POCACITO

european post-carbon cities of tomorrow

Milan Strategy Paper

14 OCTOBER 2016

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 613286.

Katie Johnson, FEEM

Cristina Cattaneo, FEEM

Margaretha Breil, FEEM

Project coordination provided by Ecologic Institute.

Manuscript completed in June 2016.

This document is available on the internet at: http://pocacito.eu/

Document title	Collated Strategy Paper
Work Package	7
Document Type	Deliverable 7.2
Date	October 2016
Document Status	Final version

ACKNOWLEDGEMENT & DISCLAIMER

The research leading to these results has received funding from the European Union FP7 SSH.2013.7.1-1: Post-carbon cities in Europe: A long-term outlook, under the grant agreement n°613286.

STRATEGY PAPER OF MILAN TOWARDS A POST-CARBON CITY

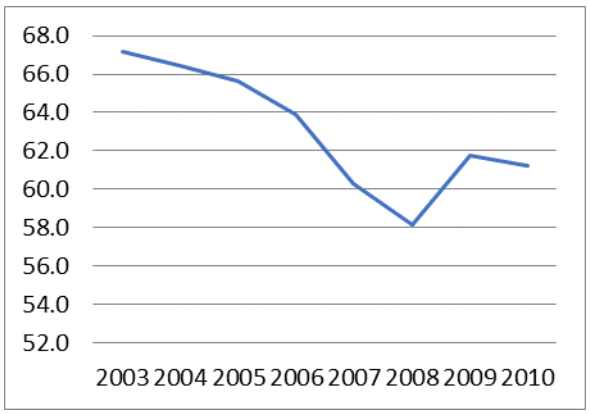
FEEM, Milan, 2016

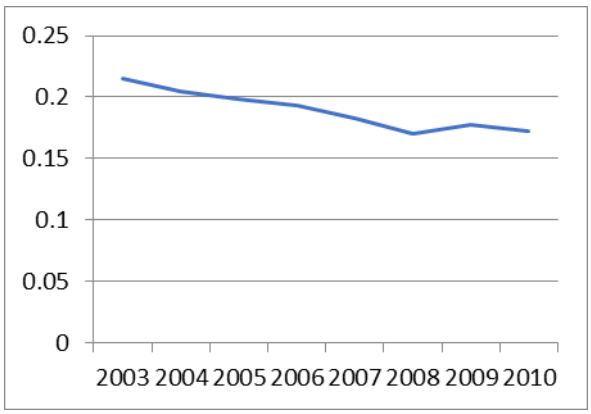
Katie Johnson, Cristina Cattaneo & Margaretha Breil, FEEM

CHALLENGES FACING THE CITY

Based on the Key Performance Indicators (KPI) analysed in at the beginning of the project (Work Package 3), and on trends derived from a comparison of indicator values from the years 2003 to 2010, Milan is currently a leading city as far as both innovation and wealth are concerned, yet progress on environmental issues is considerably lower. In terms of environmental issues and efforts towards post-carbon solutions, Milan has an advantage over most other Italian cities, yet lags far behind northern European cities, and still has much work to do to achieve average European standards. This finding is furthermore confirmed by the European City Ranking conducted for the "Soot-free for the Climate!" campaign, which ranked 17 cities located in western Europe according to nine environmental indicators, and placed Milan near the bottom, together with Rome. During the first decade of the century **energy intensity** in the province of Milan declined until 2008, which was .the growth of GDP, more than the decline in energy consumption, is responsible for the overall declining trend of the index. The largest reduction in energy intensity occurred between 2006 and 2007, with the 2007 index being 6% lower than the index in 2006. (Figure 1, left panel). In 2008 the energy intensity computed for Italy was 108.7, while the index for the Lombardia region was 93.8. Only a few regions in Italy display a lower energy intensity than Lombardia. The declining trend in energy intensity is reflected in a declining trend in **carbon intensity**. Except for the year 2009, when the index displayed an increase compared to the previous year, the index declined every year on average by 4% (Figure 1, right panel).

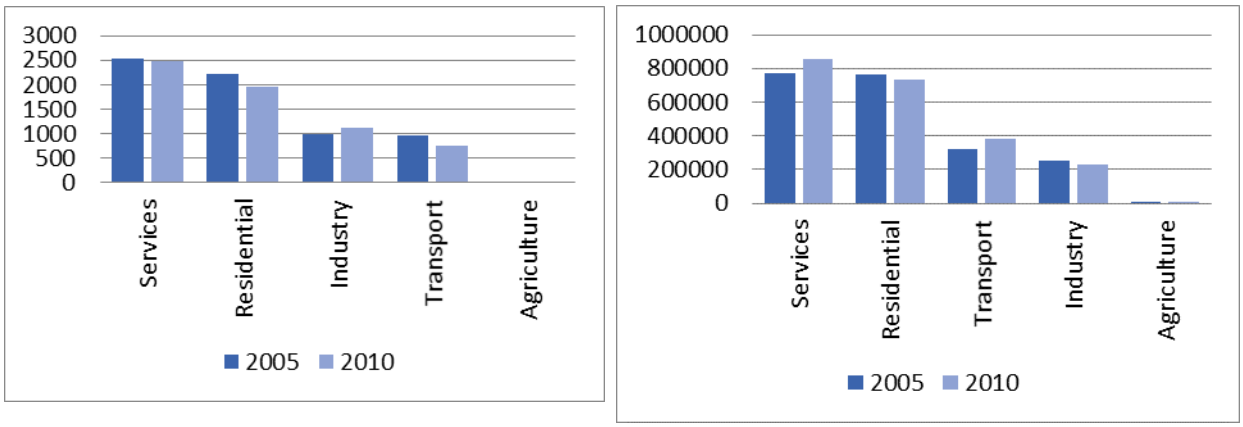
Figure 1: Energy intensity (left panel) and carbon intensity (right panel)





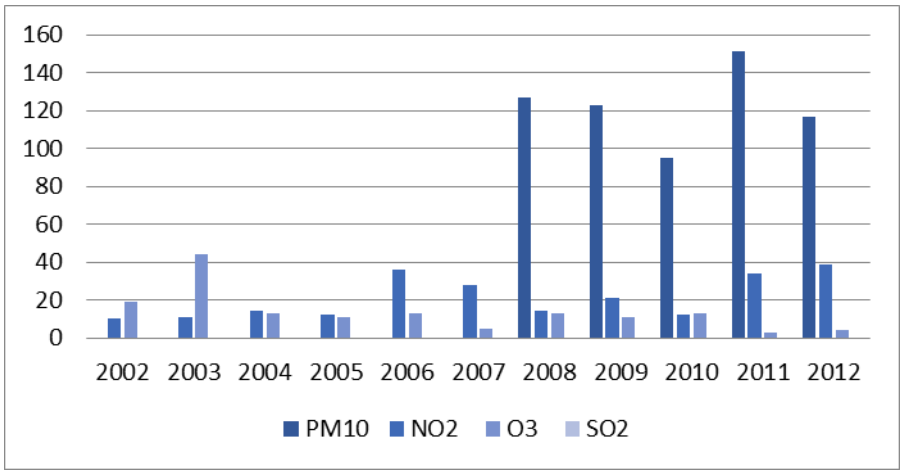
The service sector is the largest emitter of **greenhouse gases** in the city, followed by the residential, industrial, the transport and the agriculture sectors (Figure 2, left panel). All sectors except industry display lower emissions in 2010 compared to 2005. Services and residential are the sectors that contribute the most to the total energy consumption (Figure 2, right panel). While the residential sector displayed a reduction in energy consumption between 2005 and 2010, the energy consumption of the services sector grew in this period. The transport sector increased consumption between 2005 and 2010, the industry sector slightly decreased, while consumption in the agricultural sector remained constant. Services contributed to 36.6 and 38.9% of total energy consumption in 2005 and 2010, respectively. The residential sector contributed 36.1 and 33.3% in the two years respectively. Transport contributed 15.2 and 17.5; industry 12 and 10.3%. Finally agricultural share was 0.04% in both years.

Figure 2: Carbon emission in KT (left panel) and energy consumption in TOE (right panel)



Air quality in Milan is a critical issue, as the city is situated in the Po valley, where air stagnates and pollution concentrates at high levels due to the position of the Alps (Figure 3). In particular, PM10 is an issue. The concentration of PM10 exceeded the threshold limits established by Directive 2008/50/CE on 127 days in 2008. In 2009, 2010, 2011, and 2012, the numbers of days of exceedance were 123, 95, 151, and 117, respectively. Lack of a clear trend in these numbers indicates that much has still to be done to solve the problem of PM10 in Milan. Additionally, exceedance of the threshold limits for both NO2 and O3 have been registered several times over the years. Yet while the peak of exceedance for S02 traces back to 2002, the highest recorded concentration of O3 in the previous 10 years was in 2012, indicating that sources of air pollution are shifting.

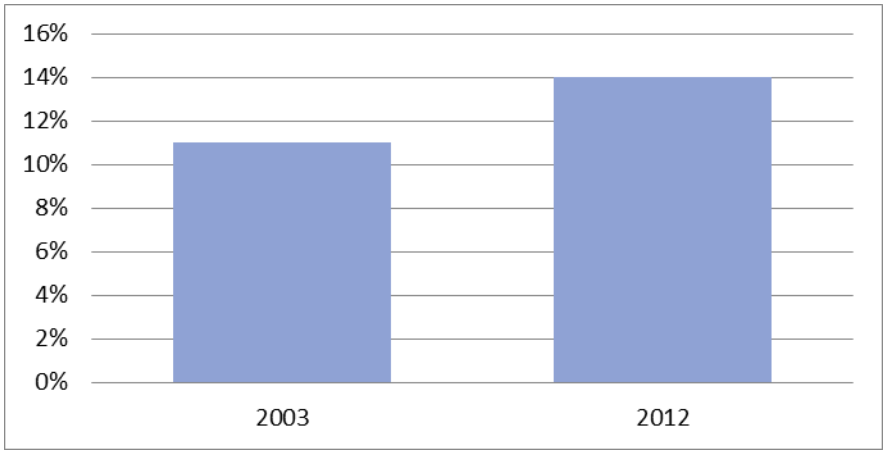
Figure 3: Exceedance of air quality limit (days)



According to the most recent report on environmental quality in Italian cities, Milan ranks 78th out of 83 cities with regards to the concentration of PM 10, and 59th out of 86 cities with regards to the number of days in which the threshold for O3 (120 µg/mc) was exceeded in 2013.[1] Recent local strategies for traffic limitations have yielded some improvements in terms of reducing PM 2.5 or PM 10; and some improvements with regards to the generation of black carbon within the LEZ zone have been observed.

Leaking water is another major issue in Milan (Figure 4). The city lost 14% of water due to leakage in 2012, and the values shown in the statistics increased between 2012 and 2014. Throughout Italy the problem is quite severe, and Milan is actually one of the Italian cities where leaks are most contained. There are cities, in particular in the southern part of Italy, where leaks represent more than 60% of total water inflows.

Figure 4: Water losses (%)

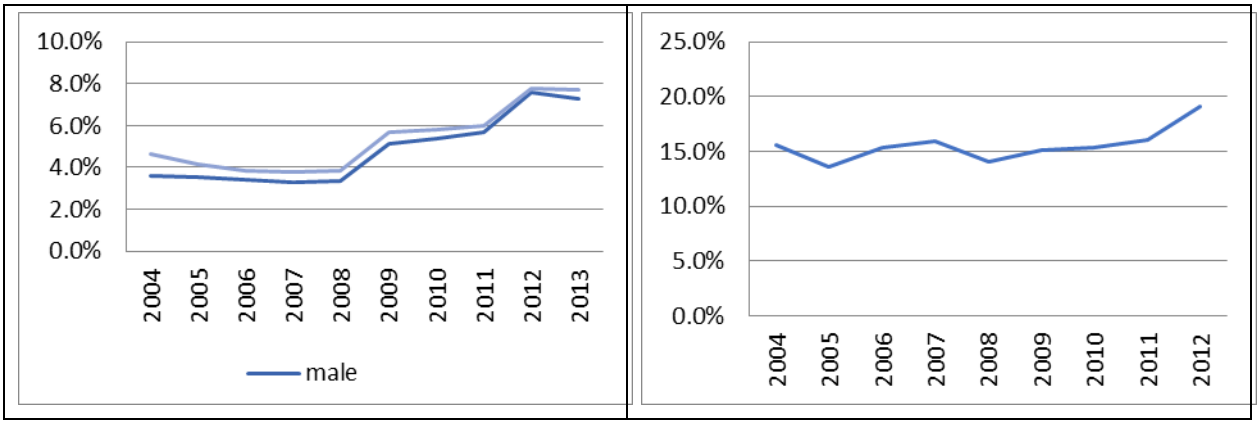


[1] Ambiente Italia (2014) Ecosistema Urbano; XXI Rapporto sulla qualità ambientale dei comuni capoluogo di provincia, pp. 29-30.

In terms of the socio-economic situation in Milan, unemployment and poverty are amongst the greatest concerns. The **unemployment** rate both for men and women has increased gradually from 2004 onward (Figure 5, left panel). Men are better off than women, even if the gender gap has decreased during this same period. In 2004, the male unemployment rate was 2.4 percentage points lower than the female rate, while in 2012 it was only 0.4 of a percentage point lower. Despite the rising trend, the unemployment rate in the province of Milan was much lower than the average national rate in Italy in 2013, when 11.5% of males and 13.1% of females were unemployed. Despite these quite high rates of unemployment, there are actually few provinces in Italy that have lower unemployment rates than the province of Milan.

The level of **poverty** has also been gradually increasing in the Lombardia region (NUTS2). From 2004 to 2008, the trend was not monotonic, with some years experiencing growth and some years experiencing a decline in the percentage of people at risk of poverty (Figure 5, right panel). However, the rate has been increasing since 2008. From 2011 to 2012, the rate displayed the largest positive growth, with the 2012 rate 3 percentage points higher than the rate in 2011. The increasing trend in poverty creates particular concern, alongside the unemployment rate, meaning that improvements in the employment situation not necessarily contribute to a reduction of poverty rates. Although it needs to be observed that the level of poverty in the Lombardia region is low compared to the rest of Italy. The average national poverty rate was 30% in 2012, and only few regions display lower rates than in Lombardia the numbers nevertheless indicate that there is a consistent group of citizens who are not able to participate in the city's increasing wealth.

Figure 5: Unemployment rate (left panel) and people at risk of poverty in % (right panel)



DESCRIPTION OF THE STAKEHOLDER CONSULTATION WORK

A series of workshops on Milan's post-carbon transition have been conducted. These workshops were conducted following a participatory approach with a strong focus on the inclusion of stakeholders. Stakeholders participating in the meeting represented the municipal environmental agency, an energy company, the national institute of urban planning, a transport consulting firm, a regional environmental organisation, a financial development agency, and the local association of architects

and planners. The first two workshops followed a three-step approach consisting of an initial assessment, and vision-building and backcasting exercises. The starting point used in the approach consists of the creation of a common view on the baseline and objectives to be established among participants. The description of the actual situation of the city was made using the common set of indicators (Silva et al., 2014), intended to assess and monitor the post-carbon city transition process. The discussion of the indicator data set with stakeholders represented the starting point for the second step, building a local vision, during which elements for a post-carbon vision were designed and discussed by stakeholders. Creative brainstorming was employed to induce stakeholders to first envision the future of their city, and then in the third step, develop qualitative scenarios describing how the ***transition*** to reach their post-carbon vision might be translated into single actions. Multiple background scenarios were proposed in order to allow for a first form of sensitivity analysis, verifying whether the external development factors described in these scenarios would have compromised the achievement of the goals defined in the city vision.

In a first meeting, stakeholders and researchers discussed the results of the initial assessment and proceeded immediately to the building of a local vision. Combining the two, the main challenges the city is facing in terms of social, economic, and environmental indicators. Stakeholders offered their local knowledge, which added further information to what researchers had concluded from the data sources used for the initial assessment, and discussion of current strengths and weakness helped clarify what municipal competencies are and where progress can be made and is needed most. Discussions on the initial assessment furthermore served as the starting points from which the vision was projected.

Within the visioning process activated by the POCACITO Project, the vision represents the normative end point, different than the one that would be reached without specific dedicated action. Stakeholders imagined how Milan should look in 2050 as a post-carbon city. To do this, they divided into smaller groups and started to collectively draw images visualising their vision. This creative activity encouraged expressiveness and facilitated the disconnect from daily policy discourse, thereby encouraging less formal interaction. They were furthermore invited to reflect on the vision as members of the community first, and only subsequently as representatives of their respective organisations. Stakeholders then summarised the drawings, and organised their ideas using a mind map. The main themes were identified and the key messages were synthesised to develop the post-carbon vision.

While the purpose of the first workshop was to imagine what a post-carbon future could look like, the second focused on what steps should be taken to get there. The backcasting workshop was based on the visioning process and developed the pathway from the current situation towards the post-carbon vision. Specifically, the aim was to engage stakeholders to conceive of the intermediate steps of future actions, measures and strategies for urban management in achieving the vision. The qualitative scenario was intended to reflect local challenges identified through the initial assessment of Milan.

Using the 2050 post-carbon vision, stakeholders created a clear definition of several endpoints that represent the main sectors and ideas proposed in the first workshop. For each normative end point, stakeholders discussed the various obstacles and opportunities anticipated in working towards the endpoint under a business as usual scenario, and wrote them down on index cards that were then arranged on a timeline from present day to 2050. The same process was carried out for milestones

and interim projects, visually highlighting intermediate objectives that mark the way towards the desired endpoint. Next, stakeholders brainstormed concrete actions needed to reach interim and final goals, and again placed them on the timeline. Attention was given to what has to be done, who needs to do it, and when it has to happen. Groupings of actions and interrelations between actions were considered.

During the second meeting, the vision created previously was briefly discussed again, spending some time talking about the importance of municipal decision supporting the work, and of the availability of funding for the actions proposed to meet the vision. One of the participants recalled that the city already has an extensive catalogue of projects/planned actions that would support the shift to a post-carbon city, to be included in the roadmap[2] The discussion produced further ideas regarding actions, milestones, and obstacles.

The third stakeholder workshop was held as a combined event, together with Milan's joint case study city - Turin. The purpose of the workshop was to apply the POCACITO Critical Influences Assessment (PCIA) sensitivity model to understand the influence that different factors/variables have on each other in the cities development, and to identify specific important factors for both cities. The outcome feeds directly into the quantitative assessment, where the most important factors/areas are modelled for 2050 for two scenarios: business as usual (BAU) and Post Carbon (PC). Quantification identifies gaps between what is desired and the projected outcome so that further measures that are required to meet PC goals can be identified. The PCIA process helps to identify further measures that are necessary to achieve PC and the associated costs and benefits.

INSIGHTS FROM THE GAP ANALYSIS FOR THE CITY

The Post Carbon Scenario to 2050 (PC2050) is developed from an interpretation of the vision, action and milestones developed in the stakeholder workshops. It is therefore a judgement based on the consistency and robustness of supporting actions and on their ability to foster the desired post-carbon state. It is not a quantification of an idealistic state. Beside these assumptions, the post-carbon scenario for 2050 is built upon some general assumptions that have been made for population increase and urban change. In particular, under the PC scenario, population will increase by 665,300 (or 17.1 %). The main assumptions for the sectors' energy efficiency increases are shown in Table 1.

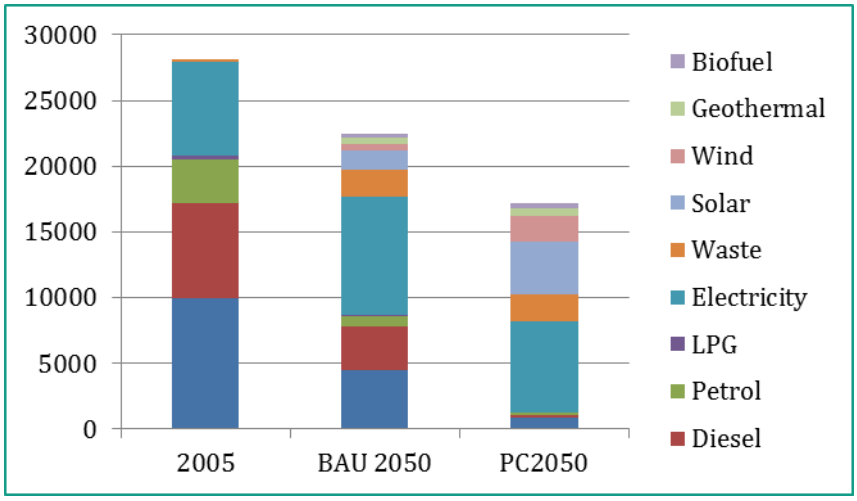
Table 1: Main assumption for the sectors' energy efficiency under the PC2050 scenario

Domestic uses	31% more new people, 40% less energy use
Domestic heating	Existing buildings becomes 40% more efficiency whilst new dwellings use only 40% of energy as before
Industry and tertiary	Efficiency improves 30%
Public lighting	No change
Private transport	Private transport uses 20% of total energy and efficiency of electric cars is 60%
Public transport	10% more efficient than BAU due to focus on electric and smart technology, but requires 27% more volume

[2] This catalogue had already been taken into account by the POCACITO team during the initial assessment.

The vision, actions and milestones have been translated into actions to quantify energy, environmental, economic and social indicators. A full list of actions quantified can be found in Deliverable 5.2, while other assumptions can be found in Deliverable 5.3. These include milestones/actions in the areas of transport, housing, building, and air quality. No notable actions are quantified for water use, food and consumption, or waste. In the post-carbon vision for 2050, Milan is expected to be dense, spacious, green and rich in biodiversity, suitable for pedestrians, and uses carbon-free transport. The energy sources are renewable, with energy-efficient technologies widely employed. People are sensitive to environmental issues and use accessible services with a low carbon footprint. The city has experienced a general change in direction from previous patterns of carbon intensive consumption and emissions. Milan has a green economy, with continuously enhancing economic, environmental, and social well-being. This success has been achieved by setting short-term goals – once one is achieved, the next goal is set, to limit costs and maintain momentum.

Figure 6: Energy Consumption in 2005 and in 2050 according to the BAU and the post-carbon scenario (GWh)



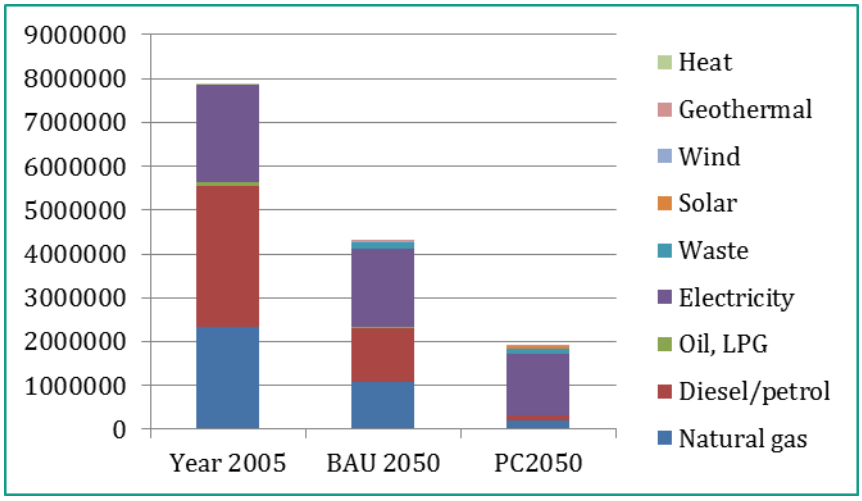
As indicated in Figure 6, these visions and actions resulted in a reduction in the overall consumption of energy of approx. 40% with respect to 2005 data and of 23% with respect to BAU (17,199 GWh in PC 2050 instead of 28,168 GWh in 2005 and 22,422 GWh under BAU) and a reduction of GHG emissions by well 76% and 56% with respect to 2005 and BAU, respectively (1,906,095 tCO_2 instead of 7,881,386 in 2005 and 4,284,609 under BAU, thanks to a more pronounced conversion to renewable energy sources like geothermal, wind, and solar energy[3] (Figure 7).

Under the PC2050 scenario all public transport is electric (or similarly low-emission) and 50% of private transport is fossil fuelled. By interpreting the actions and milestones developed in the

[3] The contributions by renewable energy sources to the overall GHG emissions calculated are due to GHG emissions based on a lifecycle assessment, related to the production of transformation devices (solar panels, etc.) which correspond to approx. 3% of the overall GHG emissions in the PC Scenario.

stakeholder workshops, it seems that there is room for improvement in the development of local renewable energy. In fact, comparing the GHG emissions for 2005 and under BAU with the PC2050 scenario (Figure 7), it can be seen that the major portion of GHG emissions in PC2050 arises from the electricity (national supply).

Figure 7: GHG emissions for Milan Municipality for 2005 in 2050 according to the BaU and the Post carbon scenario (tCO_2)

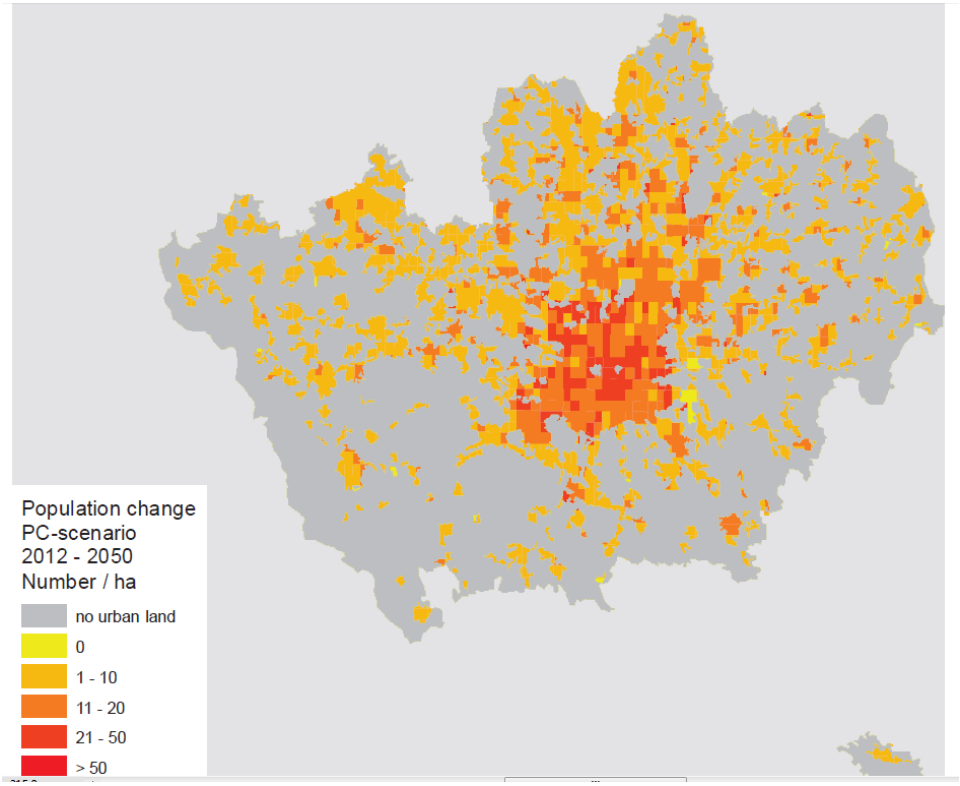


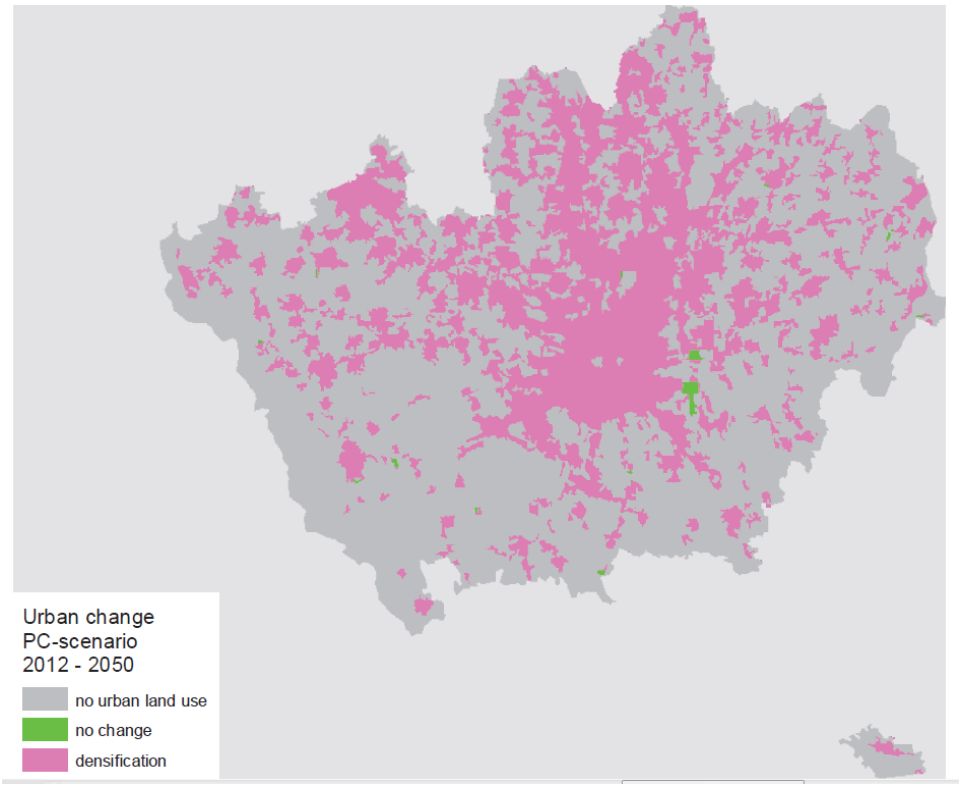
The post-carbon scenario did not only produce estimates of energy consumption and GHS emission, but also for spatial development in the Province of Milan. Within the post-carbon scenario, the estimated population increase for the PC scenario is assumed to take place exclusively within areas that are already urbanised, as one assumption of the post-carbon scenario is that population increase would not result in urban spread, but only lead to densification. No de-densification would occur. Table 2 summarises results from the historical and the scenario analyses in more detail. Results are shown as change in km² of urbanised land and in population numbers for existing areas which remain unchanged, for expansion areas (urban spread) and for areas which would undergo further densification. Observations for the period from 2000 to 2012 show mixed trends: while urban spread is ongoing, also some existing urban areas experience population growth, resulting in densification, and other areas lose population resulting in 'de-densification'. For the PC 2050 scenario, densification tendencies will be most significant for central zones, but will involve, to some extent, all areas that are urbanised at present, except areas under environmental protection.

Table 2: Spatial extension and changes in population densities under the PC2050 scenario

	Change 2000-2012		BAU scenario		PC scenario	
Type of urban change	**km²**	**population**	**km²**	**population**	km²	population
Urban spread	61.0	190,267	40.4	126,094	0	0
Urban no change	107.2	0	117.4	0	5	0
Population densification	396.0	1,231,740	432.7	609,981	710.4	665,255
Population de-densification	151.2	-1,106,862	165.3	-526,632	0	0
Non-urban	-61.0	0	-40.4	0	0	0
Total population		**315,145**		**209,443**		**665,255**
Total urbanised area	**715.4**		**755.7**		**715.4**	

Figure 8: Changes 2012 - 2050 Scenario PC for population density (above) and land use change (below)





According to the Gap Analysis carried out in Work Package 5, the most prominent gaps that remain for Milan under the proposed PC2050 scenario are as follows:

Energy

The projected per capita GHG emissions for PC2050 are low by current standards, but the current gaps in actions result in total emissions of 1.9 million tCO_2e per year. The main cause of this is the inadequate supply of local renewable energy and a reliance on national grid supplied electricity (a large portion of which is still projected to be based on fossil fuels in 2050).

Under the current PC2050, renewable energy should reach 8.962 GWh (or be just under 7000 GWh, if energy generation from waste is not included). To further remove the reliance on grid electricity, an additional 7000 GWh would need to be supplied with renewable energy, using local off-grid solutions like, for example, co-generation. However, given that a city like Milan relies on the national energy generation to meet its entire energy needs, changes in the national energy generation system will be necessary to further reduce GHG emissions.

It is also true that the role of increased energy efficiency should not be ignored in further reducing overall energy use. There is more potential to reduce energy use in the residential and services sectors.

Social

There is some concern regarding the poverty level, which has increased to a very high 21%. As this is still a level that is well below the national average, stakeholders were initially not aware about this problem in Milan. The argument entered the discussion because poverty levels in Turin are higher, in

a situation of less economic growth. This indicates that, despite the city's economic growth, the problem will continue to cause concern, and should be addressed in a vision for a post-carbon Milan.

Urban sprawl

Under BAU urban sprawl is projected to increase by 40.4 km^2 due to a population increase of 315,000. Currently, the potential for urban sprawl and increased densification is not adequately addressed within the PC2050 scenario. With a projected increase of 665,300 people by 2050 under PC2050 (due to the assumption of densification of the city), there is still a need for a clear series of milestones and strategies to ensure that urban sprawl is contained. This also has ramifications for energy use, infrastructure investment, and transport.

Circular economy and lifestyles

The potential for improvements in the impact of consumption are not well addressed in the PC2050 scenario. Options for improving consumption patterns in the post-carbon transition include increasing the number of facilities for reuse (e.g. through provision of locations to leave unwanted goods for reuse) and repair (such as repair cafes), as well as supporting businesses and innovation in this area.

Some further gaps emerge looking at the indicators developed within the initial assessment made for Milan in the early phase of POCACITO. Based on these indicators, a semi-quantitative and qualitative assessment of how Milan performs under both BaU and PC2050 is developed (Table 4).

The qualitative assessment is indicated by both a colour and simple scoring system with green and "++" indicating a very likely positive performance and improvement. Whilst red and "--" indicate a very poor or negative performance, as shown in the Table 3 below.

Table 3: Legend for scoring

+	Likely very positive
+	Likely progress
0	Likely neutral or similar to current situation
-	Likely negative
--	Likely very negative

Table 4: Semi-quantitative assessment of the POCACITO KPI's under BAU and PC2050 for Milan

ENVIRONMENT	Biodiversity	Variation rate of ecosystem protected areas	0	+
	Energy	Energy intensity variation rate	+	++
		Variation rate of energy consumption by sectors	N/a	N/a
	Climate and Air Quality	Variation rate of carbon emissions intensity	+	+
		Carbon intensity per person	+	++
		Variation rate of carbon emissions by sector	N/a	N/a
		Exceedance rate of air quality limit values	+	++
	Transport and mobility	Variation share of sustainable transportation	+	++

	Waste	Variation rate of urban waste generation	+	+
		Variation rate of urban waste recovery	+	+
	Water	Water losses variation rate	-	-
	Buildings and Land Use	Energy-efficient buildings variation rate	0	++
		Urban density variation rate (population)		+
	Sustainable economic growth	Level of wealth variation rate	++	++
		Variation rate of GDP by sectors	N/a	N/a
ECONOMY		Employment by sectors variation rate	N/a	N/a
		Business survival variation rate	N/a	N/a
	Public Finances	Budget deficit variation rate	N/a	N/a
		Indebtedness level variation rate	++	++
	Research & Innovation dynamics	R&D intensity variation rate	+	+
	Social Inclusion	Variation rate of unemployment level by gender	-	+
		Variation rate of poverty level	-	-
		Variation rate of tertiary education level by gender	++	++
SOCIAL		Variation rate of average life expectancy	++	++
	Public services and Infrastructures	Variation rate of green space availability	0	+
	Governance effectiveness	Existence of monitoring system for emissions reductions	++	++

Workshop 4 provided an opportunity for stakeholders to reassess and amend the list of proposed actions and milestones in achieving a post-carbon transition to address the gaps described herein.

A STAKEHOLDER VISION FOR THE CITY

The post-carbon vision for Milan is an output from the first stakeholder workshop, which covers a wide range of issues. Because of the long timeframe, the vision is rather holistic and explorative. The 2050 post-carbon vision for Milan sees a city that is dense, spacious, green and rich in biodiversity, suitable for pedestrians, and uses carbon-free transport. The energy sources are renewable, with energy-efficient technologies employed. In Milan, people are sensitive to environmental issues and use accessible services with a low carbon footprint. The city has experienced a general change in direction from previous patterns of carbon-intensive consumption and emissions. Milan has a green economy, with continuously improving economic, environmental, and social well-being. This success has been achieved by setting short-term goals – once one is achieved, the next goal is set, to limit costs and maintain momentum.

The six primary sectors identified in the 2050 vision for Milan include social issues, mobility and transport, environment, land use, energy, and innovation and technology:

SOCIAL ISSUES

Sensitive to environmental and energy issues, where citizens have reached a high awareness of their consumption and behaviour
Services nearby, with greater reach and usability
Participative city society that is open to the world and thereby richer
More liveable city for all

MOBILITY AND TRANSPORT

City of sharing, that makes services accessible even through alternative or complementary forms of private transport
Pedestrian-friendly city with shared spaces
Accessible and usable without a car
Integrated transport systems
Carbon-free transport

ENVIRONMENT

Reuse and recycling of materials
Endowment of green space, which helps to create a micro-climate that reduces the heat island effect; green is integrated into the urban fabric and connects to the territory
Rich in biodiversity

LAND USE

Dense, spacious, and highly populated city
More permeable surfaces

ENERGY

Very high energy efficiency
Energy needed for the city to function is produced from renewable sources
Low energy buildings, in the direction of the passive house
Many buildings able to produce energy feed it back into the system through the smart grid

INNOVATION AND TECHNOLOGY

Integrated technology systems and networks that clearly and effectively support all aspects of daily life; promote telecommuting, access to services, and reduce the need to travel
Milan / Turin drivers of innovation

ACHIEVING THE VISION

Milestones and actions proposed during the second stakeholder workshops,[4] as related to transport, energy, social issues, and consumption include:

[4] See Report on Stakeholder Workshops, POCACITO Deliverable 4.2, available at http://pocacito.eu/content/report-stakeholder-workshops

TRANSPORT MILESTONES	TIMEFRAME	STARTEGY TOWARDS MILESONE
Integration, connection, multimodality		
Creation of an integrated public transport system	2030	Create a new policy framework with incentives, parking and congestion implications, and modal shift
		Make sustainable accessibility to new areas of urban transformation
		Make the parking system more efficient
		Organise and develop the logistics of the last mile for the distribution of goods in the city
		Overcome barriers and make the city more accessible for everyone
		Promote the development of a new urban freight logistics.
		Rationalise the use of motor vehicles, i.e. Area C sharing systems and smart solutions
		Urban car park programme
		Urban traffic plan
		Enact road pricing to support more efficient distribution of goods within the city
		Develop informatics infrastructure including smart stops and smart times for public transportation on busses, trains, and trams
Changes in transport Infrastructures		
A more widespread network of public transport, including extension of the circular lines to connect outlying areas.	2050	Create park and ride parking lots
		Enhance rail service
		Raise levels of security, spreading pedestrian areas and environmental islands
		Set a vision for the subway system
		Create pedestrian areas in the periphery of the city, especially to link the centre to surrounding suburbs
		Develop infrastructure for public transport
		Limit car use through extension of pedestrian areas, speed limit zones, parking payment
		Facilitate and support cycling. Create bike, also electric bike, sharing projects to provide alternative options to taking one's own car
		Extend road pricing to encourage use of public transport and discourage private car use
		Make preferential lanes for people who are carpooling
Quality of public transport		
Public transport becomes	2020	Promote already initiated actions, such as traffic limitations

faster and less expensive than private transport		and better public transport, in order to create consensus and momentum for new further reaching policies, as public policies are highly visible
		Triennial programme of local public transport services
		Strengthen and make public transport services more efficient, and encourage sustainable mobility (e.g. bicycle, electric, car sharing) (PAES)
CO2 free transport		
All (or a certain percentage of) cars are electric	2030	Marketing and communication, and education and awareness-raising on the benefits of electric vehicles
		Create incentives for buying electric rather than gasoline-fuelled vehicles
		Substitute municipal vehicle fleets with new ones that use clean technologies
There are a sufficient number of electric car charging points inside and outside the city	2020	Increase number of charging points for electric cars
Electric transport used for the distribution of a certain percentage of goods throughout and within the city	2020	No specific measures have been indicated
10% transport consumption met by renewable energy	2020	-

ENERGY MILESTONES	TIMEFRAME	STARTEGY TOWARDS MILESONE
Reform of energy generation and distribution		
17% final consumption of energy through renewable sources	2020	Promote and encourage the use of solar thermal, photovoltaics and geothermal heat pumps (PAES)
The city is using more renewable energy than carbon energy sources	2030	
The number or percentage of households or the city connected to the district heating/cooling network can be used to measure progress	2050	Build smart grids
		Develop decentralised system of power/heating/cooling plants
		Develop new technologically innovative applications that will support co-generation and tri-generation
		Create a co-generation (heat and electricity produced from same energy source) network to use excess heat from industry to heat residential/commercial properties through the district heating/cooling network

ENERGY MILESTONES	TIMEFRAME	STARTEGY TOWARDS MILESONE
		Create micro tri-generation (heating, cooling, and energy production) plants as pilot projects for big public and private energy users (hospitals, schools, etc.)
Overall Concepts and plans, improvements of energy performance		
Goals for emission reduction reached in time (PAES target: 20% by 2020, compared to the baseline year 2005)	2020	Identify necessary regulations, incentives, and training in order to trigger actions for energy improvement and the reduction of electricity consumption and emissions in the business sector (PAES)
		Give incentives for carbon-free energy production and consumption
		Set electric energy standards
20% final consumption met with renewable sources (use electrical, thermal and transport)	2020	Communicate the economic benefits derived from equipment conversion toward district heating, heat pumps, and solar and thermal energy
20% reduction in consumption of primary sources compared to the forecast trend, by increasing efficiency	2020	Measures of energy recovery from the integrated water cycle using heat pumps to heat buildings near (or in) industrial wastewater treatment plants
		Power public lighting with lost energy consumption
13% reduction in GHG emissions in non-ETS sectors compared to 2005	2020	No specific measures proposed
Energy efficient/energy producing buildings		
Overall national energy savings of 9.6% by 2016 in accordance with the National Action Plan for Energy Efficiency (*Piano d'Azione Nazionale per l'Efficienza Energetica – PAEE*)	2020	Create regulations for increasing energy efficiency for buildings taking into account characteristics of existing buildings
		Develop smart infrastructure and buildings to consume less energy
		Identify regulatory measures, create incentives, and train citizens to reduce electricity consumption and emissions in public and private buildings (PAES)
		Create a network for district heating and cooling
One hundred percent of new buildings are zero energy or carbon neutral	2030	-

LAND USE MILESTONES	TIMEFRAME	STARTEGY TOWARDS MILESONE
Quality of the urban environment		
The number of parks opened,	2020	Re-open some of the city's waterways

percentage of permeable surfaces, and waterways re-opened increase		Increase the concentration of production/industrial areas and structures, as this allows for better organisation of transport logistics
		Rehabilitate deprived areas by creating eco-districts
Acoustic classification of the Territory (*Classificazione acustica del Territorio – Zonizzazione acustica*): safeguard areas not yet hit by noise pollution, and identify areas that require recovery plans because detectable acoustic levels exceed the limits identified to risk to public health	2020	Acoustic classification of the territory
Pedestrian areas in the periphery of the city, especially to link the centre to surrounding suburbs (make sub-centres in the periphery more attractive)	2020	Construct 'green mile'

SOCIAL MILESTONES	**TIMEFRAME**	**STARTEGY TOWARDS MILESONE**
Citizens change their lifestyles and become more sensitive	2030	Educate citizens on their role and responsibilities as 'members' of the city

CONSUMPTION MILESTONES	TIMEFRAME	STARTEGY TOWARDS MILESONE
High percentage of waste reduced and high percentage of materials recycled	2020	Increase waste sorting (PAES). Make the separation of waste and recyclables more user-friendly and more efficient
		If waste cannot be prevented, it should be reused or prepared for reuse, recycled, incinerated with energy recovery, or disposed of in landfill, if no other option is available (EU Waste Framework Directive)
Effective waste management	2020	Increase the efficient energy recovery of residual waste (PAES). Make efficient use of the existing system, i.e. use incinerators to create energy and lower the amount of materials placed in landfills, and consider opportunity costs, i.e. in some cases there are high costs to recycle materials that also produce good energy (e.g. paper)

Milestones and actions modelled in the quantification of PC2050 (as noted in Deliverable 5.2) include:

ELEMENT	ACTIONS & MILESTONES FROM PC2050
Transport	City of sharing, that makes services accessible even through alternative or complementary forms of private transport Pedestrian-friendly city with shared spaces Accessible and usable without a car Carbon-free integrated transport systems Public transport faster, cheaper and more convenient than private transport Creation of an integrated public transport system A more widespread network of public transport, including extension of the circular lines to connect outlying areas Bike network – bike sharing Smart park and ride facilities New urban freight logistics Extend road pricing to encourage use of public transport and discourage private car use Electric cars Substitute municipal vehicle fleets with new ones that use clean technologies Add more electric car charging points (serviced by renewably produced energy)
Housing	Low-energy buildings, in the direction of the passive house District heating and cooling with renewable energy sources for all households
Building	High energy efficiency Energy needed for the city to function is produced from renewable sources Low-energy buildings, in the direction of the passive house Many buildings able to produce energy to feed it back into the system through the smart grid District heating and cooling with renewable energy sources for all households Linked with CHP network with industry so that waste heat is utilised Micro tri-generation (heating, cooling, and energy production) plants as pilot projects for big public and private energy users (hospitals, schools, etc.) Measures of energy recovery from the integrated water cycle using heat pumps to heat buildings near (or in) industrial wastewater treatment plants Goal of 100% of new buildings are zero energy or carbon neutral

ASSESSMENT OF NEEDS

The stakeholders discussed the assessment of gaps in relation to the planned actions presented by the POCACITO researchers and confronted them with the current status and ongoing trends in Milan. They concluded that several aspects of Milan's post-carbon development require further consideration. In particular, they highlighted the need to:

- Increase the supply of local renewable energy and decrease the reliance on national grid supplied electricity;
- Increase energy efficiency;
- Reduce social inequality;

- Limit urban sprawl and address implications for energy use, infrastructure investment, and transport;
- Improve consumption habits and the impacts of consumption; and
- Decrease water losses.

In the fourth workshop, held jointly with representatives from Turin, stakeholders analysed the results from the quantification of the PC2050 scenarios to assess these remaining needs. The main conclusion for Milan was that the biggest gap in terms of the use of renewable energy is attributable to the use of electricity from the national grid, considering that the major gap in relation to CO_2 emissions calculated corresponded to the emissions from energy generation for the national grid and consumed inside Milan. Stakeholders determined that a solution would require political competencies beyond the municipal level. Addressing this issue of renewable energy requires national policies of de-carbonisation, which can take advantage of the potential of innovation developed in recent years. Furthermore, stakeholders noted that ambition and concrete investments can continue to support the trend towards a higher share of renewable energy, also within the city.

In relation to the necessary investments, legislation and fiscal security is needed in the medium to long term, which is currently discouraged by frequent regulatory changes. A financial security mechanism for the duration of capital depreciation is needed, for example regulations for installations for the use of the geothermal energy. In the case of Italy, this assurance has not always existed, as with subsidies for photovoltaic systems. A second issue brought forward by participants is related to the need for proper resources related as a basic condition for autonomous local de-carbonisation policies. Beyond the legal and fiscal security of investments used for the implementation of local policies for de-carbonisation, there is indeed a need for human resources to create projects, follow their implementation, and monitor their actual effectiveness. Currently, Italian municipalities are not able to devote the necessary resources to these tasks. Some stakeholders even expressed doubt about the effective local capacities for implementing local plans for energy-saving projects due to lack of personnel to drive the implementation or mainstreaming of these plans.

In a period where local authorities struggle to maintain essential local services, the implementation of de-carbonisation projects suffers from a lack of resources and long-term perspectives. The stakeholders call on the European Commission for European strategies to safeguard local authorities' autonomy and allow the implementation of autonomous local policies.

The implementation of a **carbon tax** might provide local authorities with such targeted financial resources, provided that the implementation follows principles of transparency, communication and monitoring of resources, to ensure their re-use for de-carbonisation strategies.

Besides these national level measures needed to realise a complete de-carbonisation by 2050, stakeholders identified some further strategic measures to be implemented at the city level. For example, an important measure that has been discussed is the complete ban of cars that use fossil fuels by 2025. This measure is actually under discussion in Norway.

Stakeholders did not identify any new measures for energy generation strategies for Milan or Turin.

With regards to the issues connected to urban sprawl at the expense of agricultural or natural areas, stakeholders discussed the potential efficiency of measures already in place, such as maintaining fixed definitions of expanding areas in master plans of municipalities. Stakeholders agreed that Milan's

growth period was over and as a consequence the need for new buildings could be satisfied by replacing existing underused buildings and using internal derelict areas. The use of existing areas was also connected, in the discussion among stakeholders, with the creation of new spaces for new enterprises closing links in the circular economy; this was seen at the same time as a potential measure for social inclusion, as recycling initiatives are already now frequently connected to the third sector and provides occupation for less qualified persons. Stabilising these initiatives by providing them with public support and space was seen as a cross-cutting measure to promote the circular economy by re-using underused areas in the city and reducing social exclusion and urban poverty. Most measures and strategies supporting a post-carbon transition under the themes of urban society, sprawl, and circular economy and lifestyles that were discussed potentially serve more than one of the gaps identified, especially those related to circular economy and lifestyles which would, at the same time, serve also for closing social gaps, promoting social and spatial inclusion:

MILESTONE	STRATEGY TOWARDS MILESTONE
Improved access to new technologies, to create knowledge and reduce the generational gap and the gap between social groups	Implement open data structures, infrastructures and networks, and open innovation
Urban regeneration projects	Economic development, reduce social inequalities, balance environment and urban design, stop soil consumption
Eliminate food waste	Agricultural policies for food security

Urban society

- Cohesion - besides increased interaction between public and private spheres, expand the space of the third sector in urban areas (with organisational interventions and the provision of physical and virtual spaces); this would enlarge spaces for circular economy, creating physical and logistic spaces for new economic activities, and new occupation;
- The accessibility to networks, services and goods – creating new networks for sharing resources and opportunities ; would provide the infrastructure for a circular economy and
- Equitability – support for the weaker sections of society in the participation and access to the energy reduction tools (i.e. purchases and investment in energy efficiency and renewable energies supporting the necessary investment for low income households).

Circular economy and lifestyles

- The aim is to obtain a more continuous circular economy chain to facilitate the connection and the relationship between 'supply and demand' – extend the use of existing elements (e.g. via used market, sales and recycling of used items, etc.) and create physical space (at the neighbourhood level) and economic space (by eliminating obstacles in this sector and for small professionals) for the exchange of goods and non-professional

services: further to the measures mentioned in relation to social inclusion and a more inclusive urban society,

- Facilitate and support the bureaucracy of processes with the aim of facilitating exchange and new economic activities in this sector;
- Promote access and the relationship between supply and the offering of second-hand goods by creating physical and logistic spaces for exchange for both professional and non-professional services and
- Make the management of start-up of activities and professions less bureaucratic.

Urban sprawl

Stakeholders agreed that the city's expansion phase has come to an end and the increase in population of more than 600,000 people (as proposed in the POCACITO Post Carbon Scenario in 2050) seems unrealistic given the low birth rate and the expected trend in immigration in the city. However, some considerations on strategies to be enforced for avoiding further urban sprawl were made with the aim of supporting planning policies for 'zero' consumption of land for urban expansion in the territory;

- Analyse existing urban plans and currently unused existing building volumes to be exploited and
- Encourage urban regeneration in building replacement creating spaces also for new economic activities, for instance promoting activities for a circular economy.

ANNEX. STAKEHOLDERS: MILAN

Institution	Name	Workshop 1 - Vision building	Workshop 2 Backcasting	Workshop 3 Critical Influences	Workshop 4 Roadmap
Milan Stakeholders					
A2A	Riccardo Fornaro	•		•	•
Agenzia Mobilità Ambiente Territorio (AMAT)	Maria Berrini	•			
	Marta Papetti	•			•
Finlombarda S.p.A., Direzione Energia	Dino De Simone	•		•	
Fondazione Lombardia per l'Ambiente	Mita Lapi		•	•	•
IEFE Università Bocconi	Edoardo Croci		•		
	Tania Molteni			•	•
Istituto Nazionale di Urbanistica Lombardia (INU Lombardia)	Luca Imberti	•	•	•	•
Legambiente Lombardia	Damiano Di Simine	•			
Ordine Degli Architetti, Pianificatori, Paesaggisti e Conservatori Della Provincia di Milano	Alessandro Trivelli	•			•
Politecnico di Milano	Stefano Caserini		•		•
TRT Trasporti e Territorio	Patrizia Malgieri	•			

Institution	Name	Workshop 1 - Vision building	Workshop 2 Backcasting	Workshop 3 Critical Influences	Workshop 4 Roadmap
Turin Stakeholders participating in joint Milan-Turin workshops					
Agenzia per la Mobilità Metropolitana Torino	Andrea Stanghellini			•	•
ARPA Piemonte	Cuviello Maria				•
Collegio Costruttori Edili	Paolo Peris			•	
Confindustria	Cristina Manara				•
Dislivelli	Federica Corrado			•	
Politecnico di Torino	Luigi Buzzacchi			•	
	Stefania Guarini				•
Torino Strategica	Riccardo Saraco			•	•
Turin Municipality – Environment Department	Enrico Bayma			•	
	Mirella Iacono			•	
Turin Municipality – Transport Department	Giuseppe Estivo			•	
Turin Municipality – Urban planning Department	Liliana Mazza			•	
Unione Industriali Torino	Elisa Merlo			•	