

Special report

Smart cities

Tangible solutions, but fragmentation challenges their wider adoption



EUROPEAN
COURT
OF AUDITORS

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Executive summary

I Three-quarters of EU citizens live in urban areas, which are central economic players and a major source of pollution. By using technological innovation, cities and towns can improve how they are managed and contribute to achieving the EU's priorities of the Green Deal, advancing digital technology, and promoting an economy that benefits people. Smart cities can bring benefits to citizens and businesses by reducing their carbon-footprint and transforming traditional processes and services.

II In the 2014-2020 period, the Commission managed various programmes and initiatives supporting smart-city projects. In the area of research and innovation, these included the Horizon 2020 Lighthouse programme, worth approximately €400 million.

III The Commission's current flagship initiative (2021-2027) in this area is the Horizon Europe Mission on Climate-Neutral and Smart Cities, which aims to support 100 EU cities in becoming climate neutral by 2030 and serving as role models so that all EU cities can follow suit by 2050.

IV Our audit assessed whether the Lighthouse programme achieved its goals and helped EU cities in their efforts to become smarter, and whether the Commission applied the lessons learned to the Mission on Climate-Neutral and Smart Cities. By doing so, we aimed to contribute to the implementation of this new EU initiative, following its mid-term evaluation planned for 2023.

V Our overall conclusion is that the Lighthouse programme has helped cities in their efforts to deploy smart-city solutions and become smarter. Still, the lack of coordination between EU initiatives and public and private funding may hinder the wider adoption of these solutions beyond the participating cities.

VI We found that the Commission designed the Lighthouse programme well, and provided support to the projects, meeting the needs of EU cities and other stakeholders consulted. However, a lack of appropriate indicators, targets, and plans to assess the replication of project solutions, means that the Commission cannot properly measure its overall impact.

VII We found that the closed Lighthouse projects delivered positive results and met the majority of their expected targets. However, the Lighthouse projects faced challenges in engaging with citizens, which resulted in changes and delays to some of them.

VIII We noted that the present level of coordination between the Lighthouse projects and the Mission on Climate-Neutral and Smart Cities does not allow for the full exploitation and replication of project solutions. And although the Mission aims to coordinate various EU initiatives in the field of smart city and urban development, the available funding is not clear, and it is too early to assess its impact.

IX We recommend that the Commission should:

- take stock of the funding capacity of the Mission cities and support those with funding weaknesses;
- ensure adequate citizen engagement in future urban demonstration projects;
- assess the replication of Lighthouse projects; and
- better coordinate the Lighthouse programme with the Horizon Europe Mission on Climate-Neutral and Smart Cities.

Introduction

The need for research and innovation investment in smart cities

01 The EU is highly urbanised, with nearly 75 % of its citizens living in cities and towns and 80 % expected to do so by 2050¹. Cities and metropolitan areas, as well as being central economic players, are also major sources of greenhouse gases, air, water, and soil pollution. Using technology to improve how cities are managed, can help achieve three of the EU's priorities: [the Green Deal](#), [a focus on digital technology](#), and [an economy that benefits people](#).

02 In a smart city, sustainable urban development is achieved through “new, efficient, and user-friendly technologies and services, in particular in areas of energy, transport, and ICT”². As well as using technology to save resources and reduce pollution, a smart city also aims to make city services more responsive and accessible, make public spaces safer, and improve transportation, water and waste management, street lighting, and heating in buildings.

03 Cities become smart by deploying innovative technologies, establishing new business models, management practices and development strategies, and adopting supportive governance frameworks and regulations. All this is only possible through appropriate research and innovation (R&I) investment. [Table 1](#) provides a non-exhaustive list of key features and enabling technologies of smart cities.

¹ European Environment Agency, [Urban adaptation in Europe: how cities and towns respond to climate change](#), 2020.

² [Horizon 2020 Work Programme 2014-2015](#).

Table 1 – Key features and enabling technologies of smart cities

FEATURES	ENABLING TECHNOLOGIES
<ul style="list-style-type: none"> • Energy efficiency and green energy • Water and waste reuse • Public safety • Innovative education and healthcare • Green buildings/housing • Efficient mobility and public transport • Innovative citizen services • Climate and stress resilience • Social inclusion • e-Governance • Transparency and privacy protection 	<ul style="list-style-type: none"> • Internet of Things • AI and machine learning • Data analytics • 5G • Smart sensors • Data governance and security • E-government tools • New materials for energy efficiency • Smart grids • Energy storage and renewable energy technologies • Geospatial technology

Source: ECA.

EU smart-city initiatives 2014-2020

04 Several sectoral policies and initiatives in the period 2014-2020 contributed to defining and implementing the EU's R&I strategy on smart cities. The most relevant ones include:

- [Horizon 2020](#), which set overarching goals and provided funding for innovative urban R&I projects;
- the [European Innovation Partnership for Smart Cities and Communities](#) (and its successor, the Smart Cities Marketplace), which brought together EU industries and cities to align public and private R&I agendas and promote collaborative initiatives; and
- the [European Strategic Energy Technology Plan](#), which promotes cooperation among EU countries, companies, and researchers on low-carbon technologies and climate-neutral energy systems.

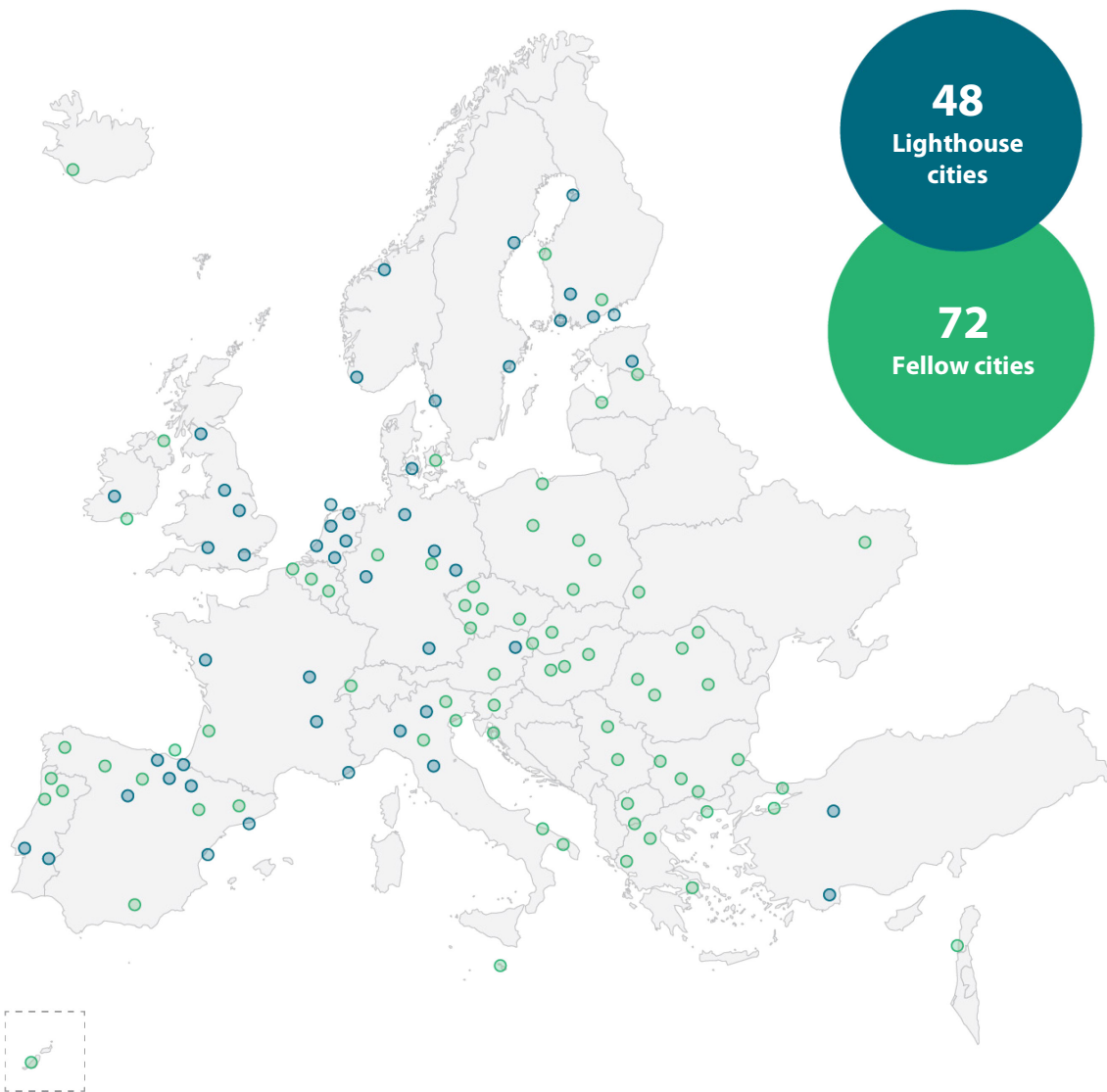
05 Urban R&I projects were featured in all Horizon 2020 pillars and specific objectives. The programme's third pillar ('Societal challenges') supported cross-sectoral projects to demonstrate innovative urban technologies and services, governance approaches, and management solutions through dedicated 'Smart Cities and Communities' calls for project proposals.

06 The ‘Smart Cities and Communities’ calls for proposals supported 18 ‘Lighthouse projects’, collectively referred to in our report as the ‘Lighthouse programme’, which:

- bring together city authorities, public and private companies, and researchers under project consortia of between 22 and 53 partners;
- endeavour to engage and empower citizens in demonstrating smart-city solutions;
- are led by two to three ‘Lighthouse cities’, where new technologies and solutions are demonstrated, and involve at least two ‘Fellow cities’, which replicate the demonstrated solutions at the end of the project (the Lighthouse projects do not fund this replication); and
- are part of larger urban plans.

07 The overall Horizon 2020 funding granted to Lighthouse projects amounts to €381 million. The value of supported projects, including co-funding, amounts to €446 million (see [Annex I](#)). The 18 Lighthouse projects involved or still involve 48 Lighthouse cities, 72 Fellow cities, and 515 other partners (see [Picture 1](#) and [Annex II](#)). The participating cities are spread over 24 member states. No cities from Cyprus, Lithuania, and Luxembourg participated in the Lighthouse programme.

Picture 1 – Lighthouse and Fellow cities



Source: ECA.

08 The Innovation and Networks Executive Agency (INEA) managed the selection of the Lighthouse projects, under the supervision of the Directorates-General for Energy, Mobility and Transport, and Communications Networks, Content and Technology. The European Climate, Infrastructure and Environment Executive Agency (CINEA), which superseded INEA on 1 April 2021, monitors the projects' implementation. For readability, we use 'CINEA' in this report to refer to both agencies.

EU smart-city initiatives 2021-2027

09 The Commission currently manages or contributes to a broad set of initiatives with and for cities. The flagship R&I initiative in this field is the Horizon Europe Mission on Climate-Neutral and Smart Cities ('the Mission'), which aims to deliver 100 climate-neutral cities by 2030 and ensure that all EU cities follow suit by 2050³. In April 2022, the Commission selected 100 cities from EU member states and 12 cities from [Horizon Europe associated countries](#) to participate in the Mission ('Mission cities'). Of these, 51 cities participate in the Lighthouse projects.

10 In October 2021, the Commission launched the Mission Platform, managed by the NetZeroCities project. The platform provides technical, regulatory, and financial assistance to the 'Mission cities'. It also supports interested cities, including those other than 'Mission cities', through a series of pilot actions, funding opportunities, and peer-learning services.

³ [Communication on European Missions, 29 September 2021.](#)

Audit scope and approach

11 The audit assessed the design and implementation of the Horizon 2020 Lighthouse programme and whether the programme has achieved its goal of helping EU cities become smarter effectively. We also assessed whether the Commission applied the lessons learned from the programme to the design and implementation of the Mission on Climate-Neutral and Smart Cities, a flagship initiative introduced in Horizon Europe. Our audit work covered the period from July 2012 to December 2022.

12 We decided to conduct this audit because the Lighthouse programme is a large urban demonstration initiative newly introduced in Horizon 2020. We expect our findings to be useful in the context of the mid-term evaluation of the Mission on Climate-Neutral and Smart Cities planned for 2023.

13 Our audit focused on whether:

- the Commission designed the Horizon 2020 work programmes containing the Lighthouse projects appropriately;
- the Lighthouse projects helped EU cities become smarter, through deploying innovative smart-city solutions;
- the participating cities replicated the smart-city solutions demonstrated through the projects;
- the Commission supported the Lighthouse projects adequately; and
- the Commission monitored the Lighthouse projects appropriately and applied the lessons learned to Horizon Europe and the Mission.

14 We reviewed the Commission's role in designing and managing the Lighthouse programme and assessed EU smart-city policies, programmes, and support services through meetings with the Commission and CINEA, and by analysing available documentation.

15 We assessed all 18 Lighthouse projects through:

- written questionnaires and meetings with the project coordinators and other project partners;

- analysis of available project documentation, notably grant agreements, periodic and continuous reports, and assessment reports; and
- analysis of the data contained in the Commission's eGrants database.

16 We held discussions with representatives from 15 cities, which we selected to reflect the population of participating cities while ensuring diversity in terms of:

- type of city (11 Lighthouse cities and four Fellow cities);
- role in the project (eight project coordinators and seven project partners);
- geographic location (cities from nine different countries); and
- size (three cities with a population of more than 1 million people; seven with a population between 0.5 and 1 million people; and five with a population of less than 0.5 million people).

17 We surveyed Lighthouse project participants, collected replies from 40 cities (20 Lighthouse and 20 Fellow cities) and 52 other participants (see [Annex III](#)), held discussions with experts in the field of smart cities, and assessed the relevant literature. The audit work did not include interviews with individual citizens, civil organisations, or interest groups, but included direct evidence from city representatives, project coordinators, partners, and experts across 15 representative cities participating in the programme.

Observations

The Lighthouse programme, while generally well-designed, is part of a fragmented landscape of measures

18 Lighthouse projects are large urban-demonstration initiatives that should reflect the collaborative and cross-sectoral nature of smart-city initiatives. By design, they should innovatively integrate close-to-market technologies from different fields to test and replicate solutions and business models.

The design of the Lighthouse programme responds to EU cities' needs

19 We found that the Lighthouse programme was well-designed overall. It brought together multiple smart-city stakeholders, in line with the cross-sectoral nature of smart-city projects, and addressed the goals of EU smart-city initiatives (see paragraphs **02**, **03** and **18**). The Commission, through the work of the European Innovation Partnership for Smart Cities and Communities and the European Strategic Energy Technology Plan, consulted various stakeholders, including cities, private companies, researchers, and citizens. It then included the outcome of these consultations when designing the Lighthouse programme, the Horizon 2020 multiannual work programmes, and the calls for proposals to select the Lighthouse projects.

20 The European Innovation Partnership for Smart Cities and Communities (see paragraph **04**) included experts on smart cities in its governance bodies and engaged with hundreds of stakeholders through action groups. It produced a strategic implementation plan, which identified three areas for action: sustainable urban mobility, sustainable districts and built environment, and integrated infrastructures and processes across energy, ICT, and transport. The Commission included these areas in the Horizon 2020 work programmes, and all 18 Lighthouse projects addressed them.

21 The Working Group on Smart Cities and Communities, established under the European Strategic Energy Technology Plan, engaged representatives of cities, industry, research organisations, and citizens from fifteen member states and two [Horizon 2020-associated countries](#). It defined ‘positive energy districts’ (i.e., a district with an annual positive energy balance and net zero CO₂ emissions) and prepared an implementation plan for deploying and replicating such districts in the EU⁴. The Commission then included these concepts in its 2018-2020 Horizon 2020 work programme and calls for proposals. Accordingly, the funded Lighthouse projects were designed in such a way to contribute to the goal of the European Strategic Energy Technology Plan of establishing 100 positive energy districts in Europe by 2025.

22 Following the general provisions of Horizon 2020, the multiannual work programmes defined the eligibility and selection criteria for the 18 Lighthouse projects. Annual calls for proposals from 2014 to 2020 invited consortia from the EU and the [Horizon 2020-associated countries](#) to submit project proposals. External experts, contracted and supervised by CINEA, then assessed and ranked these proposals based on three criteria: excellence, impact, and quality and efficiency of implementation.

The Lighthouse programme lacks quantitative indicators and targets to assess impact

23 The Horizon 2020 multiannual work programmes defined the impacts the Commission expected the Lighthouse projects to achieve. While these impacts evolved (see [Table 2](#)), the work programmes described them in general terms without including overall quantitative indicators and targets. Such indicators and targets would have steered the actions of the Lighthouse programme and those of the individual Lighthouse projects. They would also have made it possible to measure their progress and assess their impact.

⁴ SET Plan ACTION n°3.2 Implementation Plan.

Table 2 – Main impacts expected from the Lighthouse projects

2014 - 2015

- Deploy innovative and replicable energy, transport and ICT solutions, and trigger large-scale economic investments.
- Increase energy efficiency and the use of renewables, while making the energy system more secure and cheaper.
- Increase mobility efficiency with lower emissions of pollutants and CO₂, and increase overall air quality.
- Increase quality of life by creating local jobs.

2016-2017

- Put into practice bankable solutions to identified city challenges and reduce technical and financial risks to support their replication.
- Increase energy efficiency on a district scale, promote renewables and make the energy system more secure and cheaper.
- Ensure the rollout of electric vehicles in cities, reduce transport-based CO₂ emissions, and increase overall air quality.

2018 - 2020

- Meet EU climate mitigation and adaptation goals, and national/local energy, air-quality and climate targets.
- Promote large-scale roll out of positive energy districts.
- Promote energy efficiency and increase the proportion of renewables, waste heat recovery and storage solutions.
- Increase the uptake of e-mobility solutions.

Source: ECA, based on Horizon 2020 work programmes.

24 The calls for Lighthouse project proposals invited consortia to set their own project-specific impact indicators, targets, and monitoring practices. While the funded Lighthouse projects share some goals, notably for reducing energy consumption and CO₂ emissions, they largely differ in their quantitative indicators and targets, baselines used for comparative indicators, and monitoring methodologies. Such data heterogeneity poses limitations for the Commission in properly measuring the programme's overall impact.

25 Unlike the Lighthouse programme, the Mission sets quantitative indicators and targets and has a defined timeframe for achieving them (see paragraph 09). The Commission also intends to provide the Mission cities with a pre-defined monitoring and reporting system. The Mission was designed in a way that could overcome the limitations of the lighthouse programme. However, it is too early to assess its implementation (see paragraphs 23 and 24).

The Lighthouse programme is part of a fragmented landscape of EU initiatives for cities, with limited coordination

26 In the 2014-2020 period, the Commission managed or supported more than 50 initiatives, including funding instruments and support actions, directly or indirectly relevant to urban development (see [Annex IV](#)).

27 Twelve Commission directorates-general and three executive agencies launched, managed, and monitored these initiatives and continue to manage and monitor those that are still ongoing. In the field of R&I, the Directorates-General for Research and Innovation, Energy, Mobility and Transport, and Communication Networks, Content and Technology played a leading role, along with CINEA. In addition, the Directorate-General for Regional and Urban Policy, under shared management with the member states, monitored the deployment of structural funds supporting investment in urban development.

28 The Commission established direct links between the Lighthouse programme and some other initiatives of potential relevance to Lighthouse and Fellow cities, notably the European Innovation Partnership on Smart Cities and Communities (see paragraph [20](#)), the European Strategic Energy Technology Plan (see paragraph [21](#)), the Scalable Cities Group (see paragraph [54](#)), and the Smart Cities Marketplace (see paragraph [55](#)).

29 However, an overall strategy guiding and linking other EU initiatives on smart cities and urban development was missing. As a result, limited coordination existed between the Lighthouse programme and funding instruments and initiatives other than those listed in paragraph [28](#). From our assessment of the Horizon 2020 work programmes and interviews with cities, Commission officials and CINEA project officers, we noted, in particular, that the Commission did not establish links between the Lighthouse programme and other funding instruments or provide Lighthouse and Fellow cities with information on such instruments. Moreover, no formal cross-departmental governance structure existed within the Commission for coordinating EU funding instruments and other initiatives concerning smart cities or urban development. The absence of an overall strategy is particularly significant, given that funding for the replication of the solutions is not included in the design of the Lighthouse programme.

30 The Mission intends to coordinate various EU initiatives in the field of smart city and urban development and, through the Mission Platform (see paragraph [10](#)), help cities pool funding from multiple public and private sources. However, it is currently too early to assess whether the Commission's actions will effectively support the Mission to achieve this goal.

The Lighthouse projects have delivered tangible results but have faced numerous challenges

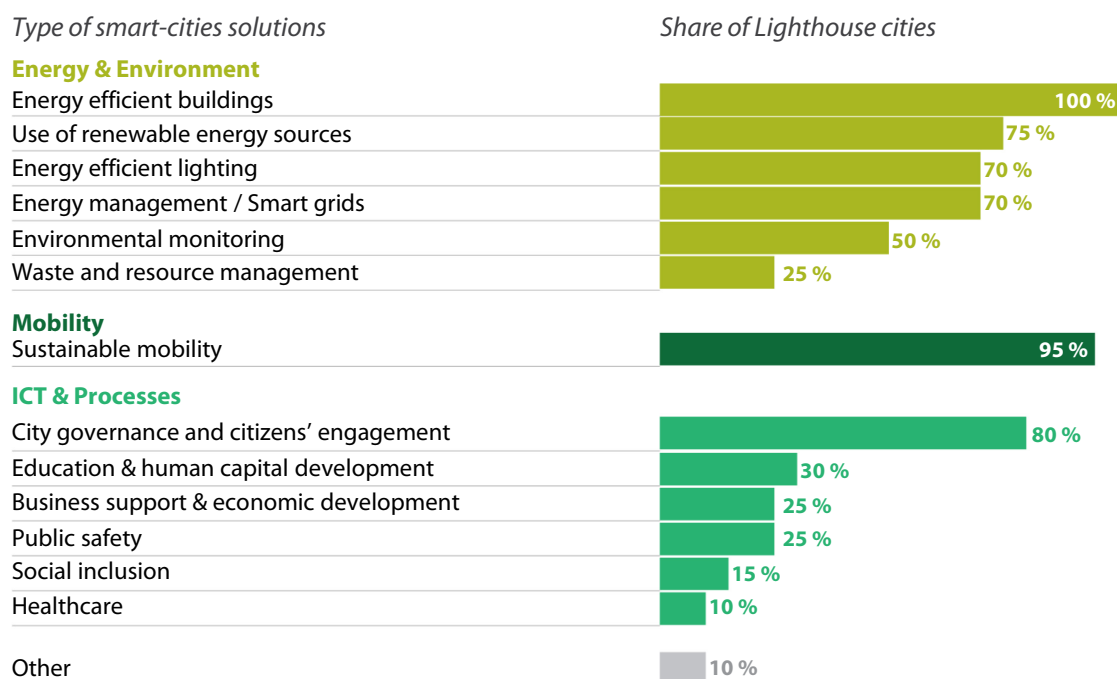
31 The Lighthouse projects' aim is to demonstrate innovative urban solutions in Lighthouse cities and promote their replication in both Lighthouse cities and Fellow cities. To achieve this, the participating cities need to engage all relevant stakeholders of the smart-city ecosystem, notably their citizens.

The closed Lighthouse projects have delivered tangible results and mostly met their individual targets

32 Though it is difficult to isolate single solutions, our analysis of the grant agreements and implementation reports of 16 projects allowed us to identify several hundred smart-city solutions planned in Lighthouse cities. We found that the majority of these solutions related to energy.

33 [Figure 1](#) shows various types of solutions and the share of Lighthouse cities that introduced or will introduce them, thanks to the projects audited. [Box 1](#) provides examples of such solutions.

Figure 1 – Types of smart-city solutions and the share of Lighthouse cities introducing them



Source: ECA survey.

Box 1

Examples of smart-city solutions deployed by the Lighthouse projects

BARCELONA (Spain) – The city of Barcelona demonstrated a ‘smart tower’ solution, which transforms lampposts into distributed urban telecom hubs and enhances wireless network connections. The towers provide an open-source connectivity infrastructure that can host different types of sensors, including those for air-quality or traffic monitoring. This solution responds to the growing demand for connectivity and enables Internet-of-Things functionalities. The municipality installed nine towers as part of the ‘GrowSmarter’ project, which served 2 200 users and handled 55 GB of data per month. After the end of the project, it started installing more towers in other parts of the city.



Smart tower in Barcelona.

DRESDEN (Germany) – As part of the ‘MAchUp’ project, the city of Dresden deployed a new thermal storage solution at the Reick Innovation Power Plant to increase its district heating efficiency. The installed thermal storage consists of 20 pressure vessels for a total water capacity of 7 800 m³, in addition to the 6 600 m³ already installed. The newly expanded unit gives greater flexibility in energy supply and optimises power plant operation, thus cutting annual CO₂ emissions by more than 7 300 tonnes. In the long term, this will make storing green heat from renewable energy sources possible, guaranteeing even greater environmental benefits.



Thermal storage at the Reick Innovation Power Plant, SachsenEnergie, Killig 2021.

ROTTERDAM (Netherlands) – As part of the ‘Ruggedised’ project, RET, the Rotterdam public transport operator, developed a planning software to optimise the charging schedules of its electric buses. The software uses real-time information on bus batteries and urban traffic to optimise bus trips and reduce overall consumption while keeping to timetables. RET plans to upscale this solution to its entire Rotterdam bus fleet, which by 2030 should entirely consist of electric buses.

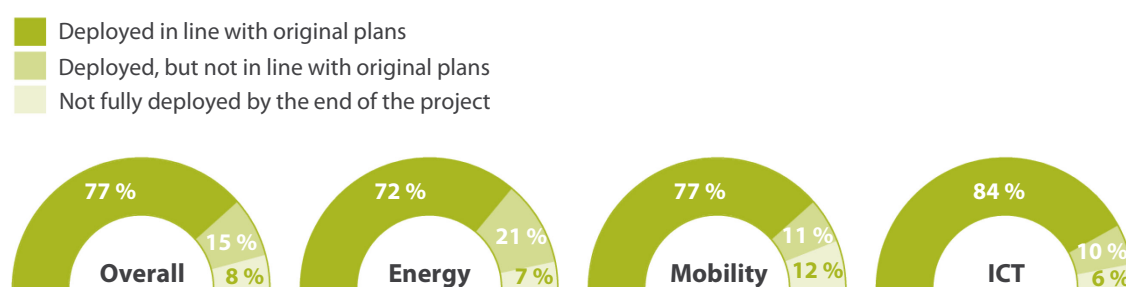


Electric buses in Rotterdam.

34 By the end of 2022, nine of the 18 Lighthouse projects had been closed. As for the remaining projects, barring delays, four were expected to finish in 2023, four in 2024, and one in 2025. We analysed the nine closed projects (see [Annex I](#)) to determine the number of solutions that were:

- deployed in line with the original plans included in the grant agreements;
- deployed, but not in line with the original plans; and
- not fully deployed by the end of the project (see [Figure 2](#)).

Figure 2 – Deployment of solutions in Lighthouse cities (overall and by area of application)



Source: ECA, based on reports, questionnaires and interviews with project coordinators and cities.

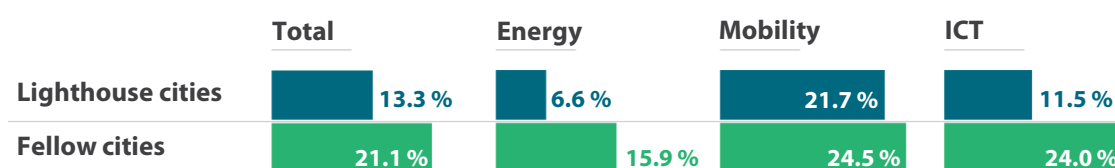
35 Regarding the expected deliverables for the 18 projects, the grant agreements included project-specific qualitative and quantitative goals. These included, for example, deploying a mobility IT platform, increasing the use of renewables, reducing energy bills (qualitative goals), 30 % energy saving on refurbished buildings, and CO2 emission reduction by 5 000 tonnes/year (quantitative goals).

36 While it was not possible to aggregate data and calculate overall performance levels for the Lighthouse programme (see paragraph 24), we analysed official reports to check whether individual Lighthouse projects had achieved the targets included in the grant agreements, like reducing energy consumption and CO2 emissions and increasing the use of renewable energy sources. This analysis only covered seven closed projects for which sufficiently detailed information was available. Nevertheless, we found that these projects had achieved or exceeded approximately two-thirds of their expected targets. And one-third of the targets, notably on energy savings and CO2 emission reduction, were partially achieved.

Replication of smart-city solutions within project consortia has started, but significant obstacles exist

37 By analysing the project reports and collecting information from the project coordinators and cities of the nine closed projects, we assessed how many planned project solutions had been replicated by other cities, even though replication can take years and many projects are either recently completed or still ongoing. [Figure 3](#) summarises the results of our assessment.

Figure 3 – Proportion of planned project solutions replicated in Lighthouse and Fellow cities (overall and by area of application)

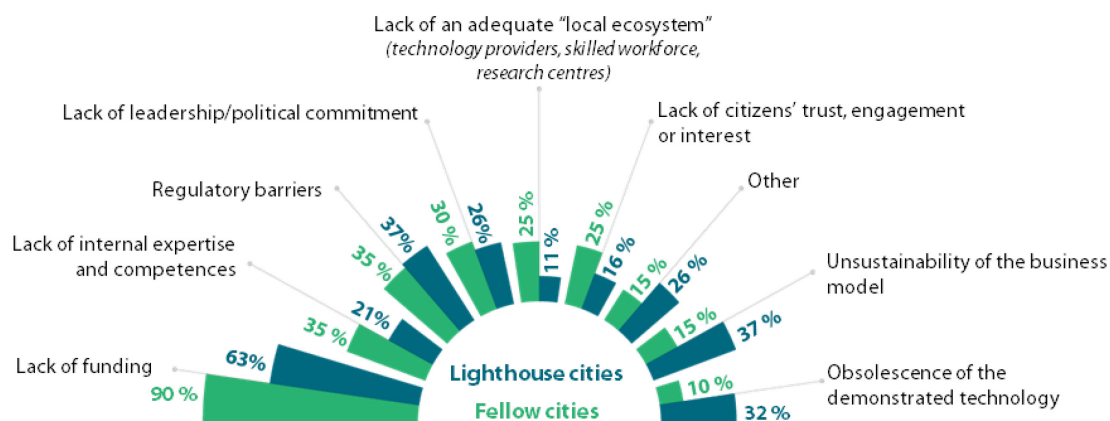


Source: ECA, based on reports, questionnaires and interviews with projects coordinators and cities.

38 The Lighthouse cities that replied to our survey declared plans to replicate 59 % of the project solutions. And 90 % of the Fellow cities declared their intention to replicate at least one solution demonstrated by their Lighthouse project.

39 [Figure 4](#) provides an overview of the most frequent obstacles to replicating project solutions and the percentage of cities that have experienced them. The perception that a lack of private and public funding is a key obstacle to solutions being replicated is linked to the fact that the Lighthouse programme does not finance such replication and also the lack of sufficient coordination with other initiatives (see paragraph [29](#)). In addition, the immaturity of some project solutions also contributes to the lack of private funding (see paragraph [59](#)).

Figure 4 – Proportion of Lighthouse and Fellow cities experiencing obstacles to replicating project solutions



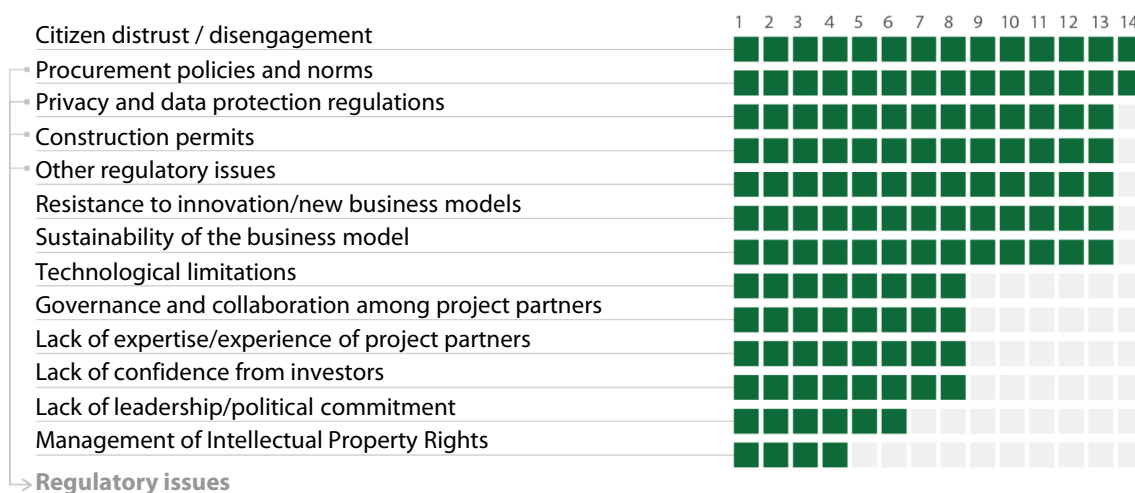
Source: ECA survey.

40 The grant agreements require the Lighthouse projects to share their activities and outcomes with the public, notably with potentially interested cities. This information sharing encourages others to replicate the project solutions beyond the Lighthouse project partners. However, it is too early to assess if the project outcomes will be replicated by others beyond the Lighthouse project consortia (see paragraph 37).

The challenges encountered by Lighthouse projects have led to substantial delays

41 The Lighthouse projects operate in complex and ever-changing urban environments. As a result, the Lighthouse cities faced several challenges that delayed the deployment of the planned solutions and, in some cases (see paragraph 34), led to the re-design or cancellation of solutions. [Figure 5](#) lists the types and frequency of such challenges. [Box 2](#) illustrates some of them with concrete examples.

Figure 5 – Number of Lighthouse projects facing identified challenges



Source: Questionnaires, meetings with project coordinators, and reports of the 18 Lighthouse projects.

Box 2

Examples of challenges faced by cities

TRENTO (Italy) – As part of the ‘Stardust’ project, the city of Trento wanted to retrofit three social housing condominiums comprising 156 apartments and equip them with innovative renewable energy solutions. The construction work faced several delays, mainly due to “red tape”, and completely stopped when the Italian government, in response to the COVID-19 crisis, approved the ‘110 % super bonus’. This special tax relief measure provided a 110 % tax credit on expenses incurred to increase the energy efficiency of buildings. Since the ‘super bonus’ provided higher incentives than Horizon 2020, some private apartment owners declined the offer of the ‘Stardust’ project and opted for a more conservative retrofitting solution.

UTRECHT (Netherlands) – As part of the ‘IRIS’ project, a social housing company in Utrecht planned to retrofit 12 apartment buildings but faced opposition from citizens. In the low-income and multicultural district selected for the demonstration activities, a mismatch emerged between the citizens’ basic needs for school proximity, affordable food and safety, and the project’s goal of deploying smart technologies for increased energy efficiency. So, the project partners appointed local ambassadors, who went door-to-door to explain the proposed solutions, and organised school information sessions to reach parents through their children. Eventually, the project succeeded in retrofitting four of the 12 original buildings and replaced the remaining eight with new ones.



Retrofitted building in Utrecht.

VIENNA (Austria) – As part of the ‘Smarter Together’ project, the city of Vienna demonstrated multiple e-mobility solutions to reduce energy demand, fossil fuel consumption, and CO₂ emissions, while improving mobility for residents and businesses. One solution was an e-car sharing service for social housing neighbourhoods. However, since the business model for this solution proved unsustainable without EU grants, the cooperation with the provider of e-cars did not continue after the end of the Lighthouse project. Later, building on the experience gained, the social housing company and other operators re-designed the service by opening it up to a wider public and found a new provider. As a result, the service is now operative and sustainable.

42 The COVID-19 pandemic adversely affected the implementation of 16 Lighthouse projects, notably by:

- delaying or forcing the cancellation of project activities (e.g., during lockdowns, apartment owners could not meet to vote on whether to approve retrofitting work, and on-the-spot peer-to-peer exchange between Lighthouse and Fellow cities could not take place); and

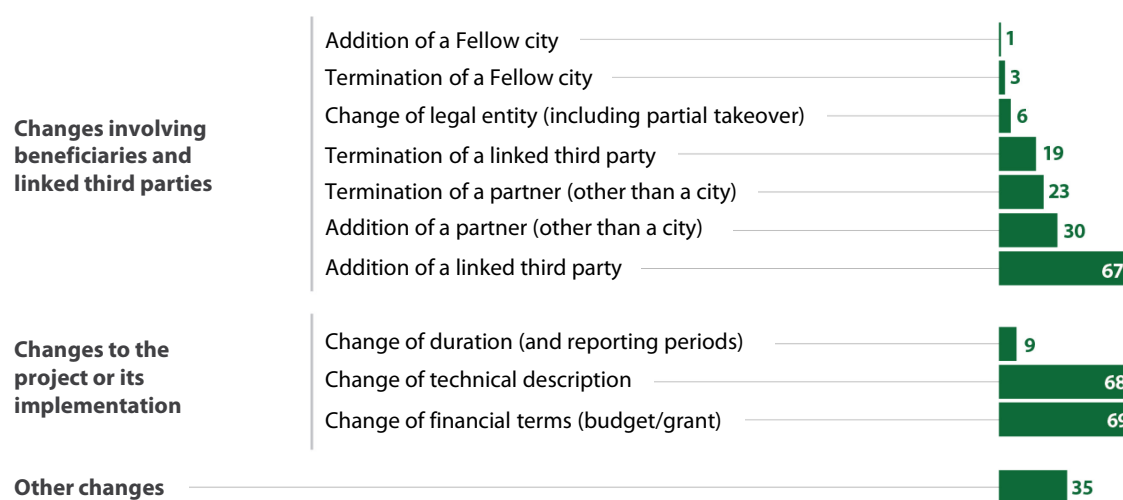
- o distorting the monitoring of deployed solutions (e.g., during lockdowns, energy consumption values for retrofitted office buildings were anomalous and new public transport solutions were heavily underutilised).

43 The global energy crisis that erupted in 2021 affected the Lighthouse projects to varying degrees. High price volatility and uncertainty on the markets for energy, raw materials, and components prompted businesses and public authorities to delay new investment projects. For example, an innovative heat and power co-generation solution was put on hold in one Lighthouse city and eventually replaced by a smaller-scale solution since it was hard to simulate its future operational costs.

44 Due to these delays, nine Lighthouse projects requested extensions of 6 - 18 months (on top of their original duration of 60 months) (see [Annex I](#)). And another nine projects did not deploy all their solutions in time to monitor their performance for 24 months or more, despite it being required by the [Horizon 2020 work programmes](#).

45 Cities modified their planned activities and solutions due to the challenges experienced, resulting in 73 amendments to grant agreements – an average of four per Lighthouse project. An additional nine amendments were prepared during the audit, and ongoing projects may request further amendments. [Table 3](#) summarises the specific changes made to the grant agreements.

Table 3 – Amendments made to grant agreements



Source: Amendments to the grant agreements (Status end of 2022).

46 Based on the information provided by the project coordinators, two-thirds of the projects experienced at least one amendment process that lasted between six months and two years, from initial informal discussions to formal submission and approval. The duration of the amendment processes was related to the complexity of the projects and the changes required to adapt to the evolving urban environment.

47 Lengthy amendment processes delay project activities in several ways. For example, while waiting for the formal approval of an amendment request, cities may need or prefer to put on hold their tendering procedures, private companies not to install their technology solutions, and research centres to delay their recruitment of new personnel. Meanwhile, given the fast-paced technological and market development, smart-city solutions may become technologically or economically obsolete.

Obtaining citizen engagement has proven crucial but often difficult

48 Citizens' involvement is crucial in designing and implementing smart-city solutions that best meet their needs. Cities are responsible for gaining the trust of their citizens and the Commission should check that cities have taken appropriate steps to engage their citizens before starting their smart-city projects or during the projects. Many Lighthouse projects faced a significant challenge in engaging citizens.

49 Each Lighthouse city used its own strategy to build trust with its citizens and involve them in designing and rolling-out project solutions. Moreover, the degree of citizen engagement depended on the nature of the solution. For example, while the renovation of a conference centre required no direct involvement of citizens, a dedicated information office located in a city district planned for renovation helped inform and convince citizens of the benefits of the proposed project solutions. Similarly, a series of workshops facilitated the implementation of ten urban energy-transition projects, which citizens directly proposed.

50 According to project coordinators, three-quarters of the Lighthouse projects experienced either resistance or lack of citizen engagement while deploying their planned solutions. While regulatory issues typically delay project activities, a lack of citizen engagement, and even worse, the opposition from citizens, can cause smart-city solutions to fail (see [Box 3](#)).

Box 3**Examples of how citizens' resistance prevented the implementation of smart-city solutions in Lighthouse cities**

- (a) Apartment tenants blocked the retrofitting of the buildings they lived in, fearing that the work would increase rent and failing to recognise the benefits in terms of, for example, lower energy bills and increased comfort.
- (b) Low-income families living in social housing could not afford to co-invest with the Lighthouse project in improving the energy performance of their homes.
- (c) Taxi drivers opposed the deployment of a position-tracking app meant to reduce urban congestion because they did not trust the service provider and did not approve the handling of collected data.

Source: interviews with city representatives and project reports.

The Commission has supported the Lighthouse projects but so far cities have not been successful in attracting private investment

51 A team of CINEA project officers, supported by external experts, have monitored the implementation of the Lighthouse projects while providing them with administrative guidance. For multiple reasons, including the long duration of the projects, the team has changed composition several times. While the project coordinators we interviewed expressed appreciation for the support received, half of them expressed the desire for less turnover of project officers.

52 The Commission also supports the Lighthouse projects and the replication of their solutions through dedicated services offered in the context of the Scalable Cities Group and the Smart Cities Marketplace. While it created the Scalable Cities Group specifically to support the Lighthouse projects, the Smart Cities Marketplace pre-dates them. And it primarily serves cities and other stakeholders that are not part of any Lighthouse project consortia.

53 The Commission contracted out these support services to two distinct consortia of private companies, research centres, and other entities. These consortia act as secretariats for the two services and meet on an ad hoc basis to coordinate their activities.

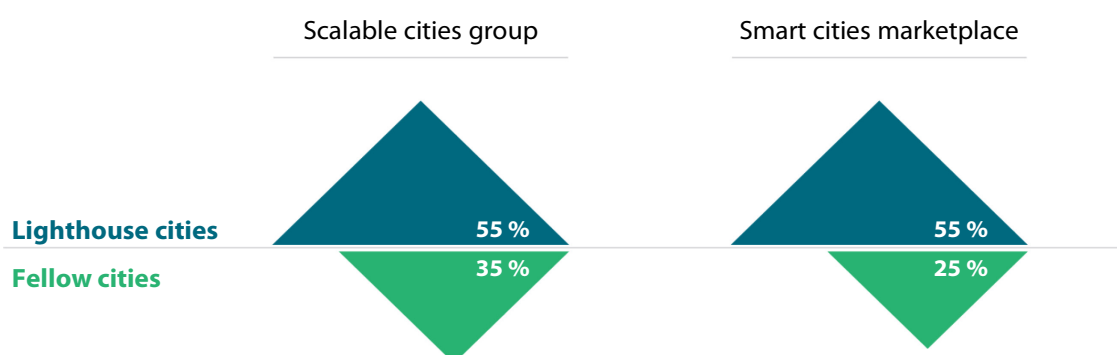
54 The secretariat of the Scalable Cities Group aims to assess the solutions demonstrated by the Lighthouse projects and support their replication across projects by:

- o organising knowledge-sharing initiatives aimed at cities;
- o providing financial support to replicate proven solutions; and
- o bringing together practitioners and advising cities.

55 The Smart Cities Marketplace consists of a matchmaking platform bringing together cities, companies, investors, and researchers, to support the market replication of smart-city solutions. The marketplace also provides cities and other stakeholders with support services, such as community-building events, best-practice sharing, and regulatory and financial advice.

56 More than half of the Lighthouse cities surveyed used the services offered in the context of the Scalable Cities Group and the Smart Cities Marketplace; fewer of the Fellow cities surveyed did so (see [Figure 6](#)). On average, participating cities were satisfied overall with the support from the Scalable Cities Group and the Smart Cities Marketplace.

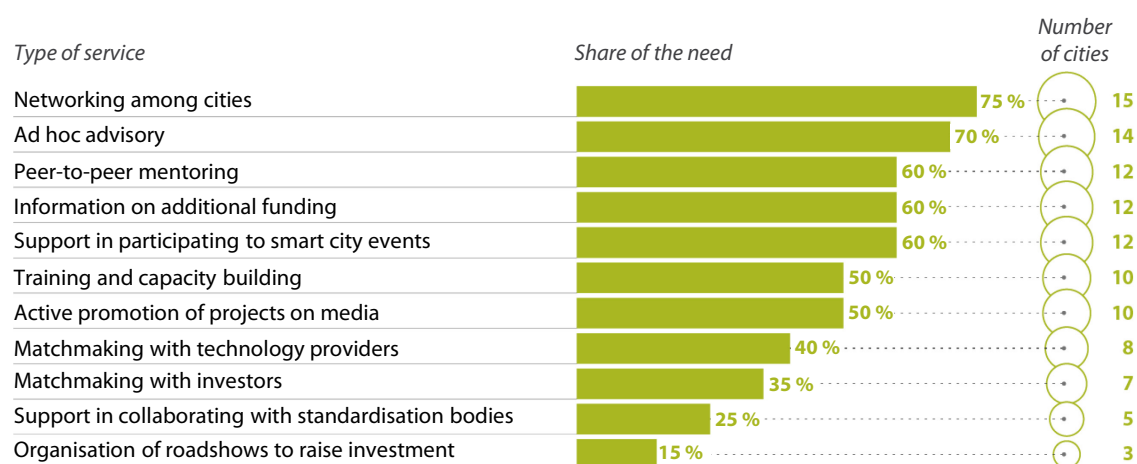
Figure 6 – Proportion of Lighthouse and Fellow cities participating in the activities organised in the context of the Scalable Cities Group and the Smart Cities Marketplace



Source. ECA survey.

57 In the survey, more of the cities reported benefitting from sharing experiences with other cities and acquiring new knowledge (i.e., through networking, mentoring, capacity building activities) than from services that help them find private investors (like roadshows or matchmaking tools) (see [Figure 7](#)).

Figure 7 – Proportion of cities benefitting from different types of support services



Source: ECA survey.

58 Since its launch in 2018, the Smart Cities Marketplace has matched approximately 130 smart-city project promoters (primarily cities) with private investors for a total investment exceeding €610 million. However, for various reasons, no Lighthouse or Fellow cities have yet found a private investor through the Smart Cities Marketplace matchmaking platform.

59 During interviews, project coordinators and city representatives explained how the activities organised in the context of the Scalable Cities Group and Smart Cities Marketplace supported the Lighthouse projects. They also explained that:

- some of the project solutions are still too immature to attract funding in the short term, which is a major obstacle to replicating them (see paragraph 39);
- these activities helped Lighthouse and Fellow cities share their project outcomes and connect with other cities and smart-city stakeholders; and
- the networking events and other activities provided useful contacts. Still, some of these events lacked focus on specific challenges, technologies, or areas of application and did not yield practical results.

Shortcomings in assessment and follow-up undermine the exploitation of the Lighthouse projects

Shortcomings in the monitoring and assessment framework prevent the impact of the Lighthouse programme from being measured

60 CINEA's project officers, supported by external experts, follow the standard Horizon 2020 monitoring framework and only monitor the Lighthouse projects until their end. They assess project reports, conduct project reviews, and organise on-site visits and virtual meetings with project beneficiaries.

61 However, the grant agreements give the Commission the right to evaluate the impact of the Lighthouse projects, directly or through external bodies, up to five years after their completion. By signing the grant agreement, project participants undertake to provide the Commission with the information needed to perform this evaluation.

62 The exact scope and content of any such evaluation are not defined, and no plans exist to perform one. Although the ongoing final evaluation of Horizon 2020 covers the Lighthouse programme, it is not expected to specifically focus on it⁵.

63 The Lighthouse projects have technical reporting obligations to provide information on their impact, such as increased energy efficiency or reduced air pollution. However, there is a lack of common performance indicators (see paragraph 24) and a standard approach for impact monitoring. Accordingly, the reported data cannot be fully aggregated.

64 The secretariat of the Scalable Cities Group plans to assess the climate impact achieved by the Lighthouse projects in 2025. However, the service contract between CINEA and the secretariat of the Scalable Cities Group does not specify the scope or content of this assessment.

⁵ Article 32 of the Regulation (EU) No 1291/2013.

65 Although the replication of project solutions is an integral part of the Lighthouse programme and one of its key goals (see paragraph [31](#)), the Commission does not currently plan to assess the replication of the solutions demonstrated by the Lighthouse projects. Without such an assessment, it will be impossible, in practice, to:

- measure fully and reliably, the overall impact achieved by the Lighthouse programme while drawing lessons from the replication process; and
- distinguish between replicable solutions and those that have become obsolete, unsustainable, or are not replicable for other reasons.

Insufficient coordination with the Mission hinders the replication potential of the Lighthouse projects

66 One of the Mission’s aims is to “scale up and replicate solutions developed in past R&I programmes”⁶, including, where applicable, those resulting from the Lighthouse programme. The Mission Platform (see paragraph [10](#)), through its set of networking and peer-learning services, helps the Mission to achieve this objective.

67 The Mission and its Platform may help:

- other cities beyond the present community of Lighthouse and Fellow cities, replicate Lighthouse project solutions; and
- Mission cities build on the solutions already demonstrated by the Lighthouse projects and benefit from the experience of the Lighthouse and Fellow cities.

68 The Commission selected the 112 Mission cities solely on their merits and independently from their participation in any previous EU programmes. Consequently, 51 of the 120 Lighthouse and Fellow cities are also Mission cities (see paragraph [09](#)), while the others are not.

69 While some degree of cooperation between the Scalable Cities Group and the Mission Platform exists, the Mission’s implementation plan does not provide for the establishment of any coordination mechanisms between the two services.

⁶ “100 Climate-Neutral and Smart Cities by 2030 - Implementation Plan”, 29 September 2021.

70 To support the work of the Mission Platform, the Commission’s Joint Research Centre analysed proven R&I solutions relevant to urban climate neutrality, including Horizon 2020 projects, and assessed their replicability. While the analysis included some examples of solutions demonstrated by the Lighthouse projects, it was not intended to, nor did it provide the Mission Platform with a complete view of the results achieved by the Lighthouse programme.

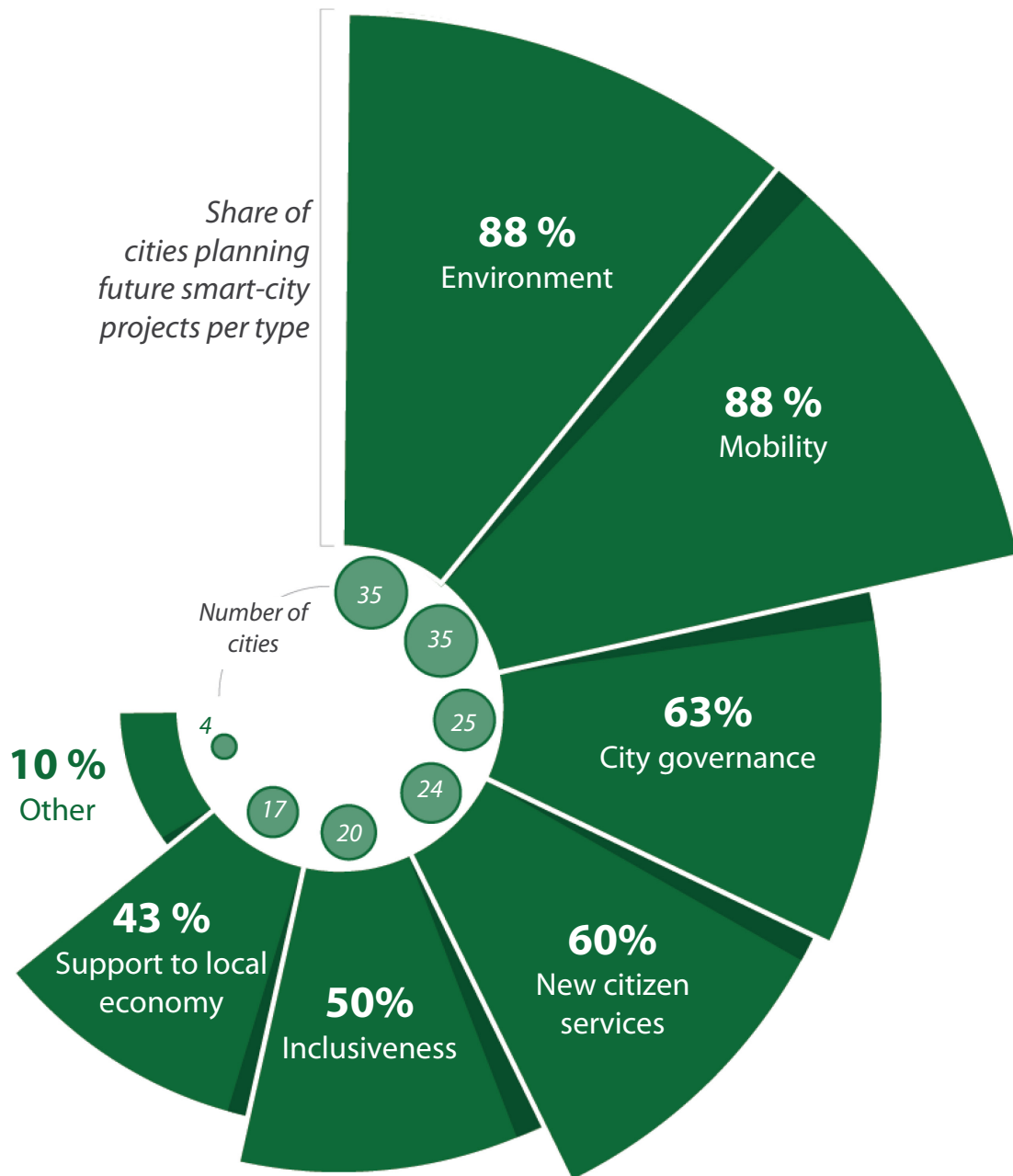
71 The current level of coordination between the Lighthouse programme and the Mission does not facilitate the full exploitation of the experience gained by the Lighthouse and Fellow cities. It also limits the potential for replicating Lighthouse projects’ results beyond their project consortia.

EU funding has proven valuable to cities, but the Mission cities lack certainty regarding the overall EU funding available

72 EU cities must invest substantially in R&I and new infrastructures to become smarter and pursue climate neutrality. Therefore, the amount of resources available to cities is a crucial input in designing climate-neutrality plans and related investment plans.

73 Looking at a timeframe up to 2030, all but one of the Lighthouse and Fellow cities surveyed claim to have plans for new smart-city projects. *Figure 8* illustrates the proportion of Lighthouse and Fellow cities planning future projects by area of application, regardless of their participation in the Mission.

Figure 8 – Proportion of Lighthouse and Fellow cities planning future smart-city projects by area of application



Source: ECA survey.

74 On average, each Lighthouse city plans to invest approximately €1.1 billion and each Fellow city €400 million to carry out such projects. [Table 4](#) lists the three primary sources of funding that the Lighthouse and Fellow cities plan to use for their investment plans.

Table 4 – Main sources of funding for future smart-city projects by Lighthouse and Fellow cities

Lighthouse cities	Fellow cities
Own resources	National/regional public funds
EU funds under direct management	EU funds under shared management
National/regional public funds	EU funds under direct management

Source: ECA survey.

75 The pool of experts engaged by the Commission to support the design of the Mission (the “Mission Board”) estimated that 100 European cities with an average population of 100 000 would need to invest €96 billion to become climate neutral by 2030⁷.

76 A total of 377 cities expressed interest in participating in the Mission. Of these, 112 qualified for the programme and became Mission cities. Thirty-five of these provided information on the capital they would require for climate neutral actions. The stated requirements amounted to €112 billion in total and varied from €2.1 billion to €12 billion.

77 The estimated investment needs of cities (see paragraphs 74-76) far exceed the funding the EU provided through Horizon 2020 and can provide through Horizon Europe or other EU funding instruments. However, the EU Framework programme for Research and Innovation plays a key role. The Lighthouse and Fellow cities reported that the programme had helped cities to:

- establish international cooperation with other cities and smart-city stakeholders (as reported by 67 % of the Lighthouse and Fellow cities surveyed);
- test innovative urban technologies and solutions, which they could not have done using other funding sources (as reported by 53 % of the Lighthouse cities surveyed); and
- participate in other R&I projects, thanks to the experience gained and the international network of contacts established (as reported by almost 60 % of the Lighthouse projects’ coordinators interviewed).

⁷ “100 Climate-Neutral and Smart Cities by 2030 - Implementation Plan”, 29 September 2021.

78 At present, the following EU funding instruments support the Mission in pursuit of its goal of achieving 100 climate-neutral cities by 2030:

- Horizon Europe has so far issued Mission-specific calls for proposals and other actions totalling €254 million under the 2021-2022 work programme and €105 million in 2023;
- the Connecting Europe Facility calls for proposals published in September 2022 for Trans-European Transport Network projects, totalling €5.12 billion, specified that the award criterion *Priority and urgency* will also consider the participation in the Mission⁸;
- the LIFE call for proposals for “Strategic Integrated Projects - Climate Action”, worth €30 million, specified that applicants can target urban-based actions, including in the context of the EU Mission on Climate-Neutral and Smart Cities⁹;
- the Mission Platform has so far been awarded €140 million, of which 60 % is intended to fund R&I urban pilots; and
- a 2023 European Urban Initiative call for proposals, worth €120 million, supports the creation of links with the Mission.

79 In addition, 13 member states (Bulgaria, Croatia, Czechia, Greece, Hungary, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden) committed to include measures contributing to the Mission in their national or regional operational programmes.

80 The Mission’s implementation plan specifies that Horizon Europe will have a budget for climate neutrality in cities. However, in line with the Horizon Europe regulatory framework, this budget is not specifically allocated to the 112 Mission cities. For example, in the first round of Horizon Europe calls for proposals addressed to cities, only 48 % of the cities funded are included in the list of 112 Mission cities.

⁸ Call for proposals “CEF 2 Transport”, 13 September 2022.

⁹ Call for proposals “Strategic Nature and Integrated Projects”, 6 May 2022.

81 The same applies to the Horizon 2020 resources that the Mission Platform has so far made available to support city-led piloting and replication projects. While legal limitations stemming from the Horizon 2020 Regulation prevented the Mission Platform from specifically allocating its resources to a pre-defined group of entities, no such limitation will apply under Horizon Europe.

82 The Commission plans to award the selected 112 Mission cities a 'Mission label'. This recognition would allow targeting EU calls for proposals that explicitly reference it in their award procedures. However, information on how this Mission Label will work and to which funding programmes it will apply is not yet available.

83 The Mission Board advised the Commission to set up a new 'lending and blending' facility (a combination of financial instruments and grants), co-financed by Horizon Europe and InvestEU, to support the Mission cities. The Commission is presently discussing its potential launch with the EIB. However, according to the Mission's implementation plan, any such instrument will not materialise before 2024.

84 We note that the ambitious objective of attaining climate neutrality in 100 EU cities by 2030 needs extensive effort and wide spanned facilitating actions. While insufficient by itself, EU funding can significantly contribute to the design and implementation of the climate-neutrality plans of the Mission cities. However, beyond Horizon resources dedicated to the Mission, the Mission cities lack certainty regarding the resources (public and private) that are or will be available to them and the means by which they can be secured.

Conclusions and recommendations

Conclusions

85 Our overall conclusion is that the Lighthouse programme has benefitted the participating cities by supporting their efforts to become smarter through deploying innovative smart-city solutions. However, a lack of both public funding (EU and national) and private funding hinders the replication of these solutions. Moreover, the experience gained by the participating cities risks being underexploited given the present level of coordination between the Lighthouse programme and the Horizon Europe Mission on Climate-Neutral and Smart Cities.

86 We found that the Commission designed the Lighthouse programme well. In line with the collaborative and cross-sectoral nature of smart-city projects, the design of the Lighthouse programme provided the appropriate framework to bring together stakeholders and demonstrate close-to-market technologies from different fields (see paragraphs [18-22](#)).

87 However, the programme was part of a fragmented landscape of EU funding instruments and other initiatives, which lacked an overall strategy and appropriate coordination. It also lacked global impact indicators and targets. In this respect, we noted that the Horizon Europe Mission on Climate-Neutral and Smart Cities has quantitative indicators and targets and aims to coordinate various EU initiatives in the field of smart city and urban development. It is, however, too early to assess its impact (see paragraphs [23-30](#)).

88 The closed Lighthouse projects achieved tangible results and met the majority of their expected targets. Some projects have started replicating smart-city solutions within project consortia, but significant obstacles to replication exist, in particular, due to the lack of both public and private funding (see paragraphs [31-40](#)).

89 The Lighthouse projects operated in complex and ever-changing environments and faced several challenges, especially in engaging citizens. These contributed to changes and significant delays to a number of project activities, which triggered many amendments to grant agreements and affected the timely deployment of some smart-city solutions (see paragraphs [41-50](#)).

90 The Commission supported the Lighthouse projects, and the participating cities generally appreciated the support received. However, cities have not been successful so far in attracting private investment through the dedicated support service set up by the Commission (see paragraphs [51-59](#)).

91 We found that the Commission's monitoring and assessment framework cannot properly measure the overall impact achieved by the Lighthouse programme, due to the absence of:

- plans to assess to what extent smart-city solutions are replicated; and
- a standard way to monitor and report on the impact, with common performance indicators for all projects (see paragraphs [60-65](#)).

92 The Horizon Europe Mission on Climate-Neutral and Smart Cities could support the full exploitation of the Lighthouse projects' results and the potential replication of their solutions. In return, the cities participating in the Mission could benefit from the experience of the Lighthouse and Fellow cities. However, the existing level of coordination between the Lighthouse projects and the Horizon Europe Mission on Climate-Neutral and Smart Cities and the absence of plans for conducting a replication assessment hamper the full exploitation of Lighthouse projects' results and the potential replication of their solutions (see paragraphs [66-71](#)).

93 The future investment needs of EU cities in smart-city and climate-neutrality projects far exceed the amounts the EU can provide through its range of funding instruments. However, EU funding instruments such as the Lighthouse programme provide value to EU cities by helping them exchange experience internationally, demonstrate innovative solutions, and participate in other research and innovation projects (see paragraphs [72-77](#)).

94 Accordingly, EU funding plays, amongst other actions, an important role to facilitate the achievement of the climate-neutrality goals of the Horizon Europe Mission on Climate-Neutral and Smart Cities. However, the cities participating in the Mission currently lack certainty regarding the resources the Commission will make available to them and how they can be secured (see paragraphs [78-84](#)).

Recommendations

Recommendation 1 – Assess financing capability of Mission cities

The Commission should:

- (a) take stock of the capacity of the cities participating in the Mission on Climate-Neutral and Smart Cities to pool sufficient public and private funding, including EU funding, to achieve their climate-neutrality goals; and
- (b) enhance the support provided to the cities where financing weaknesses that could endanger the achievement of the Mission goals are identified, by paying particular attention to synergies with national and regional sources of funding and private investment.

Target implementation date: 2024

Recommendation 2 – Ensure citizen engagement

To ensure that future Horizon Europe-funded urban-innovation projects include adequate citizen engagement, the Commission should:

- (a) when developing Horizon Europe Work Programmes with Member States, ensure that adequate citizen engagement and co-design activities are reflected in them; and
- (b) allow projects sufficient flexibility to conduct citizen engagement activities at the start of projects and later incorporate the results into those projects.

Target implementation date: 2024

Recommendation 3 – Carry out a replication assessment

Once all Lighthouse projects are completed, the Commission should assess whether their results have been replicated and feed the results into the Mission Platform's activities.

Target implementation date: 2026

Recommendation 4 – Coordinate the Lighthouse programme better with the Horizon Europe Mission

The Commission should strengthen the coordination between the Lighthouse programme and its support services, and the Mission on Climate-Neutral and Smart Cities, involving the Lighthouse and Fellow cities in the networking and peer learning activities planned by the Mission Platform.

Target implementation date: 2024

This report was adopted by Chamber IV, headed by Mr Mihails Kozlovs, Member of the European Court of Auditors, in Luxembourg on 19 September 2023.

For the Court of Auditors

Tony Murphy
President

Annexes

Annex I – List of Horizon 2020 Lighthouse projects

Project acronym	H2020 grant(*)	Total cost(*)	Start date	Original end date	Actual end date	Lighthouse cities	Fellow cities	Other partners
ATELIER	€19 608	€21 895	01/11/2019	31/10/2024	31/10/2024(**)	2	6	22
CityxChange	€20 000	€23 939	01/11/2018	31/10/2023	31/10/2023(**)	2	5	25
GrowSmarter	€24 821	€35 802	01/01/2015	31/12/2019	31/12/2019	3	5	32
IRIS	€17 997	€20 864	01/10/2017	30/09/2022	31/03/2023	3	4	39
MAKING-CITY	€18 090	€19 984	01/12/2018	30/11/2023	30/11/2023(**)	2	6	26
MAtchUP	€17 418	€19 426	01/10/2017	30/09/2022	30/09/2023(**)	3	4	21
mySMARTLife	€18 656	€21 156	01/12/2016	30/11/2021	30/09/2022	3	3	24
POCITYF	€19 998	€22 182	01/10/2019	30/09/2024	30/09/2024(**)	2	6	40
REMOURBAN	€21 542	€24 755	01/01/2015	31/12/2019	30/06/2020	3	2	17
REPLICATE	€24 965	€29 268	01/02/2016	31/01/2021	31/01/2021	3	3	36
RESPONSE	€19 820	€23 558	01/10/2020	30/09/2025	30/09/2025(**)	2	2	49
Ruggedised	€17 693	€19 343	01/11/2016	31/10/2021	31/10/2022	3	3	29
Sharing Cities	€24 754	€28 000	01/01/2016	31/12/2020	31/12/2021	3	3	30
SmartEnCity	€27 890	€31 479	01/02/2016	31/07/2021	31/07/2022	3	2	33
Smarter together	€24 743	€29 699	01/02/2016	31/01/2021	31/07/2021	3	5	29
SPARCs	€19 701	€23 852	01/10/2019	30/09/2024	30/09/2024(**)	2	5	24
STARDUST	€17 940	€20 686	01/10/2017	30/09/2022	31/03/2024(**)	3	4	24
Triangulum	€25 421	€29 508	01/02/2015	31/01/2020	31/01/2020	3	4	15
TOTAL	€381 057	€445 399				48	72	515

(*) In thousand euros.

(**) Expected future end dates.

Annex II – List of Lighthouse and Fellow cities

Country	Type	City
EU countries		
AT - Austria	Lighthouse	Vienna
	Fellow	Graz
BE- Belgium	Fellow	Brussels, Ostend, Seraing
BG - Bulgaria	Fellow	Asenovgrad, Burgas, Gabrovo, Smolyan, Sofia, Vidin
CZ - Czechia	Fellow	Brno, Kladno, Písek, Prague
DE - Germany	Lighthouse	Dresden, Hamburg, Cologne, Munich
	Lighthouse and Fellow ¹⁰	Leipzig
	Fellow	Essen
DK - Denmark	Lighthouse	Sonderborg
	Fellow	Copenhagen, Hvidovre
EE - Estonia	Lighthouse	Tartu
	Fellow	Võru
EL - Greece	Fellow	Alexandroupoli, Ioannina, Kifissia, Kozani, Ptolemaida
ES - Spain	Lighthouse	Barcelona, Bilbao, Pamplona, San Sebastian, Valencia, Valladolid, Vitoria-Gasteiz
	Fellow	Granada, León, Palencia, Sabadell, Santa Cruz de Tenerife, Santiago de Compostela, Sestao, Zaragoza
FI - Finland	Lighthouse	Espoo, Helsinki, Oulu, Tampere, Turku
	Fellow	Kerava, Vaasa
FR - France	Lighthouse	Dijon, Lyon, Nantes, Nice
	Fellow	Bordeaux
HR - Croatia	Fellow	Rijeka
HU - Hungary	Fellow	Budapest, Miskolc, Ujpest
IE - Ireland	Lighthouse	Limerick
	Fellow	Cork
IT - Italy	Lighthouse	Bari, Florence, Milan, Trento
	Fellow	Bassano del Grappa, Lecce, Parma, Venice
LV - Latvia	Fellow	Riga

¹⁰ Leipzig is Fellow city of the Triangulum project and Lighthouse city of the SPARCs project.

Country	Type	City
MT - Malta	Fellow	Valletta
NL - Netherlands	Lighthouse	Alkmaar, Amsterdam, Eindhoven, Groningen, Rotterdam, Utrecht
PL - Poland	Fellow	Krakow, Lublin, Bydgoszcz, Gdansk, Warsaw
PT - Portugal	Lighthouse	Evora, Lisbon
	Fellow	Maia, Matosinhos, Porto
RO - Romania	Fellow	Alba Iulia, Botosani, Cluj-Napoca, Focşani, Suceava
SE - Sweden	Lighthouse	Gothenburg, Stockholm, Umeå
SI - Slovenia	Fellow	Celje
SK - Slovakia	Fellow	Bratislava, Trenčín
Non-EU countries		
CH - Switzerland	Fellow	Lausanne
IL - Israel	Fellow	Herzliya
IS - Iceland	Fellow	Reykjavik
MK - North Macedonia	Fellow	Skopje
NO - Norway	Lighthouse	Stavanger, Trondheim
TR - Turkey	Lighthouse	Antalya, Tepebasi
	Fellow	Kadiköy, Nilüfer
UA - Ukraine	Fellow	Lviv, Severodonetsk
UK - United Kingdom	Lighthouse	Bristol, Glasgow, London, Manchester, Nottingham
	Fellow	Derry

Annex III – Survey of Lighthouse project participants

The audit included a survey to all Lighthouse project participants. Three questionnaires were designed to specifically target the Lighthouse cities, the Fellow cities, and the other partners of the Lighthouse projects, including universities, research centres, and private companies. The questionnaires allowed us to collect information on experiences and opinions otherwise not directly obtainable and needed for the audit. This exercise contributed to our conclusions on the type of smart-city solutions introduced, the obstacles to replicating these solutions, the challenges faced by the cities, the support that the Commission provided to the city, and the cities' plans for future smart-city projects.

The ECA survey ran from 31 October to 25 November 2022. We received replies from 20 Lighthouse cities (out of a population of 48), 20 Fellow cities (out of a population of 72), and 52 other project partners (out of a population of 515). We did not draw conclusions from the responses of the other project partners, due to the low response rate for this group of survey participants.

Annex IV – Commission supported initiatives with and for cities in the 2014-2020 period

Initiative	Managing/Monitoring body
Circular Cities and Regions Initiative part of the Circular Economy Action Plan	DG RTD
City Science Initiative	JRC, DG RTD, DG REGIO, DG EAC, CINEA, EASME (Executive Agency for Small and Medium-sized Enterprises)
Community of Practice on Cities (CoP-CITIES)	JRC, DG RTD, DG REGIO
Covenant of Mayors for Climate and Energy	DG ENER, DG CLIMA
Creative Europe	DG EAC
Cultural and Creative Cities Monitor	JRC
Digital Single Market	DG CNECT
Eltis Urban mobility observatory	DG MOVE
Environmental Technology Verification	JRC
EU Action Plan for the Circular Economy (2015)	DG ENV
EU Adaptation Strategy Climate – ADAPT	DG CLIMA
EU Topic Page on Cities ('ONE-STOP-SHOP' portal for cities)	DG REGIO
European Green Capital and Green Leaf Awards	DG ENV
European Innovation Partnership - Smart Cities and Communities	DG ENER, DG MOVE, DG CNECT
Eurostat dedicated webpage on City statistics	ESTAT
Green City Accord	DG ENV

Initiative	Managing/Monitoring body
Horizon 2020 - supported initiatives	
BRIDGE for Smart Grid, Energy Storage, Islands, and Digitalisation projects	DG ENER, CINEA
BUILD UP, European portal for energy efficiency in buildings	EASME/CINEA
CIVITAS	DG RTD
ERA-NET Cofund Electric Mobility Europe	DG EAC
Espresso (systEmic standardisation apPRoach to Empower Smart cities and cOmmunities)	DG RTD
European Capital of Innovation Award (iCapital)	DG RTD
European City Facility (EUFC)	DG RTD
European Technology and Innovation Platforms, in particular, on Renewable Heating and Cooling, and Smart Networks for Energy Transition	DG RTD, DG ENER
European Technology Platforms, in particular the European Construction Technology Platform	DG RTD
FOOD 2030 – Cities for food systems transformation	DG RTD, DG MOVE
Horizon 2020 Public-Private Partnerships, in particular, on Energy-efficient Buildings (EeB) and European Green Vehicle Initiative (EGVI)	DG RTD
Horizon 2020 Smart Cities & Communities programme (including the Lighthouse programme)	DG RTD
Large Demonstration Projects (Innovation Actions)	CINEA
Leadership in Enabling and Industrial Technologies	EASME
Nature-based Solutions Platforms, Community and Evidence Base (thinknature platform, FP7-supported Oppla platform, and Eklipse evaluation framework)	
Prospect (Capacity building for cities and regions)	CINEA
Societal Challenge ‘Smart, Green and Integrated Transport’ - Urban Mobility	CINEA
Intelligent Cities Challenge	DG GROW

Initiative	Managing/Monitoring body
International collaboration programmes	
EU-BRAZIL Sector Dialogue on R&I for Sustainable Cities and Nature-based Solutions	DG RTD
EU-CELAC Cooperation on sustainable urbanisation	DG RTD
EU-CHINA – Sustainable Urbanisation Flagship Initiative	DG RTD
EU-USA Twinning programme in R&D in Urban Logistics	DG RTD, DG MOVE
International Cooperation in the field of Urban Mobility (SOLUTIONS, UEMI)	DG RTD, DG MOVE
International Urban Cooperation (IUC)	DG REGIO, FPI
Joint Programming Initiative Urban Europe (funded i.a. by ERANET SUGI and ENUTC)	DG RTD
Knowledge Exchange Platform (KEP)	DG RTD, European Committee of the Regions
LIFE Programme	DG ENV
living-in.eu community	DG CNECT
Multilevel Third Space for Systemic Urban Research & Innovation	DG RTD
Smart Cities Information System	DG ENER
Smart Cities Marketplace (the result of merging the European Innovation Partnership on Smart Cities and Communities with the Smart Cities Information System)	DG ENER
Social Innovation Community (SIC), with specific reference to its work on "Cities and regional development"	DG RTD
Strategic Energy Technology Plan and the 100 Positive Energy District Initiative	DG RTD, DG ENER
Synergies between H2020 and the European Structural and Investment Funds (Sustainable Urban Development)	DG RTD, DG REGIO
The 7th Environment Action Programme	DG ENV

Initiative	Managing/Monitoring body
The European Institute of Innovation and Technology (EIT) Knowledge and Innovation Communities (KICs), in particular: Innoenergy KIC, Climate-KIC and Urban Mobility KIC	EIT
Transport Research and Innovation Monitoring and Information System	DG MOVE, DG RTD, JRC
Urbact	DG REGIO

Abbreviations

CINEA: European Climate, Infrastructure and Environment Executive Agency

EIB: European Investment Bank

INEA: Innovation and Networks Executive Agency

R&I: Research and innovation

Glossary

Direct management: Management of an EU fund or programme by the Commission alone, as opposed to shared management or indirect management.

eGrants: The Commission's online platform for managing EU research grants throughout their lifecycle.

Horizon 2020: The EU's research and innovation funding programme for the 2014-2020 period.

Horizon Europe: The EU's research and innovation funding programme for the 2021-2027 period.

InvestEU: Mechanism to mobilise private investment in projects of strategic importance for the EU.

LIFE: Financial instrument supporting implementation of the EU's environmental and climate policy through co-financing of projects in member states.

Operational programme: Framework for implementing EU-funded cohesion projects in a set period, reflecting the priorities and objectives laid down in partnership agreements between the Commission and individual member states.

Shared management: Method of spending the EU budget in which, in contrast to direct management, the Commission delegates to the member state while retaining ultimate responsibility.

Replies of the Commission

<https://www.eca.europa.eu/en/publications/sr-2023-24>

Timeline

<https://www.eca.europa.eu/en/publications/sr-2023-24>

Audit team

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This performance audit was carried out by Audit Chamber IV Regulation of markets and competitive economy, headed by ECA Member Mihails Kozlovs. The audit was led by ECA Member Ildikó Gáll-Pelcz, supported by Kinga Bara, Head of Private Office and Zsolt Varga, Private Office Attaché; John Sweeney, Principal Manager; Marco Montorio, Head of Task; Christian Detry, Maria Echanove, Alvaro Garrido-Lestache Angulo, Maria Isabel Quintela and Radostina Simeonova, Auditors. Michael Pyper provided linguistic support.



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We assessed whether the Horizon 2020 Lighthouse programme helped EU cities become smarter, and whether the Commission applied the lessons learned to the Horizon Europe Mission on Climate-Neutral and Smart Cities.

The Lighthouse programme has delivered tangible solutions and helped participating cities. However, the lack of coordination with other EU initiatives, notably the Mission, and with additional public and private funding may challenge the wider adoption of the smart-city solutions.

We recommend the Commission to assess the financing capacity of the cities participating in the Mission and address identified weaknesses; ensure citizen engagement in future urban demonstration projects; assess the replication of Lighthouse programme' solutions; and strengthen the coordination of the Lighthouse programme with the Mission.

ECA special report pursuant to Article 287(4), second subparagraph, TFEU.



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