



PATHFINDER CHALLENGE

Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

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EIC will hold an Info Session on this Pathfinder Challenge topic in spring 2025. You will be able to find the information about the Info day, when it is available, at [Events - European Commission](#). 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 on [EIC Pathfinder Challenges 2025 - European Commission](#).

Table of Contents

1	About this document	2
2	Scope and objectives of the Challenge as defined in the Work programme	2
	Background and scope.....	2
	Specific objectives.....	3
	Expected outcomes and impacts.....	5
3	Portfolio considerations for the evaluation of applications to the Challenge	6
	Categories	6
	Portfolio considerations	8
4	Implementation of the Challenge portfolio	8
	Proposal preparation and Grant negotiations.....	8
	Portfolio Strategic Plan.....	10
	Tools through which projects can receive additional support.....	12
5	Annex 1: Extensive example for a work package on portfolio activities.....	12
6	Final considerations	15

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 Work Programme 2025.

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 additional categories and 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 strategy 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 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.

Background and scope

Fossil fuels supply a majority of the world's energy and also provide the raw materials, or feedstocks, for many essential everyday products. While energy provision is becoming increasingly decarbonized, the production of fuels, chemicals and materials requires carbon atoms as feedstocks. However, their production can be "de-fossilized", by utilising renewable energy and alternative carbon sources. Likewise, a circular economy approach offers scope to reduce external dependencies and source other essential molecular feedstocks including critical raw materials from wastes.

This Pathfinder Challenge therefore focuses on the development of next generation technologies that turn today's problematic waste streams into essential building blocks of a future circular economy. Furthermore, it specifically focusses on currently non- or hard-to-recycle types of synthetic polymer materials (including among other mixtures of different types of plastics, polymeric composite materials, micro-/nanoplastics, untreated plastic waste, diapers, rubber, etc.), flue gases, wastewater and seawater desalination brines. Proposals must target real-life industrial and household waste

Challenge Guide – Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

streams where current recycling methods face insurmountable barriers e.g., due to impurities, the presence of noxious additives, inseparable material mixtures or non-biodegradable materials. An important side effect is the remediation of waste streams with respect to micro-/nanoplastics, trace metals and noxious substances. These novel technologies should be scalable, easily applicable and deliver products with higher economic value as compared to waste destruction.

The scope of technological solutions addressed in this Challenge is limited to the following technologies with currently low Technology Readiness Levels (TRLs), where significant synergies by working in a Challenge portfolio are expected: solar reforming¹ and synthetic biology devices, brine mining² and integrated capture and conversion technologies³. Microbial-based and photocatalytic remediation processes are included as well. Computational material science and AI, and bottom-up synthetic biology are supported as key enablers at the fundamental research level.

Thermochemical approaches (such as pyrolysis or gasification) and “dark” (not light-driven) chemical recycling are out-of-scope of this Pathfinder Challenge. Likewise, food and biomass waste, traditional bulk metal waste, glass, paper, cardboard and mono-PET waste are also out of scope.

Specific objectives

The Challenge seeks ambitious proposals that address one (and only one) of the following focus areas:

Area 1: Fully integrated waste-to-value devices

This includes 1) devices for converting waste streams into (feedstock for) fuels, chemicals and materials and 2) devices for remediation; where processes are solely driven by renewable energy sources (preferably directly by sunlight) and focus on the selective production of added value products, beyond hydrogen as the sole end product:

- i) Fully integrated solar reforming or synthetic biology devices, enabling the treatment of synthetic polymer materials, while delivering fast and efficient decomposition under sustainable reaction conditions (including the use of process chemicals).
- ii) Integrated capture and conversion technologies, capturing and converting feedstock from flue gases, or wastewater in a single step/ single device into fuels, chemicals, and materials, providing increased energy- and materials efficiency as compared to not fully integrated process chains.
- iii) Membrane-based and electrochemical brine mining technologies recovering raw materials, CO₂ and water from seawater desalination brines.
- iv) Ex-situ remediation devices based on microbial/enzymatic and/or photocatalytic degradation, both purifying wastewater and seawater of noxious substances, metals, or nano-/microplastics, and producing added value remediation products. This should take place in a reactor, not in the open field.

¹ Solar reforming: Sunlight-driven transformation of waste substrates into valuable chemical products facilitated by a photocatalyst and utilising a wide range of the solar spectrum, including solar catalytic reforming (UV and VIS) and solar thermal reforming (IR). It thus goes beyond: Photolysis (polymer degradation under direct light irradiation with very long treatment times), Photocatalytic decomposition (photolysis facilitated by photocatalyst), or Photoreforming (Light-driven reforming using classical photocatalysts absorbing high-energy UV or near-UV radiation only).

² Brine mining: Recovery of useful materials dissolved in seawater desalination brine.

³ Integrated capture and conversion: the capture of a molecule, e.g., CO₂, from a waste stream is directly coupled with its direct utilization, i.e. conversion, within a single device.

Challenge Guide – Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

Proposals addressing only parts of the full waste-to-value process (e.g., half reactions) will not be considered. Integrated hybrid approaches, at the interface of various disciplines, and autonomously operating devices continuously optimized with AI, are particularly welcome. The resulting devices must reach TRL 4 within the 3–4-year project lifetime.

The associated processes must not down-cycle the waste substrate but create products of higher economic and environmental value as compared to the initial waste stream. They must be energy and material-efficient and fully sustainable, minimising the associated energy, water, chemicals, and land footprint. Operating conditions (e.g., related to temperature, pressure, and the use of additional chemicals) should be optimised and the circular use of process consumables, such as water, catalyst materials or chemical additives maximised. They must deploy environmentally safe, stable materials, with non-toxic degradation products and the developed devices must be recyclable-by-design.

Proposals must take a holistic view of the complete waste valorisation chain by optimising the different elements (pre-treatment, conversion, product separation and storage) with respect to one another. The systems must also be robust and easy-to-handle to allow operations that are independent from large-scale infrastructures, with extended lifetimes and a capability to treat real-life waste streams which have undergone minimal sorting and pre-treatment.

Proposals have to clearly indicate how the proposed solution benchmarks against industrially deployed recycling methods such as mechanical recycling, composting, biogas fermentation or waste-to-energy technologies, and emerging recycling methods such as chemical recycling or thermochemical approaches.

Area 2: Understanding underlying mechanisms by means of computational material science and AI

Projects in this focus area must deliver advances and scientific breakthroughs in the fundamental understanding of the underlying physical, chemical, and biological processes that will enable fully sustainable and scalable waste-to-value devices. Projects should address all the following specific objectives:

- Explore fundamental phenomena crucial to multiple waste-to-value device types, such as the development of efficient, stable and inexpensive catalysts, interface engineering and the effect of the surrounding medium.
- Develop more accurate and less resource-intensive quantum mechanical and AI methods to guide, predict and interpret reliably experimental works.
- Bridge the scales from describing properties at the atomic, mesoscopic level up to the macroscopic device level within a multiscale approach and describe phenomena over different timescales.
- Adopt a holistic approach to exploring phenomena applicable to multiple waste-to-value device types (aligned with Area 1). Devices stemming from Area 1 should serve to validate the developed theoretical models.

Area 3: Cells from scratch by means of bottom-up synthetic biology

- Projects in this area must look to deliver scientific breakthroughs in bottom-up synthetic biology to enable the use of tailored microbial cell factories for the degradation and valorisation of waste and the production of fossil-free fuels, chemicals, and materials. Projects should address all the following specific objectives:
- Develop synthetic, fully artificial cells for future large-scale biotechnology applications, tailored to deliver desired functionalities such as carbon fixation or synthetic polymer decomposition.

Challenge Guide – Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

- Engineer cell-like systems to produce compounds from abundantly available building blocks, such as water and carbon oxides.
- Engineer cell-like systems to decompose diverse types of waste, in particular synthetic plastic waste, into compounds that are valorisable as feedstock for a downstream production of fuels, chemicals and materials. At this stage, systems will not have to be completely autonomous and self-replicating, but the integration of different modules should be implemented.

Expected outcomes and impacts

This Challenge is in line with REPowerEU⁴ and Fit for 55⁵. It is compliant with the Renewable Energy Directive⁶, the Waste Framework Directive⁷ and the Critical Raw Materials Act⁸. It supports the EU's Circular Economy Action Plan (CEAP)⁹ and the herein included Plastics strategy. It builds on the Industrial Carbon Management strategy¹⁰, the Communication on Sustainable Carbon Cycles¹¹, and the Directive on the promotion of the use of energy from renewable sources¹².

The portfolio of projects selected under this Challenge are expected to collectively cover Areas 1, 2 and 3. A maximum of one proposal from each of Areas 2 and 3 will be selected, whereas the aim for Area 1 is to select proposals that cover as many device categories (i-iv) as possible. Combining these three aspects into a single portfolio with close interaction between the projects and a commonly developed vision is expected to significantly speed up the innovation journey by driving synergies and mutual learning.

The resulting portfolio of projects will in time contribute to:

- Local energy and resource supply, allowing communities and remote areas to have access to reliable and sustainable waste recycling, supporting the local production of fuels, chemicals and materials. Reduction/ eventual independence from the importation of critical raw materials in the context of increasing demand for such materials for renewable energy and fuel technologies.
- Increased share of recycled waste, minimizing waste disposal in open dumps, landfills and incineration and the related negative impacts on our environment.
- Micro-/nano plastic removal, towards a zero-brine discharge.
- Decentralised, circular production of fuels, chemicals and materials where waste serves as an indispensable local resource enabling on-site production replacing fossil resources. Reduction in the demand for fossil fuels alongside associated CO₂ and pollutant emissions reductions.

⁴ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

⁵ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal/fit-55-delivering-proposals_en

⁶ https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

⁷ https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en

⁸ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/european-critical-raw-materials-act_en

⁹ https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

¹⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2024%3A62%3AFIN&qid=1707312980822>

¹¹ https://climate.ec.europa.eu/system/files/2021-12/com_2021_800_en_0.pdf

¹² https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en#:~:text=The%20Renewable%20Energy%20Directive%20is%20the%20legal%20framework,supporting%20cooperation%20between%20EU%20countries%20towards%20this%20goal.

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 28-35.

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

1. The EIC expert evaluators will assess each proposal separately against the award criteria and the EIC evaluation committee will ensure consistency across scores.
2. The EIC evaluation committee, consisting of EIC expert evaluators and an EIC Programme Manager, will map all the proposals above the threshold according to criteria described below in a number of categories stemming from the overall goal and specific objectives of the Challenge. Examples of possible categories are building blocks or subsystems, technical areas and/or competing technologies, platforms, applications areas, risk level and stage of technology readiness level, size, etc.

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

Categories

The overall objective of this Challenge portfolio is to develop, within the given timeframe of the projects, fully integrated waste-to-value devices reaching at least the small-scale prototype level with auxiliary systems laboratory validated (TRL 4). At the same time, fundamental phenomena crucial to various waste-to-value device types will be explored, along with the pursuit of scientific breakthroughs in bottom-up synthetic biology.

The first category, which will be used in the portfolio building is the “Area” a proposal belongs to, as defined by the work programme (WP). Each proposal should address exactly one (and only one) of the three areas:

1. Fully integrated waste-to-value devices.
2. Understanding underlying mechanisms by means of computational material science and AI.
3. Cells from scratch by means of bottom-up synthetic biology.

The portfolio-building process will be based on the preliminary mapping of the proposals to one of these three Areas.

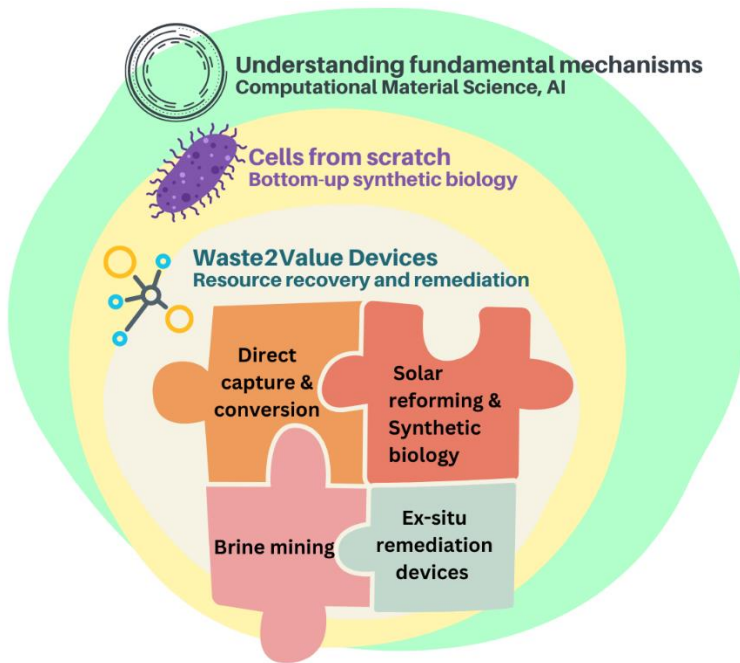


Fig 1.: The three Areas of the present EIC Challenge portfolio. Device development projects on waste-to-X technologies are accompanied by computational material science to explore underlying fundamental mechanisms. Bottom-up synthetic biology enables the exploration of next-generation devices by designing cells from scratch, capable of valorizing waste streams.

In a next step, proposals within Area 1) will be further mapped according to “Tech topics”. The latter include the following four values:

- (i) Fully integrated solar reforming or synthetic biology devices,
- (ii) Integrated capture and conversion technologies,
- (iii) Membrane-based and electrochemical brine mining technologies,
- (iv) Ex-situ remediation devices based on microbial/enzymatic and/or photocatalytic degradation.

In addition, a few secondary categories will provide even finer granularity:

- Waste feedstock, e.g. non- or hard-to-recycle types of synthetic polymer materials (including among other mixtures of different types of plastics, polymeric composite materials, micro-/nano-plastics, untreated plastic waste, diapers, rubber, etc.), flue gases, wastewater, and seawater desalination brines, etc.
- Other feedstock during operation, e.g., water, nutrients, chemicals, etc.
- Envisioned product(s), e.g. monomers, fuels, chemicals, etc.
- Targeted sector(s), e.g., chemical, energy, agriculture, transport, etc.
- Future application scenario(s), e.g. waste management and valorisation in remote locations, etc.
- Necessary energy input(s), such as solar light, electricity, heat, etc.
- Desired functionalities e.g., carbon fixation, synthetic polymer decomposition, etc.

Portfolio considerations

The evaluation committee will compose a balanced and diverse Challenge portfolio covering the three aforementioned areas, starting from the highest ranked proposals.

During the portfolio building process, first Area 1 projects will be selected. In Area 1, the Challenge portfolio should aim to represent as many different Tech topics as possible to create maximum diversity. At the same time, the evaluation committee will examine the complementarities, defined by the secondary categories, among projects within and across the Tech topics of Area 1. The objective is to enhance the overall impact of the Challenge portfolio by leveraging these complementarities among the different projects.

For Area 2 and Area 3, portfolio considerations foresee that a single project per area will be sufficient in the final portfolio composition.

In Area 2, the project with the highest relevance (Applicability to the Tech topics selected in Area 1) will be chosen. A holistic approach should be applied to explore phenomena applicable to multiple waste-to-value device types (aligned with Area 1, Tech topics). Devices stemming from Area 1 should serve to validate the developed theoretical models.

In Area 3, the project with the highest expected cross-fertilization with the Tech topics from Area 1 will be selected, taking into account also the secondary categories.

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 consider in preparing their proposals.

Proposal preparation and Grant negotiations

In order to facilitate the portfolio building during step 2 of the evaluation, all applicants are asked to clearly indicate in their proposal:

- 1) to which of the three Areas they apply.
- 2) For proposals of Area 1, to which Tech topic they intend to apply, and to indicate the values of the relevant secondary categories in order to find complementarities.
- 3) For proposals to Area 2, for which Tech topics the explored fundamental phenomena and developed methods are relevant.
- 4) For proposals to Area 3, the values of the relevant secondary categories in order to find cross-fertilisations with the projects of Area 1.

The requested information may be provided by filling in the appropriate cells in the table below.

Category	Possible values	Value(s) in the proposal
Area	1. Fully integrated waste-to-value devices. 2. Understanding underlying mechanisms by means of computational material science and AI.	

Challenge Guide – Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

	3. Cells from scratch by means of bottom-up synthetic biology.	
Tech topics in Area 1	(i) Fully integrated solar reforming or synthetic biology devices, (ii) Integrated capture and conversion technologies, (iii) Membrane-based and electrochemical brine mining technologies, (iv) Ex-situ remediation devices based on microbial/enzymatic and/or photocatalytic degradation.	
Secondary categories	Waste feedstock	<ul style="list-style-type: none"> - Non- or hard-to-recycle types of synthetic polymer materials (including among other mixtures of different types of plastics, polymeric composite materials, micro-/nano-plastics, untreated plastic waste, diapers, rubber, etc.) - Flue gases - Wastewater and seawater desalination brines - Other
	Other feedstock during operation	<ul style="list-style-type: none"> - Water - Nutriments - Chemicals - Other
	Envisioned product(s)	<ul style="list-style-type: none"> - Monomers - Fuels - Chemicals - Other
	Targeted sector(s)	<ul style="list-style-type: none"> - Chemical - Energy - Agriculture - Transport - Other
	Future application scenario(s)	<ul style="list-style-type: none"> - Waste management and valorisation in remote locations - Other
	Necessary energy input(s)	<ul style="list-style-type: none"> - Solar light - Electricity - Heat - Other
	Desired functionalities	<ul style="list-style-type: none"> - Carbon fixation - Synthetic polymer decomposition

		- Other	
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As specified in the Work Programme, it is advised to foresee in the proposal a dedicated work package for portfolio activities and to allocate for this Challenge at least 10 person-months (see below for the purpose and examples of such activities. You may propose concrete activities or remain generic in your description). Annex 1 provides an example of such a work package, which you may use for inspiration. This example has been conceived based on the currently running portfolio projects of the Pathfinder Challenges of the EIC work Programme 2023.

If applicants fail to include portfolio activities in their proposal, the proposal will not be scored lower during the evaluation. However, in case the proposal is selected for Grant Agreement preparation, the consortium will be requested to add the portfolio work package to the Grant Agreement. Please be aware that in this case the maximum grant received will not change, and the resources for portfolio activities must be found within the foreseen project budget.

Applicants may be requested to make amendments to their proposed project to enhance the impact of the portfolio, within the suggested budget. Such changes may for instance include additional tasks to undertake common/ joint activities (workshops, data exchanges, joint research, etc) with other projects in the portfolio.

Portfolio Strategic Plan

This Challenge portfolio promotes the development of waste-to-X prototype devices while exploring fundamental mechanisms and enabling the development of next generation devices based on bottom-up synthetic biology.

Following the selection of the proposals to be funded under the Challenge, the Programme Manager will work together with the consortium of the selected projects to develop a common strategy plan. The latter will translate the activities and milestones of the individual projects into a shared set of specific objectives and activities across and beyond the projects. It serves as a common basis for the project implementation - including possible adjustments, reorientations, or additional support to projects. It will be updated in light of emerging results or issues during the implementation. The objectives can be revised, for instance based on unexpected achievements, new technology trends, external inputs (other projects, new calls, etc.).

In particular, the portfolio strategy plan will include activities on the transition to innovation and commercialisation and stimulate business opportunities. These activities may be supported during the implementation with additional funding and expertise through pro-active management.

Non-exhaustive examples of activities towards the above-mentioned aims are:

Technology:

A close collaboration and interaction of the portfolio projects on advances, drawbacks and key findings of their technological developments is expected to strongly accelerate innovation in the field. Integrative portfolio activities are encouraged that result in collective insights amongst the projects, such as comparing performance of technologies and developing common benchmarks and standards.

Regulatory:

Challenge Guide – Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

- Portfolio activities that support, inform, participate in discussions around, or identify gaps in on-going legislative processes (e.g., development of standards) for EU carbon markets (e.g., CCU), waste management and markets deploying fossil-free fuels, chemicals or materials.

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 conditions.
- Market exploration: Map the targeted players in a market and exchange the market research analysis results with other 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.
- Discussions with early stage private and corporate investors focused on relevant fields.

Communication and dissemination:

The Challenge portfolio projects are supposed to represent a leading flagship group on waste-to-X devices driving forward the topic through open collaboration with other EU and national projects. Outreach activities should gather a broad community working on diverse aspects of waste management and valorisation. A goal is to develop a common understanding of the respective measures to accelerate innovation in the field. Attracting public and private investors and to increase public awareness in general is a desired outcome of the challenge portfolio.

Outreach activities identified by the Programme Manager include:

- A public Challenge portfolio kick-off event in year one of the portfolio activities, preferentially in the Brussel's EU environment, among others:
 - Demonstrating the State-of-the-art of the different involved domains,
 - Showcasing the different portfolio projects to be started,
 - Giving place to a broad stakeholder community, including contributions from leading representatives from academia, industry, policy and society,
 - Starting a scenario building exercise to scout what the world could look like tomorrow assuming a wide application of these technologies.
- A public Challenge portfolio final event at the end of the runtime preferentially in the Brussel's EU environment, among others:
 - Showcasing the outcome of the portfolio activities, in the best case by presenting the actual prototypes and innovative concepts to communicate the achieved results and their impact on society to a broad public including leading representatives from academia, industry, policy and society.
- A webinar on the international level every around four times by year organised by the Challenge portfolio members on diverse topics, being inclusive, interdisciplinary and reaching out to the academic community as well as industry, innovators and policy makers.

Apart from outreach activities, internal exchange of both advances and barriers is of outmost importance and will be implemented via an internal kick-off meeting to align common milestones and goals, and regular portfolio meetings to discuss progress.

These tasks require the active participation of portfolio members to a series of meetings called for and steered by the Programme Manager. Portfolio projects will be expected to exchange information on the proposed research methodologies, experimental tests, techno-economic input data and relevant results achieved, to collectively use the available resources. This exchange of data between portfolio members can enhance the potential of individual projects, use of results originating from the analysis of common databases, as well as their chances to establish key partnerships.

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 2025 (Annex 6, section 2).

Tools through 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 2025).
- Access to additional EIC Business Acceleration Services (see https://eic.ec.europa.eu/eic-funding-opportunities/business-acceleration-services_en)
- 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)
- Access to the Fast Track to the EIC Accelerator, which would follow a project review (see Annex 3 of the EIC Work Programme 2025).
- Access to the EIC Market Place, once operational, to connect with innovators, investors and other selected partners.
- 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.

5 Annex 1: Extensive example for a work package on portfolio activities

WPX PORTFOLIO MANAGEMENT

Start Month 1, End Month

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:

- **Harmonize Technological Assessments and Standards:** The goal is to enable a cohesive evaluation of technological advancements by establishing and adopting common benchmarks, standards, and performance metrics across all projects.
- **Accelerate Innovation through Regulatory Alignment and Market Readiness:** The goal is to bridge the gap between technology development and market deployment by coordinating efforts in regulatory compliance, life-cycle analysis, techno-economic analysis and market exploration. By identifying regulatory barriers for innovation, the portfolio of projects can jointly contribute to potential improvements and further development of the regulatory framework. Through common communication activities addressed at policy makers and other relevant stakeholders, social acceptance for proposed solutions can be increased, and

regulatory barriers for innovation can be highlighted. Sharing life-cycle analysis and life-cycle thinking on the potential environmental impact associated with each solution is expected to contribute to the acceptance and future implementation of the technologies developed by the portfolio members. Exchanging and jointly developing techno-economic insights and commercialization scenarios is expected to have more impact than individual analysis. Collective understanding of IP strategies and IP management is expected to add value to each project.

- **Foster a Collaborative and Engaged R&I Community:** The goal is to strengthen the research community both within the portfolio by facilitating regular internal communication, and with external stakeholders by increasing external outreach efforts. This comprises the joint elaboration of a strategic portfolio plan - potential synergies identified by a comprehensive in-depth analysis of shared components and complementarities amongst the portfolio members is expected to unlock additional value for each portfolio member. External outreach activities include the identification of key stakeholders, such as relevant end-users, investors, supply-chain actors and an effective communication of key outcomes to early stage private and corporate investors to attract early feedback.

Description

Task X.1: Portfolio management and governance This task will require regular meetings and exchanges among the portfolio projects. A steering committee where each project is represented will be set up and steered by the Programme Manager. Activities of the steering committee include the internal kick off meeting and the annual portfolio meetings in presence, and additional regular online meetings. Moreover, 3 thematic WGs will be set up to organize and implement activities in: WG1: **Harmonized Technological Assessments and Standards**; WG2: **Regulatory environment and Market Readiness**; WG3: **Internal and external Community building and outreach**. Each consortium will nominate a representative for each WG. A WG chair will be nominated, 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. 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 2025 (Annex 6, section 2.2).

Task X.2: Portfolio Strategic plan

Elaboration of the portfolio strategic plan under the guidance of the Programme Manager, updated on a yearly basis. The latter summarizes detailed activities providing a clear roadmap for achieving the objectives of the collaboration, ensuring that all projects work together efficiently and effectively. It will e.g. contain details of the techno-scientific collaborations and synergies of the portfolio projects (could be only one or more 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 the other tasks specified in this work-package. Individual projects do not need to add these documents as a deliverable, they explain the contribution that they made to this report in their corresponding annual deliverable "Report on portfolio activities". A public version of the strategic plan will be published on the EIC website at year 1 and updated annually afterwards.

Task X.3: Harmonized Technological Assessments and Standards

To harmonize technological assessments across the portfolio, the projects will first collaborate to develop and validate a unified set of performance metrics, ensuring that all technologies can be consistently compared. This involves coordinating with experts across different projects to identify key performance indicators and creating standardized methodologies for data collection and analysis. Additionally, cross-project evaluations will be conducted to identify the relative strengths and

weaknesses of each technology. This collective effort will culminate in the standardization of reporting formats, which will facilitate the integration of technological insights, enabling seamless comparison and benchmarking across the portfolio. LCA practices and metrics of the different projects and analyse the performance of the proposed solution with the other portfolio technologies using common agreed metrics and KPI.

Task X. 4: Regulatory Environment and Market Readiness

To accelerate the transition from technology development to market deployment, the projects will work together to align their activities with relevant regulatory frameworks, ensuring that emerging innovations meet necessary compliance standards. This will involve regular consultations with regulatory experts. Concurrently, the projects will conduct comparative techno-economic analyses to assess the feasibility and economic viability of the technologies under development. These analyses will be used to prioritize technologies with the highest potential for market success. To further this objective, collaborative market research will be undertaken to explore potential markets, involving stakeholder engagement and the identification of market entry strategies that can be leveraged by the portfolio. A portfolio report on competitiveness, business potentials in different market segments and key barriers towards innovation of the portfolio technologies is produced. Life-Cycle Assessment practices of the different projects are aligned by developing common metrics and key performance indicators and the performance in terms of sustainability of the proposed solutions is analysed.

Task X.5: Internal and external community building and outreach

To build a strong and collaborative research community within the portfolio, regular internal meetings and workshops will be organized to facilitate the sharing of progress, challenges, and best practices among the projects. These gatherings will serve as a platform for knowledge exchange, fostering a culture of collaboration and mutual support. Furthermore, a comprehensive communication and dissemination strategy will be developed, aiming to increase the visibility of the portfolio's achievements. This will include the production of publications, organization of webinars, and participation in conferences. Outreach efforts will also focus on engaging external stakeholders, ensuring that the portfolio's innovations are effectively communicated to the broader community, thereby enhancing its impact and fostering potential partnerships.

The Challenge portfolio projects are supposed to represent a leading flagship group on waste-to-X devices driving forward the topic through open collaboration with other EU and national projects. Outreach activities should gather a broad community working on diverse aspects of waste management and valorisation. A goal is to develop a common understanding of the respective measures to accelerate innovation in the field. Attracting public and private investors and to increase public awareness in general is a desired outcome of the challenge portfolio.

Outreach activities identified include:

- A Challenge portfolio kick-off event in year one of the portfolio activities, preferentially in the Brussel's EU environment, among others:
 - Demonstrating the State-of-the-art of the different involved domains,
 - Showcasing the different portfolio projects to be started,
 - Giving place to a broad stakeholder community, including contributions from leading representatives from academia, industry, policy and society,
 - Starting a scenario building exercise to scout what the world could look like tomorrow assuming a wide application of these technologies.

Challenge Guide – Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

- A Challenge portfolio final event at the end of the runtime preferentially in the Brussel's EU environment, among others:
 - Showcasing the outcome of the portfolio activities, in the best case by presenting the actual prototypes and innovative concepts to communicate the achieved results and their impact on society to a broad public including leading representatives from academia, industry, policy and society.
- A webinar on the international level every around four times by year organised by the Challenge portfolio members on diverse topics, being inclusive, interdisciplinary and reaching out to the academic community as well as industry, innovators and policy makers.

Task X.6: Protection and exploitation strategies

Conduct comprehensive mapping, landscaping, categorization, and analysis of patents, with the potential to establish key partnerships as needed. Engage strategically with partners and stakeholders - such as investors and corporations - early on and throughout the process, aiming to catalyze R&D opportunities and collaboratively address investment barriers. Design and participate in portfolio-level events to strengthen connections with stakeholders and support fundraising efforts with private entities, including corporate and financial investors.

5.1 Deliverable X.1: Contribution to the Portfolio Strategic Plan (single deliverable for all projects in the portfolio)

This deliverable is the initial project's contribution to the Portfolio Strategic Plan. It will be integrated with the other projects' contributions in the overall Portfolio Strategic Plan under the guidance of the EIC Programme Manager.

Type: R: Document, report (excluding the periodic and final reports)

Dissemination level: PUB. In case there are sensitive results, the deliverable may be duplicated and expanded and made SEN (Sensitive, limited under the conditions of the Grant Agreement).

Due date: month 12.

5.2 Deliverable X.2.i: Report on portfolio activities (i=number of each implementation year. One single deliverable for all projects per year, starting from year 2; 3 deliverables for a 36-months project and deliverables for a 48-months project)

The report will present the portfolio activities that have been carried out during the covered year and contain relevant material (e.g., PowerPoint presentations, minutes of meetings, etc.). 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. It contains an update of the plans for the following year.

Type: R: Document, report (excluding the periodic and final reports)

Dissemination level: PUB. In case there are sensitive results, the deliverable may be duplicated and expanded and made SEN (Sensitive, limited under the conditions of the Grant Agreement).

Due date: The report on portfolio activities will be submitted every 12 months.

6 Final considerations

- Effort to be allocated to this work package: at least **10 person-months**.

Challenge Guide – Waste-to-value devices: Circular production of renewable fuels, chemicals and materials

- In Month 1 the project should set up an operational internal **governance** to cover the following three main roles (with at least two distinct persons that are not necessarily from the coordinator) and with responsibilities in the three aforementioned WGs under Task X.1:
 - 1) **Portfolio manager**, in charge of:
 - Coordination of the portfolio activities (including the writing of the task's reports and deliverables) together with the portfolio managers from the other portfolio projects.
 - Identification and establishment of synergies, shared components and collaboration opportunities with one or more projects in the portfolio.
 - Assessment of the competitiveness of the proposed technologies for different applications.
 - Participation in data collection for monitoring the technology development.
 - 2) **Innovation manager**, in charge of:
 - Elaboration of the exploitation strategies and set-up of the project exploitation plan (including the IPR strategy) together with the innovation managers from the other portfolio projects.
 - Identification of market needs, coordination of market analysis, identification of business opportunities and fundraising options.
 - Assessment of the key stakeholders, analysis of the value chain.
 - 3) **Communication manager** with the following roles and tasks:
 - Defines the portfolio communication strategy together with the communication managers from the other portfolio projects.
 - Implements the portfolio communication and dissemination activities.
 - Manages a common database for events and a shared database of scientific instruments.