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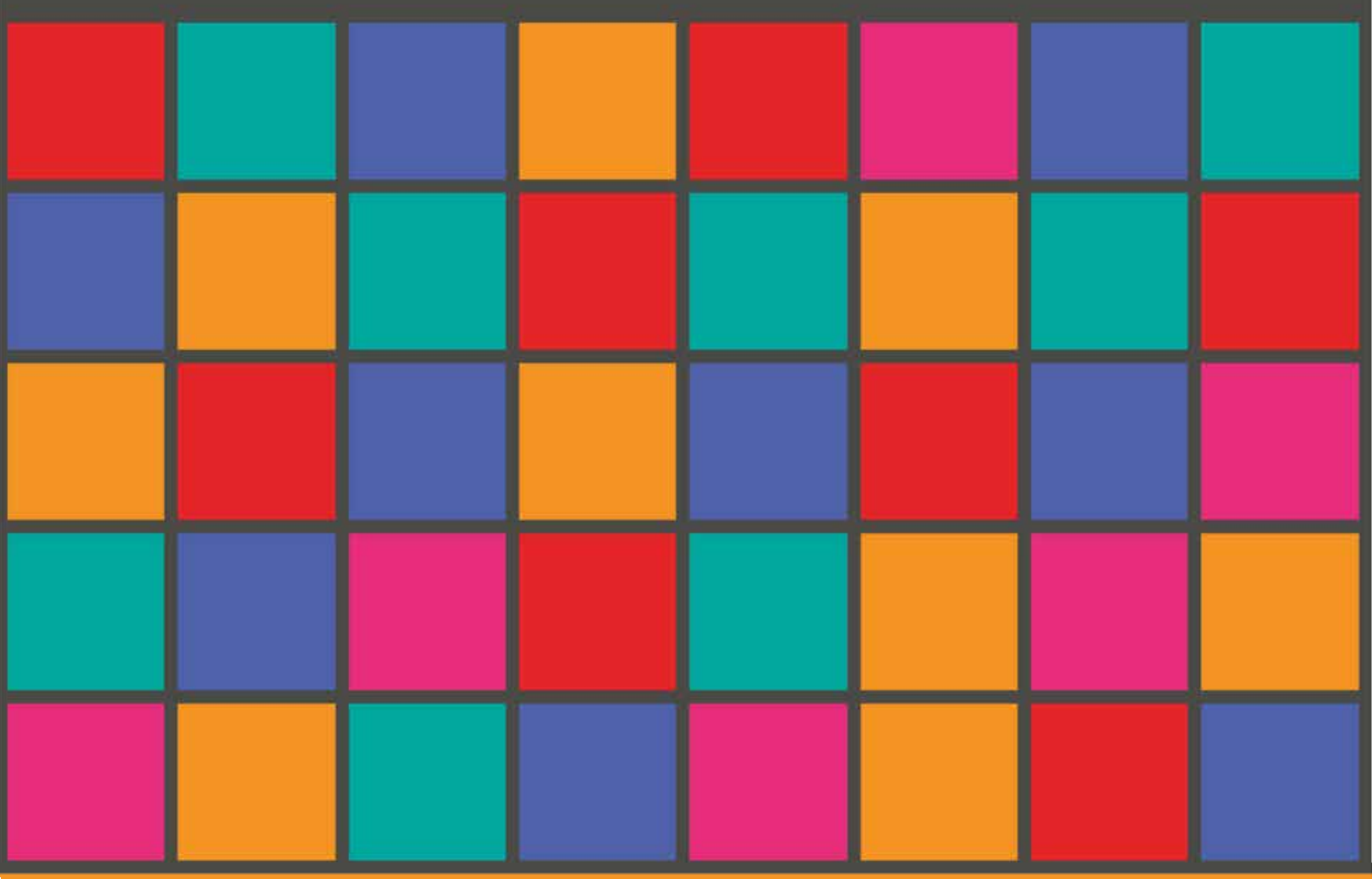

The State of European Smart Cities

Exploring and showcasing models, solutions, and financing for European replication to achieve climate neutrality.

Scalable Cities Secretariat, Editorial Board
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The State of European Smart Cities

Exploring and showcasing European models, solutions, and financing for replication to achieve climate neutrality

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Table of Contents

WELCOME TO THE STATE OF EUROPEAN SMART CITIES! **7**

SMART CITIES AND COMMUNITIES **8**

SO, WHERE DO WE STAND? **9**

THE PATH **10**

FORGING THE FUTURE TOGETHER **11**

A family working together to be the engine of city transformation 11

Fantastic network of experts learning from each other 11

Now is the moment for replication and upscaling 13

Cities are now organising activities to make their environments more beautiful and inclusive 12

A rigorous impact assessment as a prerequisite for green finance 12

Leading the Charge: European Smart Cities Paving the Way to Climate Neutrality through Innovation and Replication 13

KEY FINDINGS **14**

Leipzig. Digital unit for climate-neutral and smart city projects 14

Gothenburg. Climate Partnership 15

Lyon. Eurêka Club 15

Valencia. Mission-inspired organisation 17

Vienna. Participatory governance and learning enable scaling-up 17

Espoo. Creating positive energy districts with a co-creation 18

Munich and its Urban Living Lab 18

Limerick. The case for citizen innovation 19

Bristol. Smart Homes that reduce energy consumption 20

Évora and Alkmaar are POCITYF 21

London, Lisbon, and Milano. Engaging communities and encouraging behaviour change through a Digital Social Market 23

London, Manchester, Milan and The Hague. Transforming a city vision into a reality through a city investment fund 23

Utrecht: Toward District Investment Platforms to steer investment in a portfolio of projects 24

Valencia. Energy crowdfunding or socialised solar plant 24

Lyon Confluence. City Special Purpose Vehicle dedicated to sustainable development 26

SOURCES **28**

Table of Figures

Figure 1: Smart Cities and Communities Projects....8

Figure 2: Positive Energy Buildings in Dijon, RESPONSE project....9

Figure 3: Connected smart city concept....10

Figure 4: The European model of a smart city....14

Figure 5: Overview of the Port of Gothenburg....15

Figure 6: Conceptual design for redevelopment of the La Confluence area in Lyon....16

Figure 7: City of Valencia taking up the challenge to become climate neutral by 2030....17

Figure 8 : Vienna, a Smarter Together city....17

Figure 9 : Espoo, a SPARCS city....18

Figure 10: Overview of Munich from the Ackermannbogen, a residential energy efficient development....18

Figure 11 : Bristol, a REPLICATE city....20

Figure 12 : Evora, a POCITYF city....21

Figure 13: The Urban Technology Stack....22

Figure 14: Purpose-driven investment on the rise. State of The European Tech 2022....22

Figure 15: Examples of a Digital Social Market....23

Figure 16: Structure of a City investment fund MRA RICE project....24

Figure 17: Examples of the socialised solar plant “Las Naves Brillen»....24

Figure 18: City Special Purpose Vehicle explained....26

Figure 19: Lyon Confluence area....26

Figure 20: Lyon Confluence model....27

Figure 21: Integrating the City Special Purpose Vehicle into the governance framework....27

Welcome to the state of European smart cities!

Recent global developments, including the Russian invasion in Ukraine and its weaponisation of the energy sector have called for a radical acceleration of the European clean and just energy transition: cutting our dependency on external fuel sources, such as Russian gas, speeding up energy efficiency and the pace of building renovation and scaling up investments in renewables, resolutely addressing energy poverty and improving affordability of energy more widely, empowering and protecting consumers.

The EU's coordinated response to the crisis was the RePowerEU Plan, our strategy to become independent from Russian energy as soon as possible and well before 2030 by diversifying our supplies, saving energy and, becoming more energy efficient and more renewable – approaching climate-neutrality quicker in a just and fair fashion.

Today, the situation is improving, not least thanks to the EU's interventions. What remains is the even bigger and long-term challenge of climate change and all its effects, such as devastating storms, floods, and fires.

Cities and towns, representing three quarters of the EU's population not only have been key allies for the implementation of RePowerEU, but are also pivotal partners in the just and clean energy transition. Looking ahead, they are rallying to join the pathway to net zero. We have seen strong commitment in action when city representatives, smart city professionals, investors, SMEs, policy makers and other smart city stakeholders met during the Smart City Expo World Congress in Barcelona to discuss the state of the European Smart Cities and to showcase the way forward.

Yet, such transformation will require massive changes in usage, behaviour and a profound transformation in city organisation and governance that embraces the entire local society, and all actors that can contribute and help addressing the challenges.

Paula Pinho, Director of Directorate B for Just Transition, Consumers, Energy Efficiency and Innovation at the Directorate-General for Energy of the European Commission

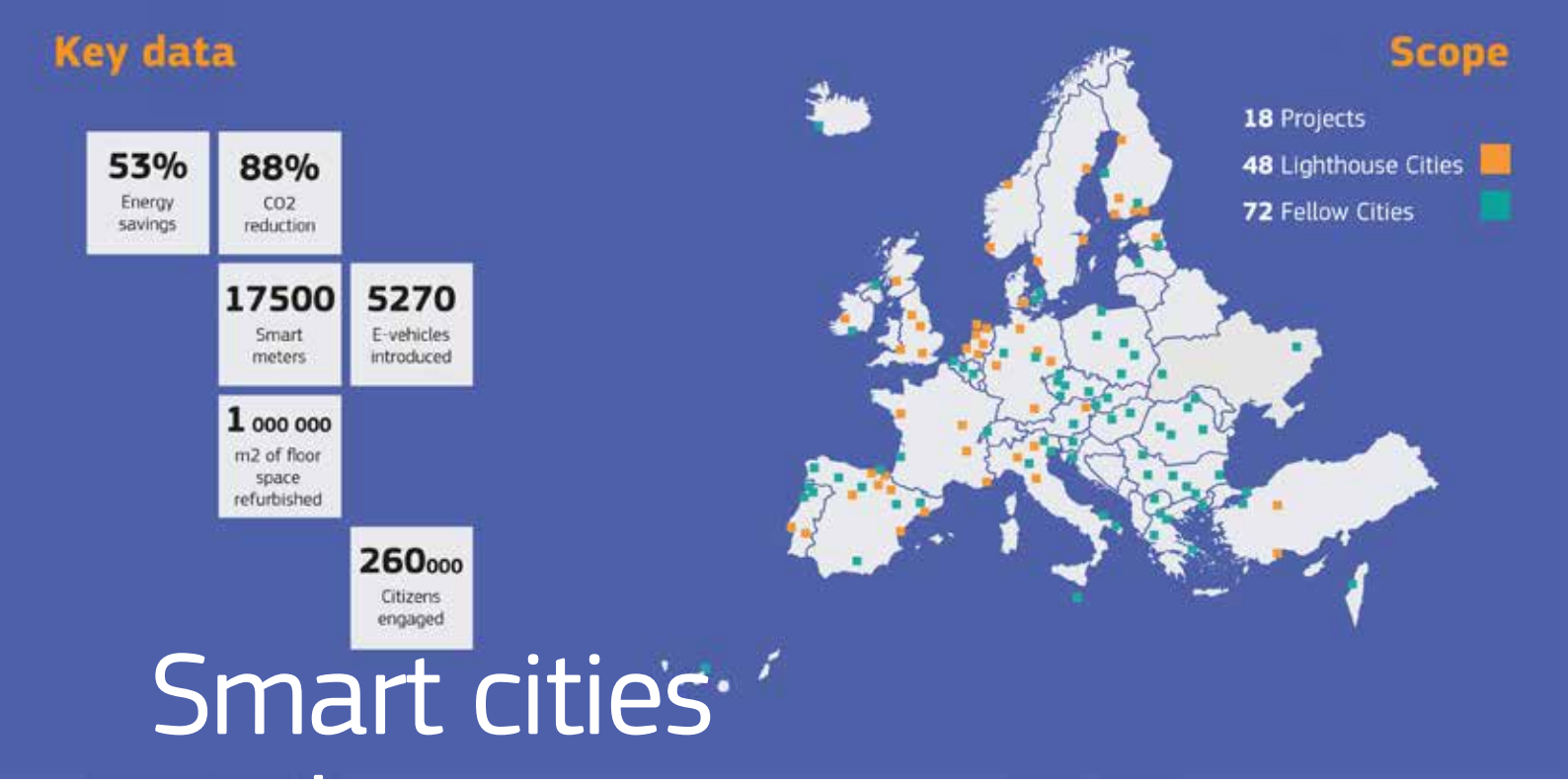
This also means directly engaging millions of citizens, empowering and motivating them to help co- designing solutions and triggering large scale implementation. This process will give European companies a competitive edge that leads to future proof jobs.

Here, cities and towns can rely on tested technologies that will shape a new energy system, the electrification of all infrastructures, powered by renewable energy sources, managed by smart energy systems and storage.

At the same time, digitalisation and its applications, use of AI-based solutions and digital twins will equally speed up the transformation that is needed to achieve carbon neutrality in European cities.

The Smart Cities and Communities Lighthouse Programme, funded under Horizon 2020 over a period of 8 years, and involving 120 cities from across the EU, showcased more than 550 concrete solutions in the frame of 18 Lighthouse projects.

The present guide highlights some of these solutions, all of which are cost-competitive and ready for wide-scale replication, forming the state of the art of European smart cities.



Smart cities

The Smart Cities and Communities initiative is one of the most extensive Research and Development programmes, designed and supported by the European Commission in the framework of Horizon 2020.

Eighteen Smart Cities and Communities projects were funded under these schemes over the years and brought together 120 cities that worked on piloting 550+ solutions. They relied on roughly €345M of Horizon 2020 co-funding, and with that have leveraged more than €1 billion in investments to develop nearly-zero-energy or positive-energy districts. The initiative brings together Lighthouse cities, which develop pilot projects in large-scale districts, and Fellow cities, which learn from the Lighthouse demonstrations and implement bold replication plans. Since 2015, these projects have collaborated to disseminate their knowledge to other cities and decision-makers across Europe, supported by the Scalable Cities secretariat.

This knowledge will feed into the EU Cities Mission, which aims at 100 climate-neutral and smart cities by 2030. Indeed, a strong link is made because more than half of the cities in the SCC initiative are also participating in the Cities Mission.

The support of the European Commission's grants to the SCC initiative led to impressive results: the programme achieved up to 53% energy savings, up to 88% CO2 reduction, over 17 500 installed smart meters, over 1 million m2 floor space refurbished, more than 5 270 e-vehicles introduced, nearly 500 e-charging stations installed, and is engaging more than 260 000 citizens in this transformation.

Figure 1: Smart Cities and Communities Projects

So, where do we stand?

Figure 2: Positive Energy Buildings in Dijon, RESPONSE project

European cities are in a prime position to spearhead climate action, develop innovative solutions and test new ways of working and living. Quality of city life and the attractiveness of cities as environments for learning, innovation, doing business and job creation are now vital parameters for success in the global competition for talent, growth, and investments.

This report presents pilot solutions to reduce greenhouse gas emissions and ensure decarbonisation. The examples range from the refurbishment and renovation of buildings, through the implementation of sustainable mobility solutions, to the deployment of information and communication technologies.

This report presents solutions for scaling up and replication across Europe and for reaching climate neutrality goals. The report offers a selection of the best and most important solutions from the more than 550 solutions tested in 120 cities.

The report also showcases approaches that address the existing structural and governance barriers and foster replication at scale by engaging citizens, stakeholders and other players in the decision-making process by intensifying policy coordination and by aligning financing and investment choices.

Aggregating all generated knowledge, sharing and promoting it, can accelerate the replication and upscaling of the tested solutions into different local contexts, and showcase how through implementing, scaling up and replicating the presented solutions, cities can contribute to achieving the European climate and energy goals by 2030 and support the transformation of Europe to a climate-neutral continent by 2050.

The path

In less than ten years, the European Commission has launched and developed a bold and comprehensive research and development programme for cities which stands out on an international scale in several aspects.

First of all, the scale and the ambition embodied by the Smart City and Communities (SCC) initiative reflected from the beginning a holistic and city-driven vision. This is demonstrated by the fact that 51 Lighthouse and Fellow cities in SCC projects, were selected in 2022 to become part of the EU Cities Mission which aims to deliver at least 100 Climate-Neutral and Smart Cities by 2030.

Secondly, the programme builds on an integrated vision. Changes will not happen following a linear process but through an interplay of technologies, innovations arriving at an uncertain rate, consumer needs, ecosystem and citizen engagement, social innovation, and political expression. Cities need to put in place the appropriate governance, organisation models and financing schemes that will allow them to scale up more rapidly the solutions they have tested with the support of the EC.

Thirdly, the programme is tailored to city needs, whatever their size or situation. For instance, the SCC initiative gathers a broad range of cities, from the largest European cities (such as London) to small cities (such as Sonderborg with less than 10 000 inhabitants), all united by bold ambitions.

Finally, it is based on a collaborative and multi-stakeholder approach, from the design to the delivery of the projects. For cities to be at the forefront of climate change mitigation and adaptation, they will have to partner with their local ecosystem (such as research organisations, universities, companies, and citizens).

Figure 3: Connected smart city concept

Forging the future together

The Smart Cities and Communities projects have cooperated closely in recent years through the 'Scalable Cities' initiative to identify and promote energy solutions and business models that can be scaled up and replicated across Europe and lead to measurable outcomes. This involved regular exchanges of knowledge and experiences through the implementation of a range of joint initiatives as well as more formal organisational structures such as a 'Board of Coordinators' as well as a City Coordinators Group.

"Looking back at those few projects that signed our first Cooperation Manifesto, I see what has grown into a huge family working together for a common goal, becoming the engine of city transformation.

A family working together to be the engine of city transformation.

For the MAKING-CITY project, being part of this community helps us to have close contact with cities that are interested in our work; chairing the Board of Coordinators is allowing us to explore collaboration opportunities that enrich our project.

Involving the new generation of projects, helping them with the experiences we have acquired and accelerating the replication of the solutions deployed in our cities are our main challenges ahead."

Cecilia Sanz , Energy researcher, CARTIF

"Collaboration with the Smart Cities and Communities projects enables me to learn from experiences gained by other Lighthouse projects and to capitalise on their knowledge. This also helps us to transfer and replicate results in similar projects.

Fantastic network of experts learning from each other.

It has been an honour for me to be chairing the Board of Coordinators from June to November 2022. It is a pleasure to be part of such a fantastic network of experts learning from each other.

It helped us to promote the participation of the MAtchUP project in smart city events and to share the knowledge gained. Moreover, the consortium has been regularly informed about the activities organised in the framework of other Lighthouse projects. And finally, it helped us boost future relationships between the project partners and their networks, as well as fostering the deployment of smart solutions in cities."

Ernesto Faubel, Head of Smart Cities Office, Municipality of Valencia

"The beginning of the smart city movement was characterised by testing innovative technologies at urban scale. The technologies themselves allowed a city to call itself "smart". Over time it became a prerequisite to be able to convincingly demonstrate the positive impacts of smart solutions on the environment, citizens, businesses, and economy.

A rigorous impact assessment as a prerequisite for green finance.

Aapo Huovila, Senior Scientist, VTT

The environmental requirements are nowadays increasingly stringent, and a rigorous impact assessment is a prerequisite for green finance. Monitoring and evaluation activities have been a significant element of all lighthouse projects. The participating cities find themselves in an advantageous position to cope with today's increasingly demanding business environment, shifting focus from individual smart solutions to positive energy districts and ultimately to become climate-neutral cities."

"The Smart Cities and Communities projects are vital contributors to European cities becoming climate-neutral by 2030, and also can contribute to the REPowerEU plan. These projects are not just about testing and developing technical solutions. First and foremost, they are showing in practice how industry, municipalities, research, citizen organisations and others can work together across sectors and disciplines to overcome regulatory, governance, economic, social, and other barriers and develop solutions.

Long-term, collaborative value creation has always been front and centre in these projects. With 120 cities having tested this over the course of eight years, with documented and evaluated processes and results, it is now the time to harvest this knowledge to help more European cities in their transition.

Furthermore, many of the projects are showing how the transition to climate neutrality can be inclusive, beautiful, sustainable, just, resilient and with good local collaboration. Since the start of the SCC programme in 2015, several of the projects had already integrated these perspectives into their mainly technical programmes.

Cities are now organising activities to make their environments more beautiful and inclusive.

Annemie Wyckmans, Head of NTNU Smart Sustainable Cities

Now, with the deployment of the New European Bauhaus initiative, we see a boost to these types of activities in all projects and cities. Several cities even mentioned that they had been organising activities to make their environments more beautiful and inclusive, together with citizens, but had never imagined that these actions also could contribute to making their city climate-neutral!

With these insights, we have high hopes to be able to contribute to the Cities Mission and help more cities advance on the journey towards climate neutrality - in an inclusive, beautiful, and collaborative way."

"The Smart Cities and Communities projects funded by the European Commission have proven very successful. Working over the last eight years on a very big challenge, under evolving but somehow similar conditions, has allowed the implementation of a large number of pilots of city transformation.

Lighthouse cities from all around Europe have implemented innovative activities. The role of Fellow cities in projects has been very beneficial, giving cities needing more time to develop and implement their strategies the opportunity to start planning their future.

The initiative has evolved continuously, but its objectives and the holistic nature of the projects are highly relevant in the context of the EU Cities Mission, the EU Green Deal, New European Bauhaus or the RepowerEU initiatives.

Furthermore, the latest projects are demonstrating that the implementation of positive energy districts (PEDs) is possible, transforming their districts into not only a very efficient ones, but a district that generates more energy than it consumed. And they are demonstrating that PEDs are a valid pathway towards the necessary climate-neutrality.

Now is the moment to take advantage of all the knowledge generated by those 18 projects, some of which are still ongoing, and to make it visible to society. Now is the moment for replication and upscaling, to achieve full decarbonisation of our EU energy system."

> ***Now is the moment for replication and upscaling.***

Rubén García Pajares, Head of Smart cities area, CARTIF

"European Smart Cities are at the forefront of implementing strategies and innovative solutions to achieve climate neutrality. These cities possess a unique advantage in addressing complex challenges through innovative approaches and practical experimentation. By employing diverse strategies such as efficient energy management, using renewable energy sources, promoting sustainable transportation, implementing effective waste management practices, adopting smart planning and urban design principles, fostering citizen engagement, and leveraging digital twins and artificial intelligence, European smart cities strive to create urban environments that are energy-efficient and have low carbon emissions.

In pursuing sustainable practices in urban areas, replication of successful strategies, solutions and technologies plays a crucial role. Replication activities are vital for accelerating progress toward climate neutrality. Furthermore, capacity-building and knowledge-sharing initiatives are essential for facilitating the scaling up and replication of best practices and successful strategies. These efforts e nsure t hat a ll s takeholders p ossess t he necessary skills and competencies to contribute to and expedite attaining climate neutrality goals effectively."

> ***Leading the change: European smart cities paving the way to climate neutrality through innovation and replication.***

Sara E. Rueda Raya, Lecturer and Researcher, AUAS

Key findings

Figure 4: The European model of a smart city

Internal working structures need profound re-thinking.

Is this the dawn of competence centres?

In the past ten years, the ecosystem of smart cities and communities has become dramatically more complex. As a results of the increasing specialisation and the need to involve a wider range of disciplines, internal working structures need also profound re-thinking. Project managers capable of steering complex and integrated projects and of developing positive energy districts are stepping up to the task.

Similarly, cities' core competencies in the areas of energy, ICT and mobility have grown following the same path. These changes are not strictly the realm of large cities as small and medium size cities are also developing their competencies by managing ambitious projects.

Leipzig. Digital unit for climate-neutral and smart city projects.

The city of Leipzig started as a Fellow city in the Triangulum project and continued as a Lighthouse city in the SPARCS project. Its experience in these projects led directly to changes in the organisational structure of the municipality.

From exchanges with other cities within the projects, and based on the implementation needs, it became evident that it is necessary to reorganise internal working structures linked to smart city and digitization issues. After an internal dialogue process between different departments the concept for the Digital City Unit was developed.

Since 2019 the Digital City Unit is a competence centre for digitization within and for the city administration as well as external actors, such as enterprises, civil society and science. The unit is responsible for the development and implementation of innovation projects funded by the municipal budget but also financed by EU and national funding.

The city realised the need for a dedicated unit to develop and implement such specific organisational capacity and processes that will help effectively design and execute smart city and international projects and engage local stakeholders in these projects.

Being a Lighthouse City in the SPARCS project, the city of Leipzig is now guiding the fellow cities of the projects and sharing its experiences in developing the organisation to become a smart city.

Figure 5: Overview of the Port of Gothenburg.

Cities are in the driving seat but are working closely with companies, citizens, NGOs, and academia. This requires a high level of coordination and much diplomacy to align potentially conflicting agendas and timelines.

However, the key question remains: how to manage knowledge within cities to avoid reinventing the wheel and to be able to scale up the approach to other city districts.

The ecosystem is flourishing and open to new partnerships.

Gothenburg. Climate Partnership.

The City of Gothenburg set up the Gothenburg Climate Partnership, a long-term collaboration between the business community in the Gothenburg region and the City of Gothenburg to reduce its carbon footprint.

Being part of the partnership offers many benefits for companies, like collaboration opportunities, marketing of their climate actions, access to key actors within the city, and support for the implementation of sustainability projects. Additionally, the city developed a Strategic Business Programme, the city's joint roadmap for creating better conditions for entrepreneurship.

Lyon. Eurêka Club.

A club of inhabitants and users of the Confluence neighbourhood in Lyon was established, to reinforce the engagement and co-creation of new urban services. The first version of this club, called 'Electryclub' was set up from the end of 2016 until mid-2017, with a partnership between SPL Lyon Confluence, Enedis (electric grid operator), ALEC (Lyon Local Energy Agency) and TUBA (association in Lyon aiming to innovate and experiment new data-based urban services).

Electryclub organised six workshops with a group of inhabitants to test a smartphone application to raise awareness about balancing electricity production and consumption in the Confluence area. The Electryclub also hosted site visits (of technical installations, a positive energy site, etc.) and organised expert presentations on photovoltaic installations in the neighbourhood.

This work showed that there was a strong interest from inhabitants in topics related to smart cities, sustainable development, and the development of new urban services. But it also

demonstrated that the smartphone application was insufficient to keep citizens involved for more than a few months.

Therefore, a partnership between SPL Lyon Confluence and a dozen public and private partners (operating in the energy, mobility, real estate and construction), including Enedis, SPL Lyon Confluence and TUBA, supported the creation of the 'Eurêka Club', a citizen incubator for circular-economy projects.

The focus of the Eurêka Club is mainly on co-creating new urban services led by citizens. The call for interest was officially launched together with support to help citizens to design and fill out the application form correctly.

Among the 29 citizen-led projects received, a jury (comprising private companies, associations of the neighbourhood, and the vice-president of Lyon Métropole for smart city) selected three winning projects. These projects are related to sustainable development and quality of life in the Lyon-Confluence area:

- 'Atelier des Nouveaux Designs': Creation of a collaborative place dedicated to the reuse of materials and self-creation, open to both professionals in these sectors as well as the general public.
- 'Ek-eau studio': Creation of a hybrid place focusing on the challenges of positive energies (electrical, human, economic) and the setting-up of an "energy observer" to re-think how to conceive and consume energy in the future.
- "What about urban farming": Deployment of three pilot sites of urban agriculture in the Lyon-Confluence area to reinforce the transition of the experiments conducted in the neighbourhood.

Cities are implementing profound changes in governance and integrating ongoing learning.

Cities are organised to exploit and deliver public services and are usually organised in departments, frequently operating in silos with conflicting agendas.

However, cities are starting to implement profound changes in governance to address the problem, strengthen coordination and increase overall efficiency. This can take the form of creating a new vision for the city, nominating innovation managers working directly in the different departments, or creating mission or coordination mechanisms.

Figure 6: Conceptual design for redevelopment of the La Confluence area in Lyon.

Figure 7: Promotional image of the City of Valencia taking up the challenge to become climate neutral by 2030.

Valencia. Mission-inspired organisation.

The City of Valencia has a strategy for achieving climate neutrality and a multi-departmental core group that invites other departments and external stakeholders to coordination meetings on a case-by-case basis. The strategy was backed by the council which overwhelmingly endorsed the strategy with 31 votes in favour out of 33 votes. This can secure support for the strategy even in case of a future change of mayor or council.

Vienna. Participatory governance and learning enable scaling-up.

During the Smarter Together project, Vienna adopted an integrated "Learning Governance" concept focussing on city governance and project stakeholders. Its aim was to activate human resources, to develop common visions and values as well as to encourage participatory project development and implementation. By focusing on governance stakeholders with specific leverage capacity and on business decision-makers, long-term financially relevant and/or bankable project outcomes were boosted. The participatory concept of Learning Governance goes beyond the traditional citizens participation.

Vienna's management team for the Smarter Together project encouraged co-creative cooperation amongst its staff from different departments by using all the possibilities that the legally-defined competencies of city administration units/departments provide but may not be inherent to their respective organisational culture. Its main tool beyond the political agreement was to provide funding for the involved staff, improved governance, and involvement of private project partners. As a result, the people involved did not only produce highly-innovative solutions but went far beyond the previously agreed KPIs. They also continued to pursue the project's goals after its completion, by scaling up solutions either in other areas of the city or in their private enterprises. The participatory concept contributed to boosting the innovation dynamic within the city and of stakeholders.

The Learning Governance approach enabled all governance actors, as well as project partners, to plan and implement numerous follow-up projects and programmes and so substantially increase the project outcome, such as the launch of the urban renewal initiative «WieNeu+»; the RenoBooster project on refurbishing private housing; the further development of the Vienna Smart City Framework Strategy; a rollout of mobility stations and PV installations.

Figure 8 : Vienna, a Smarter Together city

Figure 9 : Espoo, a SPARCS city (Photo by Adunais Perez)

Espoo. Creating positive energy districts with a co-creation model.

The city of Espoo built a positive-energy district as a part of the SPARCS project thanks to a co-creation model. Within the project, they looked at how to develop sustainable and smart urban areas, districts, or blocks, in collaboration between the city, companies, educational institutions, research institutes, other organisations, and residents. They defined common goals with relevant stakeholders and integrated them into different stages of the urban planning process.

What they learned was:

- Co-creation enables people to work together on an equal footing to achieve a common goal.
- Creating an open environment is a prerequisite for information sharing, while maintaining the possibility of protecting legitimate business-related information.
- A networked, multilateral way of working and organising enables us to process complex issues, such as achieving sustainability.
- Urban development is a demanding area for co-creation because of the number of parties involved and the initial vast scope of the task.
- Co-creation can optimise public and private sector resources.

Munich and its Urban Living Lab.

The Urban Living Lab developed during the Smarter Together project in Neuaubing-Westkreuz (a suburb in the west of Munich) opened within six months of the start of the project. It was a central hub for citizen engagement in the project area, functioning as an event and exhibition location and a local cultural centre.

The Smarter Together team used the lab to engage citizens and other stakeholders on topics around sustainable and smart urban development and invited them to express their particular wishes. Informative and entertaining events, including interactive art and media projects, technology exhibitions and talks also took place.

In addition, the project managers and experts from the Smarter Together team were available to the public in the lab three days a week. Twenty-five workshops, more than 4,000 visitors as well as exhibitions contributed to raising awareness of the project's goals and to making the smart city solutions better and easier to use.

Figure 10 : Overview of Munich from the Ackermannbogen, a residential energy efficient development.

Limerick. The case for citizen innovation.

Thanks to the +CityxChange project, the city of Limerick was able to show how citizens can become co-innovators. The city involved citizens to design and test the features of new urban products and services to ensure they are practical and useful. The motto was "Getting things done" by translating strategic planning into tangible programmes.

As a result, six concepts to enable top-down and bottom-up processes of engagement have been implemented, many co-developed with the city of Trondheim:

- A Bold City Vision developed with citizens as active co-innovators.
- A Citizen Participation Playbook.
- An Innovation Playground, physical spaces located in the urban area to be transformed, linked to online spaces, to encourage innovation through new products, techologies and business models.
- A Learning Framework for the next generation of smart citizens supported by a set of tools (such as digital twins, community mapping for bikes, open calls for citizens to design innovative solutions).
- A Positive Energy Champion Network that encourages citizens to develop, test and promote their own solutions that are customised to the environment they know best - their own neighbourhood.
- A Distributed Positive Energy Block (DPEB) Innovation Lab, a dedicated centre for digital innovations. Data and visualisation tools are available to stakeholders – citizens, businesses, academia, and government agencies – to support competition and innovation. The Innovation Lab hosts open challenges to develop solutions to progress the creation of DPEBs and provides a place where the design and operation of DPEBs are visualised and analysed. The Innovation Lab can include a mini prototyping lab where Do-It-Together projects are designed, piloted, and delivered.

Actions that target citizens frequently aim to change their behaviour, but rarely make these changes desirable or rewarding.

In several cities, such as Limerick, we see the growing power of the crowd when effectively motivated. Innovation labs have flourished in recent years to showcase the impressive power of the crowd when it comes to designing, testing, prototyping, financing, and deploying innovations. Be prepared to exploit feelings such as joy, happiness, ownership, and jealousy in your next actions!

Citizen engagement.

The power of the crowd is increasingly purpose driven, digital and innovative.

Cities have implemented urban data platforms gathering datasets with different models. Some, like Dijon and Angers, have started implementing a city-operating system aiming to optimise public services such as mobility, energy, or waste. Others have developed access to datasets that can be used to create services freely, like in London, or to foster innovation in the local ecosystem through hackathons.

Almost half of the cities surveyed are starting to explore urban data platforms, but only a third are using them operationally. This leaves plenty of ground for improvement in the coming years.

Digitalisation is starting to scale-up.

Integration of data remains a challenge.

Hot topics right now? Energy Communities, Digital Twins, and the potential of using blockchain and AI.

Energy management systems have been put in place to enhance the energy system efficiency, develop renewable energy, couple storage capacities and buildings, as well as to integrate energy, buildings, planning, and mobility.

For energy communities, business models and financing schemes are critical and are being developed and tested.

Figure 11 : Bristol, a REPLICATE city

Bristol. Smart Homes that reduce energy consumption.

During the REPLICATE project, Bristol piloted the smart homes project which aimed to reduce household energy consumption whilst trialling the use case for an energy demand management system. In addition to smart appliances, homes received smart home monitoring equipment to capture electricity use data from both the smart appliances and the whole house. A virtual private network was deployed through a Raspberry Pi to securely transmit data to the Smart City Platform.

The team implemented a co-design approach in all stages of project development:

- They appointed a Community Engagement Group and recruited champions to build capacity and empower the local community for future projects.
- They organised energy awareness workshops and outreach engagement events using a mobile testing vehicle (Mobile Future Home) to help participants use electricity more efficiently at home.

The demand side response (DSR) trial and learnings from the community engagement approach are already being scaled up within other city council initiatives.

The impacts are well beyond purely environmental benefits. It is estimated that individual households could save up to 260kg of CO2. As activities and events were also focused on lower-income households to ensure a wide range of beneficiaries, it has successfully targeted homes more likely to be in fuel poverty. The estimated electricity energy savings in households are at up to £150 per year.

AI is getting creative for greater good, or?

Artificial intelligence (AI) is becoming mainstream, and many city applications are using AI or other data-driven approaches. These generative models, “general-purpose AI” systems, can be used for many different things.

The tremendous progress made by generative AI models will bring challenges around privacy, disinformation at scale, biased and toxic associations buried in training data taken from the internet. At the moment we do not know the direct consequences for cities. To manage these risks, the EC proposed a new EU regulation, the EU AI Act.

Évora and Alkmaar are POCITYF.

The POCITYF project is creating positive energy blocks in the heritage cities of Évora and Alkmaar. In Évora, innovative building integrated photovoltaic (PV) solutions, such as shingles and glass, will be installed respecting the architectural and cultural heritage of the city.

Additionally, the municipality will build a community solar farm and use second-life batteries together with a peer-to-peer energy trading platform and control algorithms to provide flexibility and energy market services.

In Alkmaar, the sports complex is installing a heating and cooling storage solution where waste heat from the ice machines and heat from an aquifer thermal energy storage are used as the sources for cascaded heat pumps. Excess heat will be shared with neighbouring buildings by extending the low temperature grid. The roof of a high-rise building is being retrofitted with insulation from circular materials and PV will be installed on the roof and façades of the building.

At the city level, an energy-producing sound barrier and a smart lamp post with EV-boat charging capabilities will be installed, together with centralised solutions, such as a city energy management system, that offers flexibility services and a decentralised peer-to-peer energy-trading platform.

Figure 12 : Evora, a POCITYF city

There is a need to further develop use cases for digital twins to better understand their added value in the decision-making and how cities can combine, in open-source environments, different sets of data (remote sensing, sensors, drones, earth observation, etc.) and combine them in practical use cases.

Earth science missions and remote sensing satellites provide more than 50% of essential climate variables that are measurable only from space, providing data on GHG emissions and insight into the consequences for all aspects of the climate. This integration remains a considerable challenge.

Digital twins still need to tackle the data compatibility issues.

Between January and October 2022, European urban tech start-ups raised $28 billion, already more than in 2020, but were projected to fall short of 2021 by 23%.

Why it matters: The battle against climate change will be won or lost in how we manage emissions from cities. More investment in urban tech is required to hit net-zero targets. When an economic downturn creates turbulence across global markets, venture capital investors become more cautious and selective.

Cities are booming, and so is sustainable urban tech.

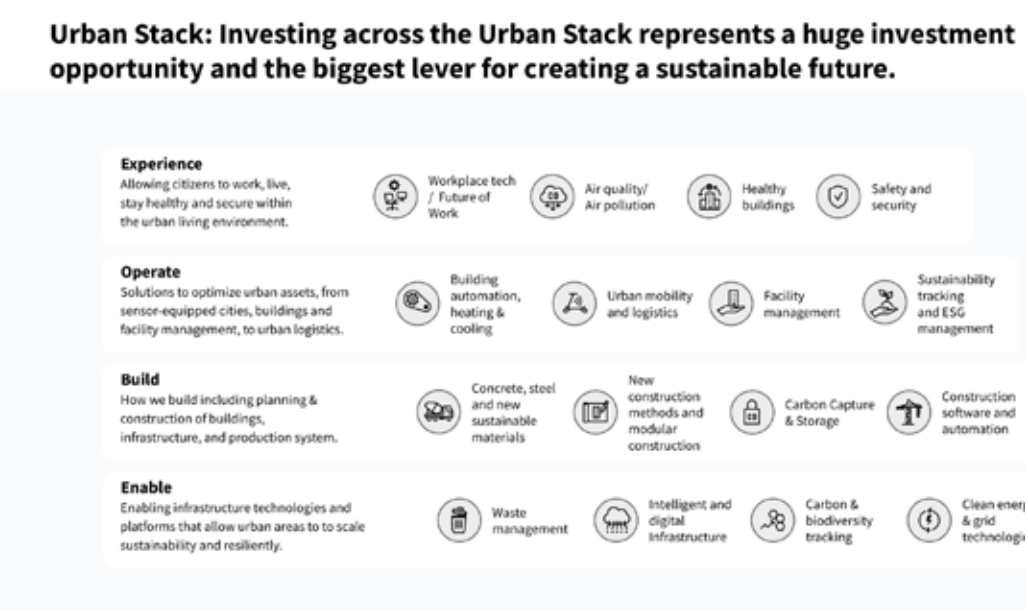


Figure 13: The Urban Technology Stack, Urban Tech 2022 Deal Room 2150 report

Bridging the financial gap.

How do we derisk investments?

Cities on their path to become climate neutral will have to bridge the financial gap. Cities are not usually frontrunners in financing innovative schemes and the city budget is usually only a fraction of the money needed. Stakeholders and potential investors can struggle to understand the nature of the projects and their structure. All need the investments to be de-risked.

Promising innovation in financing schemes will attract more interest given the urgency of achieving climate neutrality and the amounts of money needed. The creation of city investment funds, revolving funds, digital social markets, or territorial crowdfunding are only the starting blocks.

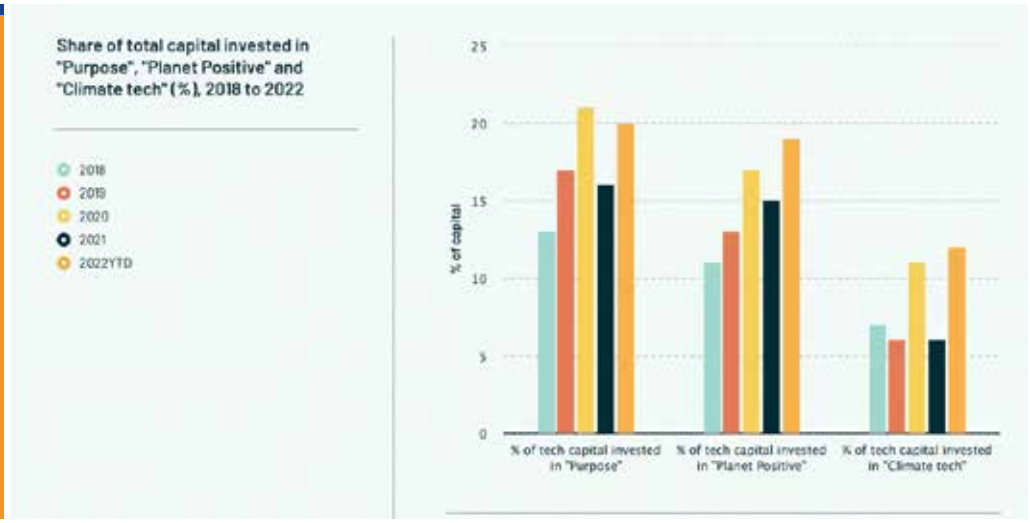


Figure 14: Purpose-driven investment on the rise. State of The European Tech 2022

London, Lisbon, and Milan. Engaging communities and encouraging behaviour change through a Digital Social Market.

Engaging the community to change their behaviour is a less costly solution with one of the highest rates of return. The three cities in the Sharing Cities project developed a digital social market to promote certain behaviours amongst their citizens.

The digital social market (DSM) is a new approach to citizen engagement. At its heart, a DSM is a mobile application designed to enable digital and physical interactions between users, services, and service providers. It aims to shift perceptions and encourage behaviour change by using rewards. Ultimately this will boost the uptake of sustainable smart city services.

For example, Milan developed SharingMi, a social media platform which brings together Milan citizens who care strongly about sustainability issues. It encourages users to share stories, experiences, and ideas with other members to grow awareness and stimulate action around urban challenges. The aim is to inspire citizens to think and act differently. The community seeks to reframe and normalise sustainability and encourage users to reflect on their behaviour and make changes.

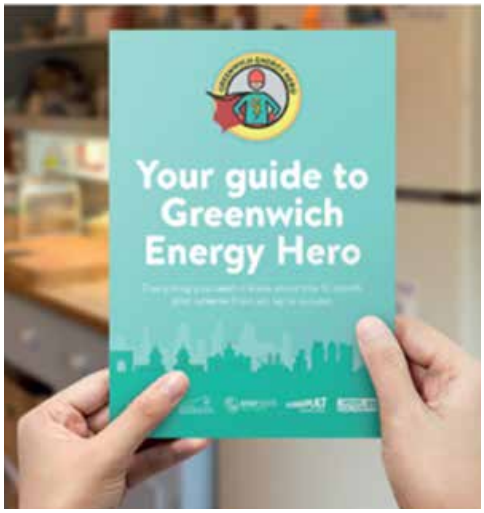


Figure 15: Examples of a Digital Social Market

London, Manchester, Milan and The Hague. Transforming a city vision into a reality through a city investment fund.

The commitment of the 100 EU cities to become climate-neutral by 2030 as part of the EU Cities Mission, highlights the importance of financing climate projects across Europe. Such projects can specifically give a new boost to create city investment funds that can reach a critical mass to attract large investors such as the European Investment Bank or national banks.

A potential solution has been piloted through the project Multi-Region Assistance Project-Revolving Investment for Cities in Europe (MRA-RICE), where London, Manchester, Milan and The Hague created a blueprint for a city fund by gathering their best practices.

The new MRA-RICE blueprint city fund is a flexible model that can be adapted to the specific needs of cities across the EU to support urban development. Through the creation of the city fund, cities have the opportunity to operationalise their vision and strategy. The development of an urban investment strategy is led by the cities, while the involvement of an independent fund manager drives its implementation.

The vision for the blueprint of the MRA-RICE city fund is a city-led financial instrument, independently managed, with an investment strategy aligned to the city's strategic priorities, that achieves significant leverage of public investment. Such a city investment fund can pool a portfolio of projects, attract investors to finance them and entrust the management of the investment fund to highly-skilled external asset managers, like a traditional investment fund. The city investment fund could be specialised (energy, for instance) or multi-thematic, targeting infrastructures, asset-based projects, innovative start-ups, or SMEs (such as the Greater London Investment Fund).

Utrecht: Toward District Investment Platforms to steer investment in a portfolio of projects.

Using the experiences from a pilot in the IRIS project, Utrecht calculated that an investment of €9.5 billion is needed to make its energy system climate neutral. The municipality share is 15.7% or €1.5 billion. Achieving climate neutrality will therefore require significant i nvestments f rom businesses, real estate owners, utility companies, and other stakeholders. Utrecht wants to create a joint investment plan to coordinate the different investments and mobilise the financial community to develop innovative financing s chemes. T he project is to create a district investment platform that can orchestrate the process and increase the efficiency in the financing allocations.

Valencia. Energy crowdfunding or socialised solar plant.

As part of the MatchUp project, Valencia is launching "The Las Naves Brillen" initiative, whereby the first photovoltaic (PV) plant on a public building is financed by citizen investments. Individual citizen participation ranged from €100 to €2 000 and more than 100 citizens participated! This total cost of the PV plant was €100 000, with the Las Naves public owner contributing €20 000 and citizens €80.000. The plant has an expected production capacity of 100 KW.

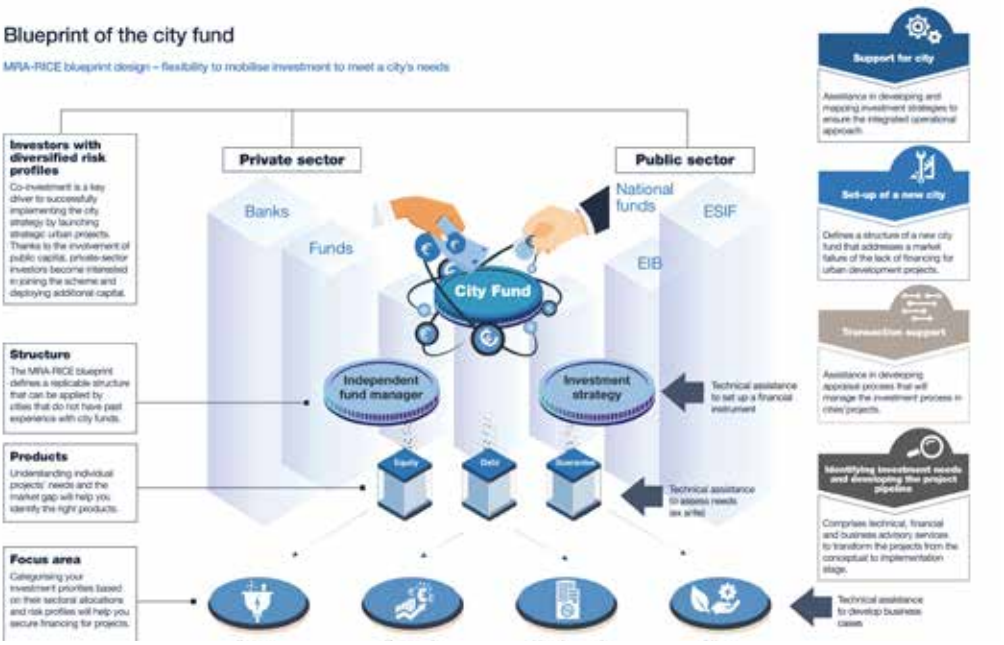


Figure 16: The Urban Structure of a City Investment Fund, MRA RICE project

Figure 17: Examples of the socialised solar plant "Las Naves Brillen»

In principle, cities are good at exploiting, that is, repeating a known winning pattern, and managing a predictable risk. They are less used to exploring what needs to be done in a distributed world and dealing with uncertainties. Their organisational, cultural, and societal model is often not suitable for uncertain activity.

Reaching climate neutrality in such a short time frame will require leaning towards exploration rather than exploitation, figuring out the methods that allow us to quickly make solutions cost effective, energy efficient, and scalable.

Robustness and longevity are perhaps among the top qualities of a city. They could, however, render the process of implementing transformative actions to reach climate neutrality long and cumbersome.

Raising funds is not the only challenge.

Accelerating the pace of implementation is crucial.

Reaching climate neutrality is, first and foremost, a question of ability to implement change, spend money wisely, and accelerate and leverage the incredible power that innovative local ecosystems have. In other words, it is a question of execution.

Following business as usual scenarios to solve the implementation question will most likely deliver slow responses to an actual emergency. Partnerships and commitment are essential conditions, but there is a urgent need for a coordinated and accelerated implementation.

Cities have a dire need for coordinated implementation.

The City Special Purpose Vehicle is a way to establish public in-house companies, mainly or wholly owned by the Cities and are purpose or mission-driven, where potential profit is only a tool to achieve a goal.

They act like hybrid companies: combine the exploitation management model of a city with the exploration one of a private company. They help avoid silos between departments and develop cross-cutting solutions with more freedom and means.

They provide i) more flexibility to hire competencies needed, staff or experts, and ii) agility to deal with the private sector and the population, two aspects essential for delivering climate neutrality.

A way forward for the City Special Purpose Vehicles?

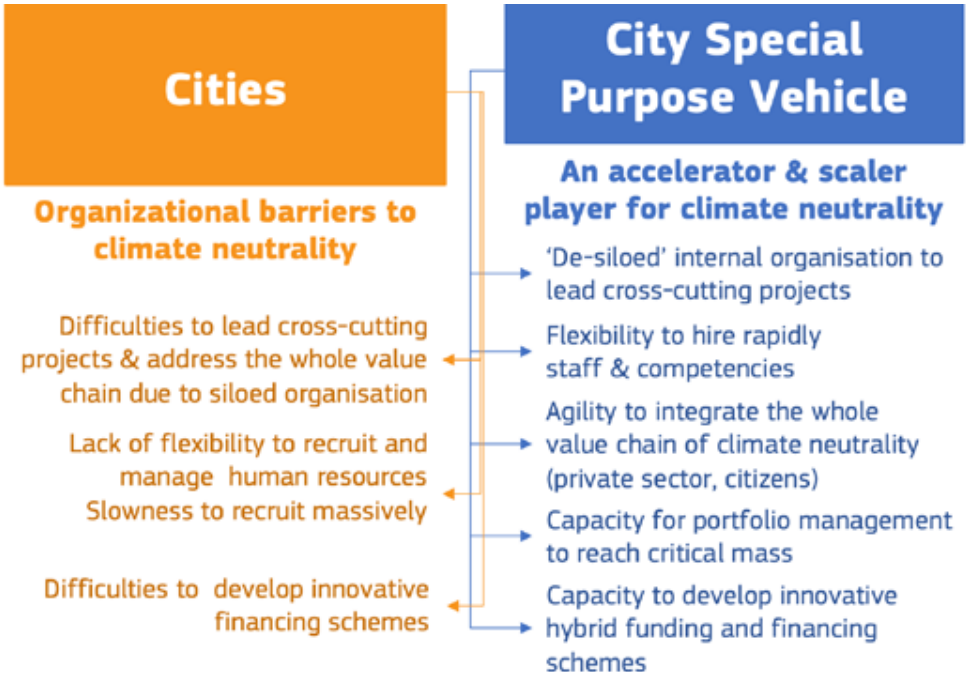


Figure 18: City Special Purpose Vehicle explained

Figure 19: Lyon Confluence area.

Lyon Confluence. City Special Purpose Vehicle dedicated to sustainable development.

Lyon Confluence has a double identity. It is, first and foremost, an urban area, densely populated, located near the historic city centre of Lyon. The objective of Greater Lyon (the Metropolis of Lyon) is to make this area an extension of the centre of Lyon, to double the size of the city centre. However, the construction of this new district must not lead to a major increase in energy consumption, and the last phase of development of Lyon Confluence aims to become a positive energy district.

Lyon Confluence is also the special purpose vehicle, created and fully owned by Greater Lyon and the City of Lyon to develop and deliver the large-scale urban development project an area of 150 ha. The company is public but acts with the flexibility of a private company, enabling it to develop the area, create an ecosystem of partners and recruit expertise and skills quickly. Lyon Confluence is at the centre of an ecosystem of partners and plays the role of a public developer but also of an investment and innovation lab.

Figure 20: Lyon Confluence model

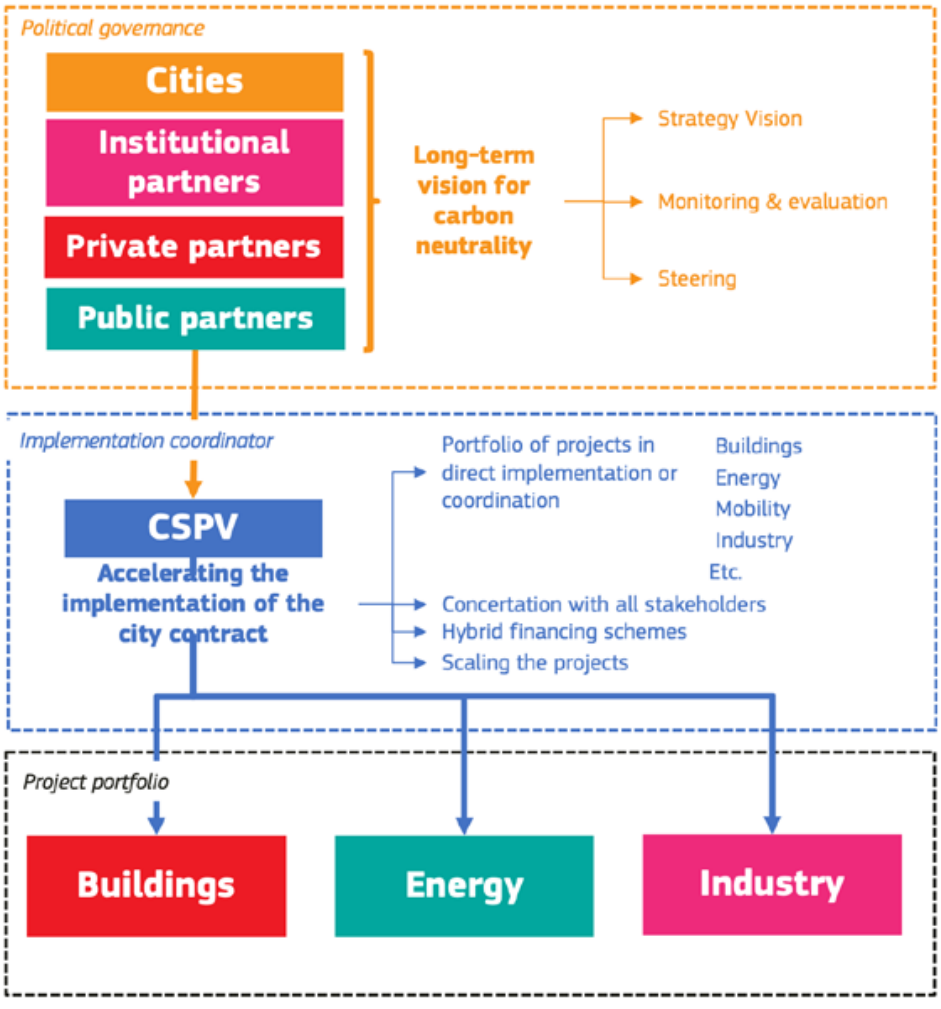


Figure 21: Integrating the City Special Purpose Vehicle into the governance framework

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