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REGULAR ARTICLE

OPEN ACCESS

Supporting trans-national access to key nuclear research infrastructures – OFFERR and JRC OASIS: two complementary projects – One goal

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Abstract. The OFFER and OASIS projects both provide transnational access to key nuclear research infrastructures. Since September 2022, the OFFERR project, funded by Horizon Europe/Euratom, supports the SNETP Association by providing R&D experts access to key nuclear research infrastructures across Europe. It addresses financial and logistical barriers that hinder nuclear research by offering a platform for financial support and access to more than 230 experimental facilities. Researchers can submit applications through the OFFERR Call Platform, ensuring eligible projects receive necessary funding and access. This initiative aims to accelerate innovation in nuclear energy by bridging the gap between research ideas and advanced facilities, adhering to EU regulations and fostering international collaboration. The OASIS project is funded by an Administrative Arrangement between the Directorate General for Research and Innovation (DG RTD) and JRC since February 2020 and aims at enhancing open access to JRC's nuclear facilities (11 out of 16 are opened) and the associated technical support. So in the OASIS project, JRC makes available its nuclear research infrastructures to external users free of charge while DG RTD provides their financial support to eligible users to cover their travel and subsistence costs. This allows an optimal use of JRC's unique facilities and nuclear materials not available to European scientists at their home institutions and results in scientific excellence in research that could otherwise not be performed. With a large participation of students and young scientists, OASIS also contributes to the training of the next generation of European scientists in various nuclear fields. Whereas the two projects have one goal, they follow complementary approaches.

1 Introduction

Nuclear research infrastructures play a central role in delivering and stimulating high-quality research and innovation. They are essential to enable scientific progress in the field of nuclear science and technology and constitute a founding principle of the European Research Area.

Priority areas for joint action is a true European single market for research and innovation including – as a strategic point for the deepening of a truly functioning internal market for knowledge – also research infrastructures (RI) [1]. This led to high-level European activities in the area of research infrastructures, such as the

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European Strategy Forum on Research Infrastructures (ESFRI) Roadmaps and the European Research Infrastructure Consortium Legal Framework (ERIC), that have transformed the availability of state-of-the-art facilities. ESFRI brings together national governments, the scientific community and the European Commission to support a coherent, strategy-led approach to RIs in Europe. The ERIC Legal Framework is a specific legal form that facilitates the establishment and operation of research infrastructures with European interest and allows the establishment and operation of new or existing research infrastructures on a non-economic basis. Financial and operational sustainability are main challenges.

Experimental data produced in nuclear research infrastructure is instrumental to understand the behaviour of the materials, structures, components, and systems that constitute the building blocks of the applications of nuclear science and technology. JRC nuclear research infrastructure focuses especially in the major areas of Euratom research and training: nuclear safety, nuclear security, nuclear safeguards, and nuclear science applications (medical, space exploration).

However, such facilities require a specific technological laboratory configuration, along with highly trained personnel, the appropriate exploitation authorisations and licenses, and an access to radioactive and nuclear materials. Nuclear research infrastructure is also expensive to build, maintain and operate, due not only to the sophistication of the experimental equipment, but also to the complexity and challenges of handling nuclear and radioactive material, and upholding the necessary safety and radiation protection features. Meeting up all these criteria typically goes beyond the reach of individual laboratories and stretch available resources in Member States willing to set up some kind of nuclear research infrastructure. Therefore ensuring the availability and accessibility of these scarce, state-of-the-art infrastructures for EU researchers is critical to develop and sustain nuclear competencies and expertise at EU level and guarantee the highest levels of safety and security. This poses several challenges spanning over the following elements [2]:

- some research infrastructure (notably nuclear research reactors) are being shut down and are not timely replaced, (e.g. Osiris in France, FiR1 in Finland),
- ageing of old infrastructure (many research reactors and other nuclear research infrastructure were built in the 50s and 60s) imposes expensive upgrading needs and repairs [3],
- there are delays in commissioning new nuclear research infrastructure (e.g. the Jules Horowitz Material Test Reactor in France with a delay >10 yr),
- operating and maintenance costs increase,
- support to the mobility of scientists to work abroad is often limited, and
- finding the needed high skills and competences for the operation of the facilities is difficult.

Addressing them at EU level requires strategic actions to build new infrastructure or upgrade existing ones to meet the research and training challenges of the new nuclear technologies under development, such as Small Modular Reactors and advanced (sometimes called Generation IV) nuclear systems, or to reinforce strategic autonomy through developments in nuclear medicine or nuclear systems for space exploration. A description of the current status and the foreseen scenario with the refurbishment of existing research reactors and construction of new ones is presented in [4].

Fostering and supporting the mobility of students and scientists is one of these strategic actions. Indeed, ensuring access to nuclear research facilities has become a priority issue in the EU, with the goal to improve cross-border cooperation and bridge capacity gaps between EU Member States, overall building a stronger European Research Area. Moreover, this contributes maintaining and developing further scientific and technical competences in the EU, also in the nuclear domain by offering education and training opportunities for nationals of countries that do not host research facilities and allowing fruitful exchanges of scientists in multinational teams.

The Euratom Research and Training programme 2021–2025 features amongst its main objectives the maintenance and further development of expertise and competence in the nuclear field by supporting the provision and availability of European and international research infrastructures, as well as guaranteeing appropriate access to them for European researchers, including the JRC's research infrastructures. The programme provides Community support and funding to foster the development of a network of nuclear research infrastructures which will be optimised in order to increase trans-border collaboration.

These have materialized in the two projects OFFERR and OASIS built on former initiatives as the Actinide User Laboratory (ActUsLab), pioneering open access to JRC's laboratories in 2002 for JRC Karlsruhe site, followed by the EUFRAT Open Access programme that started in 2005 at JRC Geel. On a broader basis the ACTINET-6 initiative, started at 2004, aimed to gather the actinide science community through a network and also including the idea of transnational access to experimental facilities. It's followers the Integrated Infrastructure Initiative (ACTINET-I3) and TALISMAN fostered the networking between existing European infrastructures in actinide sciences and opened them widely to European scientists by offering and supporting transnational access to unique facilities. The establishment of a network of nuclear research infrastructure and related competences is driven forward as a strategic investment in the development and increased use in terms of capacity and performance of nuclear research infrastructures [5].

The nuclear research infrastructure listed in the catalogues under OFFERR and OASIS Nuclear research infrastructures offer essential and unique scientific services and capabilities to the European research community and enhancing their accessibility by EU scientists enables exchanges and stimulates the advancement of research in all nuclear areas.

2 Results and discussion

The nuclear field requires infrastructure for its industry and research institutions and to train its new recruits and researchers. Access initiatives are launched since a while not only in Europe [6,7]. As for the industry, experimental facilities are essential for studies, both for extending the lifetime of the current reactor fleet and for qualifying new fuel, structural materials, and installations [2]. On the other hand, infrastructure is becoming increasingly scarce, with many experimental reactors having been shut down or closed in recent years and expensive nuclear infrastructures not being affordable in each single Member State. To keep promises and prepare for the future, it is necessary to support and pool existing infrastructure and enhance their visibility and accessibility through the creation of a network and the funding of application projects. These are the reasons that motivated the launch of the two projects OFFERR, a consortium of Member States facilities and OASIS, facilities of the Joint Research Centre serving as research arm of the European Commission independent of Member States and enabling fair access to all European citizen.

2.1 OFFERR

2.1.1 Description of OFFERR

OFFERR stands for eurOpean platForm For accEssing nucleaR R&d facilities.

The OFFERR project is a Nuclear Research and Training (HORIZON-EURATOM-2021-NRT-01) project that started on September 1, 2022, for a duration of four years. The project has two main components: one dedicated to coordination (budget of 1.8 M€) and one dedicated to funding experimental activities (budget of 7.2 M€). The coordination of the project aims to establish a network of experimental infrastructures in Europe in the nuclear field and a system of calls for applications using these infrastructures. To achieve this, the project's work packages are structured as follows:

- WP1 User facility network.
- WP2 Design & launch call for infrastructure access.
- WP3 Evaluation process monitoring.
- WP4 European & international interactions & training.
- WP5 Scientific monitoring, dissemination & exploitation.
- WP6 Project coordination, management & communication.
- WP7 Facilitating access to infrastructure.

Figure 1 summarises the interaction between the six work packages in OFFER. WP 1's main function is to create the infrastructure network. Once this is established, WP 2's primary task is to launch the call for projects. WP 3 then evaluates the project proposals received. Meanwhile, WP 4 manages international collaborations. Scientifically, all the work is monitored by WP 5. Finally, WP 6 is responsible for project coordination management and WP 7 for funding applications.

The OFFERR project consortium consists of 17 partners (EDF, CEA, CIEMAT, ENEN, IRSN, JSI, KIT, NRG, LGI, SCK CEN, SNETP, STUBA, UJV, USTUTT, VTT, JRC, OECD NEA) (cf. Fig. 2) in 9 countries. Today, OFFERR's network gathered research infrastructures in more than 20 countries, (cf. Fig. 3). All the partners meet periodically, once or twice a year, in a General Assembly, one of the two decision-making bodies for the coordination of the project. The Steering Committee, on the other hand, is the operational body of the project. It meets more frequently, every month during the first year, and every two months thereafter, to manage the project. The Steering Committee is composed of the coordinator and the work package leaders.

2.1.2 OFFERR Objectives

The objective of the OFFERR project is to support the SNETP association in setting up a system for R&D experts to facilitate access to key nuclear research infrastructures all over Europe. Its primary function is to serve as a channel for financial support from the Euratom programme. This support is allocated by paying and granting access to user institutions that offer services to selected projects through OFFERR calls. Additionally, the project offers financial support to successful research teams who have applied through the calls and will engage in collaboration with the research institution.

In order to structure the funded activities by orienting them towards the main objectives expected by European citizens, allocation keys have been decided between the different call themes, in accordance with the strategic agenda of SNETP [8]:

- light water reactor sustainability ∼40%.
- Advanced fission reactor concepts ∼20%.
- Waste and decommissioning ∼5%.
- Nuclear science applications ∼10%.
- Advanced nuclear fuels ∼10%.
- Innovation in nuclear instrumentation ∼10%.
- Radioprotection and nuclear medicine ∼5%.

2.1.3 First statistics

The main part of the first year of the project was dedicated in two aspects: the initialization of the infrastructure network and the creation of the call for projects process. To deploy all this, it was of course necessary to create dedicated software infrastructure, including a platform allowing applicants to submit their proposals and reviewers to assess them.

The projects built the infrastructure network by drawing inspiration from comparable projects, such as the NNUF (UK) [6] and NSUF (USA) [7] projects. Initially, the inventory of infrastructures was carried out by appealing to the members of SNETP, which brought the project about 180 facilities. Then, as the calls for projects progressed, candidates were able to propose new infrastructures. At the time of writing this article, the OFFERR network counts more than 230 research infrastructures [9]. This number increased continuously with a progress of about 25 new facilities joining each year.

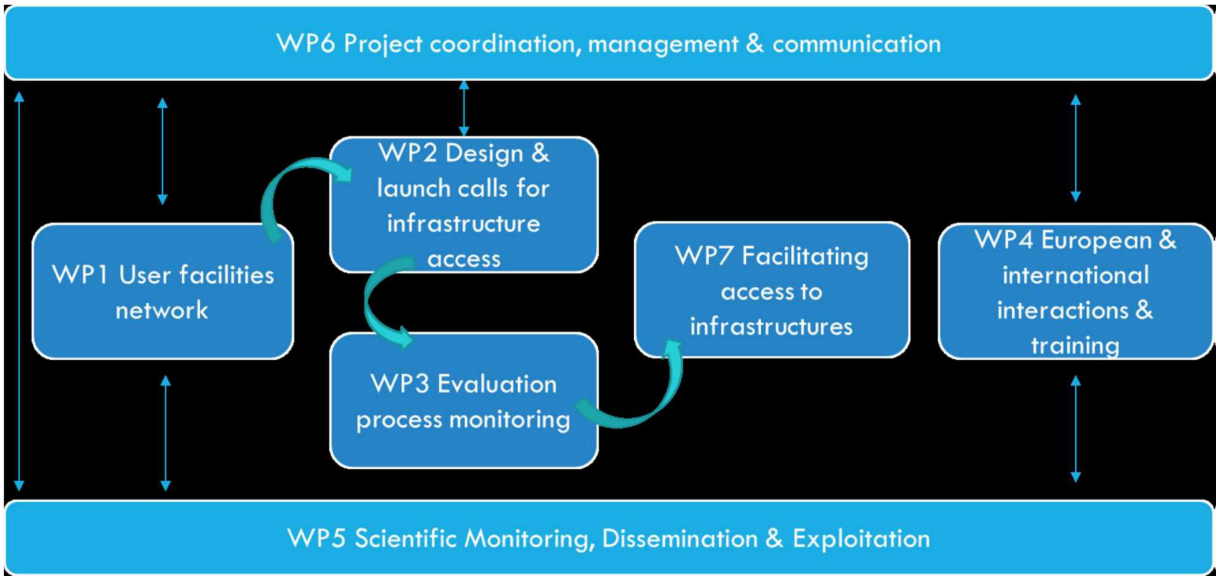

Fig. 1. Interaction between OFFERR work packages.

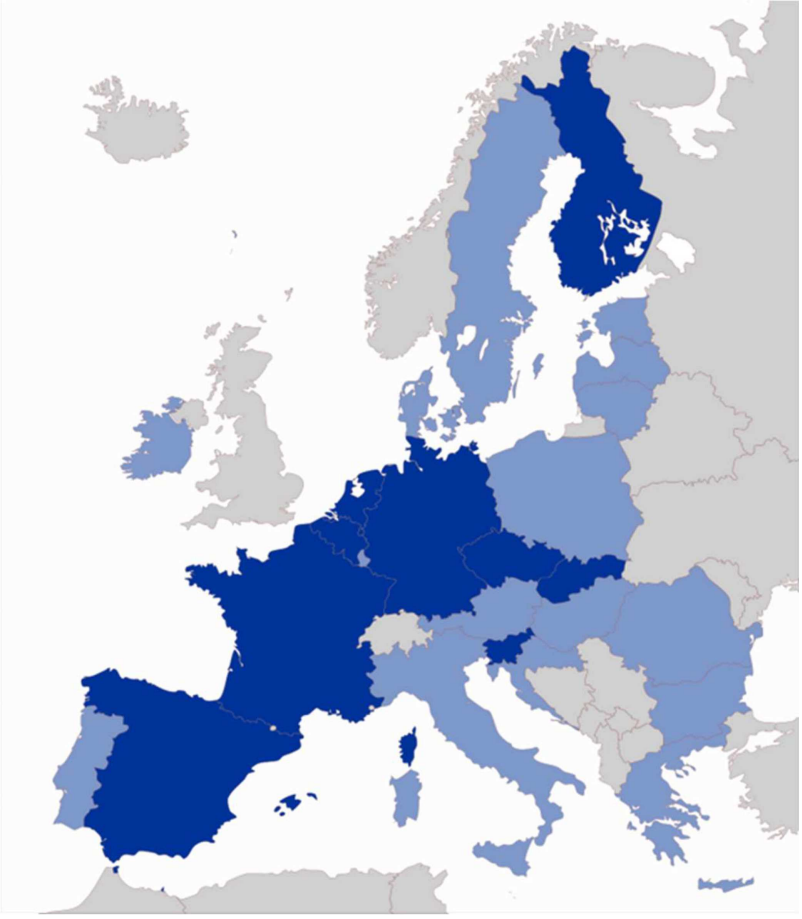

Fig. 2. Map of the Countries of the OFFERR consortium members (EDF, CEA, CIEMAT, ENEN, IRSN, JSI, KIT, NRG, LGI, SCK CEN, SNETP, STUBA, UJV, USTUTT, VTT, JRC, OECD NEA); EU member states with OFFERR research facilities are given in blue, highlighted in dark blue are the members states of the OFFERR consortium members.

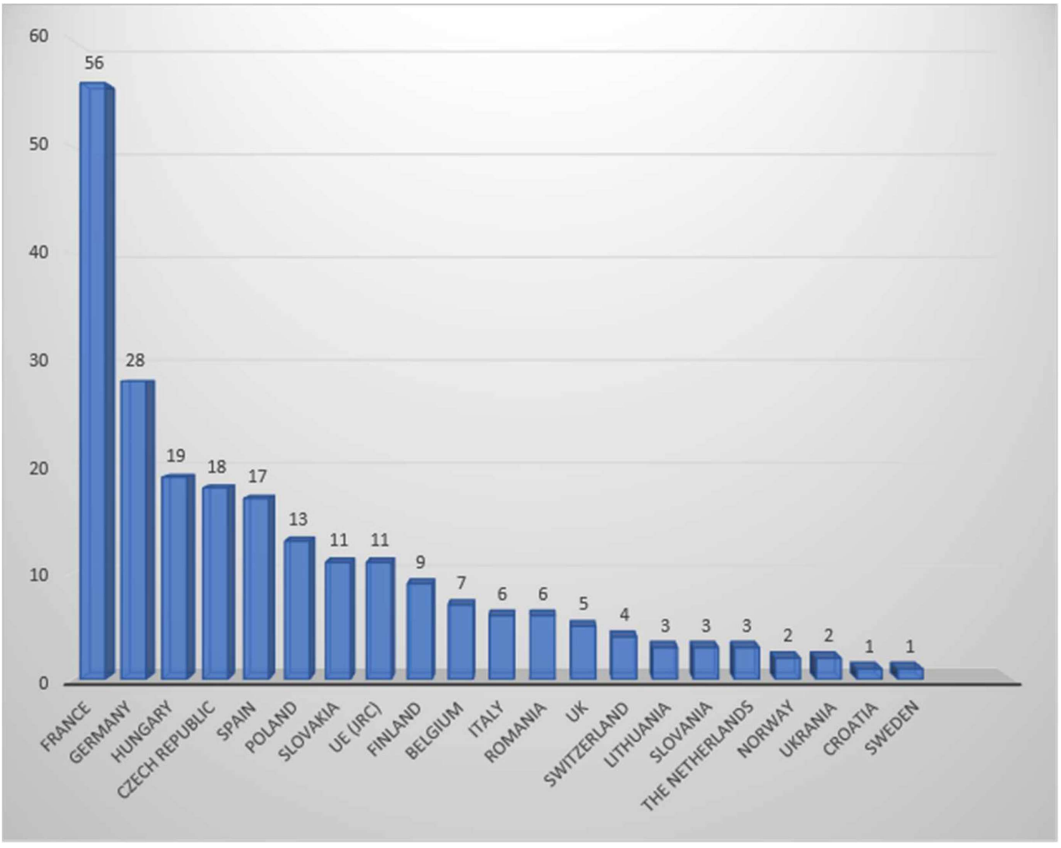

Fig. 3. Distribution of the OFFERR facilities per country.

The shares of the network per country and technical area are given below in Figures 3 and 4. The reader can notice that there are a few non-EU facilities in the network (e.g. in UK, Switzerland, Norway). These facilities can be used in OFFERR applications but they cannot receive funds from the project; the same is true for the European Commission JRC research facilities in the OFFERR catalogue.

Once the network and the call process were created, the coordination work focused on the implementation of applications, the evaluation process, and the funding process. This last task is not to be overlooked; it is complex because OFFERR has a cascading funding mechanism that was challenging to develop [10].

The OFFERR project has issued a single call (cf. Fig. 5) for projects but offers, every six months, a cut-off date to collect the applications submitted on the platform [11] and then have them evaluated by a panel of independent reviewers. OFFERR applications fall into two different categories as summarized in Table 1:

- fast-track projects with a budget less than €50k and a maximum duration for the user stay of 6 months (simplified process) and
- complex projects with more than €50k or more than 6 months user stay needed (with a maximum of 18 months) and a mandatory intellectual property agreement.

Most of the results of the OFFERR applications are public but a part of them can remain private. The IP agreements are used to manage these questions. OFFERR results are "as open as possible and as close as necessary".

The acceptance rate for fast-track projects is around 83%, slightly higher than for the complex projects with around 63%.

Evaluation criteria are scientific excellence (rating on scientific value, methodology, innovation and comprehensiveness), scientific outcome and impact and the Capacity of the applicant team and feasibility [11]. The evaluation time is about 6 weeks for the fast-track and 10 weeks for the complex projects.

At the time of writing, many applications have been launched and some are nearing completion. The technical and financial reports are not yet formally collected.

It can already be stated that in the applications, third parties (i.e. parties who are not members of the OFFERR consortium) are involved in about 80% of the application projects, generally calling upon the major infrastructures of the network, those of the OFFERR consortium members. The funding from the OFFERR project towards the infrastructures constitutes support for these infrastructures as well as for the third parties who, without OFFERR, would not have been able to launch ambitious experimental programs.

To steer the distribution of applications towards the target, workshops dedicated to call areas were organized

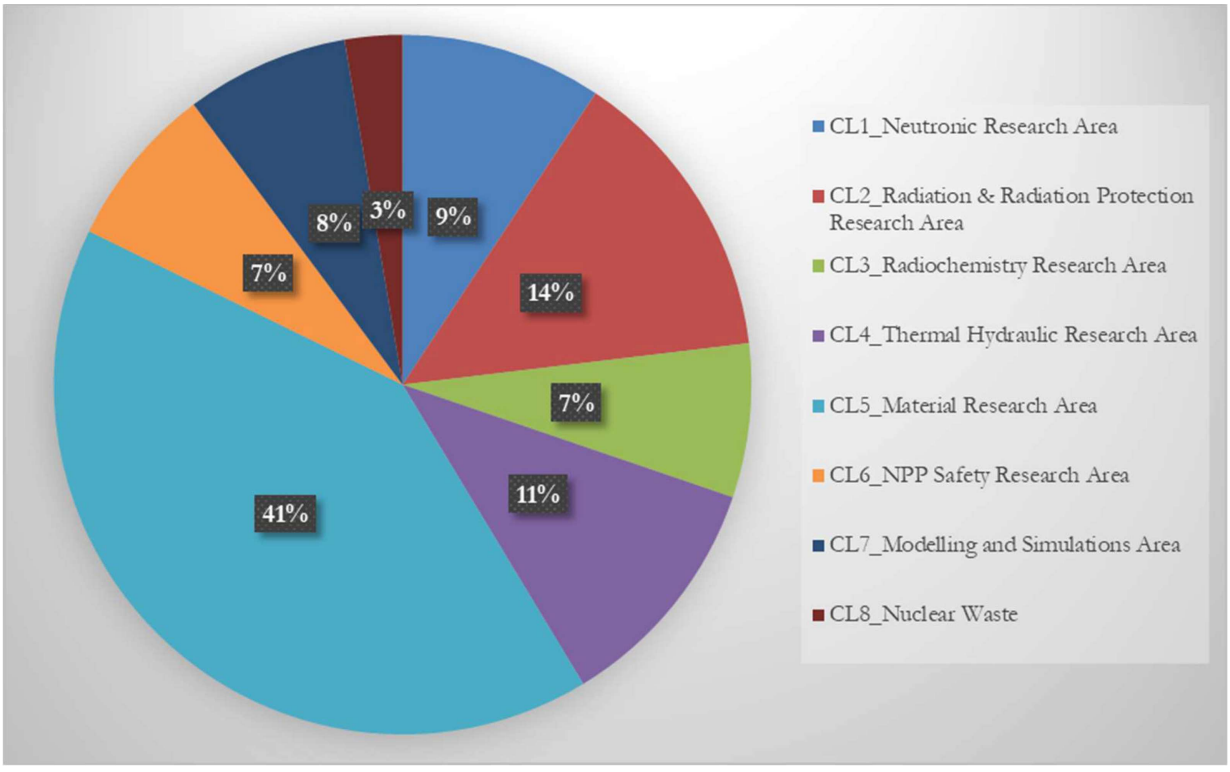

Fig. 4. Distribution of the OFFERR facilities per technical areas the facilities are placed in. These technical areas refer to scientific disciplines, while the call areas are close to scientific or industrial issues.

to connect infrastructure owners and users. In some cases, certain areas of the call were cut so that the budget could ultimately go towards the priority call areas. In the radar chart (cf. Fig. 6), the difference between the strategic target and the actual implementation is plotted.

Regarding education and training, a collaboration is in place with the ENEN++ project by aligning the OFFERR closing dates coherently. The two platforms are in addition synchronized so that, for example, the acceptance of an OFFERR project serves as proof for the ENEN++ applications. In the end, two joint projects can be co-funded by both projects. Additionally, in other applications, students, mainly PhD students, are directly involved in the experimental work performed.

2.1.4 Outlook

The OFFERR project and its network are now well-known within the nuclear community in Europe, enabling the funding of experimental projects that would have been difficult to realize without it. These applications bring together teams that sometimes did not know each other before. OFFERR is therefore a driving force for international collaboration in Europe in the nuclear field.

The primary mission of OFFERR now is to finalize the project and spend the budget effectively, in line with the SNETP strategy. Important step in reaching these goals is continued communication and interaction with stakeholders and new users to ensure that the last cut-off dates are as successful as the first ones. Ultimately, this advocates that such a project is essential for the sustainability of experimental infrastructures, a key element of the sector. As is done in the USA with NSUF, we must propose a continuity of service and even be able to open up to longer-term application projects to better meet the needs of our scientific and industrial field.

2.2 JRC OASIS

2.2.1 Description of OASIS

While OFFERR as a streamlined common funding instrument for transnational access to nuclear research infrastructures is still in its beginnings, JRC's open access to nuclear research infrastructures relies on long standing collaborations with institutions in the field. The JRC provides access to its nuclear research infrastructures since the 6th research framework programme in the frame of collaborative EU research projects and agreements and already in 2002 (with ActUsLab in Karlsruhe) and 2006 (with EUFRAT in Geel) two dedicated JRC programmes were put in place to allow for external use of some of JRC's nuclear infrastructure. Exemplarily for these first projects key points from the Actinide User Laboratory (ActUsLab) may be compared to the improved programme as it is now. Within the frame of the European Commission programme "Transnational Access to Research Infrastructures", from 2002 to 2004, 331 operating days have been delivered to 35 users to perform 34 projects in ActUsLab which at that time comprised only the PAMEC

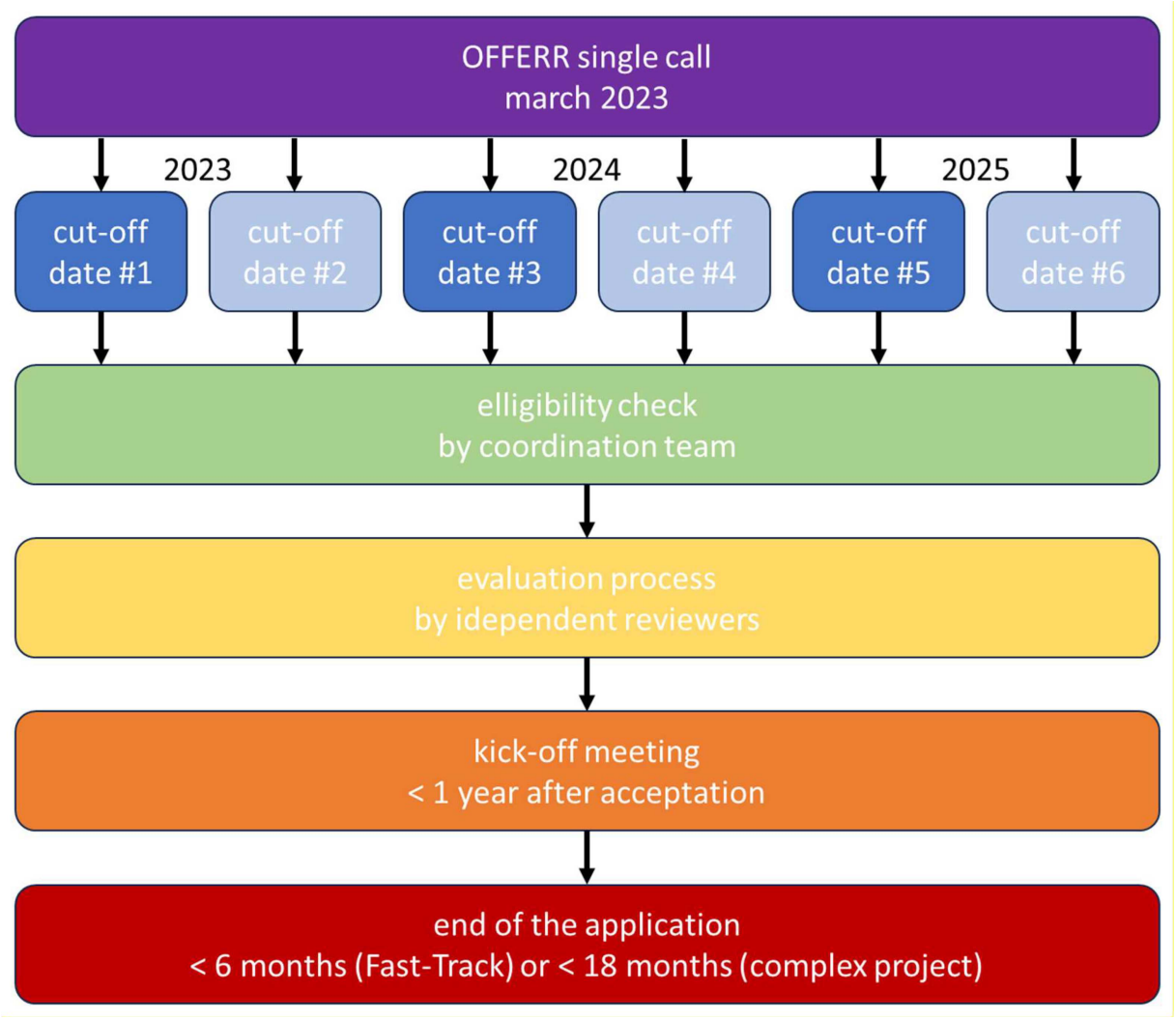

Fig. 5. OFFERR selection process.

Table 1. Synthesis of the first cut-off dates.

Fast-track projects (<€50k)		Complex projects (>€50k)	
Cut-off dates	Results	**Cut-off dates**	Results
16/05/2023	4 accepted (€192k)		
	1 rejected		
30/09/2023	11 accepted (€528k)	**30/09/2023**	6 accepted (€1931k)
	1 rejected		2 rejected
31/03/2024	6 accepted (€286k)	**31/03/2024**	4 accepted (€1555k)
	2 rejected		4 rejected
30/09/2024	3 accepted (€130k)	**30/09/2024**	5 proposals (€1038k)
	1 rejected		
31/03/2025		**31/03/2025**	
30/09/2025			

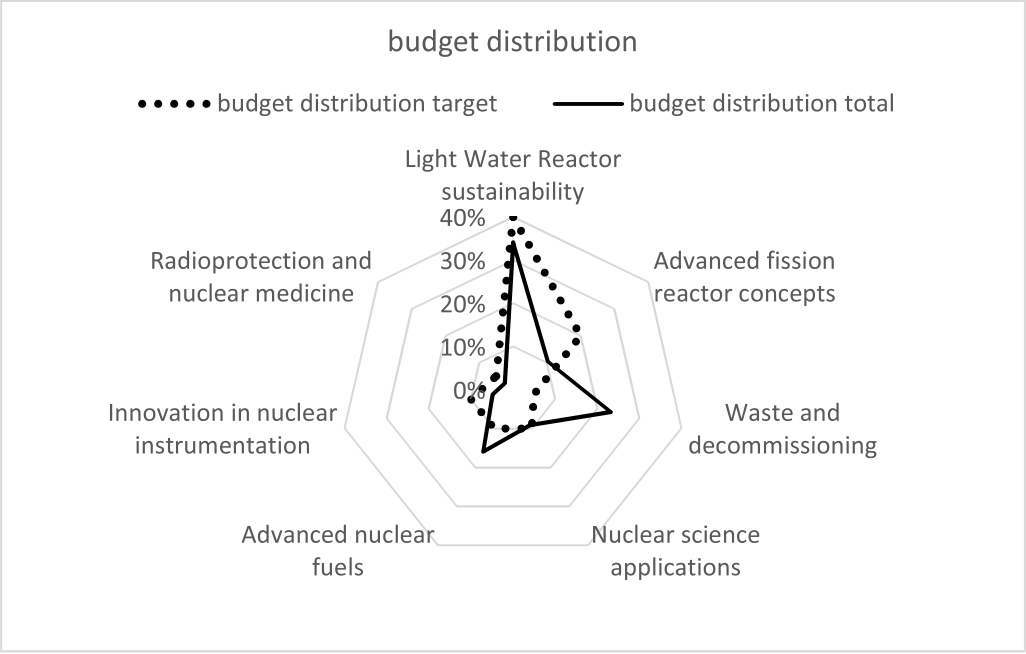

Fig. 6. Radar plot showing the repartition of selected applications per call areas. Comparison between the current budget distribution (bold line) and the initial target (dashed line). The difference can be explained by the heterogeneity of the strategies of the researchers.

laboratories. In total personnel from 22 different laboratories participated to the programme. These proposals were all short-term projects with on average 10 operating days and involved mainly experienced researchers although about 31% of the users were post-doctoral researchers or doctoral students. The use of the facility by scientists from candidate countries was high – about 30% came from Poland and the Czech Republic. The total number of 53 proposals in this very first programme highlights that from the beginning on there was a significant demand for transnational access to nuclear RIs.

In 2017, JRC launched a global program to provide open access to 17 of its scientific laboratories (including 11 nuclear laboratories) to external users from the European Union and associated countries. The OASIS project is a part of this initiative but it is focused on offering access and financial support to users for conducting experiments at JRC's nuclear infrastructures. OASIS stands for Open AccesS to research InfrastructureS. The objectives are to foster training and mobility at the European level between academic institutions, research centres, and industry and contribute to maintain multidisciplinary nuclear expertise in the fields of nuclear safety and security at the highest standards within the European Union. As part of this pilot project an Administrative Arrangement was signed between the Directorate General for Research and Innovation and the JRC in February 2020 with the aim to enhance the open access scheme by providing financial support from the Euratom budget – in total 750 kEUR for four years (extended to almost 6 years due to the COVID-19 pandemic) – to users from EU member state institutions to cover their travel and subsistence costs. In the OASIS project, JRC makes available 11 of its nuclear facilities and the associated technical support to external users, free of charge, while DG RTD provides their financial support.

The financial support to users of the RIs favours equal access regardless of country of origin and home institution and ensures a selection of proposals based on merit and not on financial resources of users.

The OASIS project should not be seen as a competitive action, JRC's open research infrastructures are also listed in the OFFERR catalogue and can potentially also be accessed via OFFERR. Up to now there was no application in OFFERR involving the research facilities participating to OASIS. This shows the long-standing high profile and significance and of the OASIS project's own structure and pathway which will be described below. On the other hand OFFERR opens up new pathways for users to JRC's products as for example the Transuranus code usage which was applied for in an OFFERR project.

The OASIS pilot project relies on the use of the nuclear infrastructures of the JRC, which are located at the JRC sites in Geel (EUFRAT comprising facilities GELINA, MONNET, RADMET and HADES), Karlsruhe (ActUsLab comprising the Laboratories PAMEC, FMR and HCKA) and Petten (EMMA with the AMALIA, LILLA, SMPA and MCL facilities), see Figure 7. A complete description of the facilities is provided on the JRC Science Hub [12] and in the Open Access brochure [13]. Each site has a very specific field of expertise and together they cover a large domain of scientific activities in the nuclear field. This gives external users the opportunity to explore an extended spectrum of research from the nuclear fuel cycle to non-power applications.

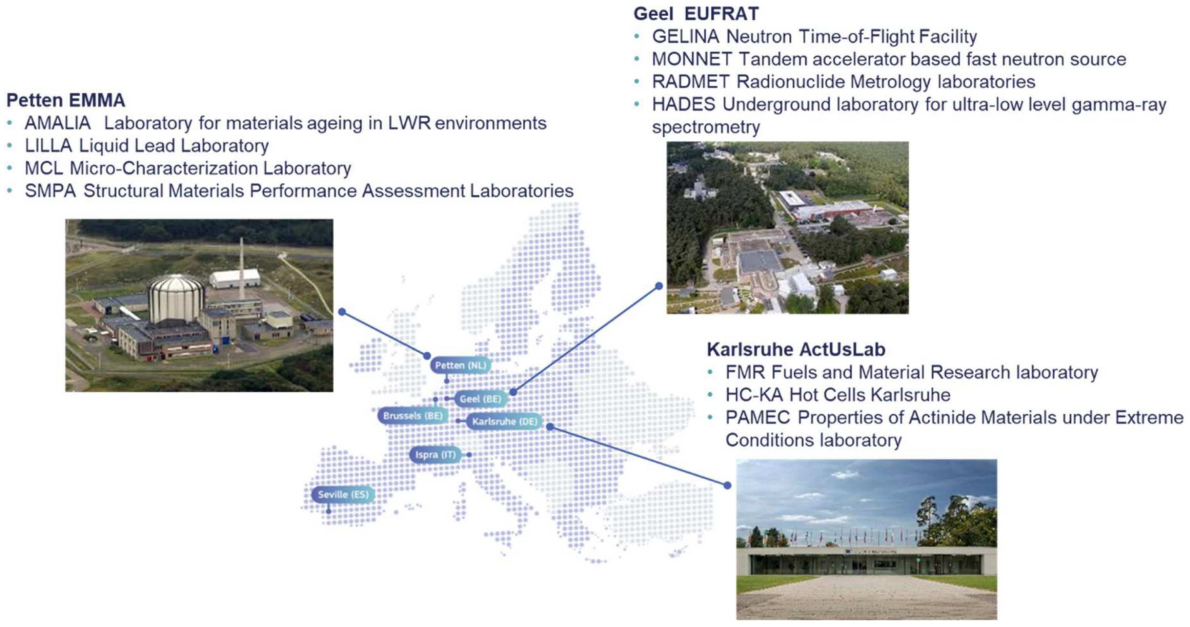

Fig. 7. Overview of JRC's open access facilities in Geel, Karlsruhe and Petten.

In Geel, the work is dedicated to nuclear data acquisition (e.g. neutron cross section measurements, accurate measurements of radioactivity for science and technology applications) while in Karlsruhe the research is primarily focused on nuclear materials (e.g. actinides, nuclear fuels, waste forms, radioisotopes for medicine...). In complement, the laboratories in Petten are offering various instruments to study the behaviour of reactor's structural components under various experimental conditions (e.g. environment, temperature, stress, and load).

Since February 2020, calls for proposals have been launched once or twice a year and advertised on the JRC Science Hub with a specific deadline. The received proposals are evaluated and ranked by independent scientific committees. The selection process is completely transparent and fair. It is based on scientific merit (50%), collaboration and access to new users (20%), as well as strategic relevance (30%, focusing on standardisation, integration and cohesion, sustainable growth and competitiveness) [12].

If accepted the lead users (i.e. the coordinators and contact points for the access proposals) are informed and a contract (RIAA) is signed between JRC and the user's institutions. Then, a date is set to organise their visit in JRC's nuclear facilities to perform their experiments. After completion of the administrative procedure that includes medical examination and security clearance, external users can stay up to 9 months and be financially supported by the programme. Experimental results have to be published in the open literature.

The whole selection process is summarized in Figure 8. The typical timeline for the process is about two month for the call, proposal submission and evaluation, the contract and administrative details need usually also about two months. The implementation of the accepted proposal usually is negotiated between the users and the facility according to the needs and possibilities of both which can be immediately after the administrative part is finished or at any other convenient date users and JRC staff agree on.

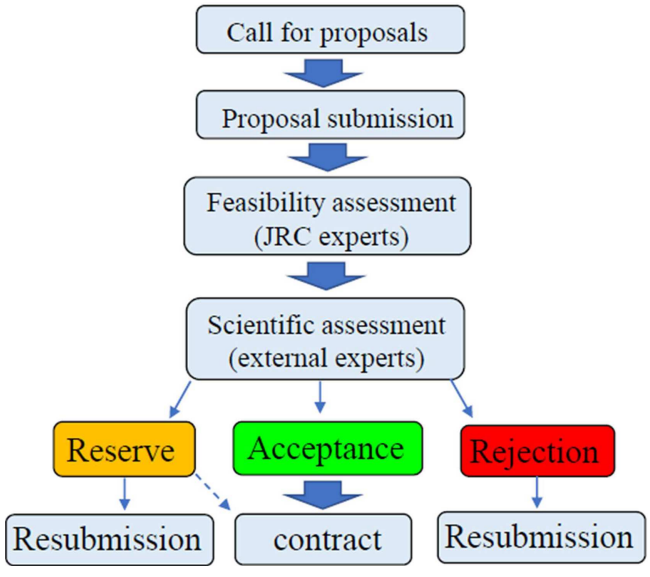

Fig. 8. Scheme of the selection process.

2.2.2 Statistics

The OASIS project started in February 2020. To date, 6 calls have been launched in the period 2020 to 2024 and more than 120 proposals were accepted. The acceptance rate is close to 90%. Figure 9 summarises the distribution of accepted proposals across the different sites.

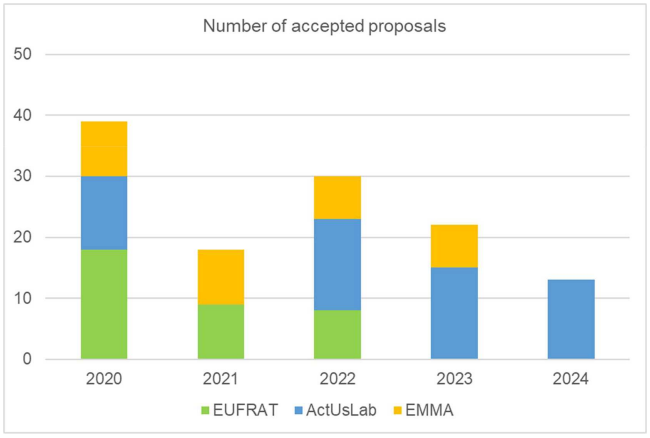

Fig. 9. Accepted open access proposals 2020–2024 for the three sites within the topical areas: Nuclear data measurement EUFRAT (Geel), Nuclear material research ActUsLab (Karlsruhe) and Reactor structural components investigations EMMA (Petten).

The variability in the numbers, specifically for the years with no calls (meaning no accepted proposals) for ActUsLab and EUFRAT reflects laboratory closures during the COVID-19 period and technical-related shut downs. At the beginning of 2025 the last calls for all three facilities were closed.

Institutions from 20 countries (EU Member States and associated countries to the Euratom Programme) used JRC's nuclear research infrastructure. Figure 10 gives the country distribution of the lead user institutions that signed the RIAA.

Around 70% of the proposals involve students (BSc, MSc or PhD) and about 40% of the users coming to the sites are indeed students, which demonstrates the importance of such programs for training and education of young generation and its contribution to maintaining a pool of qualified nuclear researchers, engineers, and professional in the European Union [14–16].

After four years of activities, a workshop was organized to assess how beneficial JRC's nuclear open access scheme has been for external users. The workshop took place on 19–20th June 2024 in Brussels. The aim of the event was to review the Open Access program's achievements, emphasising successes and lessons learned. It also highlighted the effective partnership between JRC and RTD in making nuclear infrastructures accessible, free of charge, for the Euratom research community. The event gathered around 100 participants, both online and in Brussels, from academia, industry, research organisations and the European Commission.

Key messages from the discussions held during the workshop included:

- the importance and value of the JRC Open Access program were acknowledged at both European and national levels for promoting open science and fostering innovation.
- JRC's research infrastructures are playing a vital role in advancing knowledge, contributing to scientific excellence, and developing innovative technologies. These infrastructures pool unique resources, which is particularly important given the high costs and limited capacities in some Member States.
- The program's education, training, and capacity-building components were particularly highlighted as a crucial factor for preserving and transferring relevant knowledge, especially to young scientists and students.

This workshop was an opportunity for stakeholders to come together to reflect on the successes and challenges of the JRC open access nuclear research infrastructure program. The collective insights and recommendations gathered from this event are going to be used in shaping the future trajectory of the JRC open access scheme and the associated work-program. The workshop was also the opportunity to present the concrete scientific outputs of projects in various fields and to allow networking among different research organizations.

In general, the Administrative Arrangement with DG RTD guaranteed equity between all research institutions in Member States and associated countries, irrespective of their budget and ensured a large participation of PhD students, BSc/MSc students, Post-Docs and young scientists in the programme. The financial support also facilitates the reception and selection of the best scientific proposals.

For ActUsLab a comparison of the usage of the programme before the AA (2018–2019, no financial support for users) with a comparable period within the AA (2023–2024, financial support to users) shows a significant increase from 18 users from 8 countries including 8 PhDs in 2018/19 to 46 users from 13 countries including 18 PhDs for 2023/24.

2.2.3 Outlook

The Open Access OASIS project will end in December 2025. During the workshop mentioned above, the external users set forward several recommendations to maintain and evolve the open access program. They are summarized here below:

- facilitating the mobility of researchers across Europe by ensuring continuous financial user support for the program is essential.
- Establishing close links with stakeholders, including start-ups active in the nuclear sector will enhance collaboration.
- Extending the possible duration of stays for researchers at the facilities.
- Simplifying the administrative processes to make access easier for researchers.
- Increasing awareness-raising efforts among potential users in Members States' research organisations, the industry and universities in order to attract young talents.
- Outreach efforts to policymakers is also critical for enhancing the overall visibility of JRC research infrastructures.

The objective for the last year of the program (2025) will be to explore ways to ensure sustainability of the technical and human resources.

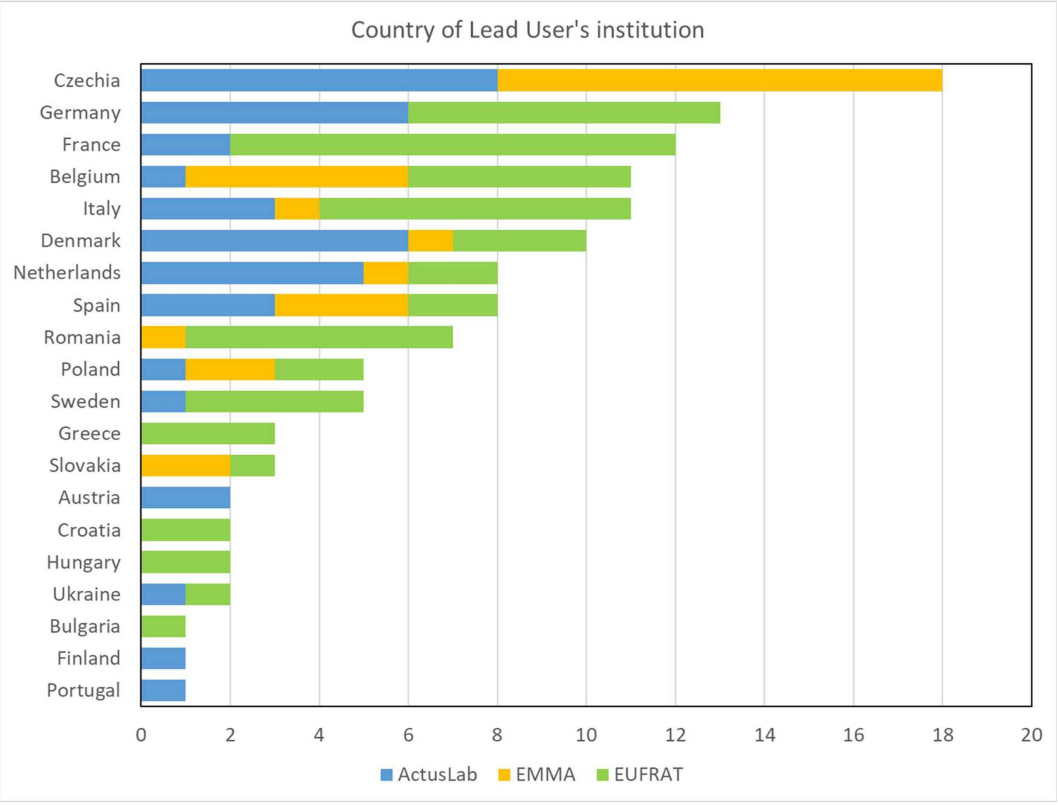

Fig. 10. Country distribution of lead user institutions with signed RIAAs from 2020 to 2024. Please be aware that the x axis relates to the number of proposals.

3 Conclusions

Comparing the two projects, it is observed that they consider different fields of intervention and scopes. While OFFERR is strongly related to SNETP's strategic research agenda, OASIS is more focused on Actinides based research, basic science and various nuclear science applications ranging from power to non-power applications, such as nuclear medical or space applications. Whereas OFFERR is a large consortium of Member States facilities put in common and fostering mutual exchanges and joint projects, OASIS covers a range of European facilities opened to Member States for experiments that are not possible elsewhere. OASIS also fosters collaboration through exchanges and joint projects, as well as education and training. Whereas the two projects have one goal which is facilitating transnational access to key nuclear research infrastructures, they follow complementary approaches.

The support from the OFFERR project is allocated by paying and granting access to user institutions that offer services to selected projects from the OFFERR calls OASIS supports the users' subsistence costs, and this has fostered the number of applications for scientific stays at JRC's research facilities. OASIS does not cover any expenses relative to the facilities themselves, such as, among others, operation and maintenance, which are paid by the direct actions share of the Euratom Research and Training Programme's budget. So far, the OASIS project has been very successful. Open access to JRC research facilities in the future requires sufficient funding to support the mobility of researchers and students but also the operation of the facilities.

The different objectives and scope of both projects are also reflected in the different budgets accounting for OFFERR ∼9 Mio€ (for 4 years) and for OASIS 750 k€ (for 4 years with an extension to ∼6 years). These figures are very small when compared internationally for example with similar funding schemes in the UK, the National Nuclear User Facility (NNUF) [6] or in the US, the Nuclear Science User Facilities (NSUF) [7] which have considerably higher funding resources (see Tab. 2).

NNUF (UK) [6] ran until March 2024 to enhance national facilities for the study of radioactive materials. The budget included 7.5 Mio £ for user access. A follow-up project considering the management of government money is underway, meanwhile at the moment, there are no grants available at the NNUF Access Scheme has concluded.

Potential for the future

The availability of nuclear research infrastructure and mobility of researchers to access them are key challenges but also crucial for maintaining and fostering nuclear competences in Europe. This is acknowledged in the current Euratom Research and Training Programme, materialised

Table 2. Funding resources in international comparison.

	Budget over full period or annually	Access mechanisms	Topics
OFFERR	9 Mio€ (4 years)	Competitive proposal process, 2 cut-off dates/year Funding of experimental activities and visits of the user teams, beneficiaries are the organizations offering access to the infrastructures and the users of the infrastructures	more than 230 facilities Light water reactor sustainability, Advanced fission reactor concept, Waste and decommissioning, Nuclear science applications, Advanced nuclear fuels, Innovation in nuclear instrumentation, Radioprotection and nuclear medicine
OASIS	750 k€ (∼6 years)	Competitive proposal process, 1–2 calls/year Funding of users' travel and subsistence costs only Available to academia and SME's	11 facilities Basic research in the nuclear field as nuclear data acquisition (e.g. neutron cross section measurements, accurate measurements of radioactivity), nuclear materials (e.g. nuclear fuels, waste forms, radioisotopes for medicine), behaviour of reactor's structural components, non-power applications (e.g. nuclear medicine, space)
NNUF (UK)	∼100 Mio £ (10 years) Including ∼7.5 Mio £ to fund researchers to use NNUF facilities	Competitive proposal process, quarterly calls Funding of facility and equipment costs, sample transport; can also fund users' travel and subsistence costs	30 facilities R&D activities on the operation and future development of nuclear plant in the UK, and the training of the next generation of nuclear scientists in core skills and the use of modern equipment
NSUF (US)	∼35 Mio $ annually (data for 2024/25)	Competitive proposal processes, quarterly calls for RTEs*, yearly call for CINR# No cost to user but also no travel funding to users Available to industry, academia and national labs for non-proprietary R&D	21 institutions R&D activities on irradiation effects in nuclear fuels and materials Education and training: Workshops and hands-on skill development

*RTE Rapid Turnaround Experiment. #CINR Consolidated Innovative Nuclear Research.

in the OFFERR and OASIS projects described in this article.

So far, OFFERR and OASIS are successful complementary projects. OFFERR is now in a state of taking up speed while OASIS is looking for potential extension, beyond 2025, of the Administrative Arrangement in place with RTD to maintain the synergy between the Direct and Indirect Action within the European Commission.

There is the need and wish for extension and ongoing of projects that support programmatically and financially an efficient and optimal use of the EU nuclear research infrastructure, and allows, through adequate mechanisms, the mobility of students and researchers to access those nuclear laboratories and facilities. As seen from the OFFERR project, the set up and coordination of such large RI network has taken significant budget and time. So, sustainability and continuity of the funding structure would be of great importance and could only facilitate any follow-up projects.

As lessons learned from the implementation of the two projects the following elements could contribute to better achieve the objective of the access to EU nuclear research infrastructure in the longer term:

- substantial increase of the budget.
- Adding flexibility to the duration of the stays of the researchers to the facilities.
- Simplifying the administrative process.
- Better announce and disseminate the mobility opportunities and open access options to the different EU nuclear research facilities among potential users in Member States and associated countries research organisations, industry and universities, in order to attract young talents.
- Liaise more closely with stakeholders of all kinds, in particular focusing on interactions with the nuclear industry, including "start-ups" focused in innovative designs, to enhance meaningful collaboration but also not yet intensively engaged Member States with nuclear facilities or nuclear aspirations.

Acronyms

AA	Administrative Arrangement
ACTINET-6	Network for Actinides Sciences (2004–2008)
ACTINET-I3	ACTINET Integrated Infrastructure Initiative (2009–2013)
ActUsLab	JRC's Actined User Laboratory, Open access facility Karlsruhe comprising facilities PAMEC, FMR and HC-KA
AMALIA	JRC's Laboratory for materials ageing in LWR environments
CEA	Commissariat à l'énergie atomique et aux énergies alternatives (France)
CIEMAT	Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (Spain)
CINR	Consolidated Innovative Nuclear Research
DG	Directorate General
DG RTD	Directorate General for Research and Innovation (European Commission)
EDF	Électricité de France SA (France)
EMMA	JRC's Environmental and Mechanical Materials Assessment, Open access facility Petten comprising facilities LILLA, SMPA, MCL and AMALIA
ENEN++	European Nuclear Education Network
ERIC	European Research Infrastructure Consortium
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EUFRAT	JRC's European research infrastructure for nuclear reaction, radioactivity, radiation and technology studies in science and applications, Open access facility Geel comprising facilities Gelina, Monnet, Radmet and Hades
FMR	JRC's Fuels and Material Research laboratory
HC-KA	JRC's Hot Cells Karlsruhe
IRSN (ASNR)	Nuclear Safety and Radiation Protection Authority (ASNR since 01/2025) (France)
JRC	Joint Research Centre (DG of the European Commission)
JSI	Jožef Stefan Institute (Slovenia)
KIT	Karlsruhe Institute für Technology (Germany)
LGI	LGI Sustainable Innovation (France)
LILLA	JRC's Liquid Lead Laboratory
MCL	JRC's Micro-Characterization Laboratory
NNUF	National Nuclear User Facility (United Kingdom)
NRG	Nuclear Research and Consultancy Group (The Netherlands)
NSUF	Nuclear Science User Facilities (USA)
OASIS	Open AccesS to research InfrastructureS project
OECD NEA	Organisation for Economic Co-operation and Development Nuclear Energy Agency
OFFERR	eurOpean platForm For accEssing nucleaR R&d facilities
PAMEC	JRC's Properties of Actinide Materials under Extreme Conditions laboratory
R&D	Research and Development
RI	Research Infrastructure
RIAA	Research Infrastructure Access Agreement
RTE	Rapid Turnaround Experiments
SCK CEN	Studiecentrum voor Kernenergie / Centre d'Etude l'Energie Nucleaire (Belgium)
SMPA	JRC's Structural Materials Performance Assessment Laboratories
SNETP	Sustainable Nuclear Energy Technology Platform
STUBA	Slovak University of Technology (Slovakia)
TALISMAN	Transnational Access to Large Infrastructure for a Safe Management of ActiNide (2013 – 2015)
UJV	ÚJV Řež, a. s. (Czech Republic)
USTUTT	University Stuttgart (Germany)
VTT	VTT Technical Research Centre of Finland Ltd (Finland)

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Conflicts of interest

The authors declare that they have no competing interests to report.

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