costs. It also aims to provide guidance for optimizing personnel and other resources, and initiating preparatory activities for decommissioning in a deliberate, timely and cost-effective manner.

PROJECT ACTIVITIES

- **Analysis of programme requirements.** Three consultancy meetings and a technical meeting will be held to develop a new Nuclear Energy Series publication.
- **Design and Development of new Nuclear Energy Series publication.** This will focus on plant life management for the transition from operation to decommissioning of nuclear power plants. The meetings mentioned above will decide the specific content of this document.
- **Workshop/training course.** This will promote the dissemination of information and knowledge related to the transition period. Specific support mechanisms will be decided during the meetings mentioned above.



Nuclear Energy

Quality and management system aspects of nuclear procurement engineering and supply chains

Ongoing Project

DURATION

Five years

BENEFICIARY COUNTRIES

IAEA Member States planning, constructing or operating nuclear power plants

EXPECTED RESULTS

Member States with new or expanding nuclear power programmes will be able to train and develop their staff using two new online toolkits on supply chain management. The project will also enable Member States to develop or improve their supply chain management and procurement practices using guidance documents that are under development. Member States will also be able to enhance their expertise by attending training courses and a Nuclear Supply Chain School related to this topic.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	270 000
Year 2	220 000
Year 3	220 000
Year 4	220 000
Year 5	50 000
Total	**980 000**

Remaining funding needs: €360 000

THE RATIONALE

The nuclear supply chain has experienced a number of significant changes in recent years. Increased globalization and a reduction in the number of traditional nuclear suppliers have made finding sustainable suppliers for nuclear components and services more complex.

OBJECTIVE

This project aims to inform Member States of good practices in the management of procurement and supply chain activities related to the construction, operation and maintenance of nuclear facilities. They include such aspects as needs identification, specifying requirements, supplier search and selection, establishing acceptance criteria, monitoring and evaluation, inventory control, receiving, warehousing, final approval, etc.

PROJECT ACTIVITIES

- **Online learning module on procurement and supply chain issues for nuclear facilities.** Will be published on the IAEA website.
- **Technical guidance document(s).** This will focus on good practices for the management and quality aspects of the nuclear supply chain.
- **Technical Meetings/international workshops.** Facilitate Member State participation in technical meetings and workshops to share good practices and lessons learned.
- **Workshops/Nuclear Supply Chain School focused on supply chain management and procurement.** These will give Member States the opportunity to expand and enhance their understanding of the nuclear supply chain and how to properly manage this field in order to make the development, or expansion, of a nuclear programme more sustainable.

Concept Note

Nuclear Energy

Nuclear power plant construction management

DURATION

Three years

BENEFICIARY COUNTRIES

IAEA Member States with new and expanding nuclear programmes

EXPECTED RESULTS

The project is expected to improve communication between experts from embarking and expanding nuclear countries and experienced counterparts from technology holding countries. It will also improve resources and capacity in energy system planning in embarking and expanding countries.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	21 400
Year 2	80 250
Year 3	101 650
Total	**203 300**

THE RATIONALE

For countries expanding or constructing nuclear power plants, capability to effectively manage project cost and schedule risk is essential. Historically, only project experience has been demonstrated to develop the ability of project teams to identify, prioritize and manage relevant risks accordingly. As interest in nuclear power expands within embarking and operating countries and new projects are launched, demand for such capability will grow.

OBJECTIVE

The project aims to develop practical guidance and a reference framework to help interested Member States develop more effective nuclear power plant project management capability—with a focus on schedule and budget control. It will be developed around four key areas: the interface between a national nuclear programme and the project; supply chains; project management and stakeholder engagement. The endeavor will gather experience from recent and ongoing work. This experience will include good practices as well as lessons learned to the extent such information can be shared. Those experiences will then be captured via the aforementioned guidance and subsequently disseminated to Member States via workshops and other innovative delivery mechanisms such as Webinars.

PROJECT ACTIVITIES

- **Analysis of programme requirements.** This will be the focus of three consultancy meetings and a technical meeting.
- **New publication.** This will identify cost and schedule risks typical of nuclear power plant projects, formulate project risk management strategies—including the prioritization of implementation measures and resources—and provide for an overview of organizational risk tolerance, capabilities, competencies and risk management tools. The meetings mentioned above will decide the specific content of this document.
- **Workshops and training.** These will promote the dissemination of technical content and lessons learned. Specific support mechanisms will be decided during the meetings mentioned above.

20-01021E

Ongoing Project

Nuclear Energy

Supporting the development of management systems and nuclear safety culture in countries introducing nuclear power programmes (Phase 2)

DURATION

5 years

BENEFICIARY COUNTRIES

Member States building nuclear power infrastructures and Member States exploring the nuclear power option.

EXPECTED RESULTS

The project is expected to enhance management systems in embarking and expanding countries, aligned with the programme needs. The focus of the project (Phase 2) is to support the organizations in developing/improving their management systems for the construction phase and, for more advanced countries, for the transition to the operational phase. The project will also focus on sharing the experience of countries where good practices were identified.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	424 000
Year 2	424 000
Year 3	424 000
Year 4	424 000
Year 5	424 000
Total	**2 120 000**

THE RATIONALE

Major organizations involved in nuclear power development are expected to establish management systems, to ensure core activities are implemented in systematic and transparent manner. Phase 2 INIR missions identified several gaps in this area varying from the complete absence of management systems to incomplete set of processes and procedures.

Phase 1 of this project supported the establishment of management systems mainly to countries developing the necessary infrastructure and to those embarked in the construction phases. Through the project, 11 expert missions were implemented and standardized materials for capacity building were developed. In addition, several meetings were organized to collect the experience of Member States in developing Management Systems to be part of document (TECDOC) in preparation.

Phase 2 of the project has similar objectives as Phase 1.

OBJECTIVE

This project aims to provide continued support to the development of integrated management systems and safety culture in key organizations involved in nuclear power programmes in embarking and expanding countries. This includes NEPIOs, regulatory bodies and operating organizations. It will also promote the use of management systems to support the development of leadership skills and safety culture in those organizations.

PROJECT ACTIVITIES

- Expert missions, upon the request of Member States, to review the management systems of key organizations involved in nuclear power programme development.
- Expert missions, upon the request of Member States, to assess organizational needs and develop an action plan for implementation.
- Consultancy meetings to develop standardized materials and conclude development of the TECDOC on case studies.
- Workshops on leadership and safety culture.

22-05025E

Nuclear Energy

Strengthening excellence in nuclear plant operations

Ongoing Project

THE RATIONALE

Member States with operating, new or expanding nuclear power programmes need to strengthen the knowledge of managers in nuclear operating organizations in several areas. These include: 1) a continuous pursuit of safety and operational performance; 2) an understanding of the competencies to support an effective workforce; and, 3) engagement with stakeholders.

OBJECTIVE

The objective of this project is to assist Member States in developing the competence of the next generation of managers in nuclear power operating organizations by providing them with new guidance and training related to concepts and practices, plus the tools to improve their knowledge, skills, attitude and behaviours. This project also aims to increase excellence in operations through a peer-to-peer dialogue among participating Member States.

PROJECT ACTIVITIES

- Development of IAEA guidance document on sustaining operational excellence.
- Development of training materials in the areas of operational excellence, human performance and behavioural competencies to support a safe and effective workforce.
- Development of a framework for peer-to-peer dialogue to share lessons learned and good practices.
- Development of tools and resources to strengthen stakeholder involvement and public communication practices related to nuclear power.
- Junior Professional Officer to support project implementation

DURATION

Five years

BENEFICIARY COUNTRIES

Member States with operating, new or expanding nuclear power programmes

EXPECTED RESULTS

The main outcomes of this project will be increased excellence in safety and performance in nuclear power plant operations for current and future operating organizations. The project will also serve to build capacity in the area of operations management, stakeholder involvement and human performance for participating Member States.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	150 000
Year 2	170 000
Year 3	350 000
Year 4	250 000
Year 5	150 000
Total	**1 020 000**

20-01023E

Nuclear Energy

Strenghtening nuclear power infrastructure development in Member States (Phase 3)

Ongoing Project

THE RATIONALE

Currently around 30 countries are considering, planning or constructing their first nuclear power plant. Phases 1 and 2 of this project contributed largely to awareness building in these Member States with regard to nuclear infrastructure development.The establishment and conduct of the Integrated Nuclear Infrastructure Review (INIR) Mission/Service, the organization of numerous events to promote information sharing among Member States, the familiarisation of countries with nuclear power human resource and workforce planning were effective way to reach the objective. Over ten key publications in the nuclear infrastructure bibliography focusing in practical implementation and case studies, including the revision of the Milestones in the Development of National Nuclear Infrastructure for Nuclear Power were developed.

OBJECTIVE

This project aims to provide continued assistance to Member States in developing the required infrastructure for a new or expanding nuclear power programme in line with the Milestones Approach. The support will consist in the development and maintenance of guidance documents, support to the preparatory steps of the INIR missions and other expert reviews requested by Member States and capacity building.

PROJECT ACTIVITIES

- Strengthening the Milestones approach, including updating and developing IAEA guidance documents and e-tools in topical areas of nuclear infrastructure development.
- Implementing four-step Integrated Nuclear Infrastructure Reviews, including self-evaluation support missions, pre-INIR missions, INIR and Follow-Up missions upon the request of Member States.
- Organizing workshops, technical meetings, conferences and other events to promote information sharing on nuclear power infrastructure development.
- Providing integrated support, guidance and assistance to embarking countries in line with the development of their programme through implementation of activities within the framework of country-specific Integrated Work Plans.
- Funds in this activity will also support the recruitment of cost free experts.

DURATION

5 years

BENEFICIARY COUNTRIES

Member States considering, embarking on new or expanding nuclear power programmes.

EXPECTED RESULTS

For more advanced countries, the project is expected to contribute to the development of the required infrastructure for a new or expanding nuclear power programme. For Member States considering the nuclear option, it will provide awareness on the commitments and obligations needed to support to the decision-making process.

The mechanisms of support will be the development and promotion of guidance materials, conduct of expert missions, conduct of INIR missions, and the conduct of workshops and training courses.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	424 000
Year 2	424 000
Year 3	424 000
Year 4	424 000
Year 5	424 000
Total	**2 120 000**

Nuclear Energy

Support to the IAEA Service of Integrated Nuclear Infrastructure Review for Research Reactor (INIR-RR) missions

Ongoing Project

THE RATIONALE

Interest in developing research reactor programmes has grown significantly in recent years, with several Member States currently at different stages of new projects. The majority of these countries are building their first research reactor as a key national installation for the development of their nuclear science and technology programmes.

OBJECTIVE

The IAEA supports Members States in such efforts. To continue facilitating the successful development of new research reactors, IAEA Integrated Research Reactor Infrastructure Assessment (IRRIA) missions help Member States to determine their nuclear infrastructure status and identify gaps and development needs.

Such a mission is intended to build upon Member States' self-evaluation to determine areas where additional work would be beneficial and to identify further actions and assistance, including from the IAEA.

PROJECT ACTIVITIES

- **Initial mission.** Following a Member State's self-assessment, an initial mission will review the overall situation in the country regarding infrastructure development activities, as described in the publication *Research Reactor Milestones.* All the missions are conducted upon the Member States request.
- **Follow-up mission.** This will focus on the response to the previous mission's recommendations and suggestions, as well as on the activities accomplished.
- **Prior to invitation for bids for the first/new research reactor.** This mission is implemented when the Member State is ready to invite bids for the research reactor.

DURATION

Four years

BENEFICIARY COUNTRIES

IAEA Member States considering and implementing new research reactor projects

EXPECTED RESULTS

The main output of an Integrated Research Reactor Infrastructure Assessment mission is a final report that summarizes its results, including a description of the mission's objectives and scope, areas reviewed and activities conducted, identified strengths and areas for improvement. Other observations that the team feels need to be highlighted to the requesting Member State, recommendations and suggestions for planning future activities are also included.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	117 700
Year 2	117 700
Year 3	117 700
Year 4	117 700
Total	**470 800**

20-01027E

Concept Note

Nuclear Energy

Support to the IAEA Service of Operational and Maintenance Assessment of Research Reactors (OMARR) mission

THE RATIONALE

As research reactors age, their proper operation and maintenance becomes ever more important. Many Member States look to the IAEA for advice, support and information exchange in this area.

OBJECTIVE

The main objective of an Operational and Maintenance Assessment of Research Reactors (OMARR) mission is to conduct a comprehensive operation and maintenance review of the research reactor facility, suggest areas of improvement and potential solutions, identify good practices, and as appropriate share lessons with research reactor communities. Its recommendations can also be used to disseminate implementation practices within the research reactor community, with the agreement of the recipient operating organization.

PROJECT ACTIVITIES

- **Missions.** Operational and Maintenance Assessment of Research Reactors missions are initiated by the operating organization. They consist of pre-mission activities, a main mission and a follow-up mission, if requested by the facility. All missions are conducted at the request of the Member State.
- **Information gathering.** The mission team gathers information from written material, interviews with personnel, direct observation of performance, and discussion of evaluations among the team members. It designates issues for which it addresses either a recommendation or a suggestion.

DURATION

Five years

BENEFICIARY COUNTRIES

Member States operating research reactors

EXPECTED RESULTS

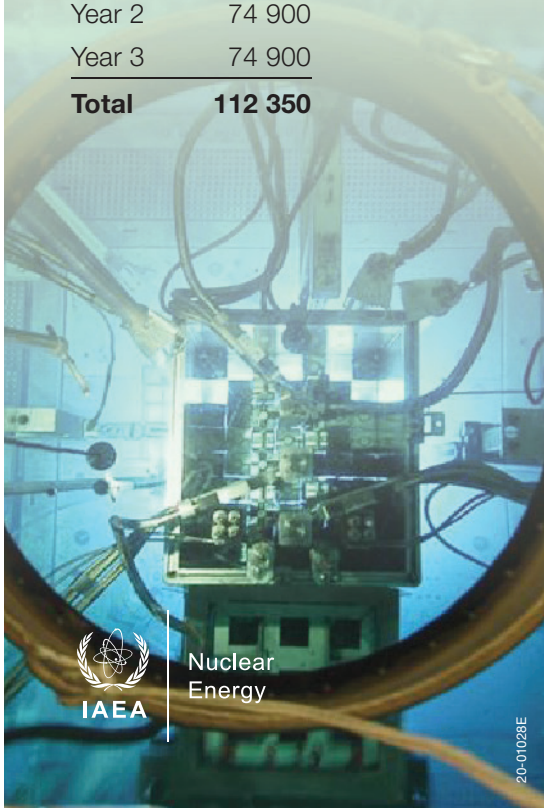
An official mission report will be produced in Vienna by the team leader and sent to the research reactor operating organization, with a copy to the Government of the host Member State. It will include good practices as well as issues for the Member State to address in order to improve the operation and maintenance of research reactors.

Such a mission will also contribute to the transfer of knowledge and experience between experts and reactor personnel, as well as the development of self-assessment capabilities.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	74 900
Year 2	74 900
Year 3	74 900
Total	**112 350**



20-01028E

Nuclear Energy

Nuclear Cost Basis: a key foundation for newcomer decision making

Ongoing Project

THE RATIONALE

A Member State's decision to use nuclear power often requires strong economic justification. This is particularly true for newcomers to nuclear power and is one of the most important factors in decision making related to energy technology choices and for the selection of acceptable, sustainable development paths.

OBJECTIVE

The objective of this project is to develop a new resource called the *Nuclear Power Cost Estimation Toolkit.* The toolkit, aimed at energy system analysts, will provide a set of principles, standards, and general guidelines for developing consistent cost estimates, taking uncertainties into account and the conditions prevailing at a country's level.

PROJECT ACTIVITIES

- **Analysis of requirements.** A team of nuclear cost experts will analyze the programme requirements and further develop the design and structure of the *Nuclear Power Cost Estimation Toolkit.*
- **Technical meetings.** These will be used to discuss the costing approaches and methodologies with experts, providing input and technical review.
- **Workshops.** Workshops will be held with nuclear newcomers. Participants will be given the opportunity to develop estimates and analyses of nuclear power costs based on the *Nuclear Power Cost Estimation Toolkit.*

DURATION

Three years

BENEFICIARY COUNTRIES

Member States considering the introduction of nuclear power, and/or interested in expanding their nuclear programmes

EXPECTED RESULTS

The main outcome will be the *Nuclear Power Cost Estimation Toolkit.* The toolkit will consist of (1) a comprehensive NE Series Publication on nuclear power costs and cost optimization strategies; (2) sample technical-economic data to support the cost estimating and analysis process; and (3) a tool for developing early-stage cost estimates and for propagating uncertainties around estimates.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	160 500
Year 2	214 000
Year 3	214 000
Total	**588 500**

20-01029E

Nuclear Energy

Capacity building through introduction and application of knowledge management methodologies and nuclear education initiatives in Member States

Ongoing Project

DURATION

Three years

BENEFICIARY COUNTRIES

IAEA Member States requiring a foundation level knowledge of the nuclear energy programmes across the world, with an understanding of some of the key challenges and recent developments in nuclear energy, together with knowledge management methodologies to support national programmes related to nuclear energy and applications.

EXPECTED RESULTS

An increase in the number of experts in Member States with a foundation level knowledge of nuclear energy programmes and an understanding of some of the key challenges and recent developments in nuclear energy, together with am access to the services and methodology available to manage the risk of critical knowledge loss.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	850 650
Year 2	850 650
Year 3	850 650
Total	**2 551 950**

Remaining funding needs: €281 993 to deliver planned activities into 2021

THE RATIONALE

The successful management of nuclear knowledge is a high priority for nuclear power plants and nuclear technology facilities all over the world as a means of ensuring continuing safe and efficient operation into the future. Ensuring the preservation of this knowledge and the replacement of qualified and suitably experienced personnel is a key IAEA deliverable to Member States.

OBJECTIVE

This project is aimed at helping Member States to:

i) Manage the risks arising from the loss of critical and essential nuclear knowledge by developing and promoting new methodologies, processes and activities to assess the current status of their knowledge management and to mitigate potential risks.

ii) Strengthen nuclear education through collaboration initiatives and provide a foundation of nuclear education for Member State participants.

PROJECT ACTIVITIES

Expansion of the International Nuclear Management Academy (INMA) University programme to a wider international educational community. This will include upgrading of the INMA curriculum and competency requirements though consultations with stakeholders in the nuclear sector and academia to include a technology specific curriculum option. The development of digital tools, applications and databases to enhance NKM services and methodology and broaden collaboration to support capacity building, education and elearning platforms for developing and embarking countries.

The upgrading and expansion of the Nuclear Energy Management (NEM) Foundation Schools and the Nuclear Knowledge Management (NKM) Specialist Schools programmes to help build and maintain an educated and qualified resource capacity in Member States.

Nuclear Energy

Development of Generic User Requirements and Criteria for Small Modular Reactors (SMR)

Concept Note

THE RATIONALE

Among more than 60 SMR concepts and technologies of all major types, dozens of designs are being prepared for deployment by 2030. One of them is already in operation and two others are in advanced stages of construction and will be put in operation in the coming years. Consequently, the interest of embarking countries in adopting SMRs not only to meet energy demand but also to combat climate change in synergy with renewable energy sources, has increased substantially. Member States, particularly newcomer countries, have requested that the IAEA provide support, guidance and capacity building in the development of national generic user requirements and criteria (GURC) for SMR deployment.

OBJECTIVE

To provide Member States and stakeholders with a **Generic User Requirements and Criteria (GURC)** document, to be published as an IAEA Nuclear Energy Series report. This high level publication is intended to offer a set of key policy, technical and economic requirements that will support embarking countries in conducting reactor technology assessment and eventually developing a tender document. The GURC document will also provide a basis for designers and technology holders to come up with a certified reactor product that incorporates the specific needs of embarking or buyer countries. The project also includes capacity building for embarking countries in the area of user requirements and criteria.

PROJECT ACTIVITIES

- Convene consultant and technical meetings to prepare a GURC Document for SMR Design and Technology;
- Develop and publish NE Series reports to establish and strengthen partnerships among Member States to facilitate SMR deployment in embarking countries;
- Identify specific issues associated with using SMRs for cogeneration of electricity and industrial process heat, by considering key technology attributes of SMRs;
- Reviewing national nuclear energy programme roadmaps in Member States by highlighting electric utility requirements for SMR designs;
- Capacity building for embarking countries to understand key differences between reactor design requirements for licensing purposes and generic requirements from the user/owner perspective to satisfy electricity and industrial market demands.
- Cooperation with the IAEA Department of Technical Cooperation (TC) on training activities with specific TC projects to be identified once the detailed proposal is developed.

DURATION

Three years

BENEFICIARY COUNTRIES

IAEA Member States expanding or embarking on nuclear power programmes with small modular reactors (SMRs) as the potential technology of choice

EXPECTED RESULTS

To provide decision-makers and stakeholders with a basis for strong investor confidence that risks associated with the initial investment to complete and operate their first SMR can be minimized.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	120 000
Year 2	120 000
Year 3	100 000
Total	**340 000**

(Photo: ©Nuscale)

20-01587E

Nuclear Energy

Non-electric applications of nuclear power using small modular reactors

Concept Note

THE RATIONALE

The deployment of SMRs beyond electric power generation is gaining momentum. This comes with the global attention of the role of nuclear power to face the climate crisis, especially through large-scale production of freshwater, hydrogen and process heat using nuclear energy for securing water and energy sustainability.

OBJECTIVE

To assist Member States interested in nuclear energy for non-electric applications in strengthening technical capabilities and capacities to tackle various issues related to the deployment of nuclear cogeneration projects. Focus will be on the coupling issues, business models, specific considerations for licensing of nuclear cogeneration projects for desalination, hydrogen production, and other heat process applications for industries. Additionally, an effort will be put on a common understanding of the requirements and considerations of end-users interested in nuclear cogeneration projects.

PROJECT ACTIVITIES

- Establish consultants' meetings, technical meetings, and training courses and workshops.
- Develop packages relevant to cogeneration scenarios for integration with the IAEA tools and toolkits to enrich its libraries and capabilities respond to various issues related to project feasibility including stakeholders and decision makers.
- Publish technical reports and strengthen international cooperation to accelerate and support research, development and deployment of non-electric applications.

DURATION

Five years

BENEFICIARY COUNTRIES

All IAEA Member States interested in nuclear energy applications

EXPECTED RESULTS

The main result is to establish a common approach for the deployment of nuclear cogeneration projects including licensing, schemes for business models, a robust road map for the identification and main considerations of involved stakeholders. Furthermore, Member States will be provided with IAEA toolkits for techno- economics and thermal analyses equipped with potential scenarios for nuclear hydrogen production, nuclear desalination and other applications. In addition, the result will provide clear understanding of potential management schemes, investment risks of first of a kind cogeneration plants, as well as appropriate value chain and potential localization schemes for such projects.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	30 000
Year 2	30 000
Year 3	30 000
Year 4	60 000
Year 5	50 000
Total	**200 000**

The Bilibino Nuclear Power Plant in Russia has been providing both electricity and heat to the mining town of Bilibino since 1974. (Photo: Rosenergoatom)

20-02739E

Nuclear Energy

Nuclear–renewable integrated energy systems: A key groundwork for strengthening development of nuclear power programmes and R&D in Member States

THE RATIONALE

Nuclear–renewable integrated energy system (N-R IES) represents an integrated facility encompassing a nuclear reactor, renewable energy unit, and industrial processes that can simultaneously address climate change mitigation, need for grid flexibility, and optimal use of investment capital. There is an increased interest among Member States to explore this synergy further.

OBJECTIVE

The main objective is to equip decision-makers with sufficient information to consider N-R IES and improve understanding of potential benefits as compared to independent nuclear and renewable generation. The project is also aimed at strengthening collaboration between Member States in support of R&D and innovation for accelerated deployment of N-R IES.

PROJECT ACTIVITIES

- Establish consultants' meetings, technical meetings, and training courses and workshops on selected topics related to nuclear power plant flexibility and integration with renewables, load following and frequency control to provide grid flexibility, safety issues specific to N-R IES that may be further communicated to decision makers, stakeholders and the general public.
- Develop new and upgrade available learning tools addressing primary drives for N-R IES R&DD such as but not limited to: (a) project financing, (b) policy and technology options (e.g. carbon mitigation targets, energy security), (c) energy and power system planning and management for increased reliability and resilience, etc.
- Publish technical reports and strengthen international cooperation to accelerate R&D and deployment, and support the links between Member States organizations contributing to N-R IES R&D and deployment.
- Develop new and/or supplement the existing IAEA databases with technical data on N- R IES.

Solar panels near the Mochovce Nuclear Power Plant in Slovakia. (Photo: IAEA)

Concept Note

DURATION

Five years

BENEFICIARY COUNTRIES

IAEA Member States expanding or introducing nuclear power programmes and with large penetration of renewable energies

EXPECTED RESULTS

a) To strengthen links between organizations involved in N-R IES development;

b) To improve their capabilities and advance R&D in the field;

c) To identify opportunities, gaps and challenges based on four-quadrant matrix (nuclear & renewables/heat & electricity);

d) To address reactor technology development needs.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	240 000
Year 2	260 000
Year 3	240 000
Year 4	260 000
Year 5	250 000
Total	**1 250 000**

Concept Note

Nuclear Energy

Development of an open-source multi-physics simulation platform for nuclear energy systems

DURATION

Five years

BENEFICIARY COUNTRIES

All IAEA Member States with a programme on nuclear science and technology

EXPECTED RESULTS

To develop an open-source, consistent and organized platform for high-fidelity, multi-physics simulation for analysis of various nuclear energy systems. The creation of a flexible and high numerical performance toolset for R&D and E&T will in turn lead to increased modelling and simulation capabilities in the Member States, widespread access to advanced simulation tools while respecting IP rights, and better standardization of open-source nuclear codes and data. It will also result in enhanced collaboration, skills and competence in the field thus supporting human capacity building.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	25 000
Year 2	50 000
Year 3	60 000
Year 4	50 000
Year 5	60 000
Total	**245 000**

THE RATIONALE

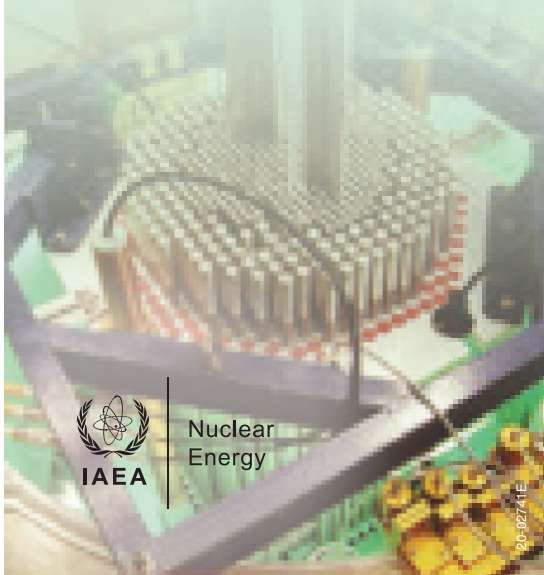
Modelling and simulation is one of the most important tools currently used in the field of nuclear energy, above all to reduce the need of expensive experiments and foster R&D. Open source code development will lead to enhanced knowledge of complex multi-physics phenomena and seamlessly support R&D and education and training activities across the world.

OBJECTIVE

Availability of open source codes to the IAEA Member States will foster research and development and support several education and training activities. The initiative will also lead to building and preservation of knowledge in the field of simulation codes and data for the nuclear power sector. The project will define the best practices for collaborative open-source code development and use. This will allow nuclear newcomer countries, to better understand the physics behind complex modelling and simulation tools, as well as access to collaboration with well-recognized experts in the field.

PROJECT ACTIVITIES

- Build an open source, multi-physics platform for nuclear reactor analysis;
- Create international network/user group to enhance collaboration and knowledge sharing among the Member States;
- Develop an online repository/database for OpenSource codes, documentation, tutorials, and related material;
- Develop training material and other learning resources for capacity building;
- Train professionals in the field of modelling and simulation, particularly focused on open source based multi-physics toolsets for nuclear applications;
- Publish technical reports and documents to disseminate the information.



CROCUS research reactor at EPFL-Switzerland

20-02741E

Concept Note

Nuclear Energy

Supporting capacity building on severe accidents in current and advanced nuclear power reactors

THE RATIONALE

Currently over 400 nuclear power plants are operating in the world, and more than 30 countries are considering, planning or constructing their first nuclear power plant. The IAEA facilitates R&D and training programmes supporting capacity building and knowledge transfer on severe accidents phenomenology, but many countries expanding or introducing nuclear power programmes asked for accelerated support and sharing of this expertise and knowledge.

OBJECTIVE

The main objective is to strengthen technical capabilities and enhance capacity building and knowledge transfer in Member States on severe accident phenomenology in current and advanced nuclear power reactors. An improved understanding of the phenomenology of severe accidents and of the codes used to analyze their progression will enable Member States to develop a robust roadmap on harmonized application of these codes, including uncertainties associated with prediction of severe accident progression. Furthermore the project is aimed at: (1) harmonizing the best practices on severe accident computer tools for NPPs and spent fuel pools; (2) supporting innovations and R&D. Special focus is on developing a reference framework for undertaking integrated severe accidents assessment analyses for nuclear power plants and spent fuel pools.

PROJECT ACTIVITIES

- Establish consultants' meetings, technical meetings, coordinated research projects, and training courses and workshops on selected topics.
- Develop new and upgrade available learning tools addressing topics that constitute key elements in the analyses of severe accidents, e.g. e-learning modules, basic principle simulators, training materials.
- Upgrade IAEA THERPRO database with corium data and develop new databases and catalogues that will provide Member States with support in analyzing severe accidents.
- Publish technical reports and strengthen international cooperation to accelerate R&D and support the links between Member States organizations involved in severe accidents R&D.

DURATION

Five years

BENEFICIARY COUNTRIES

IAEA Member States expanding or introducing nuclear power programmes and more generally considering, planning, constructing or operating nuclear power plants.

EXPECTED RESULTS

Full set of services and tools to improve Member States technical capabilities and capacity building on severe accident phenomenology in current and advanced NPPs. Additional results are to: (1) strengthen the links between organisations involved in severe accident R&D, (2) accelerate human capacity development and awareness in newcomer countries; 3) produce learning tools and databases supporting severe accident analyses.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	303 880
Year 2	293 180
Year 3	303 880
Year 4	293 180
Year 5	303 880
Total	**1 498 000**

Under a new IAEA Coordinated Research Project, a PhD training programme on severe accidents simulation and modelling will be developed and implemented for students from countries embarking on nuclear power. (Photo: IAEA)

20-02742E

Nuclear Energy

Practical support for research reactor decommissioning

Concept Note

THE RATIONALE

Many Member States need support in the preparation and implementation of decommissioning activities for their research reactors. Practical and focused support in the form of referenced decommissioning concepts, plans and model designs is needed to facilitate safe and technically sound decommissioning progress. Such support could build upon previous IAEA decommissioning costing initiatives (relevant publications and project DACCORD) and experience with planning and implementation of research reactor decommissioning projects in several countries.

OBJECTIVE

To support planning for and implementation of research reactor decommissioning projects, especially in developing countries and countries with small nuclear programmes, through the provision of a compendium of good practices and lessons learned from experience available worldwide in the decommissioning of main types of research reactors.

PROJECT ACTIVITIES

- Consultancy meetings of experts in working groups covering the main types of research reactors (open pool reactors, tank reactors and others, eventually including subcritical and critical assemblies);
- Technical meetings open to participants from all Member States with research reactors;
- Drafting and publication of TECDOCs on referenced decommissioning concepts, decommissioning plans and model decommissioning designs;
- Updating of the Decommissioning Wiki maintained by the International Decommissioning Network (IDN) for research reactor decommissioning (articles and identification of related case studies).

DURATION

Four years

BENEFICIARY COUNTRIES

All Member States with research reactor(s)

EXPECTED RESULTS

- Enhanced capacity of Member States in planning for and implementation of research reactor decommissioning projects;
- Sharing of good practices, technical and safety related considerations and lessons learned via IDN Decommissioning wiki;
- IAEA TECDOCs (3) providing referenced (i) decommissioning concepts, (ii) decommissioning plans and (iii) model decommissioning designs for main types of research reactors.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	110 000
Year 2	140 000
Year 3	130 000
Year 4	110 000
Total	**490 000**

Workshop participants undertaking group exercises involving the definition of a waste inventory expected to result from the decommissioning of a typical research reactor. (Photo: IAEA)

20-02743E

Concept Note

Nuclear Energy

Supporting effective institutional coordination in countries considering the nuclear power option

THE RATIONALE

Due to growing energy demands and the need for secure and reliable low-emission electricity, several countries have recently expressed an interest in exploring the nuclear power option. This interest has been further accelerated by the increasing developments in advanced reactor technologies, particularly, small modular reactors. As part of the initial considerations for these programmes, it is important for countries to formulate a national energy or socio-economic development strategy that identifies nuclear power as a possible option for producing energy. In order to develop this strategy, governmental institutions must have a general awareness related to the commitments and infrastructure required for nuclear power, even before entering Phase 1 of the International Atomic Energy Agency's (IAEA) Milestones Approach.

OBJECTIVE

This project aims to support effective processes and coordination related to the initial considerations for the introduction of nuclear power. The project will also support institutional capacity building for countries that are considering whether to include nuclear power as an option in a national energy or socio-economic development strategy.

PROJECT ACTIVITIES

1. Nuclear Power Awareness Workshop: this workshop would introduce decision makers to the commitments and infrastructure required for a nuclear power programme. It would also provide an introduction to the role of energy planning in the early consideration of a nuclear power programme and the need for effective institutional coordination during the development of the relevant policies.

2. Nuclear Power Roadmap Considerations Workshop: this introductory workshop would provide an overview of the timeline and activities associated with the development of a new nuclear power programme, including the roles and responsibilities of key organizations and the need for coordination, to help inform the decision about whether to include or not include the nuclear power option in national energy or socio-economic development strategies.

3. Expert Missions to Support Roadmap Development: these missions would support the further development of national roadmaps for new nuclear power programmes through expert missions with international experts.

DURATION

3 years

BENEFICIARY COUNTRIES

Member States that are at the initial stage of considering a nuclear power programme

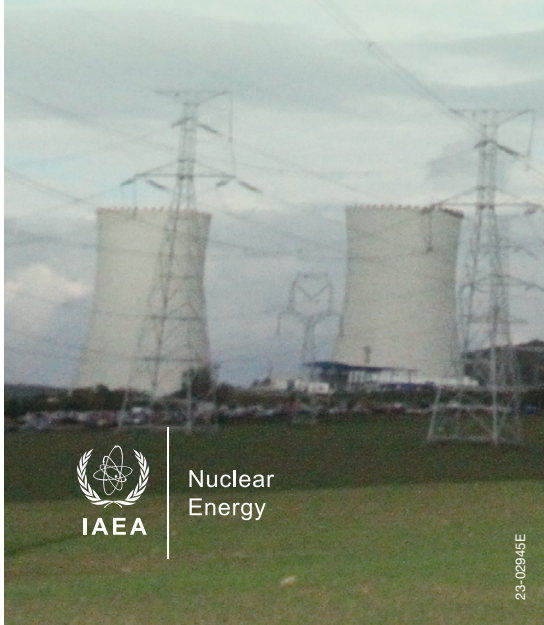
EXPECTED RESULTS

This project will prepare countries for Phase 1 of the IAEA's Milestones Approach by building capacity in the government institutions that will be involved in the preparation of studies related to the introduction of nuclear power and by facilitating the development of the related nuclear infrastructure at an early stage. As a result, countries may require less time to reach Milestone 1 – ready to make a knowledgeable commitment – reducing the overall duration of the programme.

TOTAL ESTIMATED BUDGET

Budget (EUR) with 7% PSC included

Year 1	80 625
Year 2	80 625
Year 3	80 625
Total	**241 875**



IAEA Nuclear Energy

23-02945E