



**CONNECT- NM**  
Coordination of the European  
Research Community on Nuclear  
Materials for Energy Innovation

A EURATOM Cofund Action



Co-funded by  
the European Union

## CONNECT-NM Open Call Procedure<sup>1</sup>

<sup>1</sup> This document is part of the Internal Rules  
of Procedure of CONNECT-NM

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# Procedures for the CONNECT-NM Open Call for Projects

## Short summary of this document and list of Open Call documents

This document explains the procedures applied in the various steps of the Open Call for Projects of the CONNECT-NM Partnership, including the topics on which Project proposals can be presented within each research line (RL) and the requirements they need to comply with the relevant eligibility criteria and the evaluation and selection procedure. As such, when approved by the General Assembly of CONNECT-NM, it becomes part of the Internal Rules of Procedure of CONNECT-NM.

Based on this reference document, the following documents used for practical purposes will be produced:

1. CONNECT-NM Open Call Announcement: short document that summarises the general information and lists the documents needed, providing links to them and to the templates to be used in the proposal submission procedure.
2. CONNECT-NM Open Call Work-Programme: document that explains the topics on which Project proposals can be presented within each research line (RL), including objectives, scope, expected output and outcome, and expected impact.
3. CONNECT-NM Guide for Project Proposers: schematic document with practical information about how to submit a proposal.
4. CONNECT-NM Project Idea Template: template to be used to submit Project Ideas in the first phase of the submission procedure.
5. CONNECT-NM Project Proposal Template: template to be used to submit full Project Proposals in the second phase of the submission procedure, including a separate template for financial information and a template for the Letter of Commitment that each project participant should sign upon proposal submission.
6. CONNECT-NM Project Proposal Evaluation Criteria and Scoring System: version for proposers (information purposes) and version for reviewers (with practical information on how to fill in and submit the evaluation form).
7. CONNECT-NM Evaluation Form (for reviewers).

These documents will reflect the present one but will be shorter and more user friendly.

## 1. Programme Ambition and General Objective

The ambition of CONNECT-NM is to strengthen safety and sustainability of nuclear energy by promoting innovation in the field of materials for operation under extreme

conditions (high temperature and high irradiation dose, chemically aggressive environments), to ensure high safety standards in power generation, while **accelerating the process of materials development, improvement and qualification**, thereby reducing time-to-market.

Its general objective is therefore to nurture the joint and coordinated exploitation of national competences, facilities and infrastructures in Europe dedicated to research, development and innovation in the field nuclear materials, in pursuance of the common goal of a **shift of paradigm** in nuclear materials research, from the traditional ‘observe and qualify’, to the modern ‘design and control’.

The enablers of this paradigm shift are **modern digital techniques**, such as machine learning (ML), data analytics, semantic technologies, high-performance computing, block-chain, robotics, which are at the core of data-driven modelling, high throughput calculations and experiments, and development of digital twins, together with advanced manufacturing techniques and (when available) also lifecycle sustainability assessment tools.

To define priorities within CONNECT-NM in the most transparent and balanced way, Open Calls for Projects have been identified as the tool to match top-down general requirements (established in the [Strategic Research Agenda produced in ORIENT-NM](#) and with the approval of the General Assembly of CONNECT-NM), with bottom-up formation of open consortia around specific case-studies (nuclear systems and materials or components). Importantly, CONNECT-NM activities cover reactors of any current and future generation.

Projects proposed in the Open Call for Projects (OCP) of CONNECT-NM will therefore need to outline and explain how the Project goal aligns with the above ambition and general objective and how the Project will use the listed enablers to achieve its goal.

The present document establishes the procedures applied in the first CONNECT-NM OCP, approved by the General Assembly of the CONNECT-NM Partnership. A Glossary in [Annex A](#) provides most key definitions of use to understand the present document.

## 2. General Project proposal eligibility and selection criteria

### 2.1 Project Consortium and Project Leader

Consortia must be comprised of a **minimum of three independent legal entities from two different EU Member States or countries associated with the Euratom Research and Training Programme**. Provided that this condition is complied with, the call is otherwise open to research partners from all over the world (excluding persons, groups and entities that are subject to EU financial administrative sanction or are in an exclusion situation, see [EURATOM Work-Programme 2023-2025](#), Annex B - Eligibility).

Participants in a Project can be in any number equal to or greater than 3, with a view to reaching a reasonable compromise between the capacities that are needed to perform the work proposed and the budget that can be allocated for it. Participants can be

Beneficiaries, Affiliated Entities, or Associated Partners that are already part of the CONNECT-NM Consortium, as well as organisations that are currently not in the Partnership Consortium, but can qualify as one of these categories, or as Third Parties. The list of current Beneficiaries and Affiliated Entities in CONNECT-NM is given in [Annex B](#). Third Parties should be preferably contributing in-kind, but may also be receiving partial support through one of the Beneficiaries. More information on these categories is given in the Glossary ([Annex A](#)). The legal framework for the relationship between these categories and their funding is given by the Grant Agreement (GrA), the Consortium Agreement (CoA) and the Internal Rules of Procedure (IRoP) of CONNECT-NM, accessible through the private area of the CONNECT-NM website. The present document is part of the IRoP of CONNECT-NM. All members of the Project Consortium will have to abide the GrA, the CoA and the IRoP of CONNECT-NM, irrespective of whether they signed or approved them, or not. The acceptance of these documents will be among others declared via a Letter of Commitment.

This letter will have to be signed by each member of the Project Consortium upon Project proposal submission and will include a commitment to perform the work as described in the Project proposal, according to the status that each member will have in the CONNECT-NM Consortium after Project selection for funding, via post-call amendment of the GrA. In particular, according to the GrA, Associated Partners, as well as Third Parties giving in-kind contributions, do not get any part of the grant money from the European Commission and will therefore need to have access to other funding sources to cover the whole of their activities. **The European Commission contribution received by each member of the Consortium of CONNECT-NM Projects with right to funding<sup>2</sup> will not exceed 50% of the budget declared for the Project**, by internal decision of the Consortium, i.e. via approval of the General Assembly on October 4<sup>th</sup>, 2024.

The Project Leading Organisation must be a Beneficiary or an Affiliated Entity. It is advised that the Project Leading Organisation be already a member of the CONNECT-NM Consortium ([Annex B](#)), before Project submission. It is also possible for an organisation that is not yet in the CONNECT-NM Consortium to be Project Leader, provided that such organisation can qualify as Affiliated Entity of one of the Beneficiaries and can be therefore included in the Consortium with this status, via the post-call amendment of the GrA. A permanent employee of the organisation identified as Project Consortium Leader, with sufficient knowledge of the subject of the Project, shall be appointed as Project Leader (PL). The PL will be the contact person for any communication that concerns the Project proposal and, as such, will be responsible for submitting the proposal according to the procedures described in this document ([Section 4](#)) and in the [CONNECT-NM Guide for Project Proposers](#). The PL will also act as intermediary between the Project Consortium and the Executive Board of CONNECT-NM, especially with the Coordinator and the Leader of the Research Line to which the Project belongs (see [Section 3](#)), as well as the Management Support Office (MSO) of CONNECT-NM. When the Project is up and running, the PL will be responsible to provide every year, at a time established with sufficient notice, the technical Project report to the Research Line Leader and the financial Project report to the Coordinator. The participants in the Project have the obligation to provide the Project Leader with the technical and financial details that are needed to compile the reports.

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<sup>2</sup> Thus excluding the budget of Associated Partners and Third Parties giving in-kind contributions.

The inclusion of at least one end-user (industry, TSO, regulator ...) in the Project Consortium is highly recommended. In addition, better gender-balanced Projects will be ranked better in case of equal scoring.

## 2.2 Project objective and scope

The proposed research, development and innovation (R&D&I) activities of the Project shall be aligned with the CONNECT-NM specific objective of at least one RL that the Project pursues (see Section 3) and shall contribute to realise the final product of the corresponding RL (see Table 1). More generally, they need to be aligned with the Strategic Research Agenda and the materials ID cards produced in ORIENT-NM, on which the Open Call Work Programme is of course based.

**Table 1** – Specific objectives and final products of each research line.

	Research Lines (RL)	Specific objectives	Final products
RL 1	<a href="#">Knowledge and data management</a>	To create the conditions for nuclear materials data to be correctly collected and stored, so as to be fruitfully analysed and used.	Nuclear materials knowledge organisation system
RL 2	<a href="#">Advanced materials development and manufacturing</a>	To reduce drastically the time required to improve, develop and potentially discover new or advanced nuclear materials, along with designing and progressing advanced manufacturing processes.	Nuclear materials acceleration platforms (MAPs) and advanced manufacturing processes
RL 3	<a href="#">Materials and component qualification: testing, standardisation and design rules</a>	To accelerate the qualification of nuclear materials for safe operation.	Nuclear materials qualification testbeds and accelerated qualification paths
RL 4	<a href="#">Non-destructive examination and materials health monitoring</a>	To enable safer and more efficient management of the lifetime of nuclear components.	Intelligent materials health monitoring systems
RL 5	<a href="#">Advanced materials modelling and characterisation</a>	To improve the capability to predict the behaviour of nuclear materials in operation.	Advanced predictive methodologies

The material(s) or materials' issues on which the project will focus shall be of demonstrated interest for current or future generation nuclear fission power plants, without restrictions on the type of nuclear fission system. The R&D&I activities of the Project shall concern nuclear materials belonging to (at least one of) the four categories considered in CONNECT-NM, namely:

- a) metallic materials for structural components (including vessel and core materials)
- b) cladding materials (both metals and ceramics)
- c) fuel materials
- d) concrete

The materials and nuclear systems selected as focus in the Project will correspond to a case study to which the research line methodology is applied. This case study should be demonstrably extendable to applications to other case studies, by setting a sufficiently generalisable methodology.

Irrespective of possible cross-cutting activities and content, each Project shall be explicitly oriented towards the achievement of one single specific objective of the Partnership (Table 1). Based on the explicit selection of the objective chosen by the proposers, the Project will be assigned to a specific Research Line. The same Project cannot belong to different research lines. However, the choice of the primary objective pursued by the Project and therefore of the Research Line to which it belongs will only occur in the second phase of the submission procedure (see **Section 4.2**).

In this second phase, the Project proposal will therefore need to provide a clear description of how the activities effectively contribute to take a step forward towards the selected objective and final product, as described in **Table 1**, using the corresponding methodology.

Projects will limit their activities to research, development and innovation (R&D&I), i.e. they do not have to, and should not, foresee activities related to, e.g., education and training, schemes for access to infrastructures, communication and dissemination plans, result exploitation plans, etc. All these aspects will be addressed at the level of the Partnership, upon input from Projects and Research Lines. Notwithstanding, the Project proposals need to foresee mechanisms and, if needed, financial provisions to comply with CONNECT-NM rules concerning:

- The Data Management Plan prepared in WP4
  - Projects must provide the WP4 leader information concerning the data they produce, via their Research Line Leader (RLL), particularly if different from those already foreseen in the Partnership's Data Management Plan, and must in any case ensure compliance with such plan.
- The Open Science Guidelines, following the advice of the Open Science Officer in WP3
  - Projects need to inform the Open Science Officer about publications, and scientific output in general, that they produce via their RLL, complying with the Open Science Guidelines developed at Partnership's level.
  - Financial provisions will need to be foreseen as part of the Project budget to cover the costs associated with mandatory open access publication (when the decision to publish is taken), taking into account the advice on this point of the Open Science Officer. This will include information on how to make use of existing agreements between publishers and research organisations to avoid paying the gold open access fees with Project funds.
- The use of the website and the Dissemination and Communication Plan produced in WP3
  - Projects are expected to make use of the website for Project management (approval of internal deliverables and milestones, follow up of subtasks ...).
  - Limited financial provisions might be needed to enable the setting up of the website for the specific needs of the Project.

- Projects are also expected to interact with WP3, via their Research Line Leader, in order to update the Partnership’s Communication and Dissemination Plan, with proposals of actions of this type and ensuring that information is provided in order to comply with such plan.
- The Ethical Rules as expressed in the Grant Agreement and further described in the Ethics Requirements produced in WP1
  - Projects have to abide the Ethics Requirements of the Partnership, as requested by the European Commission, and may have to provide the Coordinator with information required from their participants to demonstrate compliance with such requirements.

## 2.3 Project expected outcome and impact

Overall, CONNECT-NM Projects are expected to impact at least one of the following ambits, connected with [EC Green Deal](#) or its evolution after the recent elections and the [UN Sustainable Development Goals](#):

- Provide a drive towards innovation and technological advancement, fostering the development and qualification of new materials solutions and manufacturing processes, as well as of materials health monitoring systems, ideally of use also beyond nuclear application (materials operating in harsh environments), thereby benefitting a wider spectrum of stakeholders than just nuclear industries or regulators. Predictive capability and advanced data management are important enablers to achieve such impact.
- Promote a culture of continuous improvement and change of paradigm in materials science, supporting the growth of sustainable practices within the nuclear industry.
- Support the long-term sustainability of nuclear energy by prioritising safety and reliable operation, thus enabling its widespread use, overcoming current reluctance in several countries, thereby contributing to greenhouse gas emission reduction.

## 2.4 Project implementation

For the implementation of the Project, to be described in the proposal prepared in the second phase of the submission process (see **Section 4.2**), the following points need to be kept in mind:

- **Each Project**, once selected and integrated in the description of work of the CONNECT-NM Partnership, **will correspond to a task of the Work Package that corresponds to the Research Line to which the Project belongs**. Therefore, Projects will be formally broken down in Subtasks, with assigned Subtask Leaders. If needed, Subsubtasks may be defined, as well, within each Subtask.
- Each Project will commit to produce a number of **internal deliverables** and will define **internal milestones**. Internal deliverables and milestones will be of the same nature as deliverables and milestones of the Partnership, but they will not be uploaded or reported onto the portal of the European Commission. Instead, they will remain internal to the Partnership, after being uploaded onto the CONNECT-NM website, by default being accessible to the whole Partnership Consortium and fully

governed by the GrA, the CoA and the IRoP of CONNECT-NM, accessible through the private area of the CONNECT-NM website. For what concerns intellectual property rights and protection, they shall be called open internal deliverables. Internal deliverables may also be *public*. In this case, they will be accessible also outside the Partnership Consortium, through the CONNECT-NM website as public internal deliverables.

- Exceptionally, the diffusion of internal deliverables may be restricted to the Project Consortium as restricted internal deliverables. In this case, the Project Consortium will need to sign an internal Consortium Agreement that defines suitable rules to their own group, in order to manage the delivery of the Project activities, intellectual property rights and avoid disputes, which might be detrimental to the completion of the project. Said Consortium Agreement shall be mandatorily consistent with the terms of the CONNECT-NM GrA, CoA and IRoP, accessible through the private area of the CONNECT-NM website.
- The Partnership deliverable connected with Projects, which every year will be formally provided to the European Commission, is the Annual **Research Line Progress Report**, which will be compiled by the RLL based on the **Project Technical Reports** of the Projects that belong to each Research Line.
- The only governing body to be foreseen in a Project (except if an internal Consortium Agreement is signed) will be a **Project Executive Committee**, formed by the Project Leader and the Subtask leaders. These will assist the PL in the preparation of the annual Project Technical Reports (for the RLLs) and Project Financial Report (for the Coordinator), as well as in ensuring that internal deliverables and milestones are timely produced and reached. It is here reminded that Projects and Project Consortia will mandatorily comply with all parts of the GrA, the CoA and the IRoP of CONNECT-NM, irrespective of whether they signed them (beneficiaries) or not (other types of participants). This compliance will be stated in the Letter of Commitment.
- The duration of Projects cannot exceed the timeframe of existence of the CONNECT-NM Partnership (currently 30 September 2029).

For any doubt concerning Project proposal objectives and scope, the contacts are the corresponding Research Line Leaders (see **Sections 3.1-5**). For doubts concerning the other aspects connected with Project proposals, the contacts are: [mareike.kiwitt@ciemat.es](mailto:mareike.kiwitt@ciemat.es); [lorenzo.malerba@ciemat.es](mailto:lorenzo.malerba@ciemat.es).

## 2.5 Project funding

As stated, the funding rate of Projects in CONNECT-NM, as approved on October 4<sup>th</sup> 2024 by the General Assembly of CONNECT-NM, will be 50% of the eligible costs for which reimbursement is claimed, i.e., the contribution from the European Commission to Project participants with right to receive funding will correspond to 50% of the cost of the activities<sup>3</sup>. Notwithstanding, Project consortia or specific partners in consortia may decide to receive less than this amount, if they can rely on sufficient national, regional or institutional funding to cover most expenses related with the activities of the Projects.

<sup>3</sup> It has to be remembered that CONNECT-NM is a **co-funded** European partnership.

This financial support will be partly granted at the beginning of the Project, based on the expected costs via the payment of a pre-financing, corresponding to a percentage of the maximum grant of the Project, decided by the CONNECT-NM Coordinator at the approval stage of each proposal, and specified in the Task Agreement. The remaining part of the contribution will be paid to the Beneficiaries in periodic installments, based on the accepted costs. Beneficiaries will be in charge to transfer the due amounts to Affiliated Entities, Third Parties that are recipients of funds and Subcontractors.

As established on November 28<sup>th</sup>, 2024, by the General Assembly of CONNECT-NM:

- The **budget of this OCP of CONNECT-NM is € 13.500.000 (EC contribution)**.
- The maximum reimbursement from the EC allocation to CONNECT-NM per project will be **900 kEUR /Project**.
- Notwithstanding, the proposers can ask for a higher amount, which might be accorded if the quality of the proposal is outstanding and compatible with the financial possibilities of the Partnership.

Additional details about Project funding and flow of money are given in [Annex C – Financial Call Conditions](#). For further information on financial matters, the contact is [silvia.degrandis@sintec-nt.it](mailto:silvia.degrandis@sintec-nt.it).

### 3. Project Requirements per Research Line (Work-Programme)

This section specifies the scope and the objective, expected outcome and output, and impact for any Project proposal assigned to a specific research line, in order for it to be eligible and potentially selected for funding. It corresponds to the Work Programme of the 1st OCP of CONNECT-NM. [Annex D](#) provides rules in case generative AI tools are used to write proposals.

#### 3.1 Research Line 1: Knowledge and Data Management

##### Scope and objectives

Nuclear materials science programmes generate multidisciplinary knowledge and data across various domains, requiring effective management to advance safe and sustainable technology and make data accessible for AI-driven approaches that accelerate nuclear materials development. Achieving this requires a structured framework that facilitates communication among experts about key entities (e.g., materials, experiments) and leverages distributed data management systems. In this context, semantic technologies play a pivotal role in building an open semantic environment that enhances collaboration among experts and facilitates knowledge and data exchange. Through the use of ontologies, ontology-based metadata, and specialised databases, effective data management can uphold FAIR (Findability, Accessibility, Interoperability, and Reusability) principles while protecting sensitive information. A unique system using semantic technologies maintains federated data

distribution while adding a virtualisation layer that connects systems to enhance scalability, data management, and reduce fragmentation. Thanks to their effectiveness in improving interoperability, minimising knowledge loss, and linking data across programmes, ontology-based Knowledge Organisation Systems (KOS) have seen wide adoption across industries.

The primary aim of this RL is therefore to establish a comprehensive knowledge framework for nuclear materials, the Nuclear Materials Knowledge Organisation System (NM-KOS). The NM-KOS should be designed as a two-layer system. At the lower level, individual databases will be populated with actual data in suitable formats (Nuclear Materials Data Management System, NM-DMS). At the upper level, data will be organised according to FAIR principles using ontology-based semantic technologies to enhance data accessibility and interoperability (Nuclear Materials Knowledge Base, NM-KB). This system will improve accessibility, organisation and exploitation of nuclear materials data. Thus, the RL requires the integration and uploading of diverse datasets, as there are challenges associated with populating accessible repositories. These challenges include limited incentives and protections for data uploads, as well as the need for suitably equipped databases that adhere to FAIR principles for relevant data types.

The successful development of the NM-KOS will require:

1. Expanding or creating databases capable of securely storing data relevant to nuclear materials research, ranging from macroscopic properties to microstructure examinations and model results.
2. Implementing systems that ensure data protection and establish clear policies where necessary.
3. Developing user-friendly, even automated, methods for data uploading.

By providing secure, standardised, and easily accessible platforms, the NM-KOS will incentivise data storage in repositories. Equipped with robust data protection measures and FAIR-compliant formats, this system will streamline data uploading and encourage a culture of data sharing and utilisation within the nuclear materials field.

## Expected Results

Projects proposed in this research line are expected to contribute to the construction of both layers of the NM-KOS, as described in Section 1.2.2.5 of the Annex 1 to the Grant Agreement, accessible on the CONNECT-NM website.

Project activities are expected to encompass the following levels:

1. Creation or extension, and population, of one or more databases for nuclear materials, aimed to store data generated by experimental or modelling techniques in specific domains (e.g., irradiation, characterisation) that are relevant for materials behaviour prediction, assessment or evaluation. The projects should involve, or demonstrate the strong commitment, from the data-generating entities (e.g., research centres, communities, companies) to provide data and design the databases according to their specific requirements.
2. Development of user-friendly interfaces for data upload, extraction, use and analysis, within each domain. This should be achieved by designing suitable data formats (e.g., Excel or CSV templates, JSON Schema) to facilitate data uploading and retrieval by

end users with little or no data-management training. Each dataset entry should be fully documented with references to authoritative sources (e.g., ISO or IAEA standards) to ensure clear interpretation of data and support semantically robust database development. Data quality assessment criteria must also be included.

3. Development of a dedicated domain ontology and specific application ontologies for each database, based on the documentation provided with each dataset. The ontologies should be consistent with the guidelines provided by the CONNECT-NM T4.5 (PSP) *Nuclear Materials Knowledge base (NM-KB) Implementation and Documentation* and based on the same Elementary Multiperspective Materials Ontology (EMMO) ontological framework. The project must provide a semantic technology layer on the top of the databases (e.g., Ontop+PostgreSQL, MongoDB) in order to provide a SPARQL endpoint based on the domain and application ontologies.

Each project should provide Data Management systems for the relevant domains, each one with a Knowledge base layer providing a SPARQL endpoint. Coordinated by T4.2, all projects will work toward creating a federated data space with a virtualised SPARQL endpoint for unified querying across diverse sources, streamlining access to nuclear materials data. To achieve this, NM-DMS databases should use technologies compatible with graph database virtualisation interfaces. The use of established solutions, such as the extendable ENTENTE database, or JRC's MatDB, will make this process faster and more efficient.

Projects should leverage the latest advances in ontology development (e.g. EMMO, Elementary Multiperspective Materials Ontology) and follow the guidelines provided by EMMC (European Materials Modelling Council) and EMCC (European Materials Characterisation Council). The IAEA document on ["Exploring Semantic Technologies and Their Application to Nuclear Knowledge Management"](#) serves as relevant documentation. Connection of the Project proposals with Projects of other RLs is a relevant asset.

## Expected Outcome and Impact

The proposed Projects shall contribute to the creation of a single open knowledge framework for the European nuclear materials domain, providing a common access to nuclear materials databases that links data from diverse sources and ensures data quality control. The knowledge framework should provide fast access to well-structured and semantically enriched data, supporting the reuse and understanding of existing datasets, and facilitate the creation of meaningful training sets for AI approaches, that combine both modelling and experimental data.

This initiative aims to accelerate significantly innovation in the nuclear field, by reducing the time needed to introduce new materials for specific nuclear applications. The Projects should aim to halve the duration and cost of materials testing and characterisation, specifically by limiting material consumption and optimising the use of personnel and instrumentation. By increasing the availability of FAIR nuclear materials databases within specific domains and expanding the number of domains supported by FAIR-compliant databases, the projects should foster a more structured and accessible information environment. Ultimately, the Projects should contribute to establishing a collaborative network among stakeholders involved in nuclear materials modelling, and promote shared expertise and mutual support in advancing nuclear materials research and application.

## Reference

Section 1.2.2.5 of the Annex I to the Grant Agreement. For further information the RLL's email is: [michal.pecelerowicz@ncbj.gov.pl](mailto:michal.pecelerowicz@ncbj.gov.pl)

## 3.2 Research Line 2: Advanced Materials Development and Manufacturing

### Scope and objectives

The timely availability of innovative materials and material solutions is the prerequisite for boosting innovation in the nuclear field. However, the development of advanced nuclear materials or the full setting up of advanced manufacturing processes is currently a very time-consuming process conducted following a trial-and-error approach. It is therefore of high importance to accelerate the development of materials solutions tailored to the specifications of the envisaged application, following the 'design and control' paradigm.

A way to achieve accelerated materials development through systematic screening is the creation of so-called **material acceleration platforms (MAPs)**. These platforms integrate machine-learning methods, models of various nature, high-throughput manufacturing and materials characterisation to achieve the ability to fast screen through a large number of materials nuances, to identify those that best comply with a set of requirements, represented by specific property indicators. This research line therefore deals with accelerating the development of advanced nuclear materials and manufacturing processes, possibly developing a nuclear-oriented MAP (*n*-MAP), in a 'design and control' framework. A strategy based on the development of an *n*-MAP by extension of non-nuclear MAPs will be a favoured shortcut, whenever possible.

Challenging aspects of an *n*-MAP are the evaluation of the performance of materials produced with a specific manufacturing process under irradiation, as well as the capability of predicting their long-term behaviour from a limited set of indicators. The latter requires proving that the properties of materials associated with a manufacturing process are measurable in a relatively fast way and are indeed valid indicators of long-term performance. A suitable selection of such indicators may require the support of suitable advanced predictive methodologies (RL5). Concerning irradiation, charged particles (ions, protons, electrons) provide a reasonably fast and efficient method to assess irradiation tolerance in the framework of an *n*-MAP. These have been long used to try to emulate neutron-irradiation induced damage, because they are cheaper and more flexible than neutron irradiation experiments, while saving the handling of activated materials. However, result transferability issues remain and need to be overcome for reliable radiation-tolerance screening purposes in an *n*-MAP.

Finally, the exploitation of advanced manufacturing techniques requires establishing a rational basis for the tuning of the process, in order to guarantee the reproducibility of optimum materials and component properties. In addition, applying *n*-MAPs to processes in which active materials are handled will benefit the development of materials for nuclear reactors such as fuels. The work towards this aim can also profit from approaches close to MAPs, dedicated to fabrication process optimisation.

## Expected Results

Projects proposed in this research line are expected to contribute to the development of n-MAPs, by providing experimental and artificial intelligence modelling tools that facilitate the design and construction or improve the performance of such platforms, or by directly contributing to their actual design, construction and application. Materials screening activities are also welcome, provided that, even without using a fully developed MAP, they implement elements of novelty in the direction of accelerating the screening process, especially if combined with the use of physical and data-driven models built using machine learning and artificial intelligence. Projects should pursue at least two and possibly more of the following types of results:

- Application of innovative fabrication and post-fabrication treatment methods (advanced manufacturing) to produce larger quantities of specimens for the investigation of materials, guaranteeing reproducibility of properties.
- Optimisation of testing procedures to monitor materials properties and performance during fabrication.
- Employment of advanced characterisation procedures to collect data of relevance to predict long-term behaviour, for example, using non-destructive examination techniques.
- Development of *ad hoc* predictive methodologies of the long-term behaviour of materials, combining different modelling and/or experimental approaches (consider also linked proposals in RL5).
- Identification of proven indicators of long-term materials performance, corresponding to properties that can be fast measured or are amenable to some kind of automated high-throughput procedure.
- Development of standards or guidelines for material testing procedures that enable fast screening of specific properties, such as mechanical or corrosion behaviour.
- Development of standards or guidelines for material irradiation, for example using charged particles, and post-irradiation testing procedures, which should enable fast screening of properties under irradiation and radiation tolerance, handling aspects of transferability to neutrons or to realistic irradiation conditions.

The activities in this research line will also include production of scientific data on innovative nuclear materials, to be integrated in the framework of MAP development, for example by addressing one aspect required to improve the efficiency of screening procedures.

Activities showing the highest level of synergies between nuclear technologies, possibly including fusion, or even non-nuclear technologies, will be favoured.

## Expected Outcome and Impact

Projects dedicated to advanced materials development are specifically expected to have

an outcome and an impact on at least one of the following ambits:

- Boosting knowledge about promising known materials with low TRL, bringing them to the level of near-qualified materials solutions.
- Enabling the discovery of new innovative materials solutions, leveraging synergies with non-nuclear MAPs to improve the design of structural components, core components, advanced fuel elements (enhanced accident tolerant fuels and enhanced performance fuels), or concrete structures, for different nuclear technologies and systems.

Projects dedicated to advanced manufacturing processes in the scope of this research line are, in addition, expected to have an outcome and an impact on one or two of the following ambits:

- Boosting process parameters optimisation and the qualification of advanced manufacturing techniques for relevant materials already used in nuclear technologies.
- Building materials design strategies based on tailoring the specific process parameters of advanced manufacturing techniques to develop new materials.
- Exploring and extend the practical applications of advanced manufacturing processes to nuclear reactor components design, in view of identifying technologies with the highest interest.
- Extending the use of advanced technology coating processes to protect nuclear materials, by boosting the knowledge on these techniques and bring them to near-qualified materials solutions.

Projects contributing to the construction of fully *n*-MAPs or parts of it are expected to have an outcome and an impact on at least two of the following ambits:

- Developing screening methodologies to extend the range of materials, conditions and/or manufacturing process parameters which can be investigated.
- Finding optimised materials solutions more efficiently and speed up their development, accelerating the safety strengthening of nuclear industry, and increasing its sustainability.
- Identifying innovative materials solutions that are applicable to several nuclear fission technologies and to fusion, as well as building synergies with other industries.
- Minimising the quantity of materials used, as well as the time and costs of innovative materials development.

## Reference

Section 1.2.2.1 of the Annex 1 to the Grant Agreement, accessible on the CONNECT-NM website. For further information the RLL's email is: [marialuisa.gentile@newcleo.com](mailto:marialuisa.gentile@newcleo.com)

### 3.3 Research Line 3: Materials and Component Qualification: Testing, Standardisation and Design Rules

#### Scope and objectives

Currently, the time for the qualification and codification of a new material for nuclear applications is too often measured in decades. In order to exploit the full potentiality of nuclear energy in connection with the energy transition, by deploying next generation reactors within the 2030s decade, qualification time needs to be reduced drastically.

Materials R&D and qualification in nuclear is intrinsically a complex and time-consuming process, largely determined by the testing and irradiation requirements. To date, materials qualification is based on the ‘observe and qualify’ approach, i.e. by conducting primarily standardised tests of representative material batches in a sequential way. Data are then processed into engineering properties and design rules are derived and eventually included in materials design codes or fuel performance codes. The main bottleneck in this approach is the time required for long-lasting qualification tests, e.g. creep, corrosion, irradiation, microstructure evolution. Little can be done to reduce the time needed to carry out testing, so the focus is on minimising the reliance on long-lasting tests and, in general, experimental data that are difficult to obtain, increasing the number and quality of the information learned from the samples investigated.

This can be achieved by developing accelerated qualification paths (AQPs), which represent the crucial step towards the more advanced “design and control” paradigm. They are based on the integration of modelling and predictive capabilities in targeted characterisation procedures, which may include non-destructive testing and examination, optimising data harvesting and management by means of advanced (machine-learning based) data analysis methods. The support of modelling, data management and data-driven design of experiments can indeed help to:

1. Reduce the number of long lasting tests or data that are difficult to be obtained
2. Increase the throughput of the tests
3. Develop and/or apply accelerated tests

The last issue is addressed via i) separate effect testing; ii) use of ion irradiation to emulate neutrons; iii) accelerated aging and creep; and iv) the ability to extrapolate the resulting data to operational conditions. In this context, the use of standardised small specimen test techniques is instrumental. Despite often not suitable for licensing, due to the strict constraints of the regulations regarding the geometry and size of the samples and the number tests, these techniques, together with ion irradiation, can support and guide the licensing of materials. However, the acceptability of accelerated testing for licensing should be assessed in collaboration with regulatory bodies and their technical support organisations, with reference to standardisation bodies such as CEN, CENELEC, ETSI, ISO, IEC, ITU, EEEEC.

Another issue to be addressed to reduce the qualification time is connected with the fact that, conventionally, data are produced in different laboratories and facilities, often with little or no coordination of the work. Such approach suffers from several limitations, such as different characterisations protocols and poor alignment of the tools used, as well as differences in fabricating representative samples and measuring environmental

parameters. An optimised approach should focus on increasing the completeness of the information attainable from investigations where high-quality samples are fully characterised in highly specialised facilities connected under the same quality system. We refer to such networks as Test-Beds (TBs), i.e. integrated platforms that enable exhaustive and repeatable testing on materials, in accordance with specific and possibly accelerated procedures for the intended use. TBs should ideally include various experimental testing and characterisation facilities for materials, including irradiation, and be coupled to advanced modelling and data management. The optimisation of data harvesting by the coordination of infrastructures across Europe will be indeed the first step forward contributing to accelerate nuclear materials qualification processes.

The implementation of the above-described optimised approach, based on AQPs and TBs, is the objective pursued by this research line. It will lead to the integration of specialised infrastructures located in various European laboratories into a single delocalised entity, acting as hub for pre normative research.

The implementation of stable organisational and legal structures for the TBs for nuclear materials will be part of this effort, especially in order to make these TBs open, i.e. to create a single entry point for nuclear materials qualification in Europe, open to any potential customer, according to appropriate rules of intellectual property protection.

## Expected Results

Projects proposed in this research line are expected to establish a characterisation TB on specific issues and contribute to the development of AQPs by adopting a novel approach resulting from:

- Integration of modelling and predictive capabilities and/or non-destructive testing and examination tools in current paths as accelerators.
- Development of new accelerated tests with relevant protocols and/or suitable data harvesting methodologies and management.
- Development of protocols for currently non-standardised tests, including small specimen testing.

The definition and development of AQPs are expected to be carried out with special applications in mind as case-studies (i.e. specific nuclear system and/or material), based on the priorities and urgencies to support deployment, according to the choice of the proposing consortium. For the implementation of AQP's, the proposals must include the cooperation with the regulatory bodies, their technical support organisations and the relevant standardisation stakeholders across Europe (e.g. CEN, CENELEC, ETSI, ISO, IEC, ITU, EEEEC, industry), in order to identify the standardisation framework, existing standards and the testing plan towards standardisation. The development of harmonised guidelines, best practices and standards will be considered as pillars, and projects devoted to these aspects will have the priority. Round robin tests to assess the quality of the protocols are advised. In addition:

- For the correct operation, in application of standardised and accelerated qualification paths, the proposals will necessarily require the implementation of a TB Quality Management System.
- Proposal shall implement advanced data analysis and storage, to collect data in

dedicated shared points for the consultation between the partners of the TB. The accessibility and reusability of data produced will be assured by a complete set of metadata, in agreement with the work done in RL1 on data management.

- Proposals should include actions designed to facilitate cooperation with the projects of the other RL's of CONNECT NM and enhance their involvement.
- Proposals will provide a clear description of how the activities will effectively contribute to take a step forward towards the selected objectives and address all the legal, political and managerial aspects of TBs.

The final output of this effort will be the implementation of stable organisational and legal structures, as single entry-points for specific issues related to accelerated qualification of materials and components, open to any potential customer.

## Expected Outcome and Impact

The implementation of TBs from the coordination of existing and future infrastructures/skills is expected to be a step forward to the harmonisation of the European research in nuclear materials and the alignment on the qualification paths will allow effective resource allocation, avoiding redundancies, inefficiencies, and missed opportunities.

Such joint approach will help European players to remain at the forefront of the nuclear materials R&D assuring, on the one hand, highest safety standards of nuclear installations in Europe, and, on the other, improved competitiveness of Europe at the world scale, in this dynamic technology domain.

Standardised and quality controlled experimental procedures and methodologies will enable the reliability of the data to be drastically increased, and thus the reliability of the qualification process.

Overall, the action will allow the faster exploitation of innovative material solutions for i) the deployment of innovative reactor concepts featuring improved safety and reduced costs, for ii) further enhancing the performance, safety, and life of existing reactor fleets, and iii) pursuing higher economic sustainability, by reducing of time and costs for the licensing of innovative materials and materials solutions. This will lead to improved technical knowledge and expertise on material qualification and standardisation, as well as the interactions of the nuclear materials research community with stakeholders and industrial nuclear partners, nuclear regulatory bodies and standardisation and codification institutions.

## Reference

Section 1.2.2.2 of the Annex 1 to the Grant Agreement, accessible on the CONNECT-NM website. For further information the RLL's email is: [Massimo.angiolini@enea.it](mailto:Massimo.angiolini@enea.it)

## 3.4 Research Line 4: Non-Destructive Examination and Materials Health Monitoring

### Scope and objectives

Monitoring the degradation of nuclear materials is essential for managing component lifespan safely. Thus, it is crucial to monitor and assess the actual condition of products, components and materials, and to implement smart maintenance and repair functions, ideally at the level of individual products or components. Autonomous repair systems often use sensors to detect changes in the material's condition through physical principles or mechanical deformation. The unique feature of NDT&E methods is their ability to detect and evaluate continuously the progressive change of the material properties of the same specimen or component, *in situ* and/or in *operando* conditions. Advanced sensing techniques and the smart exploitation of this data, including distributed sensor networks and embedded microsensors, enable real-time monitoring of the material's condition. However, in the nuclear energy sector, NDT&E has traditionally focused on defect detection during periodic inspections, missing its full potential of being integrated into the design and manufacturing processes. Lessons learnt in the area of non-destructive testing and examination (NDT&E) reveal that:

- NDT&E can contribute to all stages of the product lifecycle, starting with the development of materials and products and then covering also their maintenance, their repair, and finally their recycling, where feasible.
- Continuous in-service inspection for existing and future NPPs is a powerful tool in support of high level safety and reliable operation.
- Structural Health Monitoring (SHM) using permanently installed sensors offers clear benefits as a complement to traditional NDT&E techniques, including easier and safer operations, reduced inspection time and costs, and the potential for more frequent or continuous monitoring, which facilitates predictive maintenance.
- Combining ageing models with physics-based and data-driven models (i.e. based on machine learning), thereby creating digital twins for materials and structural components, to be updated via sensor measurements, will enable enhanced diagnostics and prognostics.
- Digital twins based on the idea of accessing actual operating data, to continuously improve their capability of tracing the evolution over time of materials and components, are expected to improve NPP safety, providing support for selection process, reducing the costs and enhancing the lifetime of nuclear components.
- Inspection-oriented material and component design has to be considered from the beginning of the lifecycle, to enable replacement of components or retrofiting.

For this to be achieved, it is essential that materials and components must be easily characterised by using non-destructive testing and evaluation (NDT&E) techniques.

Systems that combine continuous and capillary SHM with digital twins, based on which suitable interventions of component repair or replacement can be timely planned to guarantee safety, are denoted as **intelligent materials health monitoring systems**

**(IMHM systems).** These systems can improve performance of structural or functional components and products, combining longevity and efficiency.

In this context, this RL of CONNECT-NM aims to develop IMHM systems to evaluate parameters related to the micro- (defect location, density, size) and macro-structural state (mechanical properties) during service. It will also consider operational factors (such as temperature and pressure cycles, irradiation parameters, mechanical loading etc.) through continuous inspection. By using cognitive sensors, the RL seeks to improve estimations of the operational lifetime of nuclear power plants and support materials development and qualification.

## Expected Results

Projects in this research line are expected to contribute to develop IMHM systems, based on innovative AI-supported multi-parameter approaches for NDT&E of degradation in materials and components for NPPs. Proposals should focus on the operation phase of specific components or materials of future NPPs and provide a strategy towards the development of the corresponding IMHM. Since the development of robust technologies capable of determining in-service material performance will depend on model accuracy and data reliability, proposals shall consider collecting experimental reliable key data captured under realistic operation conditions. All Projects shall include reliability and uncertainty studies, considering initial non-degraded microstructure, material variability, and other influencing factors. Multidisciplinary proposed Projects shall address at least two of the following aspects, preferably addressing next generation nuclear systems for one of the materials classes of interest:

- Development and optimisation of cognitive auto-adaptive sensor to understand the physical mechanisms affecting material properties in operation: thermomechanical fatigue, radiation-induced ageing, swelling, creep; corrosion and stress-corrosion cracking/dissolution/erosion in contact with heat-transferring fluids or due to solid-solid contact; creep; various concrete degradations; fuel assemblies degradation etc.
- Development of multi-parameter/multi-NDT&E-method-monitoring technologies, which fulfil requirements of NPP operational conditions and support customised maintenance and repair plans, extending component lifetime economically and environmentally.
- Application of enhanced statistical analysis, machine learning algorithms, or artificial intelligence to select relevant data, instead of 'blind' big data analysis, allowing sensors to decide which information is relevant and supporting monitoring tools for predictable materials degradation (mechanical and/or environmental).
- Advanced data fusion, interrelation of data generated by different NDT&E methods and machine learning-driven decision-making techniques can then be leveraged to enable the system to not only monitor the state of individual structures, but also to infer about their interdependencies and, thus, the evolution of the system as a whole.
- Analysis of the fault tolerance of the machine learning-driven decision-making techniques and development of embedded methods for indicating or even for qualifying the reliability of the outputs, as instrumental for human-free operation.

- Development of protocol(s) for training, testing and especially validating machine learning-driven decision making techniques that can increase the transparency of the machine learning applications in safety areas and can serve as a basis for future industrial standards and rules.

## Expected Outcome and Impact

Projects in this RL are therefore expected to demonstrate their high added value in industrial nuclear applications, in terms of increased safety and cost reduction, in particular for better estimation and management of the operational lifetime of NPPs and their components, while providing a feedback/input to models and design rules, which can be in turn improved. NDT&E techniques are also expected to contribute to the development of n-MAPs (RL2) and AQPs (RL3).

While focused only on the operational phase, Projects should describe how the techniques developed for the operational phase of a specific component could be applied on other segments or even on the whole component lifecycle, thereby increasing safety and sustainability, including economic sustainability, of nuclear energy as a whole. Projects should describe pathways to:

- Enable the capture of a variety of material properties right from the start of the component development, until its end-of-life.
- Reduce maintenance costs, quantifying the reduction compared to the state-of-the-art.
- Assess and validate the longevity of materials, components and products through accelerated testing.
- Enable the traceability of materials information throughout the value chain to identify the possible origins of defects, thanks to the significant amount of *a priori* knowledge that becomes in this way available before each inspection measurement (including multi-scale modelling of structure, and structure vs. properties correlations).

## Reference

Section 1.2.2.3 of the Annex 1 to the Grant Agreement, accessible on the CONNECT-NM website. For further information the RLL's email is: [madalina.rabung@izfp.fraunhofer.de](mailto:madalina.rabung@izfp.fraunhofer.de)

## 3.5 Research Line 5: Advanced Materials Modelling and Characterisation

### Scope and objectives

This RL pursues the development of physical models coupled to advanced microstructural characterisation to achieve high-level understanding and predictive capability, in combination with suitable data-driven modelling approaches. This should

be executed in close collaboration with the other RLs: pursuing the elaboration of design rules, assessment, and test procedures, for both operating and off-normal conditions, feeding fuel performance codes, assisting materials development and discovery, or supporting materials health monitoring, for all the materials classes of interest.

Multiscale modelling approaches should enable the prediction of the behaviour of materials under operating reactor conditions, especially radiation effects, adopting a multidisciplinary approach that may include physics of solids and fluids, chemistry, thermodynamics and materials science theory in general, combined with computer science, in close interaction with advanced microstructural, microchemical, as well as micromechanical characterisation. These approaches can be currently complemented with modern digital techniques, such as machine learning and artificial intelligence, which use available data to identify complex correlations between large variables sets and important materials properties (the so-called data-driven modelling). These techniques, if blended with physical approaches, enable researchers to overcome limitations such as those due to local chemical complexity when bridging scales, towards high fidelity and advanced numerical capabilities. The use of machine-learning approaches such as ‘few-shot learning’ is especially promising, as data in nuclear materials science are often scarce. Finally, materials modelling is recommended to involve direct integration with experimental techniques, in a two-way process: use of experiments to feed models and use of models to facilitate the interpretation of experiments, including simulation of the signal produced by the experimental technique. Hence, the focus of this RL is on **boosting the possibilities of multi-scale and multi-physics simulations, taking advantage of modern machine learning as well as experimental examination approaches.**

The main objective of the Projects of this RL is thus to improve the capability of **advanced predictive methodologies** (APM) for metallic, fuel cladding, fuel and concrete materials, used in current and future nuclear fission reactors. These methodologies are expected to blend physical and data-driven approaches and to become of direct applicability at industrial level, under increasingly wide ranges of operational conditions.

## Expected Results

Projects in this research line are expected to contribute effectively to the development of APMs that cleverly blend physics-based and data-driven modelling approaches, in interaction with the use of advanced microstructural, microchemical and micromechanical examination techniques (including non-destructive ones). Whenever necessary, i.e. when reference data are expected to be scarce, the use of ‘few-shot learning’ approaches can be an asset.

Expected activities in the Projects of this RL include i) advancing particular physics-based models and analytical tools; ii) improving bridging between scales; iii) utilising data-sets to discover new solutions through the employment of machine learning; and iv) executing particular experiments dedicated to supplying necessary data, enabling the aforementioned activities. For instance:

- Development or extension of novel APMs that address specific materials degradation modes, in increasingly complex material compositions, such as multicomponent alloys, mixed fuels, novel concrete mixtures. Examples of degradation modes are radiation-induced hardening and/or embrittlement, swelling, creep; gas production

and its consequences; corrosion and stress-corrosion/dissolution/erosion in contact with heat-transferring fluids or due to solid-solid contact; thermal creep; various concrete degradation mechanisms; effect of dose, dose rate and temperature...

- Development or extension of novel APMs capable of assisting through modelling the development or discovery of new or modified materials, with enhanced structural integrity and radiation resistance properties, for instance addressing the use of charged particle irradiation as screening tool for radiation resistance.
- Development of methods for the analysis of materials computer simulation results 'with the eyes' of a specific experimental technique, in order to facilitate comparison, as well as in support of non-destructive technique interpretation.
- Development of methods to simulate how a given experimental technique will 'see' a given microstructure or material state in general, having in mind the study of microstructural evolution and atomic transport properties in and out of irradiation.
- Development of multi-fidelity models that combine various sources of data for enhancing predictive capabilities of existing or newly developed engineering and analytical tools
- Execution of model-oriented experiments and post-exposure examination, provided that their analysis and/or exploitation with novel approaches is included.

Creativity in the elaboration of novel methodologies will be valued. Originality in the combination of physics-based and data-driven approaches to boost the predictive capability of the methodology will be especially in the focus. Purely physics-based or purely data-driven novel approaches may be proposed, as well, but they need to be of convincing game-changing nature. Methodologies that simultaneously combine the use of advanced (and fast) characterisation, physics-based models and data-driven approaches will be highly valued.

## Expected Outcome and Impact

Developments in this RL shall support n-MAPs, AQPs and IMHM systems, and/or take important steps towards advanced methodologies and engineering tools of direct interest and use for industry and/or regulators. These will boost the capability of predicting the behaviour of materials in operation and of assessing properties of importance for component lifetime management and safety, by enabling more reliable safety assessments to be carried out. This may occur by both underpinning and eventually replacing empirical or semi-empirical correlations used at industrial level, or as a support to more reliable evaluation of potential failure paths, which experimentally requires large and expensive execution programs, still often yielding simplistic results. Digital technologies are meant to contribute to reduce the number of exposure experiments and subsequent testing required on activated materials, thereby having an important impact on time-to-market and cost reduction.

The methodologies shall be applicable under an increasingly wide range of operational conditions and help transfer experimental results achieved under different irradiation conditions (for example ion irradiation vs neutron irradiation). Advanced predictive methodologies shall also support the improvement of design and fuel performance

codes, and various analytical tools used to evaluate material properties. Advanced modelling is also expected to have a crucial impact on accelerated qualification, as it provides the required links between properties and should enable the effects of degradation processes to be more precisely assessed, also in the long term, based on physical insight.

In short, advanced modelling and characterisation of nuclear materials as addressed in this RL shall crucially support the overall safety, efficiency, economy and sustainability of nuclear systems. It shall contribute to safe long-term operation of current nuclear power fleets, as well as to develop materials for next generation reactors, including SMRs.

## Reference

Section 1.2.2.4 of the Annex I to the Grant Agreement, accessible on the CONNECT-NM website, where indications of materials issues of particular interest are given, as well. For further information the RLL's email is: [Maria.Oksa@vtt.fi](mailto:Maria.Oksa@vtt.fi)

## 4. Proposal submission procedure

The proposal submission procedure will occur in two steps or phases<sup>4</sup>: Project Ideas and Project Proposals, with a Brokerage Event as intermediate turning point. The call will be launched by making the following documents available to all potentially interested participants (via download) and by advertising their availability through all possible channels:

1. *CONNECT-NM Open Call Announcement*
2. *CONNECT-NM Open Call Work-Programme*
3. *CONNECT-NM Guide for Project Proposers*
4. *CONNECT-NM Project Ideas Template*
5. *CONNECT-NM Project Proposal Template (with financial template and letter of intent template)*
6. *CONNECT-NM Project Proposal Evaluation Criteria and Scoring System: version for proposers (information purposes)*

These documents will become progressively available at [this webpage](#). The Open Call Announcement will be the first document to be diffused by the MSO under direction of the WP3 (communication, dissemination and result exploitation) leader, ahead of the opening date of the call (possibly one month ahead). In addition to being downloadable from the CONNECT-NM website, it will be distributed through the networks of the involved associations (EERA, ENEN, SNETP), as well as by directly sending emails through the CONNECT-NM network, including known contacts of organisations that are not yet part of the Consortium, based on communication from the Beneficiaries. In addition, Beneficiaries will be encouraged to make it available through their own webpages and networks. It will provide succinct instructions about the Project proposal procedure, all relevant starting dates and deadlines and all the necessary links to the other documents.

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<sup>4</sup> This is imposed by the Annex 5 to the Grant Agreement.

The Work Programme and the Guide for Project Proposers, as well as the Project Ideas Template, will have to be available upon the date of launch of the Call. The Project Proposal Template, as well as the Evaluation Criteria and Scoring System, may become available at a later stage, although well ahead of the start of the second phase of the submission procedure. When the Call is launched, a dedicated CONNECT-NM webpage will have to be operative. It will describe succinctly the submission procedure, including starting dates and deadlines, and enable all the relevant documents to be downloaded.

## 4.1 First phase: Project Ideas, first evaluation and Brokerage Event

In this phase the proposers describe succinctly the core of the Project proposal ideas, including objectives, methodology, expected results, alignment with the work-programme (**Section 3**) and expected outcome and impact. **Annex D** provides indications in case generative AI is used to produce the proposal. The Project Idea proposal also provides a first list of possible participants and a first assessment of the expected costs, organised by cost categories as described in **Section 2.5**. Names of possible external expert reviewers are suggested, as well. At this stage the Project Idea proposal should indicate which Research Lines it may be contributing to, selecting a maximum of 3 possibilities. The RL to which the proposal is assigned is decided in the second phase. The overall length of the Project Idea proposal shall not exceed 5 pages, excluding list of participants and financial information.

The submission of Project Ideas will occur by assigning each proposal a folder on the CONNECT-NM repository (members-only area). Therefore, as first action the Project Leader needs to inform by email the MSO of CONNECT-NM of the intention of sending a Project Idea proposal, indicating a name for the folder. The Project Leader also needs to ensure being registered as user of the CONNECT-NM members-only webpage. While the Open Call for Project Ideas remains open (2 months), the folder will be accessible to the Project Leader in writing mode. The Project Leader shall be enabled to give access to the folder to other participants in the Project Idea proposal, as well. This folder may thus be used to share files during the preparation of the proposal, but eventually it will only contain one file, which will be the final version of the submitted Project Idea proposal (Word file). After the deadline for submission, the Project Leader will cease to have permission to access the folder, which will only become accessible to the evaluators of the first phase.

An **Online Info Session** will be organised at the beginning of the first phase, to provide potential applicants and Euratom stakeholders the opportunity to obtain further details about the Open Call and the Research Lines and ask relevant questions. Attendees will be enabled to submit their questions in advance to ensure they are addressed during the live session.

The evaluators in this first phase will be the Research Line Leaders and/or Advisors. They are not expected to decide which proposals are accepted, but they will provide the proposers with non-binding advices after assessing:

- The compliance of the Project Idea proposals with the work-programme of CONNECT-NM, as well as with general Project proposal eligibility criteria.

- The adherence of the proposals with one or another Research Line scope and objective.
- The possible existence of overlaps or connections with other Project Idea proposals.

In this assessment, on a case-by-case basis, evaluators that may have conflicts of interest, for example because they are directly involved in a given Project proposal idea or belong to the same organisation as the proposers, will be excluded from the specific discussion of that Idea. Proposers will receive feedback in the form of non-binding advices of proposal merging, modification, or withdrawal (see below). The main objective of these advices is to make sure that the proposals that go to the second phase will be eligible, competitive and balanced in terms of Research Lines and materials classes that are covered by the overall portfolio.

**A Brokerage Event will be organised, structured into two main sessions**, namely the private assessment of Project Ideas and the actual Brokerage Event.

1. **Project Idea Assessment:** During the Project Idea assessment, the first-phase evaluation results will be discussed in a closed-door meeting between the Project Idea proposers and the relevant Research Line Leaders and Advisors, taking care to avoid conflicts of interest, as described above. The objective of this discussion is to provide the proposers with advice on how to improve, merge with others or redirect their Project Idea proposals, to be complying with the CONNECT-NM work-programme. Advise on which Research Line to choose will be given, as well. Some proposals may receive the non-binding recommendation not to proceed to the second phase. This will ensure that the proposals that go to the second phase are all eligible and competitive and overall cover the various Research Lines and materials of interest in a balanced way.
2. **Brokerage Event:** This session is designed to facilitate networking and strengthen proposals by filling gaps in consortium capacities:
  - a. **Project ideas:** The Project Leaders of the proposed Project Ideas will share the summary of their Project Idea, stressing the aspect of capacities that are required to achieve the relevant objectives (without necessarily discussing aspects that the consortium may prefer to keep confidential).
  - b. **Capacities:** Other participants will briefly describe their core competencies and capabilities to contribute to the CONNECT-NM Research Lines.

Note: All Project Ideas submitted during the first evaluation phase and intending to go to the second phase must be presented during the Brokerage Event. Other Project Ideas, not submitted in the first phase, may also be presented, if so wished, but they shall not qualify for participation in the second phase of the CONNECT-NM submission procedure. This Brokerage Event is meant to potentially enable the contribution of new valuable partners to the Consortium of the proposed Project Ideas, in view of preparing the full proposal.

This Event will be promoted widely through association networks (EERA, ENEN, and SNETP), with remote participation available to ensure broad engagement beyond the established Partnership Consortium.

## 4.2 Second phase: Full Project preparation and submission

Based on the recommendations received, the Project Ideas proposals presented in the first phase, filtered through the non-binding recommendations of the Research Line Leaders and Advisors and duly discussed in the Brokerage Event will have to become full Project proposals. These will provide full detail in terms of (see also **Sections 2.2-4**): objectives, methodology and expected results (excellence); expected outcome and impact (impact); subtask breakdown, contribution of each participant and participant capacity short description, short CV of main participants, internal milestones and deliverables, and budget, i.e. person-months per participant and subtask, associated personnel costs and travel expenses, other foreseeable costs according to the standard categories (see **Section 2.5**), indirect costs (implementation). **Annex D** provides indications in case generative AI is used to produce the proposal.

Importantly, although Project proposals are welcome and even encouraged to include cross-cutting aspects through different Research Lines, **in this second phase each proposal shall be assigned to one and only one Research Line**, upon explicit request of the proposers, because the project shall be stated to contribute mainly to the chosen RL specific objective (see **Table 1**). The Project proposal provides the description of the work proposed, organised in excellence, impact and implementation<sup>5</sup>. It will also need to address in a light way data management, open science, dissemination and ethical aspects, as described in **Section 2.2**. Thus, the Project proposal does not need to include the production of a data management plan, or a dissemination plan, or open science rules, or an ethical assessment. However, it will need to state knowledge of, and consistency with, the corresponding Partnership plans, and ensure interaction with the corresponding work packages, tasks and reference persons for any related issue, through the Project Leader and the responsible Research Line Leader.

This interaction may lead to updates of the corresponding Partnership documents, to take into account the specificities or specific intentions of the Projects concerning data, dissemination, open science, or compliance with ethics requirements: these specificities and specific intentions, if any, need to be briefly mentioned in the proposal. Projects are also strongly encouraged to foresee the use of the opportunities offered by the Partnership in terms of mobility of researchers (mainly through ENEN) and access to infrastructures (in WP2), as well as result exploitation actions (WP3). Concerning open science, Projects may count on the assistance of the Open Science Officer. However, they will need to include in their budget sufficient provisions to cover foreseeable expenses related to open access publications, in compliance with the contractual obligation to gold open access publishing<sup>6</sup>. Concerning Ethical aspects, a number of commitments will have to be accepted, some of which may depend on the type of Project. In particular, one point that the European Commission insisted on, in its Ethics Summary Report on CONNECT-NM, concerns whether or not radioactive materials are handled<sup>7</sup>.

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<sup>5</sup> In application of the rules set out in the Annex 5 to the GrA.

<sup>6</sup> The Open Science Guidelines produced by the Open Science Officer of CONNECT-NM will provide information about schemes that can be used to avoid charging the publication to the Project. These are generally based on signed agreements between countries or specific organisations with publishers.

<sup>7</sup> From the Ethics Summary Report: "SECTION 7: ENVIRONMENT, HEALTH AND SAFETY: The project documentation does not clarify whether [...] the testing activities involve hands-on

Finally, there will be no need to set up any specific governance structures, except for a Project Executive Committee comprised of Project Leader and Subtask Leaders, with the main duty of making sure the Project internal milestones and internal deliverables are timely reached and produced and of preparing the yearly Project report (technical and financial). The Project proposal template will include default indications on this point.

To submit the full proposal, the corresponding downloadable Project Proposal Template will be used, which will include, in addition to a Word file for the actual proposal, a template in Excel format for the financial part and a template of Letter of Commitment of the Project Consortium members. The latter shall outline the status of each organisation involved and engage it to perform the work promised. This letter will be a formal commitment to carry out the work described in the proposal (if the Project is selected for support), at the conditions set out by GrA, CoA and IRoP of CONNECT-NM (even if not signed by the specific organisation), available in the private area of the CONNECT-NM website, including the 50% funding rate, when the organisation is eligible for it. If the organisation is not yet part of the CONNECT-NM consortium, in addition, it needs to specify its expected status: Affiliated Entity (to which Beneficiary), Third Party (of which beneficiary, specifying whether contributing in-kind or receiving support), or Associated Partner.

The submission procedure will be similar to the one for Project Ideas. The appointed Project Leader will inform by email the MSO of CONNECT-NM of the intention of sending a full Project proposal, indicating a name. A folder will be then opened in the members-only website repository with that name. While the Open Call for Project Proposals remains open (at least 2 months), the folder will be accessible to the Project Leader in writing mode. For this, the Project Leader needs to have access to the members-only area of the website of CONNECT-NM. The Project Leader shall be enabled to give access to the folder to other participants in the Project, as well. This folder may thus be used to share files during the preparation of the proposal, but eventually it will only contain three files: the final version of the submitted full Project proposal (Word file), the financial part of the proposal (Excel file) and a compressed file with all the letters of intent, in pdf format and signed (possibly electronically). After the deadline for submission, the Project Leader will cease to have permission to access the folder, which will only become accessible to the evaluators of the second phase (see **Section 5**). The evaluators for this second phase are the members of the Evaluation Committee (EvaCo), as described in **Section 5.1**. For the financial part, the template will automatise as many items as possible. The **length of the full Project Proposal will not exceed 20 pages, excluding list of participants and their description, internal deliverable and milestone lists**, and of course **the financial part**, which will be in a different file (Excel file).

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experimentation or alternative methods, making it impossible to assess potential adverse impacts on the environment or the health and safety of individuals. To address this, the project should specify if hands-on testing/experiments will occur and, if so, outline the corresponding health and safety measures”.

## 5. Proposal evaluation and selection

### 5.1 Evaluation and ranking of the proposals

An EvaCo is formed, comprised of selected experts that guarantee independence and impartiality managing the Project Proposal evaluation procedure. The EvaCo will distribute the proposals to independent reviewers, obtaining three completed reviews for each Project<sup>8</sup>. The reviewers may be chosen from the pool of names indicated by the proposers in the first phase (Project Ideas), or independently chosen by the EvaCo members. Based on the reviews and relevant scores, the EvaCo will be in charge to rank the submitted full Project proposals in order of scores, both per Research Line and overall. Although they will be interacting with the Executive Board, especially the Research Line Leaders and their Advisors, and will be assisted for any practical purpose by the MSO, they will need to be able to act independently at all times.

**The EvaCo members are endorsed by the General Assembly and are remunerated for their work via subcontracting through ENEN.** The remuneration will be paid as lump sum and a gross amount of 2500 EUR per EvaCo member is considered appropriate for the work the committee is expected to perform. **Up to 9 members should be foreseen**, in order to cover the whole spectrum of expertise, in terms of Research Lines (5) and classes of materials of interest (4). Prior to their appointment, EvaCo members sign a non-disclosure agreement. Because of the administrative burden that this might imply, and the fact that this committee needs to be instructed and to be given time to organise its work, the EvaCo members need be identified at the beginning of the first phase and the committee fully appointed before the second phase starts. Based also on the received Project Ideas and the list of individuals and organisations involved, each EvaCo member fills in and signs a no-conflict-of-interest declaration. This is used to exclude some of them from the discussion of specific Project proposals. It is expected that the EvaCo will need to meet on at least 5 occasions:

1. To be officially constituted and instructed upon appointment of all members, electing a chair of the EvaCo as spokesperson and contact point for the MSO and the ExB (half day).
2. To discuss the proposals received, distribute them between themselves (each member of the EvaCo should follow up the review of a number of proposals) and assign suitable reviewers to each of them (1 day).
3. To discuss the reviews received and decide whether meetings with the reviewers (in case of strongly discrepant opinions on a given proposal) or even hearings with the proposers (in case unclear point emerge in the proposals, which might have been the cause of the discrepancies between reviewers) are needed (1 day).
4. To actually meet the reviewers and/or hear the proposers, for the proposals that need such type of actions, following the decision made at point 3 (1 day).
5. To discuss the final scores from the reviewers and produce the ranking (1 day).

These meetings will be organised online, with the assistance of the MSO, which will be also in charge to write the minutes. The Coordinator might participate in some of these meetings, if needed, to provide suitable explanations, for instance in the first meeting or at the beginning of the other meetings, **being however excluded from the**

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<sup>8</sup> In application of the rules set out in Annex 5 to the GrA.

**discussions.** If the members of the EvaCo are located in significantly different time zones, each meeting might have to be spread over more than one day, to enable everyone's participation.

As stated, reviewers may be selected from the list suggested by the Project proposers in the Project Idea proposal, but they will be in any case unquestionably appointed by the EvaCo, based on their international renown as experts in the relevant field. To minimise potential for conflict of interest, reviewers may be chosen from outside Europe or in any case from clearly independent and impartial frameworks. Reviewers also sign a non-disclosure agreement and a no-conflict-of-interest declaration before appointment, which advises early appointment of reviewers. The EvaCo will try, as much as possible, to select reviewers in such a way that each of them shall evaluate more than one proposal, in order to ensure a reasonable level of consistency with the scoring. In any case, **each proposal must be reviewed by a minimum of three different reviewers<sup>9</sup>.** **Reviewers will receive a financial reward proportional to the number of proposals they evaluate, via signature of a contract with ENEN.** A lump sum gross amount of EUR 200/proposal is considered appropriate. The reviewers will assign scores using a guided template (Project Scoring Sheet), divided according to the sections of the proposal template. The scores should broadly reflect the EC recommended subdivision, organising the evaluation by excellence, impact and implementation, in application of Annex 5 to the GrA. However, other items and more specific criteria may be adopted, as well, in particular emphasising adherence to the CONNECT-NM Open Call Work Programme. The ExB will be in charge to define the scoring system and produce the scoring sheet. Whichever way the scoring is organised, eventually a single value between 0 and 10 will be assigned to each proposal, to facilitate the comparison, 6 being the minimum score for acceptance.

As stated, in case of strongly diverging opinions expressed by the reviewers on a given proposal, or anyway upon decision of the EvaCo, meetings with reviewers, or even hearings of the Projects proposers, will be set up, to consensually smoothen divergences or clarify doubts about the Project proposal content. At the end of the process, the EvaCo will collectively rank the Project proposals in terms of priority for funding by the Partnership. The ranking will be primarily based on the scores assigned by the reviewers to each proposal. The input of the members of the EvaCo for the ranking of the project proposals shall be organised in such a way that any potential conflict of interest is avoided. In particular, a member of the EvaCo shall not participate in any decision in which a situation or circumstance of personal and/or professional nature can compromise his or her ability to decide in the best interest of CONNECT-NM.

The EvaCo ranks Project proposals both in absolute terms and per Research Line and produces a report that describes the review procedure, summarising for each proposal positive and negative aspects, as justification for the ranking. The final ranking and the report enter the Partnership annual report, as well as the mandatory deliverable dedicated to the description of the OCP.

## 5.2 Selection of the project proposals for funding

Based on the ranking proposed by the EvaCo, the General Assembly of the Partnership, representing all Beneficiaries, has the ultimate decision about how many projects can be

<sup>9</sup> In application of the rules set out in Annex 5 to the GrA.

funded and which ones will be selected. It is, however, in the right of the proposing consortia to decide to pursue with their own means Projects that have not been granted financial support by the Partnership. They will in any case be enabled to count on the opportunities and support offered by the Partnership to Projects in terms of transversal activities, i.e. dissemination, communication, result exploitation, access to infrastructure and mobility opportunities, within fund availability in the transversal work packages (WP2 and WP3) for these types of activities and subject to the endorsement of the Executive Board.

## 6. Project launch and reporting

Following the decision of the General Assembly, the leaders of the Projects proposals are formally notified by the Coordinator about the acceptance for partial funding or the rejection of their proposal and the following steps to be taken. The result of the selection will be made public through the CONNECT-NM website.

Prior to the start of the funded Projects, a **Task Agreement** is signed between the Coordinator and the Project Leading Organisation, on behalf of all Project partners in the Project Consortium. This Task Agreement will be based on the full Project proposal (used as Annex after suitable modification), which will detail the subtask breakdown and the internal milestones and internal deliverables, as well as the Project budget. The Task Agreement will indicate among other items the official starting date of the Project and the duties of the Project Leader in terms of reporting, as well as the general connection between the Project and the Partnership, concerning funding (pre-financing and instalments) and services offered by the latter. This document will be as simple and concise as reasonably possible.

The Project Leader is responsible to organise a project kick-off meeting shortly after the official starting date of the Project, informing the corresponding Research Line Leader about such meeting, which may count on the support of the MSO of CONNECT-NM for its organisation, if required. The kick-off meeting should be in-presence or hybrid. Unjustified failure to organise a kick-off meeting within two months from the official starting date of the Project might lead to the decision of cancelling the relevant grant. The Project Leader is also responsible to ensure the smooth performance of the work in the Project, organising any meeting that may be required, in all cases keeping informed and involving the corresponding Research Line Leader. The Project Leader will be responsible for providing the Research Line Leader with the annual technical Project Report at mid-Partnership's year, i.e. after the end of March each year, and the Coordinator with the annual financial Project Report at the end of the Partnership's year, i.e. after the end of September each year. Based on the technical Project report from all the Projects in each Research Line, the Research Line Leader will produce the annual Research Line Progress Report (RLPR), which is an official deliverable of CONNECT-NM and thus is uploaded onto the European Commission portal. The Project Leaders can count on the assistance of the MSO, via Research Line Leaders, for any aspect related to project management (e.g. support for meeting organisation or report preparation), communication and dissemination actions, mobility requests, etc. At the closure of the Project, a final Project report will be produced, that includes all major findings of the Project and discusses its possible impact.

## 7. Proposed dates

- Call Announcement 18/12/2024 → Open Call Announcement ready
- Opening of Call for Project Ideas 20/01/2025 → Open Call Work Programme, Guide for Project Proposers and Project Idea Template ready
- Deadline for submission of Project Ideas 21/03/2025
- Brokerage Event Week: 7-11/04/2025 (RLL and RLA need to be available, poll needed)
- Opening Call for full Project Proposals 28/04/2025 → Project Proposal Template and Project Proposal Evaluation Criteria / Scoring System (version for proposers) ready
- Deadline for submission of full Project Proposals 07/07/2025 → Project Proposal Evaluation Criteria / Scoring System (version for reviewers) and Evaluation Form ready

## Annex A - Glossary

### Affiliated Entities

Affiliated Entities are organisations which are affiliated to a Beneficiary through a bespoke cooperation agreement (within the meaning of Article 187 of EU Financial Regulation 2018/10464), which participate in the Partnership with similar rights and obligations as the Beneficiaries (obligation to implement action tasks and right to charge costs and claim contributions), even though they do not sign either the accession form to the Grant Agreement, or the Consortium Agreement.

### Associated Partner

Associated partners are organisations that participate in the Partnership and its Projects, but without the right to charge costs or claim contributions, i.e. at their own cost. Generally they are organisations from outside the EU or Associated Countries.

### Beneficiary

Beneficiaries are the signatories of the Grant Agreement with the European Commission (through an accession form, the Coordinator signing otherwise on their behalf), as well as of the relevant Consortium Agreement. In a EURATOM co-funded Partnership, a Beneficiary is generally an organisation that is mandated to represent a Member State or an Associated Country in the Partnership consortium, by the national programme owner (generally a Ministry or an Agency). It may also be an Association or JRC.

### Critical risk

A critical risk is a plausible event or issue that could have a high adverse impact on the ability of the project to achieve its objectives. Level of likelihood to occur (Low/medium/high): The likelihood is the estimated probability that the risk will materialise even after taking account of the mitigating measures put in place. Level of severity (Low/medium/high): The relative seriousness of the risk and the significance of its effect.

### Coordinator

The Coordinator is the legal entity acting as the intermediary between the Parties and the Granting Authority, i.e. the European Commission, for any technical, legal or financial issue. The Coordinator's responsibilities and tasks are described in the Grant Agreement and in the Consortium Agreement.

### Deliverable

A report that is sent to the European Commission providing information to ensure effective monitoring of the Partnership. There are different types of deliverables (e.g. a report on specific activities or results, data management plans, ethics or security requirements). Deliverables can be public or restricted to the Partnership.

### Dissemination

Public disclosure of the results by appropriate means (other than resulting from protecting or exploiting the results), including by scientific publications in any medium.

## Executive Board

The Executive Board is an accompanying body to the General Assembly, which is in charge for the execution of General Assembly's decisions and for the preparation of proposals the General Assembly has to discuss and approve or reject. It is formed by the leaders of the Work Packages of the Partnership.

## Exploitation

The use of results in further research and innovation activities other than those covered by the action concerned, including, among other things, commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service, or in standardisation activities.

## General Assembly

The General Assembly is the ultimate decision-making body of the Partnership. It is responsible for agreeing the strategy of CONNECT-NM in line with the Consortium Agreement. Each Beneficiary has one representative and one vote in the General Assembly.

## Impact

Wider long term effects on society (including the environment), the economy and science, enabled by the outcomes of R&D&I investments (long term). It refers to the specific contribution of the Partnership, or of a Project in it, to the expected impacts described in the Annex to the Grant Agreement and in the corresponding EURATOM Research and Training Work Programme. Impacts generally occur after the end of the Project or Partnership.

## Internal Deliverable

A report on the activities of a Project of the Partnership, that is not sent to the Commission, but remains within the Partnership (open internal deliverable), or is public, if so is decided by the Project Consortium (public internal deliverable). If needed internal deliverables can be restricted in diffusion to the Project Consortium: in this case the Project Consortium needs to sign a Consortium Agreement to manage internally the intellectual property rights.

## Internal Milestone

Same as a milestone, but acting as control point for a Project of the Partnership. When reached, internal milestones are declared only internally to the Partnership's portal, by producing a short document to substantiate the achievement of the milestone.

## Letter of Commitment

This letter will have to be signed by each member of the Project Consortium upon Project proposal submission and will include a commitment to perform the work as described in the Project proposal, according to the status that each member will have in the CONNECT-NM Consortium after Project selection for funding, via post-call amendment of the GrA.

## Management Support Office

Group of employees of CONNECT-NM Beneficiaries and Affiliated Entities that assist the Coordinator and the Executive Board in the daily management of the Partnership, preparation of documents, communication tasks, organisation of governing and advisory body meetings, organisation of events and any other activity related with the functioning of the Partnership.

## Milestone

Control point that helps to chart the progress of the Partnership. Milestones may correspond to the achievement of a key result, allowing the next phase of the work to begin. They may also be needed at intermediary points, so that, if problems have arisen, corrective measures can be taken. A milestone may be a critical decision point in the project where, for example, the consortium must decide which of several technologies to adopt for further development. The achievement of a milestone should be verifiable. When reached, milestones are declared on the European Commission portal.

## Objectives

The goals of the work performed within the Partnership or a Project of the Partnership, in terms of its R&D&I content. This will define the Project's activities, which may range from tackling specific research questions, to demonstrating the feasibility of an innovation, or sharing knowledge among stakeholders on specific issues. The nature of the objectives will depend on the type of action, and the scope of the topic.

## Outcomes

The expected effects, over the medium term, of the Partnership or of its Projects. The results of a Project should contribute to these outcomes, fostered in particular by the dissemination and exploitation measures (including the uptake, diffusion, deployment, and/or use of the Project's results by direct target groups, or end-users). Outcomes generally occur during or shortly after the end of the project.

## Partnership

The Partnership stands for Co-funded European Partnership. It involves EU Member States and Associated Countries, via mandated organisations, at the core of the consortium. It is the initiative whereby the European Commission and the members of the consortium join efforts to achieve common objectives, which are too extensive to be reached in a single project. The Partnership centralises general tasks efficiently at Partnership level, allowing the researching partners to focus their efforts mainly on research related activities.

## Pathway to impact

Logical steps towards the achievement of the expected impacts of the Project over time, in particular beyond the duration of a Project. A pathway begins with the Projects' results, and continues with their dissemination, exploitation and communication, contributing to the expected outcomes in the work programme topic, and ultimately to the wider scientific, economic and societal impacts of the work programme destination.

## Project

A Project is a self-contained research activity that pursues an objective and produces results that contribute to the goal of a given Research Line. Projects are selected via Open Calls (exceptionally they may be pre-selected or launched with the direct approval of the General Assembly). In the administrative structure of the Partnership, a Project is formally a task of the Work Package associated with the Research Line to which the Project belongs.

## Project Consortium

The ensemble of organisations involved in a Project. They can be Beneficiaries and Affiliated Entities, as well as Third Parties (in-kind or receiving grants from Beneficiaries) or Associated Partners (from outside the EU).

## Project Committee

Committee formed by Project Leader and Subtask Leaders of a Project, in charge to ensure the smooth achievement of the Project objectives, producing all internal deliverables and reaching the internal milestones. It has to be recalled that a Project is a Task of the Work Package corresponding to the Research Line, so Projects have only Subtasks inside.

## Project Leading Organisation and Project Leader

The organisation that leads a Project, an employee of which acts as Project Leader, acts as main contact between the Project Consortium and the Partnership, via the Leader of the Research Line to which the Project belongs. This organisation signs a Task Agreement with the Coordinator of the Partnership.

## Project Research Output

Results generated by the Project to which access can be given in the form of scientific publications, data or other engineered outcomes and processes such as software, algorithms, protocols and electronic notebooks.

## Project Results

A result is any tangible or intangible effect of an action, such as data, know-how or information, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights. A Project Result is a result generated during the Project implementation. This may specifically include innovative solutions, algorithms, proof of feasibility, new business models, policy recommendations, guidelines, prototypes, demonstrators, databases and datasets, trained researchers, new infrastructures, networks, etc. Most Project Results (inventions, scientific works, etc) are 'Intellectual Property', which may, if appropriate, be protected by formal 'Intellectual Property Rights'.

## Research Line

Practises common to all material classes, recognised in the Strategic Research Agenda as the backbones of the Partnership, towards the pursued goals. They are containers for Projects. Administratively, they correspond to Work Packages.

## Research Line Leader

Research Line Leader is the person in charge for the coordination of the Work Package that is associated with the Research Line. This person should be an employee of a Beneficiary or of an Affiliated Entity of the Partnership.

## Scientific Output

Results generated by the Partnership or a Project to which access is given in the form of scientific publications, data or other engineered outcomes and processes such as software, algorithms, protocols and electronic notebooks, as well as presentations in conferences and workshops or any other form of dissemination. The intention of producing a scientific output needs to be communicated sufficiently in advance according to specific rules contained in the Open Science Guidelines.

## Subtask

Subtasks are a further subdivision of tasks into activities, in order to achieve the planned results. In the Partnership, of the projects which implements the actions needed to achieve the project results.

## Task

Tasks are the breakdown of the Work Packages into concrete actions, which enable to achieve the planned results of each Work Package. In a Partnership, the Projects funded by the Partnership are Tasks that make it possible to reach the planned objectives of the Research Lines of the Partnership. Each Research Line is a Work Package of the Partnership.

## Task Agreement

The Task Agreement is a document signed by the Project Leading Organisation and the Coordinator of the Partnership, which sets the rules of interaction between the Project Consortium and the Partnership.

## Third Party (two types)

Third parties are organisations under the responsibility of a Beneficiary that do not qualify as Affiliated Entities, including third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties via the Beneficiary.

## Work Package

Work Packages are the major sub-divisions of the planned work following the strategy of the Partnership, which give the work plan a structured implementation in order to achieve the objectives of the Partnership.

## Work Package/Task/Subtask Leader

Person in charge of the correct and timely execution of a Work Package/Task/Subtask. This person should be an employee of a Beneficiary or of an Affiliated Entity of the Partnership.

## Annex B - Current CONNECT-NM Consortium

### Beneficiaries

1. CENTRO DE INVESTIGACIONES ENERGETICAS MEDIOAMBIENTALES Y TECNOLOGICAS (CIEMAT),
2. COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA)
3. HUN-REN ENERGIATUDOMANYI KUTATOKOZPONT (EK),
4. CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (CNRS)
5. ALLIANCE EUROPEENNE DE RECHERCHE DANS LE DOMAINE DE L'ENERGIE (EERA),
6. AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE (ENEA),
7. EUROPEAN NUCLEAR EDUCATION NETWORK (ENEN),
8. GESELLSCHAFT FÜR ANLAGEN UND REAKTORSICHERHEIT (GRS) gGmbH (GRS),
9. RUDER BOSKOVIC INSTITUTE (RBI),
10. JRC -JOINT RESEARCH CENTRE- EUROPEAN COMMISSION (JRC),
11. INSTITUT JOZEF STEFAN (JSI),
12. NATIONAL SCIENCE CENTER KHARKOV INSTITUTE OF PHYSICS AND TECHNOLOGY (NSC KIPT),
13. KARLSRUHER INSTITUT FÜR TECHNOLOGIE (KIT),
14. NARODOWE CENTRUM BADAN JADROWYCH (NCBJ);
15. NUCLEAR RESEARCH AND CONSULTANCY GROUP (NRG),
16. REGIA AUTONOMA TEHNOLOGII PENTRU ENERGIA NUCLEARA - RATEN (RATEN),
17. SUSTAINABLE NUCLEAR ENERGY TECHNOLOGY PLATFORM (SNETP),
18. STRALSAKERHETSMYNDIGHETEN (SSM),
19. SLOVENSKA TECHNICKA UNIVERZITA V BRATISLAVE (STUBA),
20. TEKNOLOGIAN TUTKIMUSKESKUS VTT OY (VTT),

### Affiliated Entities

1. **UNIVERSIDAD POLITÉCNICA DE MADRID (ES) (AE CIEMAT)**
2. **EDF R&D (FR) (AE CEA)**
3. **FRAMATOME (FR) (AE CEA)**
4. **INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE (FR) (AE CEA)**
5. **CENTRALE LILLE (FR) (AE CNRS)**
6. **CENTRUM VÝZKUMU ŘEŽ S.R.O. (CZ) (AE EERA)**
7. **METAPROJECTS (IT) (AE ENEA)**
8. **NEWCLEO SPA (IT) (AE ENEA)**
9. **SINTEC (IT) (AE ENEA)**
10. **UNIVERSITÀ DI BOLOGNA (IT) (AE ENEA)**
11. **POLITECNICO DI MILANO (IT) (AE ENEA)**
12. **BUNDESANSTALT FÜR MATERIALFORSCHUNG (DE) (AE GRS)**

13. **FRAUNHOFER GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V. (DE) (AE EERA)**
14. **SLOVENIAN NATIONAL BUILDING AND CIVIL ENGINEERING INSTITUTE (SI) (AE JSI)**
15. **ENERGORISK (UA) (AE KIPT)**
16. **HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF E.V. (DE) (AE KIT)**
17. **CHALMERS TEKNISKA HOGSKOLA AB (SE) (AE SSM)**
18. **KUNGLIGA TEKNISKA HOEGSKOLAN (SE) (AE SSM)**
19. **HELSINKI UNIVERSITY (FI) (AE VTT)**

## Annex C – Financial Call Conditions

### General

**The total EC grant available for this CONNECT-NM Open Call for Projects is EUR 13 500 000.**

The maximum reimbursement from the EC allocation to CONNECT-NM per project will be 900 kEUR /Project. Notwithstanding, the proposers can ask for a higher amount, which might be accorded if the quality of the proposal is outstanding, compatibly with the financial possibilities of the Partnership. Projects may of course also ask for less, if they are particularly focused and involve a small number of contributors.

On behalf of all Beneficiaries, the Coordinator of CONNECT-NM will sign a non-negotiable Task Agreement with the Leading Organisations of the Projects selected for funding, representing the whole Project Consortium. The other members of the Project Consortium shall accord this right to the Leading Organisation via a Letter of Commitment, which they sign upon proposal submission and therefore prior to the Task Agreement signature.

The Beneficiaries are fully responsible towards the CONNECT-NM partnership and the European Commission for implementing the Projects and for complying with all their obligations. They are jointly responsible for the *technical* implementation of the action. If one of the Beneficiaries (or one of their Affiliated Entities) fails to implement their part of the action, the other Beneficiaries (or their Affiliated Entities) must ensure that this part is implemented by someone else. The Beneficiaries must ensure that all their obligations under the Task Agreement also apply to their Affiliated Entities, via the signature of a specific bilateral agreement.

The estimated budget reported in each Project proposal must comprise all the estimated costs for performing the tasks of the Project, broken down per Beneficiary and/or Affiliated Entities.

**The funding rate for each project is set out as the 50% of the eligible costs.** The European Commission grant actually paid per Project contributed by CONNECT-NM will be thus the 50% of all the accepted declared costs, up to the maximum grant set out in the Task Agreement. Participants are of course entitled to claim only part of the eligible costs, thus accepting an effective reimbursement rate below 50%.

The funds for the grant awarded by CONNECT-NM through this call are provided in accordance with the applicable EURATOM and EU regulations and the provisions of the CONNECT-NM GrA, CoA and IRoP, accessible through the private area of the CONNECT-NM website. Each participant can refer to those documents for full detail. In particular, eligible costs will be estimated in the proposals and annually declared by the Beneficiaries broken down according to the European Commission rules:

- Personnel costs: as direct or unit costs, following the rules set out in the GrA.
- Other direct costs, broken down in:
  - Travel costs: comprising all the costs for travel, accommodation and subsistence, for the participation to conferences, workshops and meetings approved by the Project Leader on behalf of the Coordinator, in agreement with the initial

- allocations as in the Project Task Agreement or without approval for participation to Partnership's meetings.
- Other goods and services: all the costs incurred by the Beneficiaries and their Affiliated Entities, related to the activities performed, for materials, publications, consumables, etc.
  - Equipment costs: intended as the depreciation costs of equipment based on the beneficiary usual accounting practice; only the percentage of the use of the equipment for the project can be eligible.
  - Internally invoiced costs.
- Subcontracting costs, after approval by the Coordinator (these costs need to be clearly stated in the Project proposal and then in the Task Agreement).
  - Direct costs of providing financial support to Third Parties.
  - Indirect costs, in a flat rate of 25% of the direct costs, minus the subcontracting costs and the costs for providing financial support to third parties

The Affiliated Entities will report their costs to the Beneficiaries following the same rules as expressed above and will receive the grant from the Beneficiaries. The financial support to Third Parties, in contrast, is direct cost reported by the Beneficiaries.

## Financial content of the proposal

Proposals must include the estimated detailed eligible total costs of the Project, per Beneficiary and Affiliated Entity, broken down in the above cost categories, as required by the European Commission rules. The template for the estimated budget will be accessible on the CONNECT-NM Website in Excel file format and is part of the Project proposal form. (Similar templates will be used for the Project financial reporting.)

These estimated eligible total costs are used to calculate the maximum grant amount awarded through the call, applying the 50% funding rate. The coherence of the costs of the Beneficiaries and their Affiliated Entities with the general objectives and the proposed activities will be a key factor in the proposal evaluation.

## Rules of funding for Beneficiaries, Affiliated Entities and Third Parties that receive funds from Beneficiaries

Beneficiaries and Affiliated Entities use their own resources (or contributions from Third Parties) to implement the Project. The costs actually incurred to perform the activities declared in the proposal must be eligible under the CONNECT-NM GrA (in particular Article 6), CoA and IRoP, in order to receive the 50% reimbursement of the accepted costs.

The Beneficiary/ Affiliated Entities shall secure the co-funding for the 50% remaining and all other costs, financing on their own funds or on funds by other entities, avoiding for any reason and under any circumstance double funding of the activities.

The amount granted and the modalities of payment are described in the CONNECT-NM Task Agreement, based on the costs accepted as eligible.

The Project costs will be declared by Beneficiaries yearly, in correspondence with the end of the Partnership's reporting periods (i.e., 30<sup>th</sup> September each year). These costs will be reimbursed following the cost eligibility criteria and the funding distribution rules regulated by the GrA, the CoA and the IRoP of CONNECT-NM, accessible through the private area of the CONNECT-NM website, up to the maximum amount per Project requested in the Task Agreement. The MSO of CONNECT-NM will accurately check the accountancy of each Project, as reported via the annual Project Financial Report, after the end of each Partnership reporting period. Consistency with the cost statements reported by the Beneficiaries for themselves and for each Affiliated Entity involved in each Project need to be ensured and will be carefully verified. The MSO is entitled to ask the Project Leader any required further information as justification of the expenses that are declared. This information needs to be mandatorily and timely provided to the Project Leader by each of the participants in the Project, in order to prepare the annual Project Financial Report and to answer subsequent requests of justification.

After receiving the corresponding grant from the Coordinator, each Beneficiary is in charge of transferring to its Affiliated Entities, if any, the funds that correspond to them, without unjustified delay and based on their accepted costs.

The total financial support to any single Third Party that is recipient of funding from the Beneficiaries, for the whole duration of the Partnership and irrespective of the number of Projects in which that Third Party is involved, may not exceed, ever, 300 k€.

## Non-funded contributors to Projects

Other participants involved in the action, besides Beneficiaries, Affiliated Entities, Third Parties receiving financial support from the Beneficiaries, and Subcontractors, are permitted following the provisions of Article 9 of the GrA, accessible through the private area of the CONNECT-NM website.

Associated Partners, as entities that cooperate in Projects, may not charge costs or contributions to the action and the costs for their tasks are not eligible.

Third parties giving in-kind contributions do not implement any action tasks. They may not charge costs or contributions to the action and the costs for the in-kind contributions are not eligible.

## Clarifications

### **When an Affiliated Entity is participating in the same Project as its Beneficiary:**

The sum transferred by the CONNECT-NM Coordinator to the corresponding Beneficiary will include the sums due to the Beneficiary, plus the sums due to its Affiliated Entities, involved in the Project.

### **When an Affiliated Entity is participating in a project without its Beneficiary:**

The CONNECT-NM Coordinator will anyway transfer the sums due to the Affiliated Entity to the corresponding Beneficiary, even if the latter is not participating in the selected Project.

**Important:**

Each Beneficiary shall sign all the appropriate documents with its Affiliated Entities to ensure that the obligations of the CONNECT-NM Grant Agreement, Consortium Agreement and Internal Rules of Procedure are respected.

## Annex D – Artificial Intelligence

When considering the use of generative artificial intelligence (AI) tools for the preparation of the proposal, it is imperative to exercise caution and careful consideration. The AI-generated content should be thoroughly reviewed and validated by the proposers to ensure its appropriateness and accuracy, as well as its compliance with intellectual property regulations. Proposers are fully responsible for the content of the proposal (even those parts produced by the AI tool) and must be transparent in disclosing which AI tools were used and how they were utilised. Specifically, applicants are required to:

- Verify the accuracy, validity, and appropriateness of the content and any citations generated by the AI tool and correct any errors or inconsistencies.
- Provide a list of sources used to generate content and citations, including those generated by the AI tool. Double-check citations to ensure they are accurate and properly referenced.
- Be conscious of the potential for plagiarism where the AI tool may have reproduced substantial text from other sources. Check the original sources to be sure you are not plagiarising someone else's work.
- Acknowledge the limitations of the AI tool in the proposal preparation, including the potential for bias, errors, and gaps in knowledge.



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