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Towards Optimized Use Of Research Reactors In Europe - The TOURR Project

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ABSTRACT

The primary objective of the TOURR project is to develop a strategy for Research Reactors (RRs) in Europe and prepare the ground for its implementation. This strategic goal can be divided into specific objectives: assessment of the current status of European research reactors fleet, including plans for upgrades, evaluation of urgent EU needs, developing tools for optimal use of the research reactors fleet and finally, rising awareness among decision-makers on the (future) role of research reactors.

The ambition of the TOURR project is to secure access and availability of RRs as a vital part of the European Research Area and support a stable supply of medical radioisotopes. Nuclear RRs have been constructed in countries implementing nuclear power plants and used in experiments necessary to develop commercial reactors and training programmes.

Neutron irradiation has found new applications in the adaption and production of existing and new materials, including medical radioisotopes. The latter enabled the development of new diagnosis and treatment techniques, for the benefit of millions of patients.

Europe has a broad and very diverse landscape of research reactors, many of them have already been for 30-50 years in operation, well maintained and regularly upgraded. Yet financial pressure, caused by a combination of declining interest and the absence of a sound financial model, led to the closure of many of them.

Those negative trends call for a coordinated European action to assess the impact of the decreasing number of research reactors, identify future needs (including new neutron sources), draw a roadmap for the upgrade of the existing research reactors fleet, and a model for harmonized resource management. The TOURR project is a response to this challenge.

The paper will introduce the TOURR project as a whole, focusing on the main envisioned outcomes and the methodology that will be used to achieve them. The project is divided in to 5 work packages which will be presented in detail. The paper will serve as an overview and reference for all future TOURR publications[1].

1 INTRODUCTION

The TOURR project is a response to the challenge of coordinating the optimization of the exploitation of available research reactors in Europe [2].

The project primary objective is to develop a strategy for RRs in Europe and prepare the ground for its implementation. To achieve this goal, 6 specific steps have been identified.

1. Assessment of the current status of European RR fleet

As start, there is the need to get the inventory of existing RR. Such inventory already exists having been created and maintained by the IAEA and their database [3]. However, the

information to be gathered in this regard, under the TOURR project, is supposed to go beyond what is already collected in [3]. Information like scope of implemented applications, scientific strength of each particular facility, user structure, instrumentation, future developing plans, actual and future needs, etc. will be collected via a questionnaire [4] and then used as the base for deriving the strategy.

2. Estimation of future needs of RR and neutron sources

The main applications of the European RR fleet can be classified into 5 categories:

i. Education and training,
ii. Basic and fundamental research and its instruments,
iii. Medical applications, including isotope R&D as well as beam applications,
iv. Material testing, including fuel, structural material and its instrumentation,
v. Core physics testing for reactors in "zero power" installations.

The future needs will be evaluated along these five main interests for neutron sources.

3. Plan for the upgrade of the RRs fleet

Starting from the picture of the current status which will be obtained with the questionnaire, it will be possible to suggest an update plan to be developed for the European RR fleet.
The idea is to take into consideration also the fact that some major facilities are currently under construction.
It is a fact that there is need for RR increased availability, because of the demand of isotope production (and the need of assuring the supply) just to name one reason.

4. Plan to maintain the fleet

Since the ultimate goal is to suggest an optimization strategy, the analysis of potential problematic aspects will have be performed. Information on which factors influence the sustainability of the RR will have to be gathered spanning from component ageing to cost of upgrades including potential problems related to personnel turnover and possible generation gap.

5. Developing tools for optimal use of RR fleet

The idea in this phase is learn from realities which are already showing a great example of optimized use of resource and produce a similar model for the RRs fleet. Examples can be found in the coordination schedule of radio isotope production, or the use by the internationally community of Material Testing Reactors (MTR) or also in the neutron scattering facilities coordination.

6. Rising awareness of decision makers and the public on the role of RR

The perception of RRs might need to be changed.
A share of the public still sees them as something related to the nuclear era, often perceived negatively, while RRs are in fact modern research facilities providing answers to the challenges of the modern society: in the field of health, energy, technology and cultural heritage, jus tot name a few. The suggested strategy for optimal use of RRs shall present all areas of application with emphasis on major achievements, demonstrate how often research with neutrons led to practical applications used by everyone in everyday life.
The implementation of the TOURR project will help as well to contribute to strengthen Europe's competitive advantage over other countries investing in nuclear research.

2 PROJECT STRUCTURE

The TOURR consortium is composed of 9 participants located in different EU countries. Six of them are RRs operators.

They cooperate working on 5 Working Packages (WPs) whose outcomes are very strongly inter-connected and dependent one from the other.

2.1 WP1 – Inventory of RR fleet

RRs have been playing an important role in supporting Research & Development (R&D) in Europe in the past decades.
Several networks and databases have been implemented already to facilitate the dissemination of information and interaction among RRs operators.

The IAEA Research Reactor Database [3] is publicly available online and it gathers technical and operation information about RRs facilities.
For the purpose of the TOURR project, the need is to investigate others aspects of RRs, from the point of view of implemented applications, their future plans and available capacities.
The main objectives of WP1 are:

- to collect data describing this other aspects of the RRs fleet
- to create an updated RR database providing information about applications, future plans, capacities of the RRs
- to perform gap analysis in three domains: Research & Development, Medical applications and Education & Training.

2.2 WP2 – Assessment of needs and opportunities to support supply of medical radioisotopes

This WP focuses mostly on medical applications.
Its main objective will be to prepare a proposal for the prevention of shortages of medical radioisotopes based on the analysis of the market and also the comparison between research interests and commercial interests. In the past, there has been a shortage of Mo-99 (today, thanks to the coordinated effort of several international organizations the situation is well under control), the goal is to have a strategy to avoid a similar situation to happen again.

The word demand for medical radio-isotopes is indeed growing: they are needed both for therapy and medical therapy applications. Furthermore, newly developed medical imaging techniques and new therapies require the use of new radio-pharmaceuticals.
WP2 will

- analyze the existing and available documentation and perform and analysis concerning available infrastructure in the RRs fleet. Possible gaps in the fields

of their availability, utilization, and performance will be identified as well.

- help optimizing the performance of RRs in the field of medical radioisotopes production.
- will propose containing solutions to prevent the future shortages in the supply of non-molybdenum medical radioisotopes.

2.3 WP3 – Tools for optimized of use of European research reactors

WP3 will start its work a bit later on in the project implementation, since it needs inputs from other WP in order to proceed. As stated at the beginning, the outcomes of the TOURR project are strongly interconnected.

The specific objectives of WP3 are to:
- integrate the results produces by WP1 and WP2 (the performed gap analysis and proposals)
- elaborate a strategy for optimized use of RRs in Europe
- deliver the tools to support the implementation of the same strategy
- support the planning of refurbishment of existing research reactors or construction of new ones (an assessment of to what extent existing and new RRs will fulfil the future needs will be performed. Furthermore, crucial time gaps in the transfer between existing and future RRs will be identified.)

2.4 WP 4 – Dissemination and outreach

WP4 will be dealing with the communication about the project.
Specific objectives of WP4 can be identified as:
- strengthen the impact of the project on relevant stakeholders.
- disseminate the project results to targeted professional audiences (operators of infrastructures and related institutes, users of medical radioisotopes, similar projects, organizations dealing with nuclear education including universities running courses on nuclear technologies) and general public with focus on youth.
- assure communication with relevant stakeholders and decision makers (ministries, politicians, international organisations, funding agencies, nuclear technology platforms, etc.)
- support outreach to potential beneficiaries.

2.5 WP5 – Project management

WP5 will be dealing with the management of the project hence its objectives are not relevant for the scope of this papers, which aims to present the TOURR project and the outcomes which will benefit the community.

3 PROJECT CURRENT STATUS AND VISION

The project is currently in the first year of its implementation. It started in October 2020 and it is scheduled to last until September 2023 after 36 months of implementation.

The main achievement given the early stage at which the project finds itself is represented by the survey conducted among European research reactors. This is presented in [4].

Project public deliverables and invitations to events connected to the TOURR initiatives will be published on the project webpage under ENEN (TOURR Project – European Nuclear Education Network (enen.eu)) and on the project website: www.tourr.eu.

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