Proposal Evaluation Form

EUROPEAN COMMISSION

Horizon Europe Framework Programme (HORIZON)

Evaluation Summary Report - Research and innovation actions

Call: HORIZON-INFRA-2026-01

Type of action: HORIZON-RIA

Proposal number: 101355076

Proposal acronym: E2-SCALE

Duration (months): 48

Proposal title: Energy Efficient and Sustainable Collider, Accelerator, and Light-source research infrastructures for Europe

Activity: HORIZON-INFRA-2026-TECH-01-01

N.	Proposer name	Country	Total eligible costs	%	Grant Requested	%
1	KARLSRUHER INSTITUT FUER TECHNOLOGIE	DE	988,321.25	9.88%	988,321.25	9.88%
2	HELMHOLTZ-ZENTRUM BERLIN FUR MATERIALIEN UND ENERGIE GMBH	DE	870,048.75	8.70%	870,048.75	8.70%
3	DEUTSCHES ELEKTRONEN-SYNCHROTRON DESY	DE	613,977.5	6.14%	613,977.5	6.14%
4	ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE	CH	2,493,496.25	24.94%	2,493,496.25	24.94%
5	CONSORCIO PARA LA CONSTRUCCION EQUIPAMIENTO Y EXPLOTACION DEL LABORATORIO DE LUZ SINCROTRON	ES	222,500	2.23%	222,500	2.23%
6	Cryoelectra GmbH	DE	353,250	3.53%	353,250	3.53%
7	COMMTIA SYSTEMS SA	ES	398,708.75	3.99%	398,708.75	3.99%
8	LUNDS UNIVERSITET	SE	345,125	3.45%	345,125	3.45%
9	ASOCIACION ESPANOLA DE LA INDUSTRIA DE LA CIENCIA	ES	209,250	2.09%	209,250	2.09%
10	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	672,610	6.73%	672,610	6.73%
11	EUROPEAN SPALLATION SOURCE ERIC	SE	173,250	1.73%	173,250	1.73%
12	UNIVERSIDAD DEL PAIS VASCO/ EUSKAL HERRIKO UNIBERTSITATEA	ES	104,875	1.05%	104,875	1.05%
13	SAS JEMA FRANCE	FR	684,420	6.84%	684,420	6.84%
14	VITAVE TECH SRO	CZ	67,875	0.68%	67,875	0.68%
15	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV	DE	364,235	3.64%	364,235	3.64%
16	CORPORACION ZIGOR SA	ES	772,187.5	7.72%	772,187.5	7.72%
17	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR	526,477.5	5.27%	526,477.5	5.27%
18	UNIVERSITE PARIS-SACLAY	FR	138,737.5	1.39%	138,737.5	1.39%
	Total:		9,999,345		9,999,345	

Abstract:

E2-SCALE addresses one of the main challenges facing Europe's future research infrastructures: the growing energy and material footprint of research accelerators. As next-generation facilities increase in scale and performance, energy consumption becomes a limiting factor for the long-term sustainability and operational costs. The project will develop an integrated framework of technologies and tools to improve the sustainability of accelerator infrastructures at component, system and facility level. E2-SCALE combines expertise from accelerator science, energy engineering and industry to deliver innovative RF sources, recycled permanent magnets, high-efficiency solid-state amplifiers, energy-optimised cryomodules, advanced power-electronics solutions, flexible and carbon-aware HPC operation, high-resolution energy monitoring, predictive sustainability assessment tools, and thermal energy storage concepts. The project follows a system-driven methodology: accelerator energy requirements are first analysed, enabling the development of efficient technologies and their subsequent assessment through advanced energy and sustainability analytics. To validate performance under real operating conditions, six demonstrators will be deployed in major European research infrastructures. These demonstrators will provide evidence of energy savings, increased reliability, reduced environmental impact and improved operational flexibility. E2-SCALE directly addresses the objectives of INFRA-2026-TECH-01-01 by delivering new scientific instrumentation, digital solutions and operational methods for research infrastructures. The project combines technology development, prototyping and validation with training, knowledge transfer and industrial exploitation. Through the active involvement of industrial partners, E2-SCALE will accelerate the uptake of its solutions across European research infrastructures and related industrial sectors, strengthening Europe's technological leadership.

Evaluation Summary Report

Evaluation Result

Total score: 13.00 (Threshold: 10)

Criterion 1: Excellence

Score: **4.50** (Threshold: 3 / 5.00 , Weight: -)

The following aspects will be taken into account, to the extent that the proposed work corresponds to the description in the work programme:
- Clarity and pertinence of the project's objectives, and the extent to which the proposed work is ambitious and goes beyond the state of the art.
- Soundness of the proposed methodology, including the underlying concepts, models, assumptions, inter-disciplinary approaches, appropriate consideration of the gender dimension in research and innovation content, and the quality of open science practices, including sharing and management of research outputs and engagement of citizens, civil society and end users where appropriate.

The eleven objectives are clear, measurable and logically structured around concrete technologies, demonstrators and quantitative targets covering RF efficiency, magnet recycling, cryomodules, solid-state amplification, computing flexibility, power quality, thermal storage, energy monitoring, predictive assessment, exploitation, training and demonstration.

The objectives are fully pertinent to the topic because the project develops instrumentation, digital solutions and methods for RI upgrades and combines technology development with prototyping, validation, staff training and industrial uptake. Greening and resilience are central to the technical concept.

Technological partners are very well integrated into development, prototyping and validation, with specialist companies contributing to RF systems, power electronics, permanent-magnet recycling, high-voltage driving and industrial transfer. This provides strong potential for co-development, knowledge sharing and uptake.

The work is highly ambitious and advances significantly beyond the state of the art through ferroelectric phase shifters, recycled permanent magnets, GaN solid-state amplifiers, an FCC-ee-type cryomodule, UPFC deployment, carbon-aware computing and predictive energy assessment. Most RI-specific developments progress beyond TRL 4 and are supported by relevant demonstrators.

The methodology is sound and follows a coherent system-component-system approach linking requirements, development, assessment and validation. Facility boundaries, operating modes, data quality and uncertainty are considered. However, the integration of component-specific material-footprint indicators with the common facility-level energy and carbon assessment is less explicitly developed. This is a minor shortcoming concerning a limited aspect of the otherwise sound methodology. The gender dimension is appropriately considered not relevant to the technical R&I content.

Interdisciplinary aspects are very well addressed through accelerator physics, RF engineering, cryogenics, materials science, power electronics, computing, energy systems, geothermal storage, AI and lifecycle assessment.

Open-science practices and research-output management are of high quality. FAIR principles, a DMP, trusted repositories, persistent identifiers, standard metadata and formats, open-access publication and reuse licences are foreseen, with proportionate restrictions for IPR and commercial sensitivity.

Criterion 2: Impact

Score: **4.50** (Threshold: 3 / 5.00 , Weight: -)

The following aspects will be taken into account, to the extent that the proposed work corresponds to the description in the work programme:
- Credibility of the pathways to achieve the expected outcomes and impacts specified in the work programme.
- Suitability and quality of the measures to maximise expected outcomes and impacts, as set out in the dissemination and exploitation plan, including communication activities.

The pathways to the topic outcomes are highly credible. The project links quantified technological advances and six demonstrators to scientific competitiveness, RI capacity, greening and resilience, digitalisation, RI-industry collaboration and innovation uptake. The greening case is particularly strong. However, some indicators do not sufficiently demonstrate the scale of realised uptake, as they combine actual adoption with follow-up exploitation or participation measures and do not consistently quantify the resulting expansion of RI services and users. This is a minor shortcoming.

The contribution to the destination impacts is strong. Recycled permanent magnets reduce dependency on critical raw materials, while European RF, cryomodule, power-electronics and digital developments strengthen strategic RI capabilities. Co-development between major RIs, technological companies and innovation actors provides credible pathways towards more robust RI innovation ecosystems and wider uptake beyond accelerators. Relevant barriers are identified with reasonable mitigation measures.

The dissemination, exploitation and communication measures are of very high quality. Target groups, channels, scientific and industrial events, demonstrator visits, matchmaking, training and policy engagement are clearly defined. A staged exploitation process identifies and prioritises Key Exploitable Results and targets at least ten transfer pathways, supported by industrial engagement and technology-transfer activities.

The IPR management strategy is of high quality and suitable to support exploitation. Preliminary ownership and protection routes are identified, including patents, joint ownership, trade secrets, open-source licensing and licensing agreements. The Consortium Agreement and technology-transfer structures provide a credible framework for ownership, access rights, confidentiality, publication and post-project use.

Criterion 3: Quality and efficiency of the implementation

Score: **4.00** (Threshold: 3 / 5.00 , Weight: -)

The following aspects will be taken into account, to the extent that the proposed work corresponds to the description in the work programme:
- Quality and effectiveness of the work plan, assessment of risks, and appropriateness of the effort assigned to work packages, and the resources overall.
- Capacity and role of each participant, and the extent to which the consortium as a whole brings together the necessary expertise.

The work plan is of very high quality and progresses logically from component development and laboratory qualification to system assessment and real-facility demonstration. Tasks, responsibilities and deliverables are clearly defined. Complementarity is established with several previous and ongoing initiatives, including RF2.0, iSAS and PACRI. However, complementarity with actions funded under HORIZON-INFRA-2022-TECH-01-01 is not clearly established. In addition, several integrated demonstrators are completed late in the project, leaving limited contingency for corrective redesign and a complete repeat cycle of validation after full integration. These are shortcomings.

The allocation of effort and resources is broadly appropriate for the hardware-intensive programme. The WP effort totals contain a 2 person-month discrepancy relative to the participant-level summary; this is minor and does not materially affect the resource assessment. More importantly, ZIGOR has substantive design, development and supply responsibilities for the UPFC demonstrator in Task 5.5, while EUR 200,000 is subcontracted for technological development of the same prototype. The boundary between beneficiary and subcontracted work is not sufficiently specified. This is a shortcoming.

Critical implementation risks are very well identified and qualified. Technical, procurement, supply-chain, integration, data-quality and operational risks are addressed through early ordering, laboratory testing, staged validation, monitoring, fallback mechanisms and dedicated risk-management responsibilities.

The consortium brings together the necessary accelerator, RF, cryogenic, materials, power-electronics, energy, digital and exploitation expertise. It includes CERN and ESS ERIC and satisfies the requirement for at least two different qualifying research infrastructures.

Participant roles are clear and complementary. RI operators lead specifications, integration and validation, while technological companies contribute specialised development and prototyping. Responsibilities are coherent with participants' expertise.

The participants have strong operational capacity and access to the laboratories, clean-room assembly capabilities, accelerator facilities, testbeds and industrial resources required for their tasks. Previous collaboration further supports their capacity to implement the programme.

Scope of the application

Status: **Yes**

Comments (in case the proposal is out of scope)
Not provided

Exceptional funding

A third country participant/international organisation not listed in the General Annex to the Main Work Programme may exceptionally receive funding if their participation is essential for carrying out the project (for instance due to outstanding expertise, access to unique know-how, access to research infrastructure, access to particular geographical environments, possibility to involve key partners in emerging markets, access to data, etc.). (For more information, see the HE programme guide)

Please list the concerned applicants and requested grant amount and explain the reasons why.

Based on the information provided, the following participants should receive exceptional funding:

Not provided

Based on the information provided, the following participants should NOT receive exceptional funding:

Not provided

Use of human embryonic stem cells (hESC)

Status: **No**

If YES, please state whether the use of hESC is, or is not, in your opinion, necessary to achieve the scientific objectives of the proposal and the reasons why. Alternatively, please state if it cannot be assessed whether the use of hESC is necessary or not, because of a lack of information.

Not provided

Use of human embryos

Status: **No**

If YES, please explain how the human embryos will be used in the project.

Not provided

Activities excluded from funding

Status: **No**

If YES, please explain.

Not provided

Exclusive focus on civil applications

Status: **Yes**

If NO, please explain.

Not provided

Overall comments

Please provide any overall comments:

Not provided





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