Societal, Research and Innovation Challenges in Integrated Planning and Implementation of Smart and Energy-efficient Urban Solutions: How Can Local Governments Be Better Supported?

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Abstract

This paper reports on a special session organized during the SPPCR 2019 conference by Urban Europe Research Alliance and the Action Cluster Integrated Planning, Policy and Regulations of the European Innovation Partnership on Smart Cities and Communities, in collaboration with several key networks, projects and programs. The aim of this special session was to discuss how integrated planning and implementation can help to boost the transition to low-carbon cities and how good examples and best practices of such an integrated approach can foster wider replication of smart and energy efficient solutions in cities across Europe. European Commission policy officers updated the audience on expected changes in smart sustainable city policies in the new programming period between 2021 and 2027. Ambitious and comprehensive on-going European smart city projects highlighted how they designed and deployed a holistic, integrated perspective during the phases of project preparation and execution, often in a living lab approach, and the challenges they had to overcome in doing so. Cities and researchers committed to replication of smart and energy-efficient solutions, shared their needs and dilemmas, in particular regarding the role of holistic, integrated approaches. However, it was also pointed out that specific constraints, make that replication has to explicitly designed for in the very early stages of any project and should be part of any holistic approach. Others presented different avenues for stepping up the efforts to create smart and energy-efficient cities in an integrated way: from providing low-threshold roadmaps for developing customized strategies and building collective transformative capacity through pooling of national research resources, to setting up learning energy communities and deploying Interreg funds for innovative decision-making on energy-efficient public buildings. Interactive sessions explored persistent knowledge gaps regarding integrated planning and implementation and how new projects can be built for positive energy districts. It is concluded that the value of a holistic or integrated approach is generally acknowledged and several good tools have been developed in EU-funded projects helping to concretize it, but that the concept needs to be better articulated, made accessible to time-pressured city administrations, geared towards specific urban situations and contexts, and translated into specific local processes and procedures to better support local governments.

Keywords:
Smart cities; Energy efficiency; Integrated planning and implementation; Local governments

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1 Introduction

While the importance of a holistic, integrated approach to planning and implementation of smart and energy-efficient solutions in cities is widely acknowledged (e.g. European Commission 2013; Bahr (ed) 2014; IEA 2017; Mission Board on Climate-Neutral and Smart Cities 2020), in practice multiple societal, research and innovation challenges make this quite complicated. How can time-pressured, often siloed local governments be better supported in this across Europe? How can the good practices demonstrated by several European projects be more easily taken up by other municipalities, and how should this information be disclosed? On 10 December 2019, an event dealing with this key issue was organized by the Urban Europe Research Alliance (UERA), an organization representing 55 universities and research institutes across Europe related to Joint Programme Initiative Urban Europe (JPI Urban Europe), at the Smart Sustainable Planning of Cities and Regions 2019 Conference in Bolzano, hosted by EURAC Research.

This event was jointly organized with a wide range of highly active key players as JPI Urban Europe, the SET-Plan Action 3.2 on Positive Energy Districts, the Action Cluster Integrated Planning, Policies and Regulation of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC), Horizon 2020-funded smart city lighthouse projects Smarter Together, REPLICATE, +CityxChange and STARDUST, the European Energy Award (eea), and Tuscan Organization of Universities and Research for Europe. The event brought together a wide range of key stakeholders around integrated planning and implementation of smart and energy-efficient solutions in cities, to discuss not only how efforts to decarbonize cities can be stepped up through wider replication, but also which agenda for research and innovation should be defined to build more collective intelligence and transformative capacity for local governments, under Horizon Europe, national policy agendas and JPI Urban Europe's Strategic Research and Innovation Agenda 2.0 (JPI Urban Europe 2019).

Many important questions were discussed at the event. What can we learn from the experiences of lighthouse projects and similar projects? What withholds urban ecosystems from replication and which role is played in this by lacking or deficient holistic, integrated approaches? How can we make better use of lessons already learned by others? And last but not least, which messages should be delivered to the newly established mission boards regarding needed research and innovation?

The lively and successful event was attended by around 140 participants. Key messages, not only for new policy agendas, but also for a new research and innovation agenda centering around holistic, integrated approaches, have been collected and will be transferred to national policy makers, the Mission Board on Climate-neutral and Smart Cities, JPI Urban Europe and SET-Plan Action 3.2 on Positive Energy Districts. Here, a summary of the event and its most important outcomes are presented.

2 Smart Cities in the future programming period of the European Commission

The opening session of the event welcomed all participants and discussed European research and innovation policies for smart and energy efficient cities, thus setting the scene for Horizon Europe. Georg Houben, Policy Officer, DG Energy Dir. C2, discussed the European Commission's (EC) plans on smart cities policies and funding schemes in the future programming period. Key tenets are the continuation of funding opportunities for smart city lighthouse projects in Horizon Europe, and in the Green Deal under preparation, which will publish calls for making cities more energy-efficient in a smart way in September 2020. In the Horizon Europe program, the intervention area 5 "Communities and

Cities" will be part of the pillar 2 "Global Challenges and European Industrial Competitiveness" in the cluster 5 "Climate, Energy and Mobility". Two co-funded partnerships are proposed: "Driving Urban Transition to a Sustainable Future and Clean Energy Transition", whereas a Mission on Climate-Neutral and Smart Cities has been launched in July 2019, chaired by Hanna Gronkiewicz-Waltz.

Following, Jérôme Böhm, Program Manager Italy and Malta of DG Regio Dir. G 4, updated the audience on the architecture of the European Regional Development Fund (ERDF) and Cohesion Fund in the new programming period 2021-2027. Within a total budget of 373 Billion Euros, important changes are a higher budget for less developed and transition regions, a lower budget for more developed regions and cohesion, beside new regional eligibilities. Apart from a more connected and more social Europe, a smarter, greener, low-carbon Europe and a Europe closer to its citizens are key objectives of Cohesion Policy from 2021 to 2027. For a smarter Europe, interregional cooperation in value chains will promote innovative and smart economic transformation. For a greener Europe, 30% of the ERDF operations is expected to contribute to climate objectives through energy transition, the circular economy, climate adaptation and risk management. For Europe closer to its citizens, integrated territorial investments and community-led local development will be important tools, while 6% of ERDF is earmarked for promoting sustainable urban development through local development partnerships. Here the European Urban Initiative will come into play, specifically to tackle the fragmentation of current support offered to cities by capacity-building, innovative actions, knowledge policy development and communication with the overall aim of strengthening an integrated and participatory approach to urban development and provide a stronger link to EU policies, in particular Cohesion Policy. Lastly, the EC plans more cooperation and synergies between Interreg (cross-border or transnational cooperation), ESF+ (Integrated development in deprived neighborhoods and social inclusion), EAFRD and EMFF (integrated strategies in rural and coastal areas), Horizon Europe, InvestEU (market-based support for integrated strategies) and technical assistance.

3 Innovative approaches to integrated planning and implementation of smart city solutions – real life examples from EU-funded projects

After the position of smart cities in the future programming period of the EC had been outlined, four EU-funded projects shared their real-life examples of innovative approaches to integrated planning and implementation of smart city solutions.

Adriano Bisello of EURAC, Project Manager of SINFONIA project funded under 7th Framework Program, highlighted the importance of co-benefits in integrated planning and implementation of smart energy district projects in Bolzano. Like when beholding an iceberg, avoided CO^2 emissions and energy savings are often well-recognized outputs of projects, but many co-benefits of solutions remain largely invisible. A co-benefit is defined as any socio-economic and environmental positive effect related to the execution of a project, exceeding the primary goal, regardless if intentional or not (Bisello et al 2017; Bisello and Vettorato 2018). In the SINFONIA project, Bisello and Vettorato (2018) categorized these co-benefits and developed a systemic method which reveals the contribution of co-benefits to overall quality of life for citizens in four specific investigations, possibly leading to a different assessment of deep retrofitting options. At first, individual participants scored relevance and likelihood of different smart city components, and ranked their priorities, what provided input to a world café set-up where knowledge and group thinking on these complex topics was elicited. Following, a hedonic price method helped to determine how energy efficiency would influence the value of residential properties. After that,

a contingent evaluation method on smart points was applied to understand the willingness to pay for a new infrastructure. Subsequently, an analytic hierarchy process on the decision on deep energy retrofitting helped to better understand the priorities of households regarding various types of sub-criteria, such as design and spatial quality, economic benefits, and acoustic and thermal comfort (Bisello and Vettorato 2018). Therefore, making co-benefits visible is of crucial importance for integrated planning and implementation of smart and energy-efficient solutions, not only by providing a better balanced assessment of different options, but also by creating a better understanding of each other's priorities while developing a communal strategy, thus securing the "buy-in" of different stakeholders.

Fig. 1 Different approaches to Urban Living Labs (source: Smarter Together)

After this, Etienne Vignali of Lyon Confluence, Project Manager of Horizon 2020-funded Smarter Together, explained how inclusiveness has played a central part during the implementation of smart solutions in Urban Living Labs in the districts of Simmering North-West (Vienna), Neuaubing-Westkreuz (Munich) and Confluence area in Lyon (Smarter Together 2020). Main outcomes of the project are 17 MegaWatt of newly installed renewable capacity, 152.000 m^2 of renovated floor space in refurbished housing, 89 electric vehicles and 64 charging stations, and three Urban Data Platforms, while 8500 citizens have been involved in this process. Inclusiveness through engagement of and co-creation with stakeholders is at the heart of the project. However, per Urban Living Lab, this took place in a different way. While in Vienna a mobile information bus which changed location every five to six weeks proved to be a much more effective means for engaging citizens and other stakeholders in the district than more traditional hearings, in Lyon and Munich a more stationary approach was taken at a centrally located co-creation place (see Figure 1). While different tools were used for engagement of and co creation with citizens, each Urban Living Lab also faced different realities and choices in smart solutions for energy retrofitting of buildings and electric mobility. Main focus in Vienna was on tenants in public and social housing and users of public facilities as schools, integrated with e-carsharing, e-bikes, e-forklifts and mobility station schemes. Lyon targeted in particular social housing operators, groups of private owners and office spaces, e-cars, autonomous shuttles and electric charging stations. Munich worked mostly with owner-occupier associations in multiple-residency buildings, in combination with e-cars, e-bikes and district sharing boxed to improve sustainability of the last mile logistics (Smarter Together 2020). Smarter Together learns that integrated planning and implementation cannot be done using a blueprint, but that different approaches have to reflect local different realities and contexts.

Subsequently Alessandra Barbieri, Project Manager at the City of Florence, shared the main features and holistic approach chosen in the Horizon 2020-funded REPLICATE project (REPLICATE 2020). Florence has a longstanding commitment to sustainability since signing the Aalborg Charter in 1998, manifesting itself in a Sustainable Energy Action Plan (2011), a long-term Smart City Plan until 2050 (2016), and a Sustainable Urban Development Plan (2016). Florence wants to regenerate the city through developing a polycentric structure for a more sustainable, compact and socially affordable resilient city. Four specific domain strategies underpin this: 1) redevelopment of dilapidated urban areas combined with rewarding energy efficient systems to prevent further urban expansion; 2) promotion of public transport, low emission and electric vehicles, walking and cycling; 3) more ICT platforms and apps, digitalization of public services and e-government, beside extension of the Wi-Fi network; and 4) sustainable construction, extension of the ecological network, smart lighting, sensor systems, green procurement, bio-schools, and the action plan on climate change mitigation and adaptation. The REPLICATE project made it possible to accelerate the transition to a smart city and the deployment of not only innovative technologies but also of novel organizational and economic solutions, in a lighthouse project with San Sebastian and Bristol. Smart solutions applied in Florence's lighthouse project are renewable energy production and thermal insulation, implementation of smart grids with sensors enabling remote control, smart lighting also offering surveillance for traffic control, a public tender licensing 70 e-taxis and four fast recharge stations for taxis, and participatory methods based on systems thinking for engaging citizens. Data are seen as a core enabler for acting, as sharing of data can help to simplify life for citizens, to improve communication not only between experts but also between citizens, and to avoid reinventing the wheel. Integrated planning means sharing skills, data, infrastructures and services and the Smart City Control Room makes this possible (Bellini et al 2018).

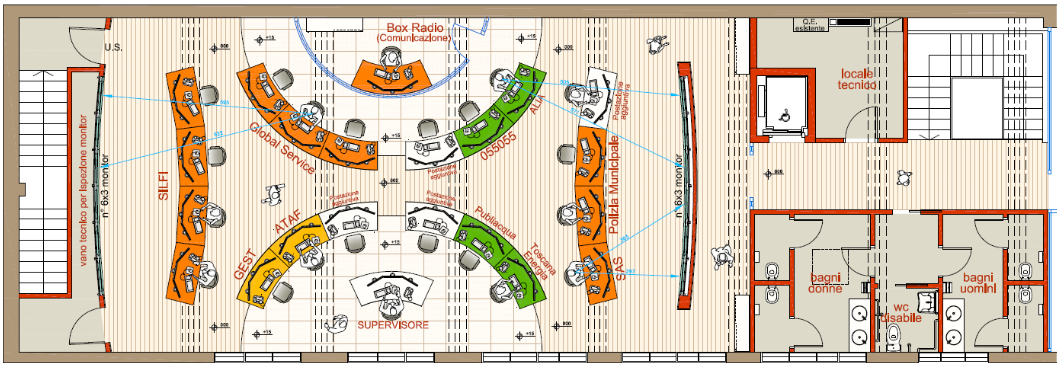


Fig. 2 Smart City Control Room: a physical place to better manage the city for a better life (source: REPLICATE)

The role of the municipality in this can be compared to that of a conductor of an orchestra: a center of aggregation that takes care of collaboration and synergies between different bodies and utilities, while the individual parties play their part. This federated model is enabled by a Big Data platform, developed together with the University of Florence, containing data on a wide array of topics but also having a physical location (see Figure 2). The municipality is the only one who can promote a joint vision and a holistic, integrated approach, where different operators and service providers can make decisions and manage public services much faster sharing systems and real-time data. REPLICATE shows how bringing together urban data in a big data platform supports not only technical but also organizational collaboration.

Lastly, Annemie Wyckmans, Norwegian University of Science and Technology, Project Coordinator of Horizon 2020-funded +CityxChange, explained how integrated planning is being used to create positive energy districts in Lighthouse Cities Limerick and Trondheim (+CityxChange 2020). This will be

achieved along two lines. At first, accelerating the energy transition through jointly developing a vision, engaging stakeholders, experimenting in the innovation playgrounds, modelling of potential impact, scrutinizing legal frameworks in regulatory zones, and fine-tuning investment plans and risk-sharing models with stakeholders from public and private sector, academia and civic society. At second, increasing the energy system integration of Positive Energy Buildings (PEBs), microgrids, electric mobility as a service, local trading and developing a market for flexibility. The barriers for replication of good smart city practices have been well-documented earlier, e.g. by Vandevyvere (2018), Borsboom-van Beurden et al (2019) and DoGA (2019), and +CityxChange wants to address them by setting up an extensive process of open innovation and co-creation with all 32 project partners and local associates. Its aims are: to build a common project culture across sectors and countries, to clarify expectations, to make mutual dependencies explicit, to integrate lessons learned into every organization, and to communicate, share and evaluate frequently (+CityxChange 2020). A concrete example contributing to better integrated planning and implementation are the glossary workshops, where a project-wide common understanding of specific terms and expected outputs provided a very useful basis for multi-disciplinary collaboration. In the same vein, the Bold City Vision provided guidelines for balancing long-term strategic planning aims for the cities with short-term incremental actions in the project. Other examples are the inventory of how regulatory frameworks should be adjusted to enable the desired innovations, and a framework for the innovation playgrounds organized in Limerick that combined both physical and digital instruments. Lastly, the CommunityxChange Framework for PEB Innovation Labs creates “a permeable culture for co-creation “in the city, while storytelling workshops explore ways towards citizen-led energy transitions (+CityxChange 2020).

4 How can the uptake of smart sustainable city solutions be accelerated in the future?

After lunch Marc Dijk, Research Fellow at the University of Maastricht, kicked-off with a keynote on how the project SmarterLabs, funded by JPI Urban Europe, worked out guidelines for better anticipating constraints on upscaling of inclusive Urban Living Lab results. Many Urban Living Labs suffer from two major pitfalls: there are unforeseen constraints on large-scale change in socio-technical urban systems, and social groups not matching the required “smart citizen” profile are excluded. To overcome these pitfalls, SmarterLabs aimed to define guidelines for this, based on literature review and retrospective analysis in the four engaged cities (Bellinzona, Brussels, Maastricht, Graz), and to subsequently test this approach through action research projects in these cities, complemented by a testing workshop in three other cities (Dijk et al 2018). Ten typical constraints to upscaling of living lab results were found:

1. Citizens lack financial, intellectual and time resources to participate in the Living Lab
2. Relevant stakeholders remain outside the Living Lab
3. Groups and impacts outside the Living Lab context are overlooked
4. Existing power structures are reproduced inside the Living Lab
5. The Living Lab’s potential for learning is underexploited
6. The Living Lab is disconnected from broader societal debate
7. The Living Lab consensus is not reflected in policy and society
8. Stakeholders and institutions are highly fragmented
9. Urban assemblage is sticky and locked-in
10. The Living Lab meets low institutional receptiveness

Per constraint, measures to anticipate this constraint, such as participatory visioning, have been collected, elaborated and validated in the cities, resulting in a set of valuable recommendations to ensure not only inclusiveness but also upscaling and replication after the project's end-of-life (see Dijk et al 2018). SmarterLabs shows that designing for inclusiveness, replication and upscaling by addressing these typical constraints on beforehand, should be part and parcel of any smart city and energy-efficiency project's architecture and its preparation and execution.

Marc Dijk's keynote was followed by an animated panel discussion with Horizon2020 SCC-01 fellow cities Lecce (Serena Pagliula, Project Manager Horizon 2020), Gdansk (Joanna Tobolewicz, Mayor's office) and Marc Dijk, moderated by Simona Costa, EIP-SCC/TOUR4EU. Key topic was how the uptake of successfully demonstrated smart city solutions for integrated planning and implementation could be accelerated in the future. The panel discussion zoomed in on challenges, needs, and how to accelerate the market uptake of smart city solutions through practice, research and innovation. The panelists agreed that the collaboration between practitioners, city administration, solution providers and civil society is key for successful smart city projects, but not yet common practice. To be successful in this collaboration, the panelists deemed it extremely important to make mutual interdependencies between different stakeholders explicit and clarify expectations. However, the panelists also indicated that working in an interdisciplinary way across different domains is not easy, and they saw much room for improvement in terms of making this collaboration more efficient and getting everybody on the same page. Further, panelists remarked that not the same problems are experienced everywhere regarding integrated planning and implementation of smart city projects, and that local situation and context play a very significant role. The research community could moderate such a collaboration process and get everybody on the same page during preparation of plans, for example by developing a glossary at EU level specifying the unambiguous meaning of terms (see for example +CityxChange 2020). Other next steps research can contribute to, are monitoring if (common) barriers are really taken away, analyzing how to adjust national/region/local procedures towards implementation of smart city projects, and performing an in-depth analysis of regulatory frameworks.

5 Stepping up the efforts to create smart and sustainable cities in the near future by practice, research and innovation

The final plenary session presented several ways for stepping up the efforts to create smart and energy-efficient cities in the near future by practice, research and innovation. The session was moderated by Georg Houben, Policy Officer, DG Energy Dir. C2.

Judith Borsboom-van Beurden, UERA/EIP-SCC/NTNU, presented the Smart City Guidance Package (SCGP), an inspirational document and self-help guide for integrated planning and implementation of smart city and energy efficiency projects, produced by the Action Cluster Integrated Planning, Policy and Regulations of the EIP-SCC with the help of nearly 100 city administrations, businesses, research institutes and universities from the wider smart city community. It bundles experiences of cities and helps other cities in avoiding common pitfalls when preparing and carrying out their plans, with a main focus on a recommended process, not on technologies. The SCGP is an easily accessible introduction into integrated planning and implementation, primarily meant for mayors and politicians, staff supporting them, such as strategists and advisors, directors of unit, project managers and other local authorities, e.g. utilities. However, it can also be used to facilitate communication with partners in the cities' local ecosystem, such as energy network and transport operators, real estate developers and facility

managers, housing associations, citizens and local businesses. It was developed because it was observed that while there is a high level of complexity in these transformative actions, city administrations are often under pressure and lack the time to explore common repositories as the Smart City Information System, and applicable ISO Standards are often perceived as rather heavy in terms of implementation. The roadmap has been composed by integrating information from a series of EIP-SCC workshops, review of hundreds of smart city projects, 29 interviews conducted, feedback from cities and city networks, and five validation workshops in Santa Cruz de Tenerife, Sofia, Vaasa, Brno and Parma. Key features of a holistic approach facilitated by the SCGP are: 1) integration of a long term perspective when deciding upon short-term actions: 2) integration of domains and disciplines; 3) integration of multiple technologies in one territory; 4) integration of different stakeholders and commitments; 5) integration of financial aspects and co-benefits. The result is a sequence of seven different stages for integrated planning and implementation of smart city projects (see Figure 3 below). Subsequently, each stage is elaborated using the same elements: the key question of that specific stage, a checklist of to do's, the main output than can be expected after ticking the boxes for all to do's, and suggestions for tools and standards than can help to facilitate each to do. More details on each to do indicate what needs to be done, give examples of good practices, and explain why this particular step is needed (Borsboom-van Beurden et al 2019). Next steps foreseen are: 1) developing a summary for local politicians in EU languages; 2) developing an Open Access web-based version; 3) supporting the development of local smart and energy-efficient cities strategies; and lastly 4) recruitment of new testbeds and gradual refinement of the method.

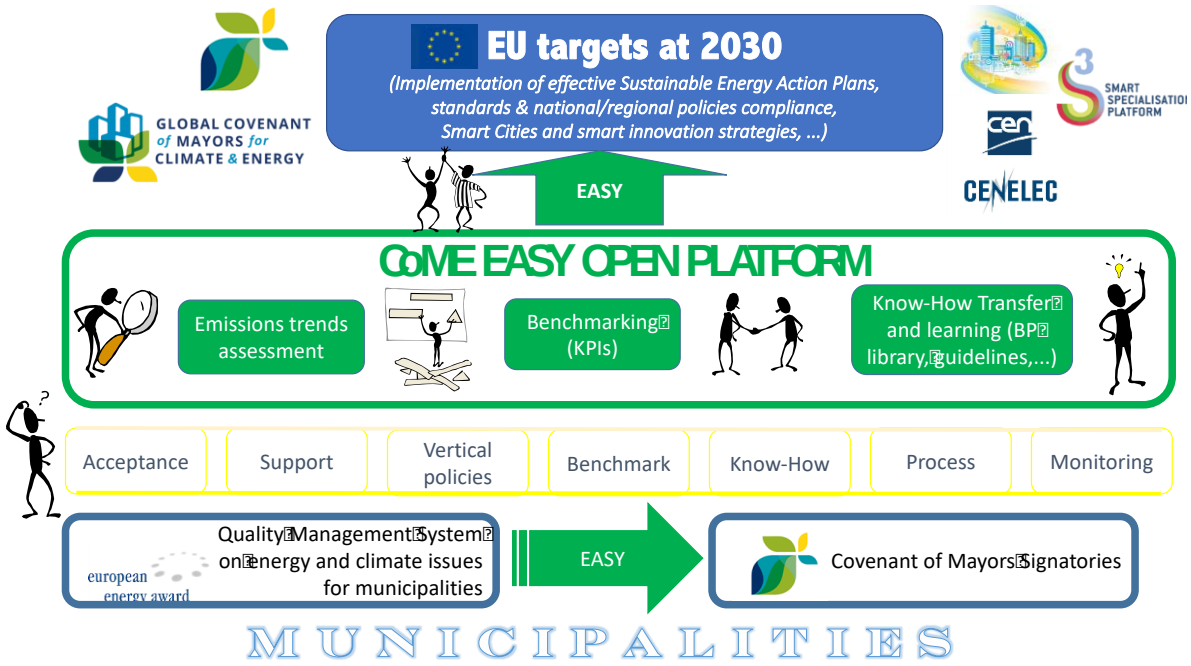
Fig. 3 Different stages in SCGP roadmap (source: Borsboom-van Beurden et al 2019)

Next, Christoph Gollner and Susanne Meyer, FFG and AIT, explained how currently collective transformative capacity is built in the SET-Plan Action 3.2 and Positive Energy Districts (PED) Program, led by JPI Urban Europe. The mission is to enhance capabilities of cities, industry and research to make Europe a global role model and market leader in technology integration for and large-scale implementation of PEDs, whilst taking into account inclusiveness. By 2025, 100 PEDs in Europe by 2025 should be synergistically connected to the European energy system, exporting related technologies. The SET-Plan Action 3.2 makes this mission concrete by innovation actions establishing PED Labs, developing PED Guides and Tools, fostering PED replication, and setting up monitoring and evaluation for existing PEDs and the new PED Labs. Focus will be on the problem-owners: public authorities which have to achieve energy and climate targets, where PEDs should be part of holistic urban strategies helping to avoid silo-thinking and fostering cross-domain collaboration (SET-Plan Action 3.2 2018). Main elements in the work plan for 2019-2020 are the publication of an overview of current PEDs, development of a common PED framework, guidelines for urban stakeholder engagement, the launch of two calls, cross-cutting cooperation with other initiatives as the EIP-SCC

and development of a European partnership. The first PED call (Spring 2020) focuses in particular on enabling factors, e.g. legislation, different contexts for feasibility of plans, and the set-up of PED Labs. AIT analyzed specific features of current 52 PED/Towards PED projects, such as size, new or old buildings, land use, mean project investment, financing and energy technologies (JPI Urban Europe 2020). Most PEDs appear to be less than 10 hectare, have both new and old buildings on mixed land use, mostly costing around 100 million Euros financed by at least three different sources and integrate four to five different energy technologies (JPI Urban Europe 2020).

Following, Chiara Tavella and Mariadonata Bancher representing the eea, shared the experiences gained in more than 20 years in terms of standardized processes and learning communities. The eea is implemented in more than 1500 cities and communities in Germany, France, Switzerland, Austria, Belgium, Italy, Croatia, Poland, Romania, Bulgaria Serbia, Greece and Luxemburg, counting between 150 and more than 1 million inhabitants. Eea helps to implement local climate change policies through a proven process, several instruments and qualified advisors, covering six themes: mobility, spatial planning, internal organization, supply and disposal of energy and waste, municipal buildings and facilities. Eea is attractive for local authorities for several reasons. It uses a result-oriented yet iterative approach and well-structured process, including the establishment of an interdepartmental Energy Team, where local climate and energy policies are continuously improved, and energy targets are often achieved faster. Coaching by an external expert and the certification scheme lead to higher quality of plan preparation and execution. Further, cities and communities get access to many country-specific tools and checklists provided by the national eea organizations. In addition, awarding proves to be an important incentive for improving climate and energy policies, while it simultaneously enhances visibility and promotes the city or community. marketing. What is more, the frequent exchange of experiences and offered training foster peer-to-peer learning, with national eea organizations learning about common barriers they might need to address. While eea can be carried out independently, it is also a tool for implementing Sustainable Energy (and Climate) Action Plans (SECAPs), and, like the SCGP, aligned with ISO standards 50001 and 37107. To bring about more cross-fertilization with adjoining initiatives, the current CoME EAsy project provides common tools, e.g. an Emission Path tool, SE(C)AP creator, buildings database, KPIs dashboard, guidelines for stakeholder engagement and best practices library (see Figure 4).

Two examples of eea are highlighted. For implementing the Climate Pact in Luxemburg, the national government provided financial support and technical assistance, and supported further development of tools, while municipalities implemented eea including its energy accounting system. In South-Tirol, eea helped to execute the ambitious regional climate strategy until 2050 where 18 municipalities (among others Bolzano) implemented measures as promotion of renewable energy, renovation of the public building stock and introduction of energy-efficient lighting. In South-Tirol, the entry awarding step proved very useful to mobilize municipalities and ensure active participation from the start, while the region contributed to the costs of the external expert. In terms of integrated planning, the municipalities mentioned several benefits of eea. It helped to overcome siloes by appointing an energy team and allocating specific roles, what leads to better exchange between departments. The catalogue proved very helpful in answering what-if questions, supporting the choice for the solutions with the highest impact, and ensuring the buy-in of different stakeholders. The scheme also improves communication with and engagement of citizens. Lastly, the external auditing and competition element of awarding allow for comparison and raise the overall ambition level.



342 Fig. 4 Mutual reinforcement of different initiatives in CoME Easy project (source: eea)

343 Lastly, Carmelina Cosmi of CNR-IMAA, presented PrioritEE, an Interreg Project to support decision-
344 making on energy-efficient buildings, which showcases how EU structural funds can be used to bring
345 about innovation in several EU territories (PrioritEE, 2020). Barriers to energy efficiency come from a
346 complex socio-technical system in which institutional and technical aspects as well as actors are deeply
347 linked. To address these barriers, PrioritEE aimed to strengthen the policy making and strategic
348 planning competences in energy management of public buildings of local and regional public authorities
349 in five Mediterranean countries. Cities and regions participating were Karlovac, Potenza, Teruel, CIMLT
350 and West-Macedonia. A twofold approach consisted of 1) developing decision making tools as the
351 PrioritEE toolbox and common strategies for developing energy consumption management plans for
352 municipal buildings; next to 2) stakeholder engagement through case study visits with peer-to-peer
353 learning, local living labs engaging the wider community, and technical workshops for gap analysis and
354 training. The PrioritEE toolbox contains a technology analytics database, How-to-Briefs and a repository
355 of good practices. It helps authorities to determine the best value for money, and how the available
356 budget can be optimally spent on which technologies. Carmelina Cosmi concludes that the availability
357 of the decision-making support tools in each country's languages was crucial for their success and that
358 having a web application did hugely increase the usefulness of the decision support tools. In Karlovac
359 the tools were integrated in Karlovac's energy recovery strategy, while in Potenza's region Basilicata
360 they contributed to local action plans on energy efficiency and SECAPs, promoting the transition to a
361 low-carbon regional economy. Regarding stakeholder engagement, she concludes that a multi-
362 disciplinary environment is essential for facing energy issues, and that non-conventional sharing of
363 knowledge can help to generate change, e.g. by making citizens protagonists of the energy transition.

364 6 Research and Innovation Collaboration for Smart Sustainable Cities:
365 recommendations for Horizon Europe

366 The event ended with two interactive sessions, where the main research topics in integrated planning
367 and implementation, including possibilities for funding and finance, were discussed. Session 1,

moderated by Judith Borsboom-van Beurden (UERA/ EIP-SCC/NTNU), Carmelina Cosmi (CNR-IMAA), and Paolo Nesi (University of Florence), focused specifically on recommendations for Horizon Europe. Researchers from Smarter Together SCC-01 project, Urban Europe Research Alliance, Tuscan Organization of Universities and Research for Europe, PrioritEE project and others discussed current knowledge gaps and barriers to widespread innovation.

The group observed that a proper common definition of an integrated or holistic approach towards smart and energy-efficient cities is still lacking. Usually the concept emphasizes cross-domain aspects and gravitates towards energy efficiency of districts. Participants mentioned several other aspects which should be part of the concept, in particular 1) the role of ICT and big data as enabler, e.g. through modelling of spatial objects and functionality; 2) financial and governance aspects; 3) the accumulated performance of the entire territory (e.g. highly energy-efficient new buildings compensating for less efficient old buildings in a district); 4) the role of mobility and transport; 5) urban planning as main integrative instrument for transforming specific parts of the city towards specific end goals; 6) inclusiveness of citizens; and 7) the integration of both energy aspects and the human factor - between functional and social structures - and how they contribute to the overall urban quality and livability of a neighborhood.

Several suggestions were made for addressing current knowledge gaps and barriers: 1) setting up quick projects with a time horizon of three to five years reflecting different contexts, aiming to bring down CO^2 emissions and energy consumption; 2) develop better data-driven, evidence-based, citizen-centric procedures for urban planning, e.g. with the help of smart city dashboards for what-if questions; 3) fostering collaboration with national energy agencies; 4) making clear which technologies are applicable, which stakeholders should be engaged, which dilemmas can be expected; 5) investigating how to make smart city plans ready for procurement; and 6) researching the role of flexibility in energy systems and demand.

7 Replication in Europe: how to build new projects for positive energy districts

The second interactive session discussed how to build new projects for PEDs through replication. It was moderated by Simona Costa and Susanne Meyer, and focused on upcoming calls in Horizon Europe, JPI Urban Europe and ERDF, which will offer new possibilities for replication of successfully implemented smart city solutions across Europe. What will it take to build new projects and capacity for Smart Cities and Positive Energy Districts and learn from the experiences in other projects?

The group stated that a Positive Energy District should not only deal with energy aspects but should also address other aspects of the inhabitants' lives. Starting from a PED lab, first of all by choosing the community focus and the aspects in which the PED lab could increase the quality of life for that particular community. For example, it can be more focused both on inclusiveness and on social aspects whenever there is a particular community that requires it, or more related to air quality in a particular area with much traffic and pollution. So, first it is important to decide the community's priorities, then what to do in order to improve the quality of life. The group agreed that the PED lab should identify the research aspects of the priorities, because it requires a great deal of monitoring and background analysis. Furthermore, this could be an interesting starting point for interacting with university campuses and university areas.

8 Conclusions and next steps

It can be concluded that Europe provides many excellent examples of integrated planning and implementation of smart city and energy efficiency projects, and a range of useful concepts and tools have been developed supporting such a holistic approach. While all approaches and accompanying tools stress the paramount importance of cross-domain working, multidisciplinarity and profound stakeholder engagement for making districts or cities effectively smarter and more energy-efficient, a commonly accepted definition of integrated planning and implementation is still lacking and some key aspects of smart and energy-efficient cities are not yet incorporated, such as the eventual contribution to local quality of life, inclusiveness and potential replication, or urban data as an enabler. The development of such a comprehensive definition could facilitate the positioning and possibly even integration of different concepts and tools in future, enlarging their joint applicability for users as city administrations. To better support local governments, it would also help to make these concepts and tools better accessible for time-pressured city administrations, adapt them towards specific urban situations and contexts, and translate them into specific local processes and procedures

Valuable suggestions have also been made for how research could address persistent knowledge and innovation gaps, to name but a few: making clear which technologies are when applicable, which stakeholders should be engaged then, and which dilemmas can be expected; or: investigating how to make smart city plans ready for procurement.

The event also made clear that besides the continuation of smart city and urban energy efficiency projects in Horizon Europe program and upcoming Green Deal, ERDF funding will be more and more attractive for achieving local innovation, the more because in the next programming period 2021-2027 synergies between ten European direct funding programs (including Horizon Europe, Digital Europe and Invest EU and ERDF) will be possible to promote the entire chain from low to high Technology Readiness Level. This will stimulate not only SME participation but also provide opportunities for researchers and practitioners. Meanwhile the Mission on Climate-Neutral and Smart Cities in Horizon Europe is intending to ensure the commitment of 100 cities through city contracts, what would mobilize citizens, policies and actors well beyond research and innovation. As such, in principle partnerships may contribute to the achievement of this mission.

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