POCACITO

european post-carbon cities of tomorrow

POCACITO ROADMAP

A POLICY FRAMEWORK FOR POST-CARBON CITIES

CEPS

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AUTHORS

Jorge Núñez Ferrer, CEPS

Cristian Stroia, CEPS

Noriko Fujiwara, CEPS

Monica Alessi, CEPS

Based on contributions and feedback by the POCACITO consortium, the POCACITO Advisory Board and various stakeholders.

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I INTRODUCTION

The environmental pressures created by urbanisation have been increasing rapidly. The growth in urban areas over the 4,000 years before the mid-20th century is the same as the growth rate in urban areas since then (IEC, 2014). In 2011, the population in urban areas outstripped that in rural areas. Climate change has put cities at the forefront of climate mitigation and adaptation needs, but climate change remains a remote issue for many stakeholders; they do not feel responsible nor do they see how they can contribute to the significant changes that are required. Many see climate mitigation as solely a technological challenge—and thus place undue emphasis on, e.g., efficient power generators and new transport technologies as necessary to bring about greenhouse gas (GHG) emission reductions—rather than as the need to change the way individuals live and interact in society. The awareness and involvement of all stakeholders is, however, fundamental to developing efficient solutions.

One misunderstood aspect of a society's transition to a post-carbon future is the potentially positive social revolution that energy transition and adaptation measures could bring about—if managed well. Energy is fundamental to how our society functions, and changing the way we produce and consume it can alter the way society moves and works in essential ways. Energy is like the bloodstream that keeps our society working. With the energy transition we can take the opportunity to address a number of social and environmental needs, beyond merely GHG emission reductions. Moreover, the present Information and Communications Technology (ICT) revolution opens the door to a large number of new opportunities in this transition.

This Roadmap, developed under the POCACITO project, is a stakeholder-driven guide towards the Post-Carbon Cities of Tomorrow, merging climate, energy and social transitions in our cities. The term "post-carbon city" signifies (1) a rupture in the carbon-dependent urban system, which has led to high levels of anthropogenic greenhouse gases, and (2) the establishment of new types of cities that are sustainable, liveable and equal places for citizens to live. Here we use "post-carbon city" instead of the term "Smart City", as the latter is generally linked to a technological transformation only in the areas of energy and transport.

The following is a Roadmap that outlines visions for post-carbon cities, new insights obtained during the course of the POCACITO project, barriers, challenges and key recommendations. It is directed at national and European Union (EU) policymakers, as well as city-level decision makers. It promotes the approach of POCACITO for consulting stakeholders and advocates its widespread use, not only to develop strategies, but to connect citizens with the future and place them clearly on the path to decarbonisation, changing them from takers of policy into shapers of the urban decision-making process. Secondly, it presents the main messages from the city stakeholders in relation to the common needs of cities and the assistance required at national and European levels to meet these needs.

II CITIES MUST BE CLEANER, GREENER, COHESIVE AND RESILIENT: A 'BEYOND-CARBON' TRANSITION

Today's cities are faced with unparalleled challenges in terms of environmental, social and economic pressures in a globalised and rapidly urbanising world. In 2011, for the first time in history, the global urban population became higher than the rural population. This unprecedented level of urbanisation is intensified by migration and births, and by 2050, the world's urban population is expected to reach 6.3 billion, representing 67% of the world's total population (Moffatt, Suzuki, & Iizuka, 2012). Migration to urban areas is accelerating globally, and while in Europe large cities are not growing as such, many rural areas are becoming 'urbanised' and increasingly integrated into neighbouring cities. Managing urbanisation will become essential to ensure the socio-economic, financial and environmental sustainability and resilience of cities. There is no 'one-size-fits-all' approach; individual cities will thus require tailored solutions and approaches. The development of efficient infrastructure and new and better services will define and differentiate cities while they compete for human and knowledge capital (IEC, 2014).

The climate change issue, a key environmental challenge, is seen first and foremost as the need to change the way we produce and consume fossil fuels (e.g. coal, oil and gas)—the main sources of GHG emissions. However, solely targeting energy sources will not be able to address all the challenges that cities face, including those linked to climate change adaptation. Cities face challenges in all societal spheres, from economic and social to environmental and political. Decarbonisation efforts, such as changes in the energy and transport infrastructure—in which new ICT technologies will play a central role—are opening doors to new opportunities and solutions for a number of these challenges.

II.I CLEAN

A clean city means healthy and more active citizens. Lack of clean air and clean water results in declining health levels, drives up costs for the health system and businesses and often also leads to discontent. A healthy city is more attractive and prosperous. Improved health standards are also linked to the existence of green spaces and sportive leisure activities.

II.II GREEN

Green spaces contribute to air quality, the health of citizens as well as the overall attractiveness of the city. They also reduce the occurrence and effects of urban heat islands. Greening a city can go beyond parks into a wider 'naturalisation of the city', with the use of green ceilings and walls as well as other innovative greening concepts.

II.III COHESIVE

Cities need to be open, social and cohesive. Urban areas are densely populated, bringing together many social groups and cultures. Cities unable to manage this diversity and failing to open opportunities for all will face difficult social challenges, such as unemployment, social exclusion and insecurity. This will make the cities hard to govern but also reduce the attractiveness of the city to investors, businesses and tourists, reducing the city's financial capacity.

A particular challenge for European cities is the ageing population. Currently, 24% of the European population is already 60 years or older, and this figure is projected to reach 34% by 2050. Globally, the number of persons aged 60 and over is expected to double by 2050 (UN, 2015). Cities need to provide the right living space for this population group, avoiding social exclusion.

In addition, cities will be the main territory impacted by large-scale migration, which includes forced migration caused by violence and conflict as well as migration due to environmental hazards and economic strain. The number of global refugees has grown to 59.5 million in 2014, a large increase compared to the 40 million refugees at the end of World War II (WEF, 2016). Rapid migration to Europe is challenging the capacity of cities in terms of integration and assimilation of new residents, as well as local finances, while threatening existing governance structures by polarising public opinion and diversifying public policy agendas. Immigrants, on the other hand, can provide economic and social positive effects by counterbalancing the ageing population and engaging in entrepreneurship. It is of paramount importance to improve integration and social cohesion in our cities.

II.IV RESILIENT

A further key to address the challenges facing cities is a rich social structure with a diversified local economy. The more a city development relies on a limited number of economic sectors, the less resilient the city will be when confronted with external shocks. Any non-diversified economy faces more risk than a diversified one. The European urban context is will likely encounter economic risks in the years to come, with cities exposed in the mid-term to rising climate change impacts, such as heat waves, storm surges and floods, and sea-level rise in the long-term (EEA, 2016).

II.V ENGAGING

To reach a future sustainable, post-carbon city, it is important that cities take a participatory engagement approach to mitigate risks and social inequality, and to build solid social integration policies with the participation of diverse groups of urban citizens, representing a multitude of urban cultures and interests. Technology approaches to reduce carbon emissions alone will not address the deeper challenges; public awareness, engagement and behavioural change will also be necessary.

III EUROPEAN CITIES' CONTRIBUTION TO KEY SECTORS OF LOW-CARBON PATHWAYS

When considering low-carbon pathways for key sectors in the urban environment, a fundamental area is the **power sector**, which has the potential to fully eliminate its CO_2 emissions by 2050 (European Commission, 2011). Generating electricity from low or zero emission sources can replace fossil fuels in heating and partially in transport. Cities can play a key role in power generation and demand, depending on the energy and energy efficiency systems they deploy. Cities will also play a central role in the power sector demand side of the transition.

In the **transport sector**, the main factors leading to more sustainable mobility are: vehicle efficiency; cleaner energy use (new fuels and propulsion systems); increased use of non-motorised transport; the development and deployment of new and sustainable fuels and propulsion systems; the optimal performance of multimodal logistic chains; increased transport efficiency and the use of infrastructure through ICT and market-based incentives (Banister, 2011). For cities, transport is much more than a shift from fossil fuels to electric vehicles; it is a change in the way cities are organised. Mobility and access to services through proximity are key components of structural change. The way cities operate and how work, leisure and services are laid out, will determine the level of motorised transport required, public or private. Decisions can also change the pattern of sharing and ownership of transport means.

The **built environment sector** plays a significant role in energy consumption, accounting for 40% of EU final energy demand (European Commission, 2013). At the same time, emissions from public, office and residential buildings could potentially be reduced by 90% by 2050. The required action to improve energy performance in buildings includes passive housing technology, refurbishment and retrofitting of old buildings and the substitution of fossil fuels in cooking, heating and cooling with electricity and renewable energy (European Commission, 2011).

Apart from these initiatives, each city has the opportunity to improve the way it operates and how citizens live and interact in line with a decarbonised future, including a higher quality of life and social cohesion. Better cities can become a reality by exploiting the opportunities arising from the use of ICT to develop a sharing economy and new business opportunities, as well as to achieve cleaner air, zero emissions, enhanced and greener mobility and less waste. Additionally, more advantages can be obtained from improved urban planning, allowing for a greater integration of natural and built areas, less wasteful and better food production and distribution systems, more social cohesion and decreased or no energy poverty. The successful transformation of these opportunities into reality is what we call a post-carbon city.

The success of cities' transition to post-carbon societies will first and foremost depend on local decisions and the support of all stakeholders. Post-carbon cities cannot be developed by decree only, at least not without great difficulty and opposition. To increase the pace and success of post-carbon transitions, more has to be done to involve stakeholders and make them part of the transformation, not just passive takers. POCACITO offers one possible path in this direction. A path to ensure that strategies are better understood by the key actors for change, the citizens and the business community acting in cities. Without a strong bottom-up approach that confronts citizens with hard

data and about their **personal role** in the process all the while supported by clear information on trends and needs, the necessary integrated solutions are likely to be far from optimal or even sufficient.

IV PARTICIPATORY STAKEHOLDER ENGAGEMENT AS A TOOL FOR CHANGE USING VISIONING AND BACK-CASTING

Post-Carbon Cities of Tomorrow reflects the philosophy that the development and transformation of cities must be achieved through an effective bottom-up strategy for citizen involvement. In order for citizens to also be able to decide on developments, they need to understand the challenges the city faces and the complexities of implementing decisions.

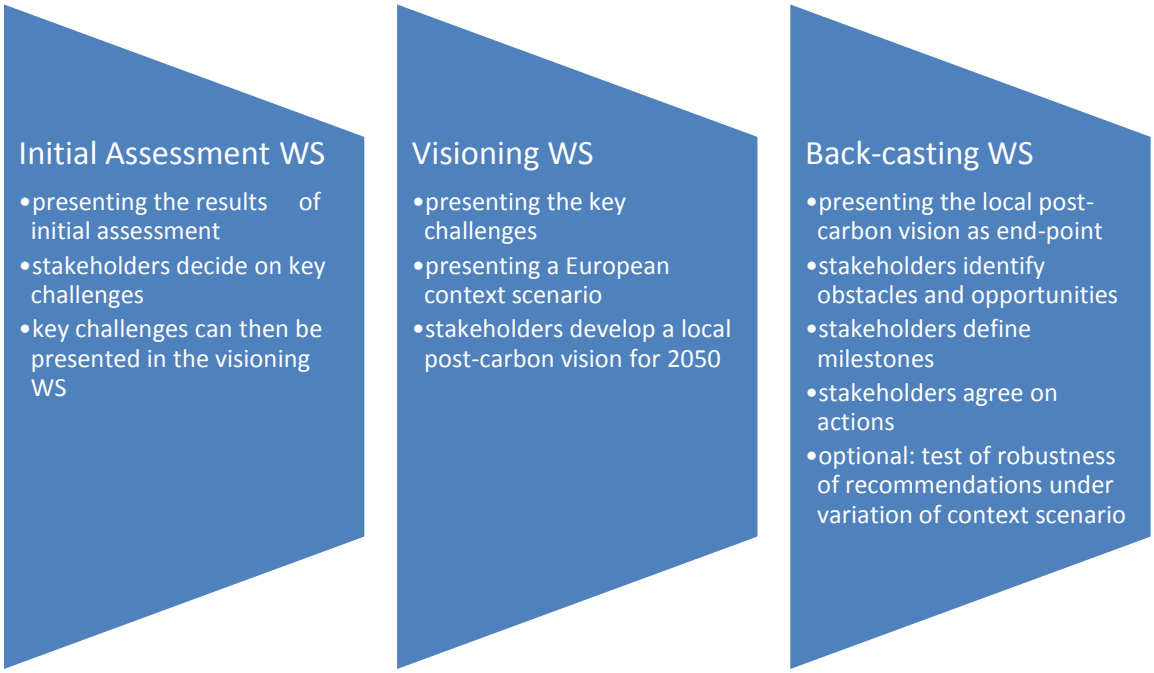
POCACITO uses an interactive consultation process that employs visioning and back-casting, backed by quantitative analysis. Stakeholders with different backgrounds—such as people in local administration, representatives of associations and specific groups of citizens (i.e. students, professional categories, etc.)—should help in shaping strategies, but to do so, also need to understand the complexity to reach the stated goals of the strategy.

A quick summary of the process is presented in Figure 1. Before a visioning and back-casting process is launched, stakeholders participating in workshops are informed of the framework conditions. This is done through an initial assessment, showing the situation of the city and the external context affecting the city.[1] This initial assessment allows stakeholders to identify the key challenges for the future and also forms the basis of the vision exercise.

The visioning exercise requires workshop participants to draw together the city as it should be in the future, e.g. in 2050. This exercise is important to pin down what stakeholders actually understand about the concept of a post-carbon city and to align and gather differing opinions into a list of clear final outcomes. When performing the visioning exercise, citizens develop visions for the city through abstraction from the present city structures. This process distances the participants from the short term needs allowing them to focus on long-term possibilities, unconstrained by present barriers and issues.

[1] The project case study assessments are compiled in POCACITO WP3 (2015). The workshops are compiled in POCACITO WP4 (2015b).

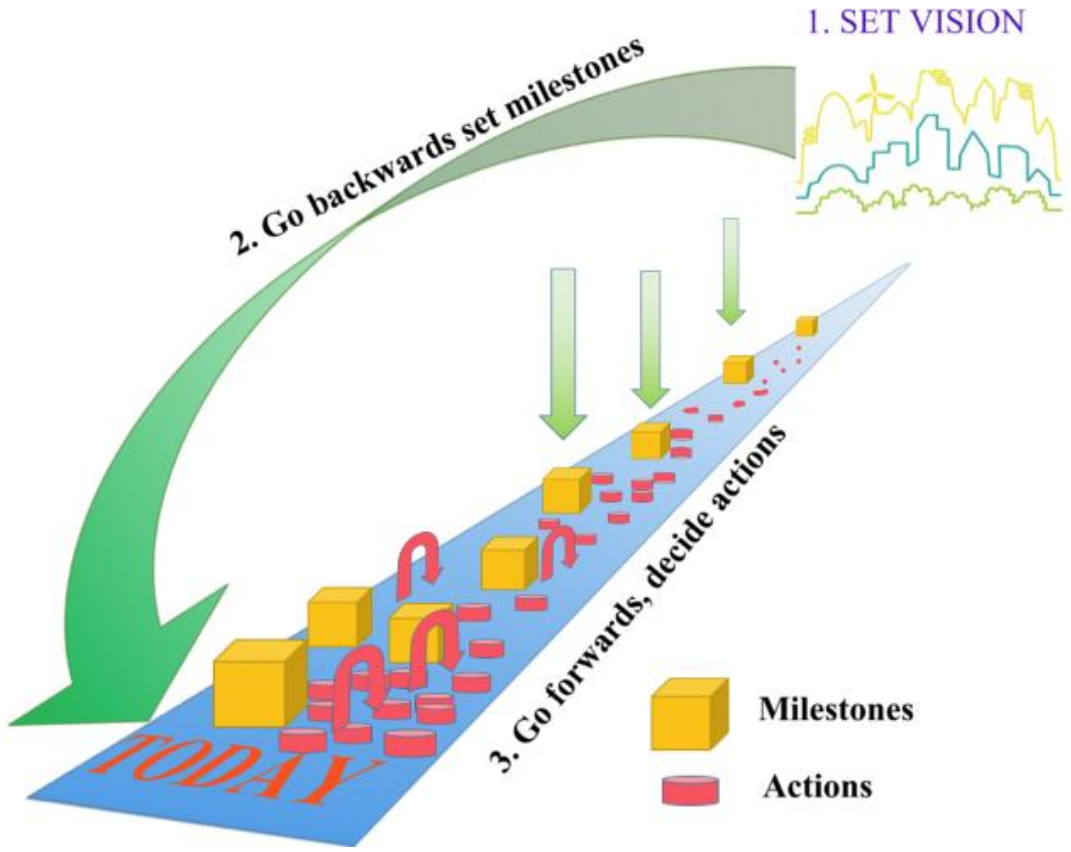
Figure 1. The stages of the POCACITO stakeholder consultation workshops (WS)



After allowing stakeholders to express their long-term (2050) vision for the city, a back-casting exercise is performed to anchor the goals in a detailed strategy, requiring stakeholders to develop milestones and actions that would bring the city's development path in line with the vision and the wider social and economic needs identified by the citizens. Once this is performed, the participants need to identify actions which would ensure that the milestones are met.

The back-casting process is described in Figure 2. After a consensus is reached on the vision, the stakeholders set milestones by working backwards from the vision. Once they have decided on the milestones, the stakeholders then identify actions to reach them. The actions should be described in as much detail as possible, making clear how the actions will take place and who is responsible, e.g., a department of the local authorities, specific organisations, schools, etc. It is important that the stakeholders clarify the role of each organisation involved. Action setting makes the stakeholders aware of the hurdles and their own role in this path. Furthermore, the level of detail required by the exercise—and getting these exact elements right—changes a vague visioning exercise into a serious strategic planning process.

Figure 2. The identification of milestones



An interesting consequence of this exercise in the POCACITO case studies (see POCACITO, 2016) is that stakeholders will eventually discover the importance of their own role in shaping the future of their city. The year 2050 is no longer a long-term abstract vision, but the endpoint of a path where ***most foundations are de facto decided and shaped in the short-term***, i.e., the decisions are made today. The results of the workshops showed that the majority of actions to reach a post-carbon city in 2015 need to be undertaken during the next decade. Visioning in fact empowers and encourages stakeholders to act. This is essential, as decisions on infrastructures, for example, will have a long term impact.

Back-casting should be accompanied by quantification exercises[2] and modelling to analyse whether the decisions by the stakeholders manage to bridge the gap between business-as-usual outcomes and the post-carbon city vision the stakeholders aimed for. The results can be used to fine-tune the strategy with the stakeholders help. POCACITO thus demonstrates an approach to citizen engagement and consultation backed up by quantitative analysis that actually develops real and concrete strategic outputs for cities. Heterogeneity in the workshop participants also ensures that strategies take into consideration the different viewpoints, increasing the acceptability of the proposed actions among a wider section of the community.

[2] Outcomes of this exercise for the POCACITO case study cities can be found in POCACITO (2016)

V KEY LESSONS FROM THE POCACITO PROJECT ON THE USE OF VISIONING AND BACK-CASTING IN CITIES

The challenges ahead require an integrated approach to urban development to reduce GHG emissions, in particular concerning urban planning of, e.g., infrastructures and land use and the opportunities provided by ICT. On the other hand, addressing the socio-economic and environmental challenges requires approaches that go beyond technology into the most fundamental forms in which citizens live, work and interact, and into a wide range of urban policy areas. As already noted, the location of services, residential, leisure, transport and commercial areas, for example, will have a huge impact on the level of emissions and the lifestyle, opportunities and quality of life of the citizens in city.

Effective solutions need the support and understanding of citizens. Therefore, public awareness about the advantages of a post-carbon transition is of paramount importance for the implementation of all strategies. With a number of new approaches to energy efficiency and transport, stakeholder behaviour is an important part of the effectiveness of the impact. This can only be achieved with a certain level of awareness in society.

POCACITO has successfully applied the visioning and back-casting approach in a manner individually tailored to local realities and contexts in European case study cities, as well as in China, India and Brazil. The exercise allowed participants to bring the distant future into the present and to develop a pathway towards a desired future state. In developing the pathway, an urgent need for action became clearer to participants: while 2050 sounds a long way off, defining all the steps to become a post-carbon city underlines the need for swift action.

The visioning and back-casting exercises are powerful tools to engage stakeholders and increase their awareness and participation in the steps towards a post-carbon future. The outcomes of the participatory visioning and back-casting stakeholder process led to the following key lessons.

Key lesson 1: Visioning and back-casting exercises are highly successful in raising awareness of the need to act today.

The POCACITO project brought together stakeholders from very different backgrounds (e.g. public officials, business, civil society etc.) and increased participants' awareness of the variety of options (visions) for the future. This process makes stakeholders understand the perspectives of other citizens, while confronting their own views with actual data. They quickly learn to make the link with the future.

The back-casting exercises were adapted to the types of stakeholder representation (from local authorities to members of different groups in societies) and to local customs, while maintaining the prime objective of the exercise, i.e., to identify what to achieve by when and to the extent possible, by which stakeholders or authorities. This exercise is essential to make stakeholders realise the difficulties ahead, but also the potential solutions and to what extent their involvement is important; it 'brings the future closer'.

Key lesson 2: Visioning and back-casting increases stakeholders' understanding of the diverging long-term views of other citizens, helping to build consensus on long-term objectives.

POCACITO sought to bring minds together for greater consensus on the vision and development path to be undertaken. Asking participants to identify integrated approaches to city development and to give an indication of the when, the how and the who regarding the necessary actions, increases participants' awareness of diverging views and needs, which they may or may not have been previously considering. Bringing them together facilitates the development of a coherent and inclusive strategy.

The visions generated in each city were quite different, yet all share common themes and overlapping ideas. The visions were classified into 12 main sectors: transport and mobility, energy, land use and infrastructure, social issues, economy, biodiversity and conservation, technology and innovation, education, tourism, governance, food production and consumption and waste. For comparison and identification of common characteristics, the main points of each vision have been organised according to these sectors (POCACITO WP4, 2015b). Attitudes towards the complexity of the visions varied among local workshops, each city addressing between 5 and 11 sectors in their vision. However, this was also due to the composition of the workshop participants, which leads to the next key lesson.

Key lesson 3: The stakeholders involved in the consultation process need to represent the heterogeneity of views of all social groups and socio-economic actors in the city.

The composition of stakeholder groups in the case study cities affected the kinds of solutions proposed. Without a representative mix the strategy will be affected by particular interests. This needs to be considered upfront and may require specific interventions for involving stakeholders who would normally not take part. Heterogeneity in the workshop participants ensures that strategies take into consideration the different viewpoints, thus increasing the acceptability of the proposed actions by a wider section of the community.

Key lesson 4: A quantitative analysis can verify the impact of stakeholders' decisions on decarbonisation. If the actions are too weak, quantitative studies can be used to encourage further action by the stakeholders.

The back-casting exercise should be complemented by an analysis of whether the actions proposed are sufficient to reach specific objectives, such as decarbonisation targets. In this project the position of stakeholders was analysed and broken down into impacts by sector. The results show that in some cases the action proposed failed to reduce emissions enough in a specific timeframe or address the main problems of the city in full. This can help sharpen the awareness of stakeholders and spur their interest in finding additional solutions.

Key lesson 5: The moderator of the Workshops on back-casting and visioning needs to ensure that the discussions will not become solely a debate on present malfunctions in the city.

Visioning requires participants to develop a vision of what the city should be in 2050 according to a common vision, not to dwell on what problems exist today. It is the role of the back-casting exercise to get into the barriers and solutions with increasing detail only once the milestones are determined. A focus on today's problems hampers "off the cuff" thinking and finding new avenues. An important

aspect of visioning is to let participants understand that another way of life is possible. The present realities are not necessarily the future ones. As countless technological and social changes have proven in the past, gradual disruptive change can lead to very different social and economic structures.

Key lesson 6: Visioning and back-casting facilitate the task of identifying the necessary regulatory and financial conditions that would enable the city to change.

While the POCACITO vision and back-casting process helped stakeholders to understand the challenges ahead and encourage them to take action, it also revealed the dependence of cities on the enabling legal and economic framework of the country in which they are located.

The stakeholders thus identified recommendations for the higher national and EU level, demanding clear changes to the legal and institutional framework. Without these changes the move towards a post-carbon city will be hampered.

Key lesson 7: Good analytical support and possibly the use of city modelling tools are needed to help the stakeholders see how their ideas impact the future and to test these ideas.

For stakeholders to understand the value of their proposals, a modelling capacity is needed to support the back-casting exercise. This sharpens stakeholders' knowledge of the city and their awareness of the needed steps.

Key lesson 8: Visioning and back-casting exercises need the support of the local authorities and city associations.

The results of the exercises can only have influence if the city authorities are fully committed to this work. Without the city authorities actively taking into account the positions of the different stakeholders, such public consultation may instead create the feeling that the city does not listen to its citizens. By increasing awareness this exercise will also raise expectations that the views expressed will guide decisions by the authorities.

The visioning and back-casting exercise is also a powerful tool to encourage the different authorities of the city to integrate better and understand their role in the path to a post-carbon city. Thus, the authorities do not only need to endorse the process but fully participate.

VI CREATING AN ENABLING FRAMEWORK: MESSAGES FROM STAKEHOLDERS

Challenges cannot be overcome by city authorities alone, as described in key lesson 6 above. The right framework and the right division of competences in line with the challenges of decarbonisation are necessary. Many enabling conditions have to be created by national and EU rules and regulations, as well as access to financial tools adapted to their needs. Without the right regulatory and financial environment, the transformative change required will be severely hampered.

In the vision workshops, the stakeholders in the case cities generally considered a change of governance models at the local, national and European levels as essential. The structures and rules in place today are still unfit to make the necessary decisions to bring about post-carbon futures. Many structural, social, administrative and financial barriers exist to achieving a sustainable and post-carbon global economy. Cities cannot play their essential role in overcoming these barriers and in exploiting enabling factors—such as citizen initiatives, technological developments and changing interactions between people as well as the flow of goods and resources—without adapted governance structures.

The key recommendations listed below emanate from stakeholders and all have one commonality, namely that they all require quick action to ensure that the path is correctly set today.

VI.I KEY RECOMMENDATIONS TO CITY PUBLIC AUTHORITIES

Key recommendation 1: Cities need to have an integrated approach to city management and planning that is in line with long-term objectives.

To achieve socially, economically and resource-efficient sustainable cities, the local public authorities need to operate in an integrated fashion, i.e., promote policy integration of post-carbon issues and include relevant actors at the different stages of policy-making and implementation. Efficient city governance can only be achieved if all sectoral parts of city services and administration work together. It is also important that the city authorities operate their investment decisions under a lifecycle-cost approach that includes social and environmental externalities (positive and negative), to ensure that these investments are optimal. Furthermore, city planning activities need to be in line with long-term objectives (i.e. post-carbon, socially inclusive and equitable, proximity of services, etc.). City authorities and service providers cannot continue to operate in sector-divided policy areas, with a strictly sectoral efficiency orientation or a private cost and benefit focus. Decisions need to consider the externalities (positive and negative) of operations, taking into account possible synergies between different activities.

The integration of city services needs to be undertaken urgently in all cities, seeking better coordination and more efficiency. This is important not only for the reduction of GHG emissions, but also to address a number of inefficiencies and incoherencies that reduce the city's capacity to tackle other social and environmental challenges.

Key recommendation 2: Apply a stakeholder-driven visioning and back-casting process when designing strategies for the city. This will increase the acceptance and understanding of city stakeholders about necessary changes.

The administrators managing city services and citizens need to be conscious of the impacts of their daily activities beyond their private sphere and own costs and benefits. They should integrate the social and environmental costs and benefits of their activities into their planning and actions. This can only be achieved if the stakeholders involved are made aware of the needs of various citizen groups, the role of businesses and the requirements for main sectors to reach a post-carbon future. The POCACITO visioning and back-casting exercises offer an efficient tool to make the needs and requirements of stakeholders known, to identify their different visions, to reach a consensus on the goals for the future and finally to create a strategy that stakeholders identify with, understand and ultimately help to implement. Stakeholders are not only the citizens but also the administrators responsible for running the city services.

It is recommended for local authorities to organise visioning and back-casting based on citizens' consultation exercises in the following manner:

- Ensure clarity on the goals of the stakeholder consultation and on the resources available to conduct the process properly, making sure that all internal actors (e.g. within the municipality) understand the stakeholder participation process.
- Make sure that engagement is appropriate.
- Select the right stakeholders to involve.
- Choose the right method for engagement.
- Identify and clarify the limitations of the engagement process. In order to avoid frustration, stakeholders should know exactly what they will be able to contribute to and to what extent.
- Cities should be clear on the fact that the result of the process is not in their hands only.

There is a need for speed, as EU member states will have to prepare strategies for the next Multiannual Financial Framework in the period 2018 and 2019. We recommend that this process should be performed quickly, involving city administrations, which need to coordinate and integrate their services. The exercises should incorporate city authorities, experts and citizen representatives to ensure maximum consensus building. Given that the number of people in a workshop has to be limited to be effective, methods to conduct parallel workshops can be developed. The feedback from such exercises should be ready to be supplied to the national authorities well before they finish their strategic documents for the European Commission.

Key recommendation 3: Support for capacity building should be provided. This could be done through initiatives such as the Covenant of Mayors. A database of global best practices should be established.

The process of decarbonisation and adaptation to climate change is far from being understood by all city authorities and stakeholders. There is a need to increase local capacity to develop mitigation and adaptation strategies. This can be done through mechanisms such as city networks, e.g., the Covenant of Mayors for Climate and Energy[3], ICLEI – Local Governments for Sustainability or through more

[3] www.covenantofmayors.eu/index_en.html

formalised collaborations between cities in Europe. In addition to these initiatives, the EU also has the Climate-ADAPT European Climate Adaptation Platform, which encourages cities to collaborate on climate adaptation and offers the information and tools to identify their exposure to climate change.

The challenges ahead affect all cities and constitute an opportunity not only to learn and transfer knowledge but also to build cultural bridges through cities. While international politics between governments may handle divisive and difficult issues of security and trade, cities have many common challenges and interests promoting technological and knowledge exchange. Transferring know-how or exporting technologies, however, needs to consider the differing technological, political, physical, cultural, social and/or economic contexts of cities in which post-carbon initiatives are implemented. There is no general approach to transfer know-how—except that it must be targeted to the specific context of the city. The city-to-city work between the EU and emerging economies cities such as in China, where a rapidly growing number of pilot cities are emerging, may be a promising approach. Chinese cities showed interest in EU city policies, and at the same time, the diversity of Chinese pilots, covering areas that have until now been less of a focus in the EU, may offer valuable insights for EU cities.

The European Commission should also provide an EU level database with best practices to help increase knowledge and best practice exchange with and between developing post-carbon cities.

This action needs to start as soon as possible. The Smart Cities Information System (SCIS) of the European Commission[4] is initiating a process to collect and streamline the information and lessons from EU financed Smart Cities and Communities projects. This is a start, but many projects financed by the EU and other sources are not included—which calls for a wider approach. However, the detailed approach from the SCIS cannot be used if other projects are integrated. SCIS can be a specialised section of a much wider database. However, there is a compromise to be found between information depth and volume.

Key recommendation 4: Education and raising awareness are essential.

Reaching a low carbon future will greatly depend on education and awareness raising. Citizens need to understand the reasons for decarbonisation, while the next generation needs to be prepared to contribute to the development of a more sustainable future. The way businesses and social interactions are undertaken is to a large extent dependant on social norms and perceptions. Education has the ability to influence the rationale behind the actions of individuals. Training and education, as well as awareness raising of the potential benefits and costs of action and inaction through exercises such as the POCACITO stakeholder consultation, are important pillars for a more sustainable future.

To promote post-carbon transitions, education about the environment, climate change, circular economy, recycling, resource efficiency, social inclusive and equitable transitions and the costs of externalities should be integrated into primary, secondary school and university curricula. At a local level, specific training and education of the needs and potential of the local community needs to be incorporated into this effort, including social work experience for students.

[4] www.smartcities-infosystem.eu

There is an urgent need to revisit the training and education programmes—from the school level up to higher education and vocational training. There is a need to adapt the skills of the citizens of today and tomorrow to the requirement for a more adaptable and flexible society. This may require preparing citizens for "out of the box" thinking and developing a more cohesive sharing economy, thereby altering the present owner-consumer oriented society that developed in the 20th century.

Key recommendation 5: City infrastructures and services need to be open, inclusive and affordable for citizens.

Strategies for cities have to be realistic and socially inclusive. New technologies and services not only need to be effective but also ultimately available for cities to use. It is important that city transformations make cities more cohesive and equitable, promoting the integration of the multitude of social groups in the city. Technological solutions have to be adapted to the needs of the various cultural, demographic, socio-economic and other characteristics of user groups. Additionally, cities need to explore alternative financing systems. However, care should be taken that the use of financial systems aiming at cost recovery can heighten the risk of excluding citizens from the benefits provided by the new services.

There is a need to integrate as soon as possible such concerns in public procurement processes. These should be focused on finding 'systemic' solutions rather than offering a product for an isolated need. Wider challenges need to be addressed, such as solving the mobility problem, rather than limiting the discussion and implementation to road maintenance repairs or any other specific single aspect.

Innovative procurement is already at the top of the policy agenda[5], but may need further thinking in terms of procurement for systemic needs and the wider use of complex public and private partnerships involving flexible approaches. There is, for the moment, a lot of attention on pre-commercial procurement or the integration of lifecycle concerns. However, the concept of procuring for innovative integrated solutions to systemic needs is not yet mature.

Key recommendation 6: Cities need to be rethought and 're-naturalised', with a focus on 'mobility', which is a concept that goes well beyond just transport.

Twentieth century cities have been developed based on the existence of motorised transport—and in particular the private car. As a result, urban areas were divided into living, commercial and industrial areas through zoning, generating lifeless business areas after working hours and residential areas that lack proper services. Green areas were also placed in separate zones. This has led to a number of problems in the area of mobility, not only due to traffic congestion, but also in terms of transport poverty (i.e. the exclusion of those that cannot pay or are unable to access transport due to *inter alia* disability or old age).

Cities need to be re-planned into functional districts better integrated with nature to increase air quality, improve liveability and reduce issues such as 'heat islands'. Functional districts need to offer proximity to private and public services to increase accessibility and to improve citizens' 'mobility' in a wider sense; with an ageing population this becomes even more important. Localisation, in fact,

[5] See for example the detailed information by the Procurement of Innovation Platform on the EU's changing approach to innovation (http://www.innovation-procurement.org/about-ppi/legal-framework/) or ICLEI's effort in developing sustainable procurement (http://www.iclei-europe.org/topics/sustainable-procurement).

reduces the need for transport while it expands accessibility, i.e., the ability of citizens to access the different functions. Such multi-functional urban areas increase the attractiveness of the city, including for families and high-skilled labour force, as well as for businesses, not only international companies but also more local business.

Such a change requires the right planning approach as well as the right incentives and sufficient time. In order to effectively change the way a city works, and reach a post-carbon city status in 2050, the planning and implementation of such a strategy must start today.

VI.II KEY RECOMMENDATIONS FOR THE NATIONAL AND EUROPEAN AUTHORITIES

Key recommendation 7: National, EU and even global strategies need to be drafted with representatives of cities.

City stakeholders from the POCACITO process have identified the areas where European and national policy actors need to act in order to facilitate cities' decarbonisation actions. Cities should be involved in the UN, EU and national level decisions.

Cities are key players for energy and climate change policy even though some cities are bigger economic players and energy consumers than others. Cities are the motors of the economy, and according to the World Bank, 80% of global Gross Domestic Product (GDP) is generated in cities[6]. This fact makes cities the key players when it comes to climate mitigation, as they are directly and indirectly responsible for 70% of GHG emissions. Without cities, the climate mitigation efforts will be far from sufficient. Despite the central role they play, cities are, however, weakly represented in the development of global, national and EU level energy strategies. There is a need for cities to be formally and more deeply involved in policy-making. Important policy decisions such as the Energy Union strategy or the energy policy packages hardly mention cities or local authorities, despite the fact that actions taken at the level of cities may significantly affect energy demand.

Key recommendation 8: The EU should support the process of reallocating competences in line with the challenges facing cities, i.e., in line with the subsidiarity principle.

The structure of governance is central to the potential of developing post-carbon cities. Given the heterogeneous needs of cities it is impossible to have a top-down approach. This issue is intrinsically linked to subsidiarity, which means that the powers of decision-making have to be given to the most appropriate level of governance. Today, the powers of many cities over regulatory aspects and raising revenue are very limited and inadequate to take the necessary actions. This should be a centre of discussion in the EU's urban agenda[7], an initiative that needs to ensure real action to give cities the policy space needed to move forward.

[6] World Bank Urban Development overview, http://www.worldbank.org/en/topic/urbandevelopment/overview, last accessed 28 November 2016

[7] Urban Agenda: http://urbanagendaforthe.eu/

There is a need for an immediate review of regulatory and fiscal power distribution at different levels of governance to ensure an efficient balance of powers that supports cities to develop tailored strategies to reach post-carbon objectives.

Key recommendation 9: The EU should provide clearer and more stringent requirements for energy efficiency while furthering the implementation of circular economy action.

The European Commission should revise directives (such as the Energy Efficiency Directive) to better guide cities in implementing actions. There is a need for clearer and more specific guidelines with more detailed examples. There is also a need for stronger actions in promoting the move towards a *circular economy*, i.e., a development cycle that preserves and enhances natural capital, optimises resource yields and minimises system risks by managing finite stocks and renewable flows. The present EU action plan for a circular economy and the development of proposals on waste[8] are encouraging, but there is still a need to refine the strategy.

Cities should use the visioning and back-casting exercise to bring together the commercial and industrial stakeholders and develop a circular economy strategy tailored to the needs of the city. The EU should encourage such exercises.

Key recommendation 10: Good statistics at the city level are required to be able to analyse needs and benchmark cities.

To develop long-term strategies and monitor impacts of measures for long-term goals, reliable city-level data is needed with standardised definitions of the indicators across the EU. In the POCACITO project, the researchers encountered considerable difficulties in finding essential information, such as city energy consumption data, education, employment, etc. In some cases local data on education, for example, was not compatible with the definition by Eurostat, making figures not comparable. It is also very difficult today to compare cities, as municipalities vary considerably in size and the definition/boundaries of a city are often not clear. Eurostat should, given the growing importance of cities, develop an integrated database specifically dedicated to cities.

Key recommendation 11: More research on the interplay between climate, energy policies and local development and easier funding rules for research projects for smaller-sized cities.

There is a need for increased research efforts on territorial economics and the link between climate, energy policies and local development at the city level. Moreover, small-sized cities face difficulties in accessing funding for European research projects due to the complexity of rules and criteria. We recommend improving the access to research funding for smaller cities and facilitating the collaboration between larger and smaller towns. An effort in this direction has been undertaken with the leading and follower cities in the Horizon 2020 programme, but more avenues should be analysed.

[8] Presented in: http://ec.europa.eu/environment/circular-economy/index_en.htm, last accessed 30 November 2016.

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