



ORIENT-NM - Organisation of the European Research Community on Nuclear Materials



From ORIENT-NM to CONNECT-NM

On behalf of ORIENT-NM team

L. Malerba, CIEMAT, ORIENT-NM and EERA JPNM coordinator, lorenzo.malerba@ciemat.es



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HORIZON-EURATOM-2023-NRT-01-04: Co-funded European partnership for research in nuclear materials

| Specific conditions | |
|---|--|
| <i>Expected EU contribution per project</i> | The Commission estimates that an EU contribution of around EUR 20.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| <i>Indicative budget</i> | The total indicative budget for the topic is EUR 20.00 million. |
| <i>Type of Action</i> | Cofund Actions |
| <i>Legal and financial set-up of the Grant Agreements</i> | <p>The rules are described in General Annex G. The following exceptions apply:</p> <p>The funding rate is 55 % of the eligible costs as it reflects the need to establish a fully integrated research Partnership for nuclear materials that makes use of the assets of laboratories and industries all around Europe.</p> |

The bases for a co-funded European partnership (CEP) on nuclear materials were set in **ORIENT-NM**



WHY a CEP on nuclear materials?

- Ongoing discussion since 2014 (FP7/MatISSE project)
- Long voyage for the research community to reach maturity
- Main motivation: good for the European nuclear materials research community and good for Europe
 - Provide continuity to research lines
 - Involve the research community to define paths and priorities
 - Optimize use of resources
 - Avoid duplications and redundancy
 - Centralize transversal actions that can be jointly addressed for all materials-related R&D projects
- **Boost innovation**

What has ORIENT-NM produced?

- 1 Single Vision Strategic Research Agenda on Nuclear Materials for the benefit of ALL reactor generations until 2040
- 2 Most suitable governance, structure and implementation design for the European Partnership
- 3 Plan of interaction of the European Partnership with all interested stake-holders



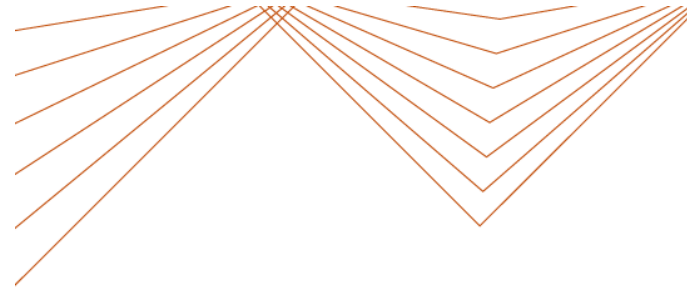
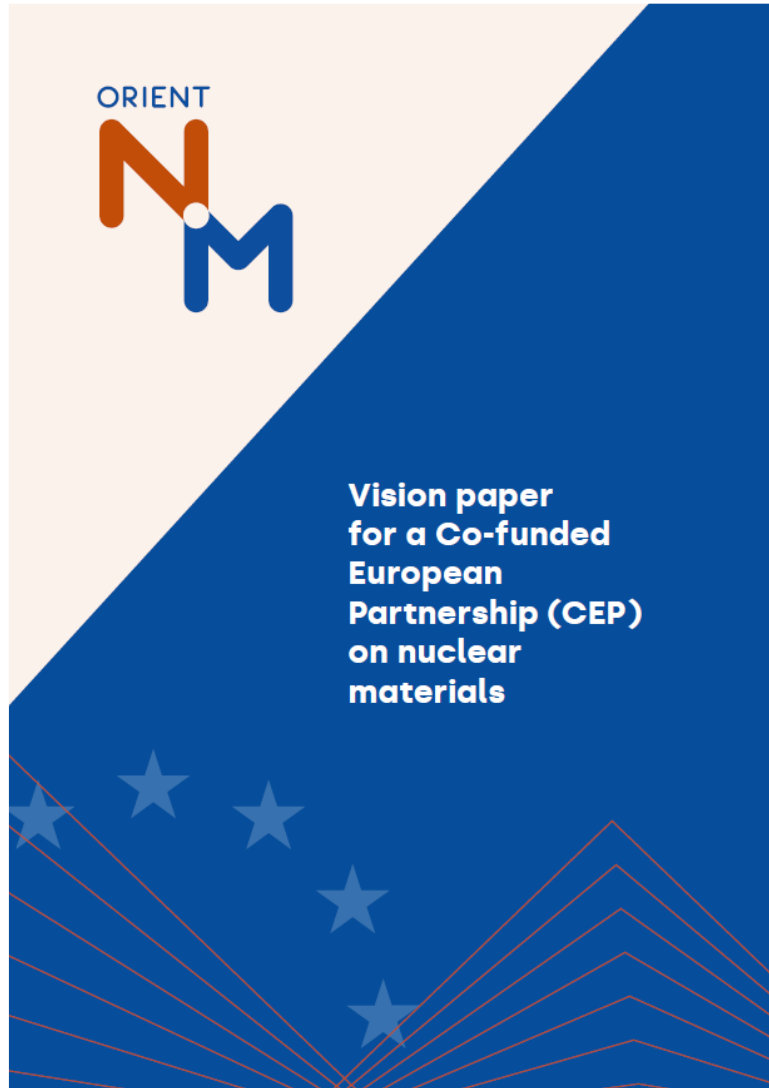
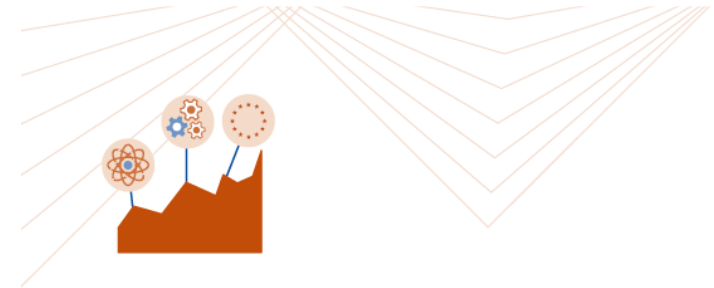


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4. Answering Europe's materials needs for the development of nuclear systems

The above considerations unambiguously show that materials are crucial to further enhance the safety and overall sustainability of current reactors, to enable the commissioning and deployment of next-generation reactors, and to fuelon. Consequently, addressing the issues mentioned earlier that still hamper the full-hearted adoption of nuclear as low carbon sustainable energy source in Europe is critical.

In this context, the European nuclear materials science community is called to provide the tools, knowledge and skills to enable each European country to maintain the desired and needed nuclear capacity and, depending on national policies and priorities, to develop advanced nuclear systems. Thus, the research activities of a European partnership dedicated to nuclear materials should support the following:

- Safe and affordable LTO of current generation reactors;
- Increasingly safe design, licensing and construction of Gen III+ new builds;
- Deployment of light water SMRs within the next decade;
- Reduction of time and costs for the design, licensing and construction of competitive next generation (Gen IV) nuclear reactors, including advanced SMRs, within the time horizon of 2040.

1 Five Grand Goals of the European nuclear materials research

Addressing the challenges described above to influence the clean energy transition requires the application of modern materials science approaches to accelerate materials development and qualification pace. The knowledge

Five Grand Goals for a change of paradigm: from “observe and qualify” to “design and control”

| | |
|---|--|
| Nuclear materials’ test-beds | Integrated networked systems to apply advanced and standardized experimental procedures and methodologies for nuclear materials qualification (exposure, characterisation and testing) |
| Nuclear materials acceleration platforms | Autonomous platforms that design materials for fitness and sustainability, combine advanced characterisation and modelling with modern digital techniques (<i>fit and sustainable by design</i>) |
| Advanced predictive methodologies | Blending physical and data-driven (i.e., artificial intelligence-based) multiscale models, to combine strong physical rooting with rapidity and efficiency, for direct application at industrial level |
| Intelligent material health monitoring | Combine non-destructive examination and testing with suitable diagnostics and simulation tools, to enable the use of digital twins and optimize safe component and plant life management through the whole materials lifecycle |
| European nuclear materials’ FAIR (findability, accessibility, interoperability, reusability) database | Develop ontologies and data formats to ensure efficient collection, storage, management and use of nuclear materials data, respecting IPR and following FAIR principles |

Keywords: Accelerate Innovation / Increase Safety and Sustainability

Timeframe: 15 years



Five transversal research lines towards these Grand Goals

Materials ID Cards

PARTNERSHIP

Concrete

Metallic
alloys for
structural
components

Fuel
cladding
materials

Nuclear fuel
materials
(fissile and
fertile)

Refractory
materials for
structural
components

Polymers for
cables and
structural
applications

Materials for
neutron
control:
absorbers,
moderators,
reflectors

Materials and Components' Qualification

Advanced Modelling and Characterisation

Materials and Components' Health Monitoring

Advanced Materials, Processes and Manufacturing

Knowledge and Data Management

Strategic programming
activities only, to build the
relevant community
*(materials ID cards could not be
prepared for these classes of materials)*

Methodological
benefit
and interaction

Fusion
Energy

Non-
nuclear
Energy

Research activities dedicated to "less mature" materials

Research activities strongly linked to specific designs, not
focused on materials, although involving them

Will remain
outside

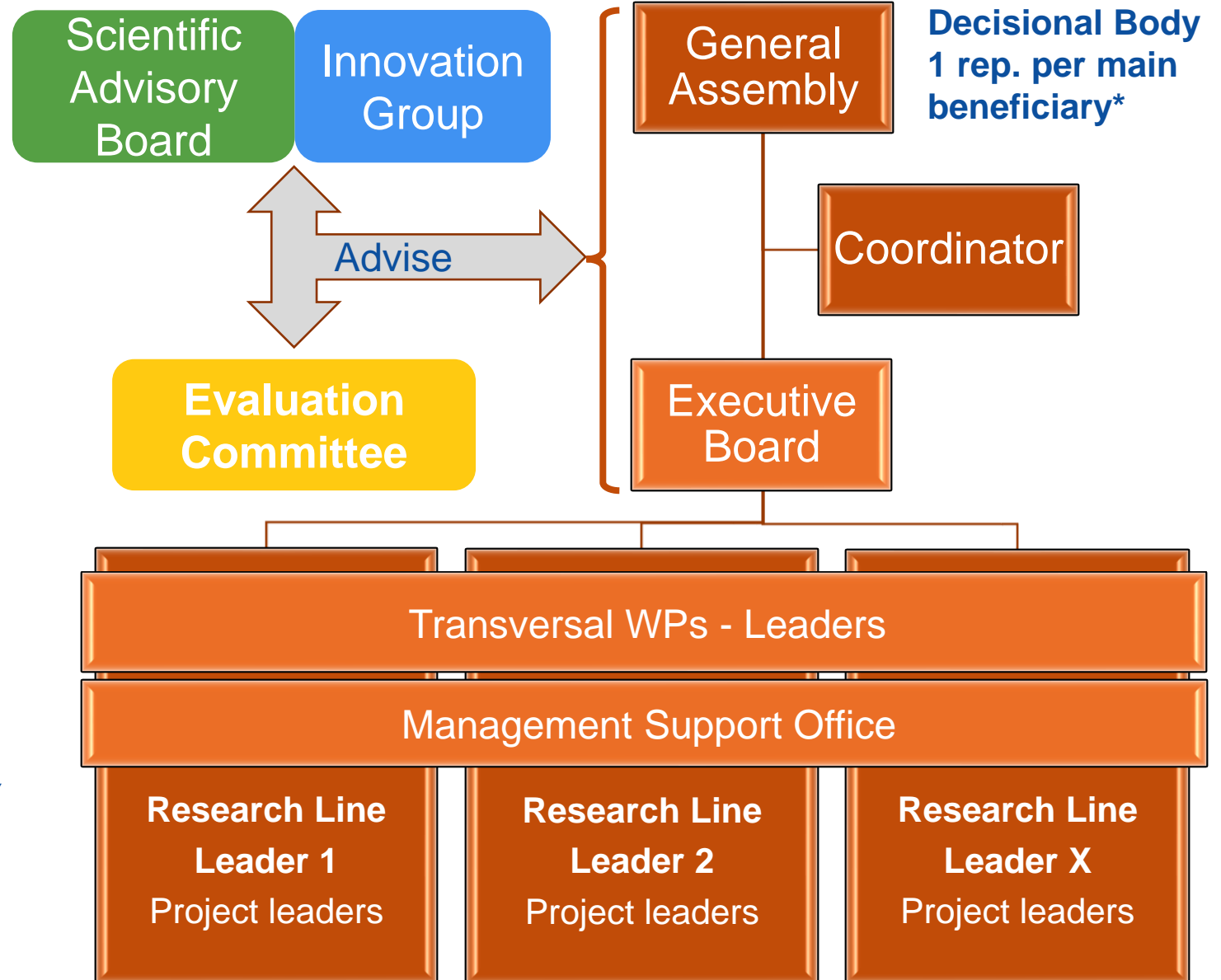
Envisaged CEP structure (governance and implementation)

SAB: “Standard” advisory body: experts in charge for the assessment of the activities with scientific and technical background, emanation of R&D environments

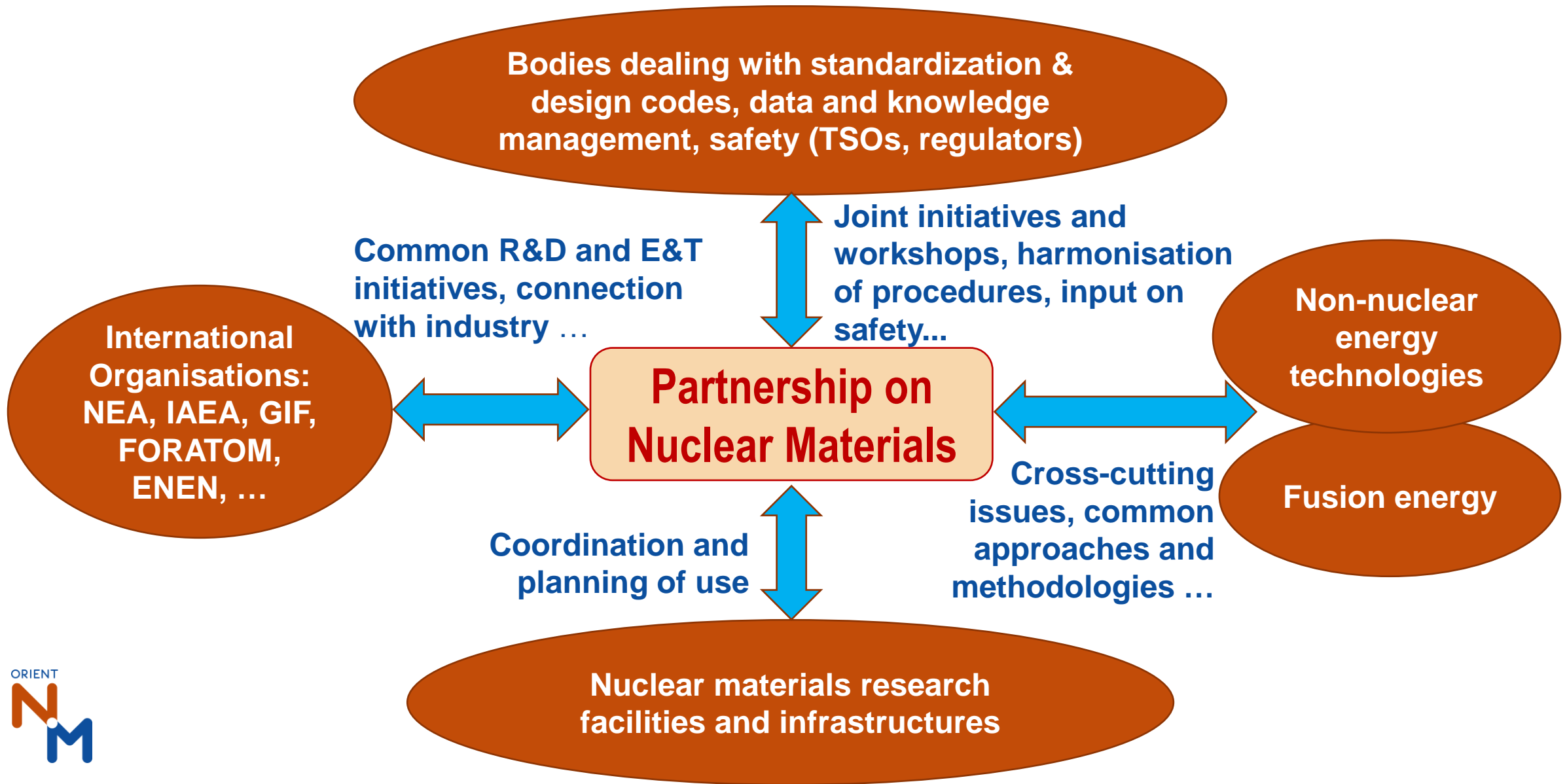
IG: Experts in leading business, supporting entrepreneurship and commercializing technology, in connection with materials development and/or nuclear energy, emanation of industrial and innovation environments

EvaCo: Representatives from SAB, IG and ExB, according to topics perspectives from R&D, Industry, Innovation, aligned with SRA and Annual Plan

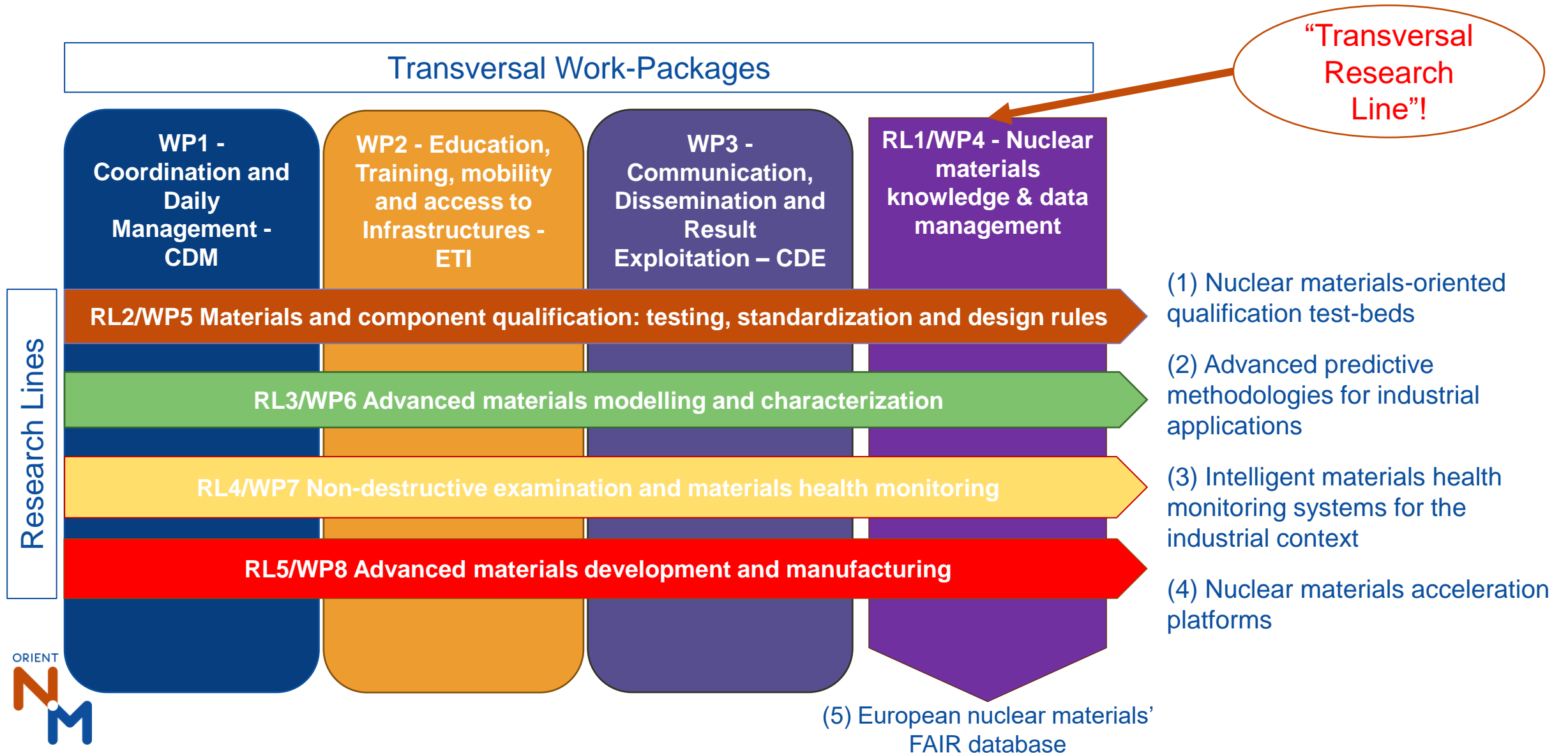
**Main beneficiaries are generally research organisations that received the mandate to sign the CA from the corresponding ministry of the country*



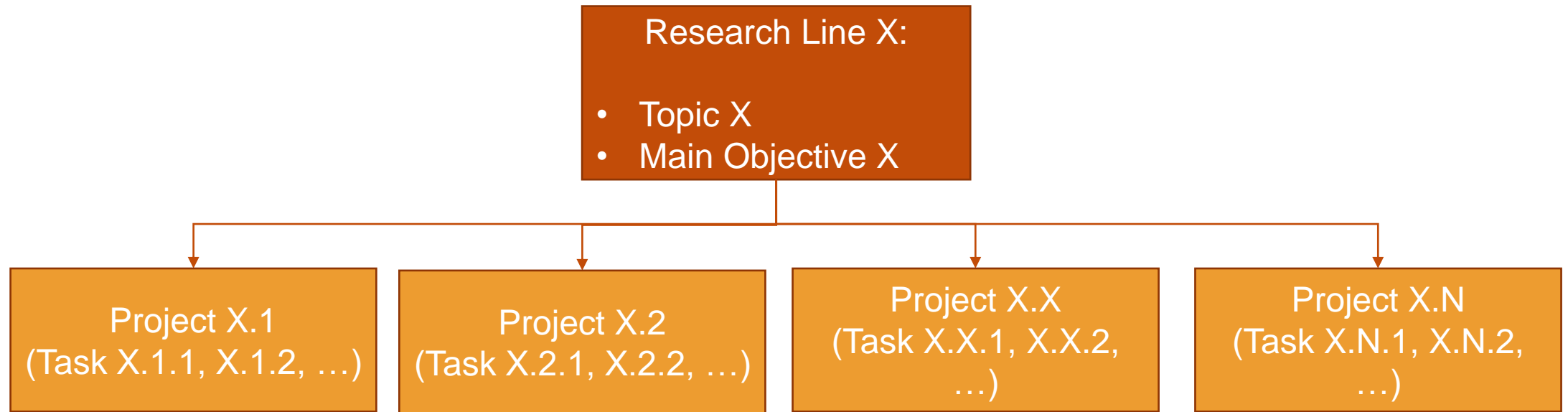
Partnership's expected interactions: groups of identified possible stakeholders



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



Projects in Research Lines



Projects may be:

- Decided at proposal level as crucial for the given research line
 - **Small projects that address an essential prerequisite for the research line**, might be coordinated by the RLL or by one RLA, or not
- Selected through call
 - They have to **comply with the criteria for the call which are specific for each research line**
 - They **have to target the main objective of the RL and clearly show how they are doing so** → by deciding the main objective to which the project contributes, the project coordinator decides which RL the project belongs to (each project belongs to a single RL, even though it might be contributing to several)

Towards a change of paradigm and way of thinking



- The RL and their objectives try to provide the direction to be followed in order to
 - Boost innovation in the field of nuclear materials
 - Progressively change the paradigm from “observe and qualify” to “design and control”
 - Accelerated materials development and qualification
 - “Fit and sustainable by design” materials
- This also requires changing way of thinking when designing projects
 - All nuclear systems are welcome as possible case studies, but the focus is on materials, methodologies and working towards the objectives of the RLs
 - The generalizability and flexibility of the approaches proposed and followed is certainly an important criterion of choice



Thank you!

www.eera-jpnm.eu/orient-nm



Instytut kategorii A+, JRC collaboration partner



sck cen



Ciemat



Contacts

mariano.tarantino@enea.it (FSN-SICNUC)

barbara.ferrucci@enea.it (FSN-SICNUC-TNMT)