European Innovation Council

PATHFINDER CHALLENGE

Advanced Materials for Miniaturised Energy Harvesting Systems

EIC Work Programme reference: HORIZON-EIC-2026-PATHFINDERCHALLENGES-01-01
Call deadline date: 28 October 2026 at 17h00 Brussels local time
EIC Programme Manager: Paolo Bondavalli

The EIC will hold an Info Session on this Pathfinder Challenge topic on 30 March 2026 (TBC). Participation in the meeting, although encouraged, is optional and is not required for the submission of an application. A recording of this Info Session will be made available after the event. Further details of this (and possibly other) Info sessions will be disseminated through Events - European Innovation Council - European Commission.

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1. About this document

The Challenge Guide serves as guidance and background for the common understanding, participation rules and obligations for the EIC beneficiaries that are involved in the Challenge Portfolio. Contractual Obligations are further detailed in the EIC Workprogramme 2026.

The Challenge Guide is a guidance document accompanying a topic of the Pathfinder Challenge call for proposals to provide further information about how portfolio considerations will be considered in the evaluation of proposals for that topic.

The Challenge Guide is prepared by and under the responsibility of the relevant EIC Programme Manager (information about the EIC Programme Managers is available on the EIC Website (https://eic.ec.europa.eu/eic-communities/eic-programme-managers_en). It complements the Scope, Specific Objectives, Expected Outcomes and Impacts, and Specific Conditions set out in the EIC Work Programme by a description of the portfolio considerations that will be used in portfolio building and explains how a portfolio will be built. Please note that in no case does the Challenge Guide contradict or supplant the Work Programme text.

Following the selection of a proposals to be funded under the Challenge, the Programme Manager will work together with the consortia of the selected projects to develop a strategic plan for the Challenge, including a common roadmap. This strategic plan will integrate the activities and milestones of the individual projects into a shared set of objectives and activities across and beyond the projects. It serves as a common basis for the project portfolio and may affect the project implementation - including possible adjustments, reorientations or additional support to projects. The strategic plan will be updated on a yearly basis in light of emerging results or issues during the implementation.

2 Scope and objectives of the Challenge as defined in the Work programme

This section is a copy of the Challenge call in the EIC work programme text. Proposals to this Challenge are expected to explain how they relate to and intend to go beyond the state of the art, and how they interpret and contribute to the objectives of the Challenge.

EIC Pathfinder Challenge: Advanced Materials for Miniaturised Energy Harvesting Systems

Background and Scope

The exponential rise in the development and deployment of IoT (Internet of Things) systems and of connected objects (~100 billion by 2025 and ~250 billion by 2030[1],[2]) will in turn increase the number of sensor networks required to provide data on the ground, with estimates pointing to ~1Trillion by 2025 and ~10 trillion by 2040

A consequence of such an expansion is a commensurate increase in energy consumption coupled with detrimental impacts on environmental sustainability: studies point to the total electricity consumed by IoTs in 2040, equalling total global energy consumption at present. Moreover, the sensor networks, generally powered by batteries, will result in 80 million batteries having to be changed each day, with knock-on effects on the wider environment.

Mitigating the impact of a rising number of such devices calls for solutions that will reduce energy consumption and increase the energy autonomy of connected sensors such as Wireless Sensor Networks (WSN) and of the IoT systems integrating such sensors.
This Challenge therefore focuses on the development of a new generation of advanced materials[3] to deliver miniaturised integrated energy harvesting devices, with significantly enhanced performance compared to the state of the art, that will give rise to highly effective energetically autonomous devices and systems.

This Challenge supports the ambitions of the European Commission Communication "Advanced Materials for Industrial Leadership[4]", which identified an urgent need to boost the development of advanced materials to enhance the EU's strategic autonomy in strategic fields while addressing sustainability, circularity and safety issues.

Specific Objectives

Applicants to this Challenge must address all of the following objectives:

- The identification and development of innovative advanced materials for energy harvesting, harnessing new physical/ chemical phenomena, leading to a radical shift in application range and performance while reducing the reliance on Critical Raw Materials (CRMs)
- The implementation of the advanced materials in a miniaturised energy harvesting module, such as, but not limited to, miniaturised solar cells, thermoelectric generators (e.g. TEG), nanotribological/ piezoelectric devices, electromagnetic wave harvesting devices
- Integration of the miniaturised energy harvesting modules in energetically autonomous systems (e.g. wireless integrated sensors) and

- Benchmarking the harvesting modules in a representative use case in a laboratory environment (TRL 4) with a view to demonstrating significant efficiency improvements, in terms of energy harvested, compared to the state of the art.
- Leveraging digital tools such as AI to accelerate the process of identifying, designing, fabricating, and characterising these new materials is encouraged.
- All proposals should also identify potential markets and the associated impacts of their innovations.

Expected Outcomes

Ambitious proposals put forward under this call will:

- identify a new generation of advanced materials for miniaturised energy harvesting modules, and
- achieve TRL 4 for the resulting energetically autonomous systems.

Portfolio Approach

The portfolio of selected projects should lead to the development of a variety of advanced materials applied to a range of miniaturised energy harvesting modules and final integrated systems.

To achieve this objective, the following factors will inform the choice of projects in the portfolio:

- Phenomena exploited to harvest energy from the environment (e.g. solar, thermoelectric, piezoelectric, nanotribological etc.)
- Composition of the proposed advanced materials, and
- Field of application (e.g. agriculture, automotive, health monitoring, wearables, smart city management, energy management, industrial monitoring etc.).

The selected projects will be assigned to lead and/or engage in portfolio activities centred on the following priorities:

- benchmarking to compare proposed technologies, phenomena exploited, advanced materials used and approaches
- sharing scientific considerations, results on the different physical/chemical phenomena studied to advance the knowledge and foster new disclosures in the field with potential shifts in the paradigm
- sharing insights on integration of the modules to solve potential issues and help advance towards delivering effective operational energetically autonomous systems
- developing an integrated approach with different complimentary energy harvesting modules for specific use-cases and to enhance the final energy harvested, and
- communicating to target audiences such as corporates, investors, alongside the broader public to raise awareness on the topic with a view to accelerating the adoption of these radical innovations.

Expected Impacts

The main impacts of this Challenge will be:

- A new generation of energetically autonomous systems enabling new services that will improve the life of European citizens through applications in areas such as point of care diagnostics, smart sustainable cities etc.
- Supporting sustainability in energy consumption and production in keeping with the ambitions of RePowerEU[5] and the Green Deal[6], and

- ✦ Enhancement of the sustainability of IoTs and energetically autonomous systems in general.

References

[1] https://link.springer.com/chapter/10.1007/978-981-15-5584-8_3
[2] https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/
[3] Advanced materials are understood as materials that are rationally designed to have (i) new or enhanced properties, and/or (ii) targeted or enhanced structural features with the objective to achieve specific or improved functional performance. This includes both new emerging manufactured materials (high tech materials), and materials that are manufactured from traditional materials (low tech materials). OECD working description on advanced materials https://one.oecd.org/document/ENV/CBC/MONO(2022)29/en/pdf
[4]https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/chemicals-and-advanced-materials/advanced-materials-industrial-leadership_en
[5] https://commission.europa.eu/topics/energy/repowereu_en
[6] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

3 Portfolio considerations for the evaluation of applications to the Challenge

This section describes how portfolio considerations will be taken into account in the second evaluation step. For more details of the full evaluation process please refer to the EIC Work Programme pages 34-37.

After the submission of your proposal, it will be evaluated in two steps:

- The EIC expert evaluators will assess each proposal separately against the award criteria and the EIC evaluation committee will ensure consistency across scores.
- The EIC evaluation committee, consisting of an EIC Programme Manager with, potentially, EIC expert evaluators, will map all the proposals above the threshold in a number of categories stemming from the overall goal and specific objectives of the Challenge.

Following this mapping of proposals against categories, a suitable portfolio of proposals will be selected by the evaluation committee by applying portfolio considerations to propose for funding a coherent set of projects that will achieve the expected outcomes of the Challenge and maximise their impact.

3.1 Categories

The portfolio's selection should lead, coherently with the scope and the specific objectives, to the development of a variety of advanced materials applied to a range of miniaturized energy harvesting modules and final integrated systems.

Therefore, to achieve this objective, the following categories will be used to classify:

I. Phenomena exploited to harvest energy from the environment, e.g.
    1. Thermoelectricity
    2. Solar (PV)
    3. Piezoelectric
    4. Nanotribological
    5. Electromagnetic wave harvesting

6. ….

II. Composition of the proposed advanced materials, e.g.
    1. Topological materials
    2. New generation of perovskites
    3. Nanostructured materials
    4. Polymers, polymer nanocomposites
    5. Low dimensional materials (2D and 1D)
    6. …

III. Field of application
    1. Automotive (e.g. for autonomous driving)
    2. Industrial monitoring (e.g. autonomous sensors for gas leakages)
    3. Health monitoring (e.g. Point of care diagnostics)
    4. Wearables sensors/devices
    5. Smart city management sensors (e.g. traffic management)
    6. Energy management (e.g. energy consumption reduction)
    7. Agrifood, agriculture industry
    8. Drones (e.g. miniaturized drone for surveillance)
    9. Sensors for security (e.g. sensors for harmful gases)
    10. ...

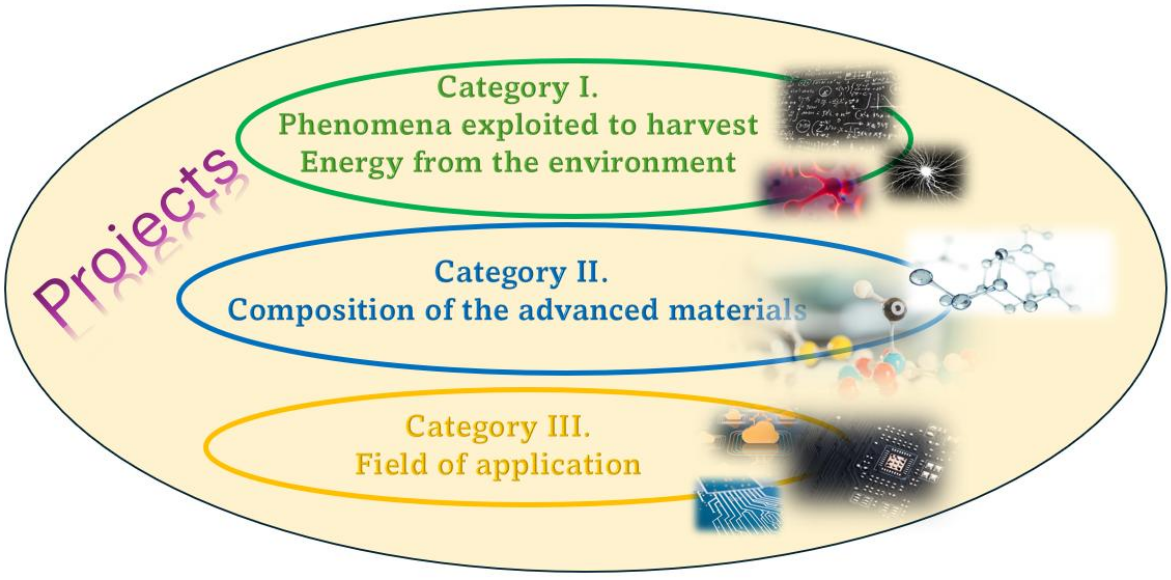

Fig.1. Categories that will be used to classify each project at the step 2 of the evaluation. Each project will be characterized by a value (a subcategory) for each category.

3.2 Portfolio considerations

In order to select the projects for the portfolio's composition, the following considerations will be taken into account:

- Projects from the same category are diversified with respect to the related Subcategories .
- A subcategory can be potentially covered by no more than 2 projects. This can only happen if the two projects differ in terms of subcategories related to the other categories.

The projects that will compose the portfolio should have complementarities and synergies with other projects in the portfolio. In terms of synergies, this means that there are projects working on the same application or on the same phenomena or on advanced materials of the same families. Complementarities means that there are projects working on different phenomena such as solar or thermoelectric, that together could potentially provide a hybrid solution.

Starting from the highest ranked proposal, a portfolio of proposals will be selected using the above considerations. This implies that if the evaluation committee considers that a highly ranked proposal does not have a synergy with any other proposal, it will not be selected for the portfolio. To ensure diversification, proposals which the evaluation committee considers to be very similar to a proposal already included in the portfolio will not be selected. Consequently, this means that the projects selected for funding after the second step are expected to differ from the ranking list established from the first step (score-based ranking after assessment of each proposal separately).

The following table summarises the portfolio building approach.

	Elements for portfolio building	
Categories	**Subcategories**	**Criteria**
I. Phenomena exploited for the harvesting of energy form environment	• Thermoelectricity • Solar • Piezoelectric • Nanotribological • Electromagnetic wave harvesting • Others	Variety in the subcategories for each of the three subcategories. No more than two projects related to each Subcategory for each of the three Categories. Every project should have a
II. Advanced materials used	• Topological materials • New generation of perovskites • Nanostructured materials • Polymers, polymer nanocomposites • Low dimensional materials (2D and 1D) • Others	

III.	Field of application	○ Automotive (e.g. for autonomous driving) ○ Industrial monitoring (e.g. autonomous sensors for gas leakages) ○ Health monitoring (e.g. Point of care diagnostics) ○ Wearables sensors/devices ○ Smart city management sensors (e.g. traffic management) ○ Energy management (e.g. energy consumption reduction) ○ Agrifood, agriculture industry ○ Drones (e.g. miniaturized drone for surveillance) ○ Sensors for security (e.g. sensors for harmful gases) ○ ... •	synergy or complementarity with another project.

4 Implementation of the Challenge portfolio

Once funded, projects will be expected and obliged to work collectively during the implementation of their projects under the guidance of an EIC Programme Manager. This section summarises some of the key aspects of this pro-active management which applicants should take into account in preparing their proposals.

4.1 Proposal preparation and Grant negotiations

Based on previous experience, it is advised to foresee in your proposal a dedicated work package for portfolio activities and to allocate at least 10 person-months (see below for the purpose and examples of such activities). Annex 1 provides a template for such a workpackage. You are encouraged to use this template.

You may propose concrete activities or remain generic in your description. If you fail to do this during proposal time, your proposal will not be scored lower during the evaluation, but in case your proposal is selected for grant agreement preparation, you will be requested to add the portfolio work package to your grant agreement. Please be aware that in that case the maximum grant you receive will not change, and you will need to find the resources for portfolio activities within the foreseen project budget.

It is also expected that in your proposal you make a self-assessment of how your proposal maps to the categories used for portfolio building by filling in the following table in your proposal. The evaluation committee will confirm or update this and use it in the step 2 of the evaluation.

Categories		Subcategories
I.	Phenomena exploited for the harvesting of energy from environment	
II.	Advanced materials used	
III.	Field of application	

4.2 Portfolio Strategic Plan and portfolio activities

Following the selection of a proposals to be funded under the Challenge, the Programme Manager will work together with the consortia of the selected projects to develop a common strategy plan/roadmap for the Challenge. This plan will integrate the activities and milestones of the individual projects into a shared set of specific objectives and activities across and beyond the projects to enhance synergies and the portfolio's impact. The strategic plan will be updated on a yearly basis in light of emerging results or issues during the implementation. The objectives can be revised, for instance based on projects' unexpected achievements, new technology trends, external inputs (other projects, new calls…) and to improve the effectivity of the portfolio's approach if correction are needed.

In particular, the Challenge strategic plan will include activities on the transition to innovation and commercialisation, and to stimulate business opportunities and to raise the awareness on the topic related to the portfolio.

4.3 Governance through working groups

The development of the Portfolio Strategic plan will require regular meetings and exchanges among the portfolio projects, to identify collaborations on specific technical aspects and exchange of information, best practices, strategies, etc.. A steering committee where each project is represented will be set up and steered by the Programme Manager. Additionally, 4 Working Groups will be set up to organize and implement activities:

WG 1: Technology/Science:

- benchmarking to compare proposed technologies, phenomena exploited, advanced materials used and approaches

- sharing scientific considerations, results on the different physical/chemical phenomena studied to advance the knowledge and foster new disclosures in the field with potential shifts in the paradigm

- sharing insights on integration of the modules to solve potential issues and help advance towards delivering effective operational energetically autonomous systems

- developing an integrated approach with different complimentary energy harvesting modules for specific use-cases and to enhance the final energy harvested

- implementing Life Cycle Analysis methods of the different technological options

- Providing access to Open Innovation Test Beds and other research infrastructure to validate the technology and performing cross-check of the results obtained by the different groups.

WG 2: Regulatory issues

- Portfolio activities that support, inform, participate in discussions around, or identify gaps in on-going legislative processes.

WG 3: Transition of technology to innovation

- Portfolio activities developing techno-economic views on the future implementation, adoption, and scaling potential of the various technologies in realistic real-world conditions.
- Market analysis: Map the targeted players in a market and exchange the market research analysis results with other the portfolio projects to identify specific players with which the entire portfolio can establish partnership(s) of much higher impact as opposed to that of the individual project.
- Discussions on IP, licensing and business models and commercialisation strategy, development of an IP cartography together with European Patent Office.
- Identification and discussions with early stage private and corporate investors focused on relevant fields disclosing the potential of the innovations developed in the portfolio.
- Organisation of webinars on specific topic related to transition from research to innovation, to raise the interest of young researchers (mainly PhD involved in the portfolio) to develop their own business/SMEs.

WG 4: Communication, dissemination and outreach activities:

- Effective communication of any key outcome of the research work of the portfolio members collectively to the larger audience (not only scientific community) to increase social acceptance for proposed solutions, or to other researchers and stakeholders through common dissemination activities at scientific conferences or trade fairs.

- Organising joint conferences, workshops, summers schools, etc.

- Writing a common white paper with all the participants to identify the key factors to define a roadmap for the topic.

Each project will nominate a representative for each WG. A chair will be nominated from among them. The chair will be responsible to prepare meeting agendas, links to the meeting and minutes of the meetings. WG Meetings are expected to be online and to be scheduled approximately every 3 months.

Additionally, it is foreseen to have one annual portfolio meeting per year in presence, where all working groups will meet and present progress.

The exchange of information for the purpose of EIC portfolio activities will fall under the conditions and non-disclosure obligations as specified in the EIC Work Programme 2026 (Annex 6, section 2).

5. Tools though which projects can receive additional support

Projects in the portfolio may be offered additional support, either individually or collectively, in order to reinforce portfolio activities or explore the transition to innovation. Such additional support includes:

- Booster grants of up to €50k (see Annex 5 of the EIC Work Programme).
- Access to additional EIC Business Acceleration Services (see https://eic.ec.europa.eu/eic-funding-opportunities/business-acceleration-services_en)
- Access to the Fast Track to the EIC Accelerator, which would follow a project review (see Annex 3 of the EIC Work Programme).
- The possibility to apply for EIC Transition if your Pathfinder project resulted in an experimental proof of concept (TRL 3), or a technology validated in the lab (TRL 4)
- Interactions with relevant projects and initiatives outside the portfolio, including other EU funding initiatives as well as those supported by national, regional or other international bodies.

Annex 1 : Template workpackage portfolio activities

WPX PORTFOLIO MANAGEMENT
Start Month 1, End Month (full project duration)
Objectives

WPX PORTFOLIO MANAGEMENT
Start Month 1, End Month (full project duration)
Objectives
Explore synergies and collaborations among the projects of the portfolio, to maximize the achievement of the scientific results, the exploitation potentials, the outreach opportunities with key stakeholders, the identification and overcoming of major barriers to introduce the innovation to the market ….

Specific objectives :

- Contribute to an effective governance of the portfolio, and contribute to the working groups.
- Contribute to the elaboration of the strategic plan of portfolio, which is composed by a list of activities of common interest to at least 2 projects identified by each working group.

Description
Task X.1: Portfolio governance and work in working groups This task will require regular meetings and exchanges among the portfolio projects, to identify collaborations on specific technical aspects and exchange of information, best practices, strategies, etc.. A steering committee where each project is represented will be set up and steered by the Programme Manager. 4 WGs will be set up to organize and implement activities in: WG1: Technology/Science; WG2: Regulatory issues; WG3 Transition of technology to innovation and WG4: Communication, dissemination and outreach activities. Each project will nominate a representative for each WG. A chair will be nominated from among them. The chair will be responsible to prepare meeting agendas, links to the meeting and minutes of the meetings. WG Meetings are expected to be online and to be scheduled approximately every 3 months, to discuss progress of the activities of the working group. Additionally, it is foreseen to have one annual portfolio meeting per year in presence, where all working groups will meet and present progress. The exchange of information for the purpose of EIC portfolio activities will fall under the conditions and non-disclosure obligations as specified in the EIC Work Programme 2026 (Annex 6, section 2).

Task X.2: Portfolio Strategic plan and other common documents: Elaboration of the portfolio strategic plan under the guidance of the Programme Manager and updates on a yearly basis. It will contain details of the techno-scientific collaborations and synergies of the portfolio projects. It contains the actions already carried out, but also an overview of upcoming actions in the form of a roadmap. It will specify the common documents that the projects will deliver because of their work in the working groups. Individual projects do not need to add these documents as a deliverable, they explain the contribution that they made to this report in their deliverable X.2.i. A public version of the strategic plan will be published on the EIC website at year 1 and updated annually afterwards.

Deliverable X.2.i: Report on portfolio activities. One deliverable per reporting period

The report will present the contribution of the project to the strategic portfolio plan and portfolio activities that have been carried out in each reporting period. It also explains how the portfolio

activities and the EIC proactive project management approach contribute to the achievement of the project objectives and help the transition to market.
Type: R: Document, report (excluding the periodic and final reports)
Dissemination level: SEN – Sensitive, limited under the conditions of the Grant Agreement
Due date: The report on portfolio activities will be submitted every reporting period.

Final considerations

- Effort to be allocated to this work package: **10 p.m.**