

Destination – Efficient, sustainable and inclusive energy use

This Destination addresses activities targeting the energy demand side, notably a more efficient use of energy as regards buildings and industry. It contributes to the activities of the Strategic Energy Technology Plan (SET Plan) and its implementation working groups.

This Destination contributes to the following Strategic Plan’s **Key Strategic Orientations (KSO)**:

- *C: Making Europe the first digitally enabled circular, climate-neutral and sustainable economy through the transformation of its mobility, energy, construction and production systems;*
- *A: Promoting an open strategic autonomy¹⁹⁸ by leading the development of key digital, enabling and emerging technologies, sectors and value chains to accelerate and steer the digital and green transitions through human-centred technologies and innovations.*

It covers the following **impact areas**:

- Industrial leadership in key and emerging technologies that work for people;
- Affordable and clean energy;
- Circular and clean economy.

The **expected impact**, in line with the Strategic Plan, is to contribute to the “*Efficient and sustainable use of energy, accessible for all is ensured through a clean energy system and a just transition*”, notably through

- Technological and socio-economic breakthroughs for achieving climate neutrality and the transition to zero pollution of the **building stock** by 2050, based on inclusive and people-centric R&I (more detailed information below).
- Increased energy efficiency in **industry** and reducing industry’s Greenhouse Gas (GHG) and air pollutant emissions through recovery, upgrade and/or conversion of industrial excess (waste) heat and through electrification of heat generation (more information below).

This Destination has at its core the ambition to deliver on the research, innovation and technological developments needs to meet EU climate and energy targets, forward-looking policy implementation and long-term carbon neutrality objective. The Destination contributes as well (e.g. through the topics that support digitalisation and smartness of buildings) to the EU digital agenda. Though biodiversity is not in the focus of this Destination, the multiple

¹⁹⁸ ‘Open strategic autonomy’ refers to the term ‘strategic autonomy while preserving an open economy’, as reflected in the conclusions of the European Council 1 – 2 October 2020.

impacts of the built environment on biodiversity (e.g. in the scope of renovation) should be considered.

The Destination has a strong policy dimension – it is steered by EU policy action in the energy and climate domains, the European Green Deal overarching policy priority, the Renovation Wave Strategy (for buildings topics), the Industrial Strategy, the Industrial Emissions Directive (for industry topics) and the forward-looking policy measures proposed in the Fit for 55 – Delivering European Green Deal package.

In the light of the Versailles Declaration¹⁹⁹, and acknowledging the need to reduce the energy dependencies of the EU, this Destination will strongly focus on innovations that boost energy efficiency and reduce energy demand in buildings and the industry, thereby contributing to making Europe independent from Russian gas supplies (and other fossil fuel supply from Russia) by the end of the decade in line with the REPowerEU Communication²⁰⁰.

Highly energy-efficient and climate neutral EU building stock

The Destination will contribute to putting the EU on track for achieving climate neutrality of its building stock by 2050 and to effectively promoting Europe’s independence from Russian gas supplies (and other fossil fuels from Russia) before 2030 by means of a more clean, efficient and sustainable building stock. It will deliver the solutions that can help increase buildings renovation rates, reduce energy consumptions of buildings, improve smart readiness, improve circularity, and improve users’ comfort, well-being and health, while keeping housing affordable, in line with the objectives of the Renovation Wave and the revised Energy Performance of Buildings Directive.

This Destination will contribute to ‘reducing our energy dependencies’ priority of the Versailles declaration across all topics, in particular by improving energy efficiency and the management of energy consumption in buildings, and by delivering more circular approaches to construction and renovation of buildings. The Destination will also contribute to the ‘Electrify Europe’ track of REPowerEU by delivering innovative solutions for energy efficiency and electrification of homes and buildings, e.g. thanks to heat pumps. These priorities are addressed in a specific flagship topic.

It will contribute to the uptake of digital and smart solutions in buildings and to improved energy flexibility, in line with the Action Plan on the digitalisation of the energy sector. The Destination’s innovation will contribute to make the sector fit to support the achievement of higher ambition on energy efficiency under Fit for 55. The Destination’s topics contribute significantly to the New European Bauhaus²⁰¹(NEB), integrating the core NEB values of sustainability, inclusion and aesthetics in the built environment (e.g. in relation to cultural heritage and quality of experience), and they are consistent with the EU roadmap and policy

¹⁹⁹ The Versailles Declaration, 10 and 11 March 2022, <https://www.consilium.europa.eu/media/54773/20220311-versailles-declaration-en.pdf>

²⁰⁰ ‘REPowerEU: Joint European action for more affordable, secure and sustainable energy’, COM(2022) 108 final, 8 March 2022.

²⁰¹ https://europa.eu/new-european-bauhaus/index_en

initiatives on digitalisation in the construction sector and on sustainability of buildings (e.g. Level(s)). On climate, one aim will also be to enhance the role of buildings as carbon sinks in the voluntary market for carbon removals, in line with the upcoming Communication on Restoring sustainable carbon cycles and the Proposal for a regulatory framework for carbon removal certification.

The Destination also relies on the Built4People co-programmed partnership's broader action and is complementary to Driving Urban Transitions partnership and to the Mission on Climate Neutral and Smart Cities.

Main expected impacts:

- The European buildings and energy sectors are able to effectively support higher EU ambition on energy efficiency, energy independence, and the transition to zero-emission buildings, with a stronger link between innovation in technology and practices, and policy drivers and instruments.
- Building stocks continue to evolve to combine energy efficiency, renewable energy sources, storage, and digital and smart technologies, supporting the transformation of the energy system towards climate neutrality and reducing Europe's energy dependencies.
- Buildings constructed and renovated see their performance enhanced across the board (energy performance, life-cycle emissions, indoor environment quality), with lower environmental impacts, and rates of holistic renovations continue increasing. Buildings are able to adapt to changing user needs for dynamic and more efficient use of building spaces and they are more resilient to climate change and better integrated in the grid.
- A higher quality, more affordable and inclusive, built environment mitigating climate change and preserving environment, safeguarding cultural heritage, considering sustainability, circularity and aesthetics, while ensuring better living conditions.

Industry

The Destination will contribute to putting the EU on track for achieving climate neutrality of the industrial sector by 2050, while also reducing other polluting emissions, and for effectively promoting Europe's independence from Russian gas supplies (and other fossil fuels from Russia) before 2030 by means of a more clean, efficient and sustainable industrial processes. It will deliver the solutions that can help a faster transition to renewable and low carbon energy sources for thermal energy generation, and a reduction of the energy consumption through waste heat recovery, storage and upgrade for reuse in other processes. These solutions will contribute to reduce GHG and polluting emissions and reinforce the frontrunner and competitive position of the European industry. They are in line with the research and innovations areas identified in the Implementation Plan of the action of the Strategic Energy Technology (SET) Plan dedicated to 'energy efficiency in industry'.

The bulk of R&I dedicated to industry is covered in Cluster 4 (Digital, Industry and Space), and in particular by the private public partnership Processes4Planet focussing on process

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industries. In Cluster 5, this Destination focusses on the management of thermal energy in industry.

Main expected impacts:

- Increasing energy efficiency in industry and reducing industry’s energy dependence, Greenhouse Gas (GHG) and air pollutant emissions through recovery, upgrade and/or conversion of industrial excess (waste) heat and through the integration of renewable energy sources into more efficient and flexible systems for the generation of heat and cold for industrial processes.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)		Deadline(s)
	2023	2024	
HORIZON-CL5-2023-D4-01	78.00		20 Apr 2023
HORIZON-CL5-2023-D4-02	44.00		05 Sep 2023
HORIZON-CL5-2024-D4-01		36.00	18 Apr 2024
HORIZON-CL5-2024-D4-02		50.00	05 Sep 2024
Overall indicative budget	122.00	86.00	

Call - Efficient, sustainable and inclusive energy use

HORIZON-CL5-2023-D4-01

Conditions for the Call

Indicative budget(s)²⁰²

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million) ²⁰³	Indicative number of projects expected to be funded
		2023		
Opening: 13 Dec 2022 Deadline(s): 20 Apr 2023				
HORIZON-CL5-2023-D4-01-01	IA	10.00 ²⁰⁴	Around 5.00	2
HORIZON-CL5-2023-D4-01-02	RIA	9.00 ²⁰⁵	Around 4.50	2
HORIZON-CL5-2023-D4-01-03	IA	8.00 ²⁰⁶	Around 4.00	2
HORIZON-CL5-2023-D4-01-04	RIA	6.00 ²⁰⁷	Around 3.00	2
HORIZON-CL5-2023-D4-01-05	IA	25.00 ²⁰⁸	Around 12.50	2
HORIZON-CL5-2023-D4-01-06	IA	20.00 ²⁰⁹	Around 10.00	2
Overall indicative budget		78.00		

General conditions relating to this call

²⁰² The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

²⁰³ Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

²⁰⁴ Of which EUR 5.50 million from the 'NGEU' Fund Source.

²⁰⁵ Of which EUR 4.50 million from the 'NGEU' Fund Source.

²⁰⁶ Of which EUR 4.00 million from the 'NGEU' Fund Source.

²⁰⁷ Of which EUR 3.00 million from the 'NGEU' Fund Source.

²⁰⁸ Of which EUR 13.82 million from the 'NGEU' Fund Source.

²⁰⁹ Of which EUR 11.00 million from the 'NGEU' Fund Source.

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<i>Admissibility conditions</i>	The conditions are described in General Annex A.
<i>Eligibility conditions</i>	The conditions are described in General Annex B.
<i>Financial and operational capacity and exclusion</i>	The criteria are described in General Annex C.
<i>Award criteria</i>	The criteria are described in General Annex D.
<i>Documents</i>	The documents are described in General Annex E.
<i>Procedure</i>	The procedure is described in General Annex F.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G.

Highly energy-efficient and climate neutral European building stock

Proposals are invited against the following topic(s):

HORIZON-CL5-2023-D4-01-01: Innovative cost-efficient solutions for zero-emission buildings

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 10.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology</i>	Activities are expected to achieve TRL 6-8 by the end of the project –

<i>Readiness Level</i>	see General Annex B.
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Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Increased number of solutions and approaches for construction of zero-emission buildings.
- Enhanced productivity of construction compared to standard practice.
- Reduced embodied emission and increased carbon storage, enhanced energy performance.
- Improved comfort, Indoor Air Quality and Indoor Environmental Quality.
- Increased awareness on zero-emission construction best practices.
- Enhanced circularity of construction.

Scope: To demonstrate that high-quality and affordable zero-emission buildings, in line with the Proposed Revision of the Energy Performance of Buildings Directive, can be delivered and mainstreamed. With new buildings already required to be nearly-zero energy buildings, the focus is on how to achieve zero emissions, zero or positive energy standards and how to reduce embodied emissions, also storing CO₂ where possible (using recycled, zero-carbon, or sustainably sourced construction materials acting as carbon sinks).

Proposals are expected to address all of the following:

- Demonstrate innovative construction approaches and scalable solutions based on integrated existing solutions into standardised packages for a cost-effective construction of (new) zero-emission buildings, in line with the Energy Performance of Buildings Directive.
- Ensure the approaches demonstrated:
 - o Allow to achieve zero or positive energy standards and to reduce embodied emissions, also storing carbon where possible, using recycled, zero-carbon or sustainably sourced carbon-storing construction materials.
 - o rely on mature construction products and materials, and technical building systems, seeking to deliver solutions that are ready for application and use, in view of significantly enhancing the energy performance of buildings.

- address all components of buildings (envelope, technical building systems, on-site²¹⁰ renewable energy – e.g. BIPV – and, where relevant, electric vehicle charging points).
 - are rooted in local and regional value chains for sourcing of buildings components and for involvement and upskilling of local and regional businesses.
 - are tailored for the applicable regulatory framework: EU, national, and (where relevant) regional and local level.
 - have strong potential for replication across Europe, in particular by construction SMEs.
- Demonstrations that include at least three real-life new construction projects, of which one at least should target public buildings.
 - Ensure that the demonstrations:
 - Cover at least three countries, with diverse climatic conditions and architectural patterns.
 - Involve local and regional value chains, in particular SMEs, based on participatory approaches to increase innovation acceptability.
 - Lead to clear and, where relevant, quantified and measurable indicators on the results achieved.
 - An ambitious EU-wide dissemination roadmap addressing all relevant stakeholders (in particular businesses and authorities) to:
 - promote the zero-emission buildings innovative construction approaches demonstrated.
 - share guidance and recommendations on best practices for zero-emission construction.
 - provide feedback to policy makers at EU, national, and (where relevant) regional and local level regarding the deployment of innovative and cost efficient solutions for constructing zero-emission buildings.

HORIZON-CL5-2023-D4-01-02: Future-proofing historical buildings for the clean energy transition

Specific conditions	
<i>Expected EU</i>	The Commission estimates that an EU contribution of around EUR 4.50

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<i>contribution per project</i>	million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 9.00 million.
<i>Type of Action</i>	Research and Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 4-5 by the end of the project – see General Annex B.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Reduction of energy demand by at least 60%, preserving historical and cultural heritage values.
- Reduction of on-site construction waste.
- Improved lifetime renovation cost effectiveness compared to conventional renovation.
- Improved comfort, Indoor Air Quality and Indoor Environmental Quality.
- Significant reduction in maintenance costs.
- Where possible, increased potential of successful installation of RES and improvement of smart readiness, in a way that respects the specificities of historical buildings.
- Increased effectiveness and potential for replicability of the proposed solutions.

Scope: Around a quarter of the existing building stock in Europe was built prior to the middle of the last century. Many such buildings not only reflect the unique character and identity of European cities, but also include essential infrastructure for housing, public buildings etc. A significant number of these have a poor energy performance, continue to use conventional and inefficient fossil fuel-based energy systems and are costly to renovate. Furthermore, changes in building use and higher indoor comfort expectations than in the past are driving up energy demand, a particular challenge when historical buildings are used or converted for residential, educational, retail, office or other purposes. Many recently developed renovation approaches are not adapted to the specific requirements of historical buildings. The process of future-proofing these buildings for the clean energy transition faces additional challenges compared

to newer buildings, as it has to take into account architectural restrictions, as well as the specificities of the materials used in their construction, which does not respond well to renovation techniques used in modern buildings.

Proposals are expected to address all of the following:

- Deliver standardised renovation approaches and solutions for the deep renovation of historical buildings to improve their energy performance, smart readiness, indoor air quality, comfort, and climate resilience, while respecting their architectural and cultural specificities, materials and traditional construction techniques.
- Target building types constructed prior to 1945 that have restrictions regarding changes of their envelope (walls, window, doors, and/or roof). (Buildings of nationally or internationally recognised significant cultural heritage built after this date may also be considered.).
- Standardised renovation approaches and solutions that are directly replicable for other buildings of the same building type, which should represent a share of at least 1% of buildings in the specific country where they are located.
- Solutions that reduce energy demand in a cost-effective way.
- Explore both internal and external insulation solutions, and where possible incorporating adaptable interventions, plug and play technical building systems, and/or renewable energy services.
- Employ both novel and traditional construction materials and techniques, exploring ways to combine, adapt and improve them.
- Improve the comfort of occupants and lower the maintenance costs for building owners.
- Where applicable, involve relevant conservation authorities.
- Validation of the solutions in a relevant environment (real-life or close to real-life) that:
 - o Covers at least three different countries, with diverse climatic conditions.
 - o Results in clear and, where relevant, quantified and measurable indicators on the effectiveness and the potential for replication of the solutions.

HORIZON-CL5-2023-D4-01-03: Interoperable solutions for positive energy districts (PEDs), including a better integration of local renewables and local excess heat sources

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 4.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a

	proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 8.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). ²¹¹ .

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Increased availability of tools, guides and interoperable solutions for planning, design, development and management of Positive Energy Districts (PEDs).
- Improved integration of energy (e.g. distributed renewable energy generation, waste heat utilisation, storage) and non-energy sectors (e.g. mobility) within PEDs.
- Improved integration of PEDs in energy systems and improved contribution of PEDs to energy grid robustness with regard to dependencies to energy supplies.
- Increased social entrepreneurship and citizen participation and engagement in energy communities.
- Increased participation of consumers and energy communities in the value chain of the energy system.

²¹¹ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Scope: Recent projects have demonstrated positive energy districts, but there is a need to demonstrate fully interoperable solutions that include improved energy efficiency coupled with a better integration of local renewables and local excess heat sources within the district. In parallel, the interoperability of positive energy districts with the urban and renewable energy system in which they are embedded needs to be enhanced through effective solutions that will allow interaction and integration between buildings, the users and the regional energy, mobility and ICT systems.

Projects are expected to address all of the following:

- Develop solutions (products, tools, etc.) for planning and managing assets (e.g. buildings, energy systems, mobility systems, ICT) in positive energy districts.
- Develop tools and methods for planning and designing PEDs, that support PED developers and managers to optimise the mix of PED solutions depending on the local conditions.
- Develop data exchange platforms (heat & electricity) and technologies to integrate buildings with energy markets (e.g. flexibility market) relying on available standards (e.g. SAREF), allowing buildings to contribute effectively to grid stabilisation at district / city level.
- Develop methodologies and/or planning tools for the optimal integration of distributed renewable generation and excess heat at district (or building) level.
- Develop innovative business models for integration of PEDs in the energy markets including technological, financial and regulatory aspects.
- Deploy and test certification and standardisation frameworks for interoperable solutions in positive energy districts.
- Demonstrate the proposed solutions in at least three PEDs to promote replication, upscaling and mainstreaming.

To ensure interoperability and integration into the grid, projects should make use of operational end-to-end architectures, digital platforms and other data exchange infrastructure for the energy system being developed under ongoing Horizon 2020, Horizon Europe as well as under other EU programs such as the Digital Europe Program, when addressing communication and data exchange between inverters and other components, other appliances and the electricity network.

The selected projects are expected to contribute to the BRIDGE initiative²¹², actively participate to its activities and allocate up to 2% of their budgets to that end. Additional contributions to the ‘Alliance for Internet of Things Innovation’ (AIOTI) and other relevant

²¹² <https://www.h2020-bridge.eu/>

activities (e.g. clusters of digital projects and coordinating actions) might be considered, when relevant.

HORIZON-CL5-2023-D4-01-04: Thermal management and energy optimisation of high energy demand IT systems equipment in tertiary buildings

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 3.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 6.00 million.
<i>Type of Action</i>	Research and Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 4-5 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). ²¹³ .

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Better understanding of the challenges in thermal management of high-energy demand IT systems equipment in facility rooms inside tertiary buildings.

²¹³ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Increased knowledge regarding solutions in the tertiary buildings case from transfer of relevant knowledge from other application field/sectors.
- Improved open access to the relevant and useful knowledge and information for the IT sector.
- Increased awareness of the most common specific use cases in tertiary buildings in EU Member States/Associated countries that could benefit from cost-effective and optimised thermal management and energy efficiency measures (solutions, practices, strategies, etc.), including solutions recovering and valorising of excess heat among others.
- Increased consensus amongst key actors regarding metrics, indicators, reporting, trends, monitoring and verification (M&V) schemes, methodologies & best practices to achieve best/optimal efficiencies through the design, commissioning, operation, management and decommissioning of IT systems equipment.
- Improved insight for future standardisation needs in relevant areas of influence (e.g. procurement, product design, manufacturing, services, cooling equipment, control equipment, buildings energy performance, operation, management, among others.) in order to facilitate further improvements and efficiencies in the relevant areas.

Scope: Energy consumption of IT systems equipment (e.g. server racks, server rooms) inside buildings is following a significant growth due to several factors. These factors include the increasing number of installed sensors and IoT devices, which feeds the need for big data handling and the increasing demand for more powerful and advanced equipment. Various voluntary and regulatory instruments have been implemented in the past years to try to mitigate the environmental footprint of a specific equipment/device or systems in isolation. However, often these instruments do not take into account real life performance, potential inefficiencies or synergies with other systems, operation under real life set-up and control conditions, or other constraints such as those from the building energy management practices, building automation and control systems, local regulations or rules. Moreover, there is potential to improve the self-assessment and self-optimisation functionalities at all levels.

Proposals are expected to address all of the following:

- Validate and improve awareness of the cost-effectiveness and value proposition of the best/optimal thermal management and energy efficiency measures (solutions, practices, strategies, etc.) of high energy-demand IT systems equipment in facility rooms inside tertiary buildings.
- Improve the self-assessment and self-optimisation tools/functionality of IT systems equipment inside high-energy demand IT systems equipment facility rooms of tertiary buildings.
- Facilitate open access to latest information, trends and knowledge to all players involved.

- Promote the best/optimal measures/strategies.
- Engage in the relevant standardisation initiatives and identify needs for future regulation or standardisation developments.

HORIZON-CL5-2023-D4-01-05: Innovative solutions for cost-effective decarbonisation of buildings through energy efficiency and electrification

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 12.50 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 25.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Increased application of the energy efficiency first principle in construction and renovation of buildings.
- Increased decarbonisation of building thermal energy demand by means of electrification.
- Enhanced buildings energy performance and (smart) energy management, leading to increased use of locally generated renewable energy and local energy storage.
- Increased number of cost-effective and commercially available solutions for electrification of building thermal energy demand, with significantly lower costs per building unit and significant potential for mass roll-out in Europe.
- Enhanced building contribution to power grid stability by offering energy flexibility services.

Scope: In line with EU priorities for buildings and the energy system, and with the need to reduce Europe's energy dependencies, to develop and demonstrate highly cost-efficient, integrated and replicable solutions for decarbonising the thermal energy demand of buildings (i.e. heating and cooling) by means of electrification, ensuring the strict application of the energy efficiency first principle.

Proposals are expected to address all of the following:

- Develop and demonstrate innovative and integrated solutions for electrification of the thermal energy demand of buildings in line with the 'Electrify Europe' track of REPowerEU (e.g. heat pumps), with high replication potential across Europe.
- Ensure the solutions developed:
 - Can be effectively combined with conventional energy efficiency measures (e.g. those that improve the performance of the building envelope).
 - Can be used optimally in combination with renewable energy sources on-site or nearby.
 - Include innovative, smart control techniques optimising the heating/cooling systems performance and efficiency based on all relevant parameters, for example, dynamic electricity price (present and future forecast), weather (present temperature and solar radiation, and future forecast, resilience against extreme weather events), thermal comfort, status of charge of electrochemical storage etc.
 - Include interoperable interfaces and rely on standards allowing to collect and store information on their operation, and communicating with other systems (e.g. building energy management systems or building automation and control systems), for autonomous or remote inspection of systems (state, performance and failures).
 - Allow to increase the use of locally generated (on-site²¹⁴ and nearby²¹⁵) renewable electricity and electrochemical storage, while offering energy flexibility to contribute to power grid stability.
 - Minimise life cycle environmental impact and improve circularity (e.g. reparability, modular design for selective replacement and upgrade, recyclability of materials, use of thermal cycle fluids with low global warming potential), while maintaining/enhancing their performance.

²¹⁴ 'on-site' means the premises and the land on which the building is located and the building itself.

²¹⁵ 'energy from renewable sources produced nearby' means energy from renewable sources produced within a local or district level perimeter of the building, which fulfils all the following conditions: (a) it can only be distributed and used within that local and district level perimeter through a dedicated distribution network; (b) it allows for the calculation of a specific primary energy factor valid only for the energy from renewable sources produced within that local or district level perimeter; and (c) it can be used on-site of the building through a dedicated connection to the energy production source, that dedicated connection requiring specific equipment for the safe supply and metering of energy for self-use of the building.

- Are cost-effective (purchase, installation, operation and maintenance).
- Are highly replicable, for new buildings and for renovation of residential buildings (individual dwellings, single apartments or flats), e.g. for the direct replacement of fossil-fuel boilers.
- Demonstrate the solutions developed in at least five real-life new construction and renovation projects, of which at least two are renovations of residential buildings (multifamily building or individual houses) and at least one is renovation of non-residential buildings.
- Ensure that the demonstration:
 - Covers at least three countries with diverse climatic conditions, of which at least one country with an energy mix that is strongly dependent on Russian fossil fuel supplies.
 - Involves local and regional value chains, in particular SMEs, based on participatory approaches to increase innovation acceptability.
 - Involves relevant authorities to ensure the best alignment with energy strategies at national, regional and local levels.
 - Is supplemented by an ambitious 5-year replication strategy for the solutions demonstrated, which will be implemented within the duration of, and after, the project.
 - Leads to clear and, where relevant, quantified and measurable indicators on the results achieved.
- Deliver guidance and recommendations for practitioners, and define and implement ambitious dissemination actions, to promote the approaches demonstrated and support their replication.

Industry

Proposals are invited against the following topic(s):

HORIZON-CL5-2023-D4-01-06: Integration of renewable heat or industrial waste heat in heat-to-cold conversion systems to generate cold for industrial processes

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 10.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

<i>Indicative budget</i>	The total indicative budget for the topic is EUR 20.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 7 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). ²¹⁶ .

Expected Outcome: Project results are expected to contribute to all the following expected outcomes, except where options are mentioned:

- Integration of renewable thermal energy sources or industrial waste heat into more energy-, emissions-, cost- and space-efficient conversion systems generating cold for several industrial sectors and processes, maximising primary energy savings and CO2 emission reduction compared to present state-of-the-art, thereby reducing fossil fuel imports dependency.
- Optionally: integration of heat storage, of renewable electrical energy sources; integration of district heating or cooling network.
- Optionally: combined generation of heat and cold for industrial processes.

Scope: Increasing the efficiency of the cooling systems and reducing costs, coupling the cooling systems with renewable energy sources, and harnessing available industrial waste heat (including from data centres), can contribute to reduce the environmental impact and make the industrial sectors more competitive and less dependent on fossil fuel imports.

In order to reach this goal, all the following development areas need to be covered:

²¹⁶ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Identify the target industrial processes which would benefit from the integrated cooling systems; assess the impacts on these processes in terms of energy savings and GHG and air pollutant emissions reductions in the EU (and Associated States, if data are available), so as to maximise the impact and coverage of the most promising solutions in the subsequent optimisation and demonstration steps. A preliminary assessment is expected at proposal stage.
- Improve the refrigeration system efficiency and environmental friendliness, for example: improve the control system and operating strategies; develop internal recoveries for refrigeration plants (e.g. vapour compression plants); environment friendly materials and working fluids and novel heat exchangers for refrigeration systems (e.g. absorption systems). Optionally: combine the generation and use of both heat and cold.
- Integrate and demonstrate the refrigeration system in an industrial application in at least one industrial sector, including the mandatory integration of on-site or near-by solar thermal or geothermal plants with minimisation of the space needed. Optionally also: harvesting of industrial waste heat; thermal storage; cold transportation; integration of renewable electrical energy sources, with possible electrical demand flexibility for contributing to the stabilisation of the electrical grid; integration of district heating or cooling network.
- Identify the potential barriers to the deployment of the integrated cooling solutions due to thermal renewables variability, investigating notably other mitigation alternatives than gas-fired backups, such as insurance mechanisms to alleviate the financial risk for the company. Identify non-technical barriers due to the local regulatory framework in the EU Member States and Associated Countries.
- Make an analysis of the potential industrial applications and related benefits (technical, economic, climatic, environmental) of integrated cooling solutions in at least four different industrial processes, in the EU and (if data are available) in the Associated States and, by extrapolation, at global level.
- Define an exploitation strategy. For proposals submitted under this topic, the plan for the exploitation and dissemination of results should include a strong business case and sound exploitation strategy, as outlined in the introduction to this Destination. The exploitation plans should include preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan) indicating the possible funding sources to be potentially used (in particular the Innovation Fund).
- Disseminate the technical and economic benefits, notably (but not only) to the communities of the relevant Horizon Europe private-public partnerships.

Call - Efficient, sustainable and inclusive energy use

HORIZON-CL5-2023-D4-02

Conditions for the Call

Indicative budget(s)²¹⁷

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million) ²¹⁸	Indicative number of projects expected to be funded
		2023		
Opening: 04 May 2023 Deadline(s): 05 Sep 2023				
HORIZON-CL5-2023-D4-02-01	IA	10.00	Around 5.00	2
HORIZON-CL5-2023-D4-02-02	IA	10.00	Around 5.00	2
HORIZON-CL5-2023-D4-02-03	IA	12.00	Around 6.00	2
HORIZON-CL5-2023-D4-02-04	CSA	2.00	Around 2.00	1
HORIZON-CL5-2023-D4-02-05	IA	10.00	Around 5.00	2
Overall indicative budget		44.00		

General conditions relating to this call

<i>Admissibility conditions</i>	The conditions are described in General Annex A.
<i>Eligibility conditions</i>	The conditions are described in General Annex B.
<i>Financial and operational capacity and exclusion</i>	The criteria are described in General Annex C.
<i>Award criteria</i>	The criteria are described in General Annex D.

²¹⁷ The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

²¹⁸ Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

<i>Documents</i>	The documents are described in General Annex E.
<i>Procedure</i>	The procedure is described in General Annex F.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G.

Highly energy-efficient and climate neutral European building stock

Proposals are invited against the following topic(s):

HORIZON-CL5-2023-D4-02-01: Innovative uses of lifecycle data for the management of buildings and buildings portfolios (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 10.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the

	Research and Training Programme of the European Atomic Energy Community (2021-2025). ²¹⁹ . The funding rate is 60% of the eligible costs, except for non-profit legal entities where the funding rate is up to 100% of the total eligible costs.
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Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Increase in the availability of key energy and environmental performance indicators from new or improved building management systems that go beyond energy management to life-cycle approach (e.g. environmental performance, circularity, comfort and well-being, indoor environmental quality, accessibility, safety, structural performance, resilience and climate risk vulnerability).
- Improved tools for the planning and management of building assets and portfolios of buildings including energy management, environmental performance, renovation optimisation and investment planning.
- Increased availability and access to lifecycle data of buildings and buildings portfolios and enhanced interoperability and synergies among data sharing platforms.

Scope: European buildings are producing an increasing amount of data on energy and non-energy uses. More and better data can lead to enhanced consumer information, contribute to an effective management of energy grids and support the creation of innovative energy services, new business models and financing schemes for distributed clean energy. Data is also a key enabler for reliable and effective policymaking, e.g. for climate policies. Several recent projects have focused on developing big data facilities and data analytics tools to monitor the energy performance of buildings based on energy related data. More work is needed to integrate energy data with lifecycle data (e.g. GHG emissions and removals, materials, water, health, comfort, life cycle cost and value, etc.), in order to optimise the performance of buildings and buildings' portfolios across the board and support the decision making of owners/tenants/developers to transform existing and planned physical assets (buildings or buildings' assets, e.g. distributed energy generation, e-mobility recharging infrastructure, micro-grids, building systems).

Proposals are expected to address at least two of the three following points:

- Develop new or upgrade existing building management systems enhanced with data analytics and real-time digital twinning tools. The developed systems should take into account buildings monitoring data (e.g. from embedded sensors/actuators), users' preferences (e.g. related to comfort and well-being, safety, and energy flexibility), and

²¹⁹ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

surrounding environmental conditions (e.g. urban density, micro-climate, etc.) in order to optimise operational energy and environmental performance.

- Develop new or upgrade existing decision support tools for the management of building assets and portfolios of buildings. The developed tools should be able to deliver energy (e.g. energy monitoring, renovation optimisation) and non-energy services (investment planning, risk assessment – e.g. risk-related, fault detection, predictive maintenance, surveillance & safety, comfort, occupancy satisfaction). The tools should be co-developed with the potential users (e.g. facility managers, fund managers etc.) and tested in real market conditions.
- Develop new or upgrade existing data sharing platforms including lifecycle data of buildings or buildings portfolios. The platforms should connect relevant market actors (technology providers, developers, aggregators, DSOs, ESCOS) with relevant user groups (consumers, energy communities), policy makers and the financial sector and offer innovative services (e.g. flexibility, prediction, investment planning etc.). The platforms should be co-developed with the participation of the potential user groups and tested in real market conditions linking, where relevant, to digital logbooks and to other relevant initiatives (e.g. the Smart Readiness Indicator under the Energy Performance of Buildings Directive).

Proposals should contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

Proposals are expected to implement at least three large -scale pilots to demonstrate the chosen system. The pilots should cover a variety of building typologies (residential, commercial, public etc.) and use cases (energy monitoring, renovation optimisation, investment planning, risk assessment etc.)

This topic implements the co-programmed European Partnership on ‘People-centric sustainable built environment’ (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership ‘People-centric sustainable built environment’ (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2023-D4-02-02: Solutions for the identification of vulnerable buildings and people-centric built environment, and for improving their resilience in disruptive events and altered conditions in a changing climate (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 10.00 million.

<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Increased awareness of approaches for the identification and categorisation of the vulnerability of existing and future buildings and infrastructures.
- Increased number of demonstrated innovative solutions to improve safety and resilience of the built environment, to extreme climatic events, and other natural disasters, as well as to altered conditions due to climate change.
- Increased use of relevant data such as weather forecasts or catastrophe warnings by monitoring and management systems in the built environment (e.g. to launch automatic emergency protocols to warn and protect buildings users).
- Improved understanding of new business models allowing to optimise the costs of resilience, taking into account asset management and lifecycle approaches.
- Increased awareness of building occupants and other key stakeholders on the available solutions in case of extreme climatic events, and natural disasters.

Scope: Buildings should contribute to an integrated approach for a safe and healthy people-centric built environment at block, district and urban level. The built environment needs to be adapted, designed, and constructed for combating the effects of Global Warming (increased heat island effect, increased cooling demands, water scarcity, etc.) and for providing safety and resilience to adverse climatic events at a larger scale, whilst ensuring their connection and integration with energy, ICT and transport infrastructures.

Proposals are expected to address all of the following:

- Develop approaches and tools for the identification and categorisation of the vulnerability of existing, and future, buildings and built environment, where possible using and/or further developing existing vulnerability assessment methodologies.
- Develop innovative designs, materials and solutions to improve safety (e.g., fire safety) and resilience of the built environment to extreme climatic events (heat waves, floods,

category 5 storms, etc.), and which may also be relevant in other natural disasters, such as earthquakes depending on the geographical location of the buildings.

- Ensure, if applicable, that the proposed solutions also improve accessibility for persons with disabilities, improve the local environment, and minimise any negative impacts on biodiversity, e.g. relying on nature-based solutions
- Where appropriate, ensure the proposed approaches and solutions address deep renovation, linking to relevant instruments for awareness and advice of building owners (e.g. renovation passports) in order to gradually adapt buildings to climate change in an adaptation pathways approach.
- Explore the use of relevant data, such as weather forecasts and / or catastrophe warnings, by monitoring and management systems in the built environment (e.g. to launch automatic emergency protocols to warn and protect buildings users).
- Investigate the potential of asset management and life cycle approaches to optimise costs of resilience (e.g. to climate and environmental factors).
- Ensure that the whole value chain from design over construction to end of life is covered.
- Demonstrate the solutions in at least two demonstrators, involving diverse building typologies, at block or district level and including where appropriate the connections to energy, ICT and transport infrastructures, in diverse geographical areas, with various local environmental, social, and economic conditions.
- Contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities.

This topic implements the co-programmed European Partnership on ‘People-centric sustainable built environment’ (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership ‘People-centric sustainable built environment’ (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2023-D4-02-03: Demonstrate built-environment decarbonisation pathways through bottom-up technological, social and policy innovation for adaptive integrated sustainable renovation solutions (Built4People Partnership)

Specific conditions	
<i>Expected EU</i>	The Commission estimates that an EU contribution of around EUR 6.00

<i>contribution per project</i>	million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 12.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Increased number of innovative solutions and packages for sustainable construction and renovation.
- Increased number of options for built-environment decarbonisation pathways towards zero-emission buildings considering the whole value chain at local or regional level.
- Increased engagement and participation of the whole value chain in local and regional innovation clusters.
- Reduced time from first demonstration to market of sustainable renovation solutions.
- Increased awareness and improved access at a local or regional level to information on construction products for reuse and circular businesses.
- Creation of new business opportunities with reduced risk for investment in the circular economy.
- Enhanced engagement amongst communities, businesses, local and regional governments, and the extended construction value chain, e.g. materials and equipment, manufacturers, construction companies.

Scope: To improve the energy efficiency, circularity and sustainability of the built environment there is a need to develop and apply integrated approaches that demonstrate, in practice, achievable pathways for decarbonisation of the building stock through a whole life carbon approach, including temporary carbon storage in built works (e.g. thanks to wood-based products). This means developing and integrating new design techniques allowing for

deconstruction and reuse; new products and components that can be dismantled and reused; and new products and components for construction works that incorporate reused and recycled elements and materials. In addition, there is a need to deploy and test through a value chain approach the enabling conditions that facilitate the integration of the innovations outlined above in planning, design, budgeting, procurement, construction practice, insurance, and related administrative and regulatory processes.

Proposals are expected to address all of the following:

- Demonstrate a value chain approach and pilot decarbonisation pathways in at least two deconstruction/re-use/construction demonstrators and supply chain approaches of market-scale renovations.
- Demonstrate low disruptive and simpler construction and retrofitting processes, which facilitate a life cycle-based approach that fosters alignment with EU Level(s) framework indicators.
- Test the enabling conditions (technological, social, and policy) that can boost innovation and reduce time from research to market of sustainable renovation solutions.
- Establish and operate demonstrative regulatory sandboxes that allow to deploy and test innovation pathways for decarbonisation of buildings at a meaningful scale with the involvement of the whole value chain at local level.
- Where relevant, explore fast tracking of cost-effective standardisation of innovative sustainable renovation solutions.
- Where relevant, investigate non-standard contractual relationships within the design-construction-client project team, including ‘as a service’ approaches for the built environment.
- Develop solutions that can stimulate the market for reused construction products at a regional level in support of the Renovation Wave and which can contribute to increased rate and depth of renovation in order to reach climate neutrality by 2050, in particular in critical segments of the building stocks such as e.g. public buildings or social housing.
- Develop design solutions that address inclusion and accessibility and leading to documented improvements in comfort and health aspects, whilst reducing emissions from the built environment and enhancing climate change resilience.
- Contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise (including social innovation), in order to produce meaningful and significant effects enhancing the societal impact of the related research activities.

This topic implements the co-programmed European Partnership on ‘People-centric sustainable built environment’ (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership ‘People-centric sustainable built environment’ (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2023-D4-02-04: Fast-tracking and promoting built environment construction and renovation innovation with local value chains (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 2.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 2.00 million.
<i>Type of Action</i>	Coordination and Support Actions
<i>Eligibility conditions</i>	<p>The conditions are described in General Annex B. The following exceptions apply:</p> <p>The following additional eligibility criteria apply:</p> <p>Projects must cooperate closely with the ECTP network of National Technology Construction Platforms and cross-border/cross-sectoral clusters, as well as with the World GBC European network.</p> <p>If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).</p>
<i>Legal and financial set-up of the Grant Agreements</i>	<p>The rules are described in General Annex G. The following exceptions apply:</p> <p>Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025).²²⁰.</p>

²²⁰ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Expansion and strengthening of the Built4People network of Construction Innovation Clusters.
- Increased awareness and improved access at a local or regional level to research outcomes for sustainable built environment construction and renovation.
- Increased engagement and participation of the whole value chain in local and regional construction innovation clusters.
- Strengthened, long-lasting and multi-disciplinary networking and collaboration on locally rooted, bottom-up innovative holistic solutions for a sustainable built environment.
- Enhanced engagement amongst communities, businesses, local and regional governments, and the construction industries and associated supply chains.
- Establishment and reinforcement of European value chains in sustainable construction and renovation.
- Creation of new business opportunities with reduced risk for investment in innovative built environment construction and renovation.
- Reduced time from research to market of innovative sustainable construction and renovation solutions.
- Increased public and private co-financing of innovation in the field of innovative sustainable built environment.

Scope: For effective fast-tracking and promotion of built environment construction and renovation innovation with local value chains, nascent construction innovation clusters need to link with regional/national innovation hubs and clusters. This will strengthen multi-disciplinary networking and collaboration amongst all actors of local and regional construction ecosystems and reinforce European value chains. A long-term network structure is needed, based on an appropriate business model and governance, to support these clusters and give them capacity to nurture and help deliver public and private investments in sustainable construction and renovation innovation also supporting digitalisation of the value chain.

Proposals are expected to address all of the following:

- Delivery of a long-term network structure for the Built4People construction innovation clusters.

- Support adoption of the enabling conditions (technological, social, and policy) that can boost innovation and reduce time from research to market of sustainable renovation solutions.
- Deliver methods and tools for the reliable assessment of innovation maturity and potential impacts (e.g. potential of replication).
- Monitor growth of Built4People construction innovation clusters and assess their effectiveness for reducing the time from research to market of sustainable renovation solutions.
- Stimulate co-financing of innovation in the field of innovative sustainable built environment.
- Disseminate exemplary practices for fast tracking of cost-effective standardisation and certification of innovative sustainable renovation solutions.
- Prepare the value chain at a local/regional level for uptake of innovative sustainable construction and renovation solutions in support of the Renovation Wave and the increased rate and depth of renovation, also post 2030, in order to reach EU-wide climate neutrality by 2050.
- Stimulate engagement in Built4People innovation clusters of the stakeholders that can lead the transformation of the building stocks at local and regional level (e.g. cooperative and social housing developers).
- Promote design solutions that address inclusion and accessibility and leading to documented improvements in comfort and health aspects, whilst reducing emissions from the built environment and enhancing climate adaptation resilience.
- Ensure the project's dissemination activities include actions that contribute to the activities of the NEB Community, and to sharing information, best practices and results within the NEB Lab.
- Seek to ensure consistency and complementarity of action with the project funded under the HORIZON-CL5-2021-D4-02-03 topic.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise (including social innovation), in order to produce meaningful and significant effects enhancing the societal impact of the related research activities.

This topic implements the co-programmed European Partnership on 'People-centric sustainable built environment' (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership 'People-centric sustainable built environment' (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2023-D4-02-05: Supporting the creation of an accessible and inclusive built environment (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 10.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). ²²¹ . The funding rate is 60% of the eligible costs, except for non-profit legal entities where the funding rate is up to 100% of the total eligible costs.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

²²¹ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Improved accessibility²²² of the built environment for persons with disabilities and older persons, following a ‘design for all’ approach.
- Improved comfort for larger shares of the population.
- Increased uptake of accessible and inclusive active mobility solutions (walking and cycling) in support of healthy and sustainable lifestyles, while catering solutions for persons with reduced mobility.
- Improved sense of inclusiveness²²³ and social cohesion in larger shares of the population.
- Availability of a common evaluation and certification framework for accessibility and inclusiveness of the built environment²²⁴.
- Improved consideration of accessibility and inclusiveness in the transformation of the built environment towards sustainability, climate change mitigation and adaptation, in line with energy and climate ambitions.
- Reduced energy consumption and lifecycle GHG emissions of the facilities of the built environment.

Scope: The focus will be on the different facilities of the built environment (buildings, multi-modal hubs, public spaces and other infrastructure for people’s use) that are open to the public. Built environment professionals require support to design, plan, build and operate facilities that are accessible and inclusive. Design concepts should make these facilities accessible for persons with disabilities and fragile people, following an inclusive, ‘design for all’ approach.

Proposals are expected to address all of the following:

- Develop innovative methods to ensure and facilitate the implementation of accessibility at all stages of design and construction processes, as well as the monitoring and testing of results.
- Demonstrate (and where applicable produce) innovative planning and design tools for new and existing buildings and/or multi-modal hubs and/or public spaces and/or other infrastructure for people’s use with the triple aim of:
 - improving comfort (e.g. improving air quality, reducing noise or vibrations);

²²² Accessibility is meant as the removal and prevention of barriers that hinder the participation of persons with disabilities in society on equal basis with others. In this case the focus is on barriers in the built environment.

²²³ Inclusiveness is meant as environments that reflect the diversity of society with full respect of the human rights and fundamental freedoms of all inhabitants.

²²⁴ In line with relevant EU legislation (e.g., the European Accessibility Act Directive (EU) 2019/882) and European standards (e.g., EN 17210:2021).

- o making them accessible and inclusive for persons with disability and/or older persons;
 - o transforming the built environment towards sustainability (including social sustainability), climate change mitigation and adaptation, e.g. relying on nature-based solutions.
- Address the adaptability of the built environment over its lifecycle, to ensure flexibility for accessibility adaptations (e.g., in the case of changing needs of people with increasing disabilities and reducing mobility).
 - Make the facilities of the built environment under consideration more energy efficient overall, therefore reducing GHG emissions.
 - Ensure the involvement of persons with disabilities by means of a participatory approach.
 - Consider the possible creation of new job opportunities that are concerned with implementing, monitoring and maintaining accessibility of the facilities of the built environment.
 - Demonstrate the solutions in at least two demonstrators.
 - Where applicable, investigate solutions aiming at removing barriers, improving storage of (cargo-)bicycles, improving charging possibilities for electric (cargo-)bicycles in an inclusive way (e.g., considering the specific needs of older persons, multi-generational groups, and persons with disabilities).
 - Where applicable, design public spaces to promote soft and active modes of mobility through attractive, safe, and green infrastructure for healthier and environmentally friendly lifestyles, therefore lowering carbon emissions and noise pollution.
 - Where applicable, develop solutions to ensure the mobility of person with disabilities (including visually impaired users) inside buildings in an autonomous, ubiquitous, and pervasive way.
 - Where new digital tools are used in the built environment (including to address energy efficiency and comfort in buildings), ensure their accessibility for persons with disabilities and older persons.
 - Ensure the project's dissemination activities include actions targeted to contributing to the activities of the NEB Community, and to sharing information, best practice and results within the NEB Lab

Infrastructure such as motorways is excluded from the scope.

Participation of / co-creation with relevant societal stakeholders should be part of the action. To this end, this topic requires the effective contribution of SSH disciplines and the

involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise (including social innovation), to produce meaningful and significant effects enhancing the societal impact of the related research activities.

Proposals are expected to contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic implements the co-programmed European Partnership on ‘People-centric sustainable built environment’ (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership ‘People-centric sustainable built environment’ (Built4People) in support of the monitoring of its KPIs.

Call - Efficient, sustainable and inclusive energy use

HORIZON-CL5-2024-D4-01

Conditions for the Call

Indicative budget(s)²²⁵

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million) ²²⁶	Indicative number of projects expected to be funded
		2024		
Opening: 07 Dec 2023 Deadline(s): 18 Apr 2024				
HORIZON-CL5-2024-D4-01-01	IA	10.00	Around 5.00	2
HORIZON-CL5-2024-D4-01-02	IA	10.00	Around 5.00	2
HORIZON-CL5-2024-D4-01-03	IA	16.00	Around 5.30	3
Overall indicative budget		36.00		

General conditions relating to this call

²²⁵ The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.

The Director-General responsible may delay the deadline(s) by up to two months.

All deadlines are at 17.00.00 Brussels local time.

The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

²²⁶ Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

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<i>Admissibility conditions</i>	The conditions are described in General Annex A.
<i>Eligibility conditions</i>	The conditions are described in General Annex B.
<i>Financial and operational capacity and exclusion</i>	The criteria are described in General Annex C.
<i>Award criteria</i>	The criteria are described in General Annex D.
<i>Documents</i>	The documents are described in General Annex E.
<i>Procedure</i>	The procedure is described in General Annex F.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G.

Highly energy-efficient and climate neutral European building stock

Proposals are invited against the following topic(s):

HORIZON-CL5-2024-D4-01-01: Low-disruptive renovation processes using integration of prefabricated solutions for energy-efficient buildings

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 10.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology</i>	Activities are expected to achieve TRL 6-8 by the end of the project –

<i>Readiness Level</i>	see General Annex B.
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Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Reduction of on-site construction activities to 1-2 days per dwelling/building unit.
- Cost reduction of at least 25% compared to conventional renovation processes.
- Significant reduction of dust, noise and waste on the construction site compared to conventional renovation processes.
- Significant reduction in occupant disturbance during the renovation.
- Improved levels of occupancy comfort (e.g. Indoor Air Quality and Indoor Environmental Quality) after renovation.
- Reduction of negative impacts of renovation on biodiversity, considering adaptability as well (e.g. to climate change, different use, evolving societal needs, etc.) and resilience of buildings to disruptive events.

Scope: Low-disruptive renovation processes, using prefabricated modules that are quick and easy to apply can play an important role in increasing the renovation rate of the European building stock. Renovation processes should cover the whole workflow from design to offsite manufacture, installation, compliance checking on site and end strategies for maintenance, operation and end of life.

Proposals are expected to address all of the following:

- Develop streamlined processes for deep energy-efficient renovation to at least NZEB performance levels using prefabricated modules.
- Use relevant available technologies to reduce quality gaps between the off-site manufacturing and on-site deployment of prefabricated modules.
- Develop processes for seamless integration of prefabricated solutions into a variety of existing constructions (e.g. various existing wall materials, presence of balconies and overhangs, existing piping in the way etc.).
- Ensure the processes minimize the disturbance for building owners, tenants and users, through a considerable time reduction of on-site construction activities, reduced impact in terms of the unavailability of the building and its main functionalities, and a minimal impact on occupancy comfort during the renovation process.
- Include at least three demonstrations covering different building categories (residential or tertiary) and various building typologies, such as single or multi-storey, single or multi-use, etc.

- Demonstrate less-disruptive retrofitting processes that are more attractive and more cost-effective for building owners, tenants and users.

HORIZON-CL5-2024-D4-01-02: Smart grid-ready buildings

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 10.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Improved integration of buildings with energy carriers (e.g. electricity grid, district heating networks) and non-energy services (e.g. mobility).
- Improved buildings flexibility for grid and network management.
- Improved contribution of buildings to energy grid robustness with regard to dependencies to energy supplies.
- Increase in renewable energy production and storage at building level.
- Empowerment of end-users by having increased control over their buildings' energy services and contracts (consumption, production, storage, flexibility).
- Enhancement of the smart readiness of buildings as rated by the smart readiness indicator.

Scope: There is a need to deliver solutions to improve the interoperability of European buildings with energy carriers (e.g. electricity grid, district heating networks) and with non-

energy services (e.g. mobility). This will allow buildings to play an active role in the energy system integration.

Proposals are expected to address all of the following:

- Develop new or upgrade existing building-to-grid integration solutions and demonstrate them in real-life pilots. The developed solutions should provide a user-friendly interface for building users and other interested stakeholders (e.g. facility managers, portfolio managers, aggregators) that allow them increased control over the use of their buildings' energy services and contracts (consumption, production, storage, flexibility).
- Enhance interoperability between buildings and grids for electricity and other energy carriers (e.g. district heating networks, hydrogen, etc.) relying on available standards (e.g. SAREF).
- Enhance synergies between on-site energy storage (e.g. home batteries, e-vehicles, etc.) and on-site renewable energy sources.
- Explore solutions for facilitating data exchange between buildings and other grid actors (such as ESCOs, aggregators, DSOs, etc.).
- Develop and pilot innovative and competitive energy balancing, storage and generation services in buildings, while maximising building users' and occupants' comfort and satisfaction.
- Demonstrate the proposed solutions in at least three pilots. Ensure that the demonstrations:
 1. Cover at least three countries, addressing different electricity markets.
 2. Involve local and regional value chains, in particular SMEs, based on participatory approaches to increase innovation acceptability.
 3. Lead to clear and, where relevant, quantified and measurable indicators on the results achieved.
- Demonstrate economic viability of the proposed solutions and business models for consumers and the economic actors involved.

Projects should build on the results from relevant past and on-going projects, in particular those that seek to upgrade smartness of existing buildings relying on legacy equipment (LC-SC3-B4E-3-2020).

To ensure interoperability and integration into the grid, projects should make use of operational end-to-end architectures, digital platforms and other data exchange infrastructure for the energy system being developed under ongoing Horizon 2020, Horizon Europe, like the European Science Cloud, as well as under other EU programs such as the Digital Europe

Program, when addressing communication and data exchange between inverters and other components, other appliances and the electricity network.

The selected projects are expected to contribute to the BRIDGE initiative²²⁷, actively participate to its activities and allocate up to 2% of their budgets to that end. Additional contributions to the ‘Alliance for Internet of Things Innovation’ (AIOTI) and other relevant activities (e.g. clusters of digital projects and coordinating actions) might be considered, when relevant.

Industry

Proposals are invited against the following topic(s):

HORIZON-CL5-2024-D4-01-03: Alternative heating systems for efficient, flexible and electrified heat generation in industry

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.30 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 16.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the

²²⁷ <https://www.h2020-bridge.eu/>

	Research and Training Programme of the European Atomic Energy Community (2021-2025). ²²⁸ .
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Expected Outcome: Project results are expected to contribute to all the following expected outcomes, except where options are specified:

- Take full advantage of alternative heating systems for electrified, efficient and precisely focussed heat generation in industry, that create the possibility for new, decarbonised and flexible processes, reducing fossil fuel imports dependency, maximising primary energy savings and CO2 emission reduction compared to present state-of-the-art, demonstrated by LCA or similar studies (assuming decarbonised electricity use).
- Environmental and technical performances, health protection, safety and economic viability of novel heating technologies demonstrated and validated in industrial processes.
- Better awareness of the challenges and benefits of alternative heating systems in the relevant industrial sectors.

Scope: Alternative forms of energy such as for example ultrasound, microwaves, plasma, infrared, visible and ultraviolet radiations ... are unconventional and contactless heat sources, that create the possibility of new, efficient and flexible processes, in that they are applied precisely where they are needed and with shortened reaction times. They are key enablers for switching processes from fossil energy to renewable or low-carbon energy sources, and can contribute to increasing their energy efficiency, thereby reducing fossil fuel imports dependency.

They provide higher production flexibility, allowing variable throughputs to better follow market demand and enabling leaner production paradigms (e.g. decreased stock, production on demand), as well as flexibility for the electricity grid via demand response. Furthermore, such technologies are suitable for downscaling, which can be an advantage in some cases (e.g. local waste or biomass feedstock processing).

Note: the electrification of furnaces to heat large volumes at very high temperatures is not in the scope of this topic, because it is covered in Cluster4 work programme.

Further research and upscaling work is necessary to demonstrate their potential to be deployed on an industrial scale.

In order to reach this goal all the following development areas are expected to be covered:

- Cost effective and improved designs for at least two alternative heat sources technologies.

²²⁸ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Integration and demonstration of the system at industrial scale of at least one alternative heat source technology in at least on industrial process; demonstrate the financial viability and develop a business case.
- Make a preliminary estimation of the future equipment cost for at least one alternative heat source technology, in a total of at least three industrial applications (including the demonstrated application), to evaluate their economic potential.
- Make an analysis of the potential industrial deployment and related benefits (technical, economic, climatic, environmental) of at least one alternative heat source technology in three industrial sectors, in the EU and (if data are available) in the Associated States and, by extrapolation, at global level.
- Define an exploitation strategy. For proposals submitted under this topic, the plan for the exploitation and dissemination of results should include a strong business case and sound exploitation strategy, as outlined in the introduction to this Destination. The exploitation plans should include preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan) indicating the possible funding sources to be potentially used (in particular the Innovation Fund).
- Disseminate the technical and economic benefits, notably (but not only) to the communities of the relevant Horizon Europe private-public partnerships.

Call - Efficient, sustainable and inclusive energy use

HORIZON-CL5-2024-D4-02

Conditions for the Call

Indicative budget(s)²²⁹

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million) ²³⁰	Indicative number of projects expected to be funded
		2024		
Opening: 07 May 2024				

²²⁹ The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.

The Director-General responsible may delay the deadline(s) by up to two months.

All deadlines are at 17.00.00 Brussels local time.

The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

²³⁰ Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

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Deadline(s): 05 Sep 2024				
HORIZON-CL5-2024-D4-02-01	IA	16.00	Around 8.00	2
HORIZON-CL5-2024-D4-02-02	RIA	8.00	Around 4.00	2
HORIZON-CL5-2024-D4-02-03	IA	8.00	Around 4.00	2
HORIZON-CL5-2024-D4-02-04	RIA	8.00	Around 4.00	2
HORIZON-CL5-2024-D4-02-05	IA	10.00	Around 5.00	2
Overall indicative budget		50.00		

General conditions relating to this call	
<i>Admissibility conditions</i>	The conditions are described in General Annex A.
<i>Eligibility conditions</i>	The conditions are described in General Annex B.
<i>Financial and operational capacity and exclusion</i>	The criteria are described in General Annex C.
<i>Award criteria</i>	The criteria are described in General Annex D.
<i>Documents</i>	The documents are described in General Annex E.
<i>Procedure</i>	The procedure is described in General Annex F.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G.

Highly energy-efficient and climate neutral European building stock

Proposals are invited against the following topic(s):

HORIZON-CL5-2024-D4-02-01: Industrialisation of sustainable and circular deep renovation workflows (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per</i>	The Commission estimates that an EU contribution of around EUR 8.00 million would allow these outcomes to be addressed appropriately.

*Horizon Europe - Work Programme 2023-2024
Climate, Energy and Mobility*

<i>project</i>	Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 16.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). ²³¹ .

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Streamlining resource-efficient nearly zero-energy performance renovation processes.
- Renovations with reduction of at least 30 % waste, 25% cost, and 30% work time (to 1-2 days per dwelling/building unit), compared to current deep renovation processes.
- Reduced energy performance gap between as-built and as-designed (difference between theoretical and measured performance), and higher construction quality.
- Innovative, tailored business models for deep renovation, generating economies of scale and contributing to an increased rate of renovation.
- Improved comfort, Indoor Air Quality and Indoor Environmental Quality.

²³¹ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Scope: In line with the Renovation Wave and in order to meet long-term climate and energy targets, more action is needed to increase the rate and depth of building renovation. Several recent projects and calls have focused on prefabrication for deep renovation, but more work is needed to develop innovative, seamless workflows from design to off-site prefabrication, to installation, construction on-site, maintenance and future dismantling, reuse and recycling of prefabricated elements, duly considering life cycle performance, sustainability, and the potential to use the buildings as carbon sinks.

Proposals are expected to address all of the following:

- Investigate innovative approaches for industrialised deep circular renovation, covering the whole workflow from design through to off-site prefabrication, installation, construction on-site and strategies for maintenance, operation and end of life.
- Ensure the proposed approaches aim to achieve the highest level of energy performance (at least NZEB level) with a view toward zero-emission buildings, ensuring a high level of indoor environment quality, keeping costs in an attractive range for owners and investors.
- Make use of innovative processes and technologies, including those delivered by previous research, such as design based on circularity principles, prefabricated components, and digital tools that allow to optimise workflows (cost, time, quality, resource use).
- Demonstrate a seamless integration of the proposed approaches with state-of-the-art digital technologies for construction and renovation (Building Information Modelling, Digital Twins, etc.).
- Select processes and technologies that can be easily tailored to give a maximum potential for rapid and broad deployment at European level.
- Investigate innovative business models (e.g. as-a-service models), accounting for potential market and regulatory barriers, in view of mass deployment and Europe-wide impact.
- Apply the proposed workflows to at least three demonstrations to assess the proposed approaches for different buildings typologies representative of the European building stock, ensuring the most adequate coverage of the respective climatic conditions. The demonstrations can be either single buildings or clusters of buildings, and at least one of the demonstrations has to address residential buildings.
- Contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic implements the co-programmed European Partnership on ‘People-centric sustainable built environment’ (Built4People). As such, projects resulting from this topic will

be expected to report on results to the European Partnership ‘People-centric sustainable built environment’ (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2024-D4-02-02: Robotics and other automated solutions for construction, renovation and maintenance in a sustainable built environment (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 4.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 8.00 million.
<i>Type of Action</i>	Research and Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 4-5 by the end of the project – see General Annex B.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Reduction of construction and renovation time on-site (at least 40% reduction).
- Reduction of errors in construction and renovation works.
- Improved resource efficiency.
- Reduction of construction and renovation costs.
- Reduction of greenhouse gas emissions resulting from, and improved energy efficiency of the works on-site.
- Reduced environmental impact of construction works, including pollution, particulate matter²³² and noise, in the immediate vicinity.
- Reduction of waste generated from the works on-site.

²³²

<https://www.eea.europa.eu/help/faq/what-is-particulate-matter-and>

Scope: The transformation of the built environment should take place in a way that minimises the environmental impact of the works themselves. With the increasing rollout of highly energy efficient, sustainable buildings and deep renovation, there is a growing need for the development of robotic and automated solutions to support sustainable building construction, renovation and maintenance processes that are less disruptive, cleaner and faster.

Proposals are expected to address all of the following:

- Investigate the use of robotic systems (including those used for 3D printing) and automation for construction and deep renovation, in order to reduce time of construction and renovation works, reduce construction errors, as well as facilitate maintenance, also minimising the impact of the works on the surrounding built environment.
- Explore the potential for lower construction costs through automation and robotics resulting from increased speed, improved resource efficiency and avoidance of errors.
- Develop robotic and automated design and construction techniques that increase energy efficiency and reduce greenhouse gas emissions from construction and renovation works on-site.
- Develop approaches that use digitally assisted design to improve resource efficiency and safety, reduce waste, and reduce construction time.
- Investigate the use of automated technologies for surveying, inspection and monitoring of the site.
- Investigate the use of automated support to augment workers' capability and safety (e.g., lift robots, exoskeletons, automated construction site monitoring, use of augmented and virtual reality).
- Test and validate the prototyped solutions in at least three prototypes to assess the proposed approaches for a variety of buildings typologies representative of the European building stock. These prototypes should be validated in a lab or another relevant environment. The testing and validation are expected to address both new construction and renovation.
- Contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic implements the co-programmed European Partnership on 'People-centric sustainable built environment' (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership 'People-centric sustainable built environment' (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2024-D4-02-03: BIM-based processes and digital twins for facilitating and optimising circular energy renovation (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 4.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 8.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: The funding rate is 60% of the eligible costs, except for non-profit legal entities where the funding rate is up to 100% of the total eligible costs. Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). ²³³ .

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Reduced buildings construction and renovation time and costs.
- Increased buildings material reuse and recycling.

²³³ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Improvement of buildings performance (energy, sustainability including whole life-cycle carbon and the potential to store carbon in built works, comfort, health and well-being, and accessibility).
- Enhanced, interoperable and accessible buildings information across the lifecycle.
- Improvement of interoperability with existing Building Information Modelling (BIM) and Digital Twin solutions.
- Broader application of BIM and Digital Twin solutions, in particular within SMEs.

Scope: To improve Building Information Modelling and Digital Twinning over the full life cycle of buildings, including construction and renovation of buildings, towards enhanced energy efficiency and sustainability and in compliance with circular economy and resource efficiency principles.

Proposals are expected to address all of the following:

- Develop and integrate solutions based on BIM and Digital Twins to support the whole buildings life cycle from design to deconstruction and reuse, including operation.
- Ensure the solutions developed address all the following aspects:
 - Supporting optimal, adaptable and reversible building design for energy efficiency, circularity and sustainability.
 - Allowing to track buildings materials and construction products, and supporting cost-effective deconstruction and reuse, recycling and recovery of building materials at end of life.
 - Integrating buildings monitoring data (e.g. from sensors and IoT devices) into an interoperable Digital Twin for automated, optimised building performance monitoring and management, and preventive maintenance.
 - Enabling buildings data interoperability, quality and integrity across the life cycle, in particular to reliably assess and track building performance over the lifecycle, enabling tailored data access for all life cycle's stakeholders (architects, engineering companies, contractors, building owners, financing institutions, etc.).
 - Relying where possible on open BIM standards and linking, where relevant, to digital logbooks and relevant initiatives (e.g. the Smart Readiness Indicator under the Energy Performance of Buildings Directive).
 - Easiness of use and cost effectiveness, in particular for SMEs and companies with limited experience in digital solutions, and high potential for replication and commercialisation.

- Apply the solutions delivered on a set (at least two) of real-life residential and non-residential building construction and renovation projects which, taken together, allow to demonstrate the potential of the solutions across all aspects listed in the topic and across the life cycle.
- Ensure that the demonstrations of the solutions delivered:
 - o Cover at least two different countries, with diverse climatic conditions.
 - o Involve local and regional value chains, in particular SMEs, based on participatory approaches to increase innovation acceptability.
 - o Result in clear and, where relevant, quantified and measurable indicators on the improvements due to the use of the solutions, for all aspects listed in the topic and across the life cycle.
- Contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic implements the co-programmed European Partnership on ‘People-centric sustainable built environment’ (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership ‘People-centric sustainable built environment’ (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2024-D4-02-04: Design for adaptability, re-use and deconstruction of buildings, in line with the principles of circular economy (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 4.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 8.00 million.
<i>Type of Action</i>	Research and Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 5-6 by the end of the project – see General Annex B.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Improved adaptability of buildings and building units to new uses.
- Increased reuse and recycling of building elements and products.
- Extended service life of buildings.
- Increased awareness on best practices for design for adaptability, reuse and deconstruction.

Scope: Based on the integration of innovative tools, products and techniques, to enable construction and renovation that embeds the principle of extending the service life of buildings, and facilitate adaptability to changing user needs (e.g. for optimal use of indoor space or to improve working and living conditions), reuse, and deconstruction, in a life-cycle optimisation and circular economy perspective.

Proposals are expected to address all of the following:

- Validate construction and renovation solutions based on the integration of innovative tools, products, techniques, processes and methods, that facilitate deconstruction and reuse, based on life-cycle approaches across the value chain.
- Ensure the solutions validated:
 - o Consider the adaptability and reversibility of buildings and building units to changing uses, and to other relevant factors (e.g. evolution of surroundings).
 - o Improve the ease of reuse of construction elements and products from existing buildings, also facilitating recycling when reuse is not possible.
 - o Develop building elements and products that can be disassembled and reused, including those made from CO₂-storing materials such as sustainably sourced long-lived bio-based materials and products and, innovative lower emission materials /aggregates.
 - o Address all components of buildings, including structural elements, envelopes, interior fixtures and fittings, and technical building systems.
 - o Are rooted in local and regional value chains, based on participative approaches for social acceptability of innovation, in particular with regard to the workforce's practices and skills.
 - o Can flexibly adapt to local / regional sourcing of innovative products and materials to increase replication.
 - o Address climate change mitigation, minimising emissions.

- o Allow to minimise any negative impacts of pollution and biodiversity loss from renovation and construction works.
- Validation of the solutions in a relevant environment (real-life or close to real-life) that:
 - o Covers residential and non-residential projects, half of which at least should be renovation projects.
 - o Covers at least two different countries, with diverse climatic conditions.
 - o Involves local and regional value chains, in particular SMEs, based on participatory approaches to increase innovation buy-in from users.
 - o Results in clear and, where relevant, quantified and measurable indicators on the improvements due to the use of the solutions.
- Deliver guidance and recommendations for technology providers, regulatory authorities, certification and standardisation bodies, and define and implement ambitious dissemination actions, to promote the approaches demonstrated and support their replication.
- Where relevant, contribute through specific and targeted actions to standardisation and regulatory evolutions that can foster reuse and deconstruction of buildings materials and products.
- Contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities.

This topic implements the co-programmed European Partnership on ‘People-centric sustainable built environment’ (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership ‘People-centric sustainable built environment’ (Built4People) in support of the monitoring of its KPIs.

HORIZON-CL5-2024-D4-02-05: Digital solutions to foster participative design, planning and management of buildings, neighbourhoods and urban districts (Built4People Partnership)

Specific conditions	
<i>Expected EU contribution per project</i>	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a

	proposal requesting different amounts.
<i>Indicative budget</i>	The total indicative budget for the topic is EUR 10.00 million.
<i>Type of Action</i>	Innovation Actions
<i>Eligibility conditions</i>	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
<i>Technology Readiness Level</i>	Activities are expected to achieve TRL 6-8 by the end of the project – see General Annex B.
<i>Legal and financial set-up of the Grant Agreements</i>	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). ²³⁴ .

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- Greater engagement of representative groups of end users as well as citizens of the impacted urban context.
- Increased acceptability and uptake of sustainable deep renovation solutions in the built environment.
- Reduced energy and mobility poverty.
- Increase in plans for climate neutral and sustainable, aesthetic and inclusive built environments with enhanced climate adaptation and resilience (e.g. based on nature-based solutions).
- Enhanced climate change adaptation and resilience in built environments.

²³⁴ This [decision](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf) is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under ‘Simplified costs decisions’ or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Scope: The transition to a climate-neutral society requires that Europe's building stock also becomes climate-neutral. At the same time, Europe's building stock has to become climate resilient. This requires a comprehensive approach beyond individual buildings, namely at the level of neighbourhoods or urban districts. However, the decarbonisation of the built environment and its adaptation to a changing climate and to societal needs in terms of comfort, accessibility, inclusiveness, and aesthetics cannot happen without active participation of the buildings' users and occupants, individual / collective property owners, and energy communities as beneficiaries of the value chain. Professionals, such as project developers, architects, engineers, building owners, planners and statutory authorities, require solutions that develop, analyse, model, visualise and present a multitude and complex set of information in such a way that facilitates such co-design processes. This topic focuses on the development of digital solutions for a stronger participation of end users, citizens and other relevant stakeholders in the design, planning and management of the renovation of existing buildings, neighbourhoods and / or districts.

Proposals are expected to address one or both of the following points:

- Digital solutions that facilitate participative design and planning through visualisation, analysis and engagement with data that is directly relevant to building users as well as citizens in the surrounding urban area (including e.g. immersive and interactive technologies, Virtual Reality / Augmented Reality, simulations and scenario modelling).
- Digital solutions that allow to analyse and model different scenarios for to-be-renovated buildings, neighbourhoods and / or districts in terms of energy use and generation; users' health and wellbeing; impact on the energy grid; provisions for active and electric mobility, and sustainable delivery solutions; life-cycle environmental and micro-climatic impacts, and; socio-economic impacts for citizens, building users, owners and occupiers.

In addition, proposals are expected to address all of the following:

- Address aspects of climate-neutrality and climate-resilience, respecting the 'energy efficiency first' principle.
- Ensure the digital solution complements, builds on and/or uses existing tools (including, where relevant, on conventional, low-tech ones) and standards recognised by the market.
- Engage citizens (seeking coverage of different genders and social characteristics), end users of the tools and other relevant stakeholders involved in the design, planning and management of urban development projects in the development process of the digital solution.
- Ensure the digital solution offers different means to exchange information and provide input that are tailored to the specific needs of laypersons, including vulnerable, minority and disadvantaged groups as well as persons with disabilities and older persons.

- Demonstrate the prototype in at least three real-life urban development projects to apply, evaluate and refine the digital solution and inform its market launch and / or commercialisation strategy.
- Ensure the project's dissemination activities include actions that contribute to the activities of the NEB Community, and to sharing information, best practices and results within the NEB Lab.
- Contribute to the activities of the Built4People partners and to the Built4People network of innovation clusters.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise (including social innovation), in order to produce meaningful and significant effects enhancing the societal impact of the related research activities.

This topic implements the co-programmed European Partnership on 'People-centric sustainable built environment' (Built4People). As such, projects resulting from this topic will be expected to report on results to the European Partnership 'People-centric sustainable built environment' (Built4People) in support of the monitoring of its KPIs.