POCACITO

european post-carbon cities of tomorrow

Malmö Strategy Paper

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Steve Harris, IVL Swedish Environmental Research Institute

Hanna Ljungkvist, IVL Swedish Environmental Research Institute

Project coordination provided by Ecologic Institute.

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STRATEGY PAPER OF MALMÖ TOWARDS A POST-CARBON CITY

IVL Swedish Environmental Research Institute, Gothenburg, 2016-05-24

Steve Harris, Hanna Ljungkvist, IVL Swedish Environmental Research Institute

CHALLENGES FACING THE CITY

The main challenges identified in the sustainability assessment that the city is facing are summarised as follows:

- Segregation, unemployment and social inclusion (recent developments).
- Renewable energy production capacity.
- Carbon reporting including consumption footprint.
- Urban sprawl.

All of these challenges are framed within the context of a consistently growing population that is expected to reach around 500,000 people by 2050.

The main areas of interest identified in the vision and backcasting workshops are:

- Local fossil free food production.
- Renewable and decentralised energy production.
- Dependence of national policies (i.e. tax reforms).
- Sharing economy (products, logistics and public transports).
- Consumption based carbon reporting.

From the PCIA workshop the following variables were identified as particularly important due to the high influence they have on other factors in the city and its development:

- National policies
- Segregation of housing
- Robust economy
- Resource /environmental tax and charges

An initial assessment of Malmö was made using a set of KPI's developed within POCACITO (Work Package 3). From the data available trends were established for each of the KPI's and these have since been assessed and projected in the sustainability assessment. Data for this was obtained from various reports, websites and information and the outcome can be found in Annex 1.

DESCRIPTION OF THE STAKEHOLDER CONSULTATION WORK

Three workshops involving city stakeholders were held during 2014 and 2015.

In the first workshop the aim was to create inspiring visions for a post-carbon Malmö 2050. The participants worked in groups, starting by drawing pictures and then step by step formulating their vision for the city.

The second workshop used backcasting methodology to list obstacles and opportunities, milestones and activities related to reaching a normative endpoint goal. The goal set by the stakeholders was:

"In 2050, the citizens of Malmö only emit 1-2 tons of carbon dioxide per person and year, including the carbon footprint of their consumption."

The milestones and activities in different areas were then positioned on a timeline to reach the 2050 goal.

In preparation for the third PCIA (Pocacito Critical Influences Assessment) workshop, IVL used the results from visioning and backcasting to develop a set of variables influencing the city system. During the workshop, participants used the variables in an impact matrix to try to describe what impacts they had on each other and how strong this impact was. They also suggested a number of additional variables. Based on the results, IVL made an assessment using the sensitivity model, and the top five variables for the Malmö city system were selected.

More detailed descriptions of the workshops and outcomes can be found in the Stakeholder workshop report (D4.2) and the PCIA report for Malmö (D5.1), both available at www.pocacito.eu.

INSIGHTS FROM THE GAP ANALYSIS FOR THE CITY

Under most indicators Malmö is performing exceptionally well as the economy has recovered in recent years and continues to prosper and grow. As in many European cities there is a move towards the service sector, which has a lower energy intensity (or energy use per economic output) and facilitates the move to a post-carbon society. Recent developments in Malmö such as Västra Hamnen and Hyllie represent some cutting edge examples of sustainable development.

POCACITO has developed and compared two scenarios as possible outcomes for Malmö in 2050: 'Business as Usual' (BAU) and 'Post-Carbon 2050'. BAU is essentially based on an examination and extension of current trends for indicators and physical aspects such as population, energy use, GDP, buildings and transport. PC2050 is a projection of the indicators and physical aspects based on an interpretation of the visions, actions and milestones developed in the stakeholder workshops. A summary of some of these is in Table 1. It is therefore a judgement based on the consistency and robustness of supporting actions to the desired post-carbon state, and not a quantification of an idealistic state (for further information see Harris et al, 2016).

Table 1: Quantification of the main elements of the scenarios for Malmo

Element	Current trend (up to 2013)	Scenario BAU 2050	Scenario PC 2050
Population	313,000	500,000	500,000
Energy	**Energy use** 7259 GWh (2013) (produced) 8230 GWh 7196 Gwh (2008). Therefore, 2003-2013, +8.8%.	**Energy use** 8175 GWh (produced 9044 GWh) **Energy production** - Electricity from grid 26% (hydro 44%, nuclear 40.5%) - Wind and solar – 12% - Gas – 18% - Avfall – 14% - Waste heat – 2% - Biofuel – 8% - Oil – 0.1% - Diesel/petrol 19.6% Renewables therefore provide 40.7% of Malmo's energy.	**Energy use** 7440 GWh (produced 8230 GWh) **Energy production** - Electricity from grid 27.9% - Wind and solar – 40% - Gas – 5% - Avfall – 7% - Waste heat – 2% - Biofuel – 8% - Oil – 0.1% - Diesel/petrol - 10% Renewables therefore provide 62.8% of Malmo's energy
Transport	Modal share change (2003-13) (%) 2003 2013 % Change Car 52 40 -12% Bus 10 14 +4% Train 3 7 +4% Bicycle 20 22 +2% Walking 14 15 +1% Other 1 2 +1%	Modal share is projected as: Car: 32% Bus: 15% Train: 9% Bicycle: 24% Walking: 18% Other: 2%	Modal share: Car 32% Bus 15% Train 9% Bicycle 24% Walking 18% Other 2%
GDP	45,400 EUR (2011)	98,700 EUR	101,600 EUR

The GHG emissions and energy use of the scenarios is compared with 2013 in Figure 1. It shows that under BAU the energy use increases (due to population growth and taking into account improvements in energy efficiency) whilst the GHG emissions decrease slightly. In PC2050 there is improved energy efficiency and electric transport is increased to about 60% of the transport. Figure 2 illustrates the GHG emissions per capita showing that in both scenarios per capita emissions are much reduced at 2.97 t CO_2e/capita for BAU and 1.37 t CO_2e/capita for PC2050.

Figure 1: GHG emissions and energy use comparing 2013 with BAU and PC2050

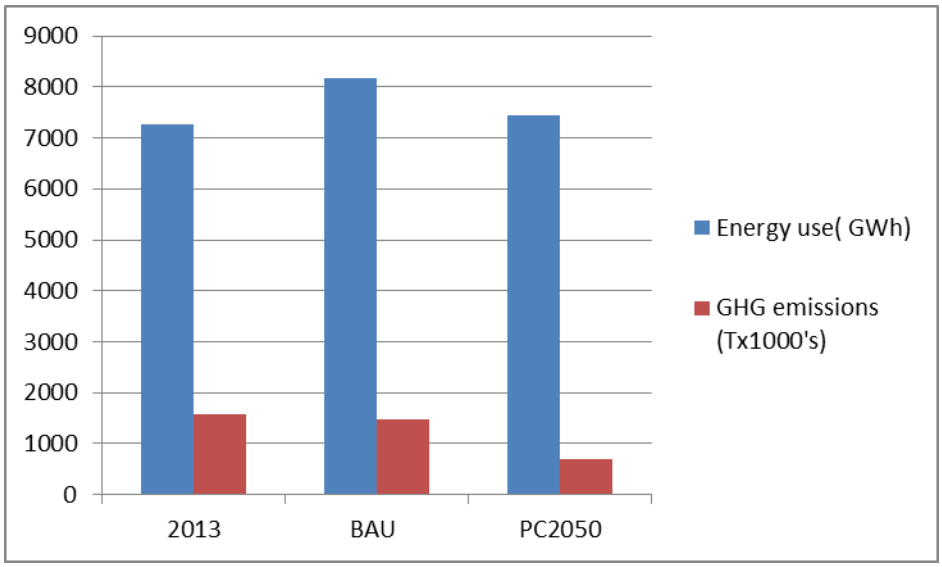
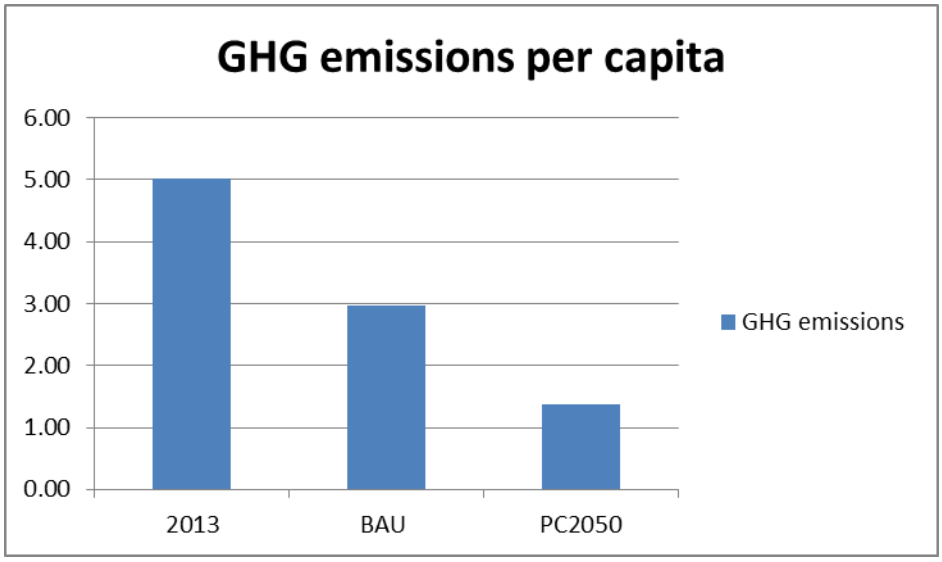


Figure 2: GHG emissions per capita for 2013 and the scenarios for Malmö



The energy production under PC2050 obtains 27.9% of electricity from the grid and an additional 40% energy from local wind and solar. Considering the low carbon national electricity supply projected for 2050[1] (although Sweden's electricity is already very low in carbon) this brings the total renewable energy supply to 62.8%. It was not considered possible to achieve a 100% local renewable energy supply by 2050, given the current set of actions and milestones developed in the vision workshop. One of the main contributors to GHG is fossil fuels used for transport which still account for 50% of the transport energy (see Figure 4). Therefore although this transport energy only accounts for 10% of the energy supply, it contributes 36.2% of the GHG emissions.

[1] Energy projections for 2050 are taken from EU Energy, Transport and GHG Emissions, Trends to 2050 (Capros P, et al. 2014).

Figure 3: GHG emissions by sector

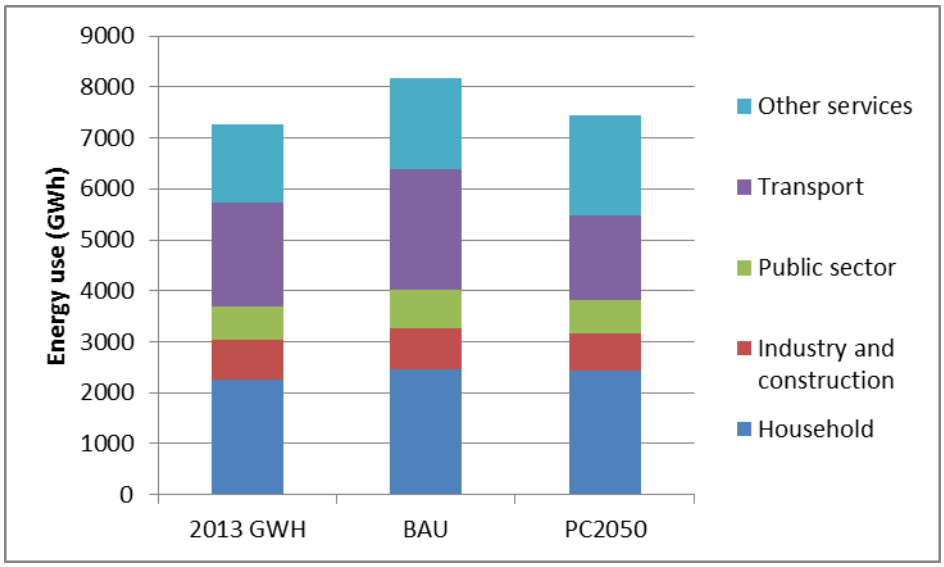
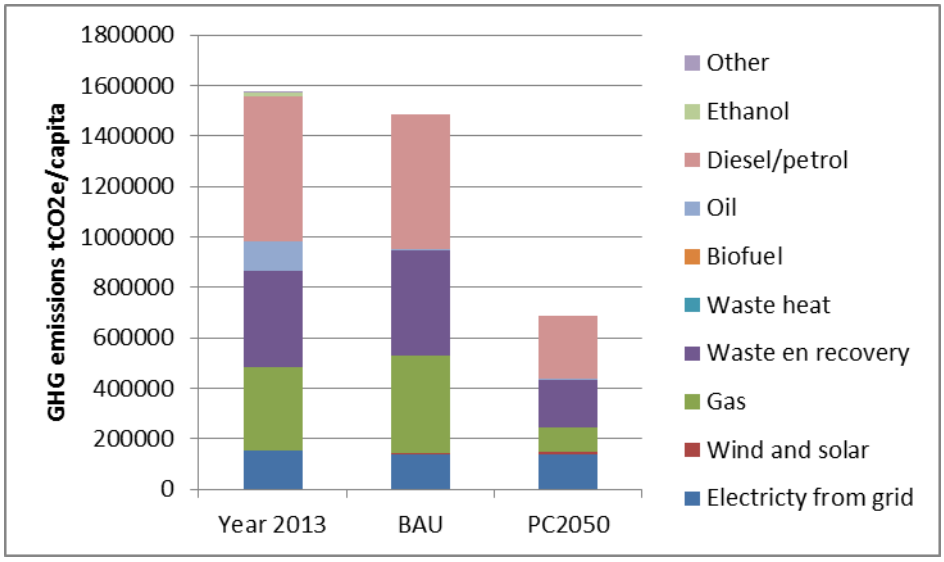


Figure 4: GHG emissions by energy source



In fact, even achieving the 40% of local renewable energy in PC2050 is an enormous challenge considering the quantities required and historical progress in local renewable energy.

The amount of additional renewable energy required for each scenario is shown in Table 2. To put this into context the amount required under PC2050 is equivalent to 8 wind farms the size of Lilligrund, which at 110 MW is Sweden's largest offshore wind farm.

Table 2: Additional wind energy and capacity requirements for the scenarios

	BAU 2050	PC 2050
Wind energy (GWh)	785	2995
Net wind capacity required (MW)	**243**	**869**

In order to replace all remaining fossil fuels under PC2050 with renewable energy an additional 830 GWh of energy is required. This is equivalent to 241 MW or about 2 further Lilligrunds. Hence there is also a requirement to investigate further options for major energy use reduction through energy efficiency measures.

Solar energy of course is a complementary option to supplement the wind energy. According to our initial calculations, about 0.834 MW of solar capacity is needed for each GWh required. This means the comparable costs are: wind 2.46 EUR/kW and solar 2.06 EUR/kW.

SUMMARY OF KEY GAPS

In addition, to the energy analysis, the main gaps identified in the sustainability assessment are summarised below.

ENERGY

Under BAU energy use continues to climb, but even under PC2050 total energy use rises slightly (due to population growth), although is less per capita. In addition, the total emissions for PC2050 are 687,000 tonnes of CO2e or 1.37 tonnes per capita, therefore falling short of post carbon status.

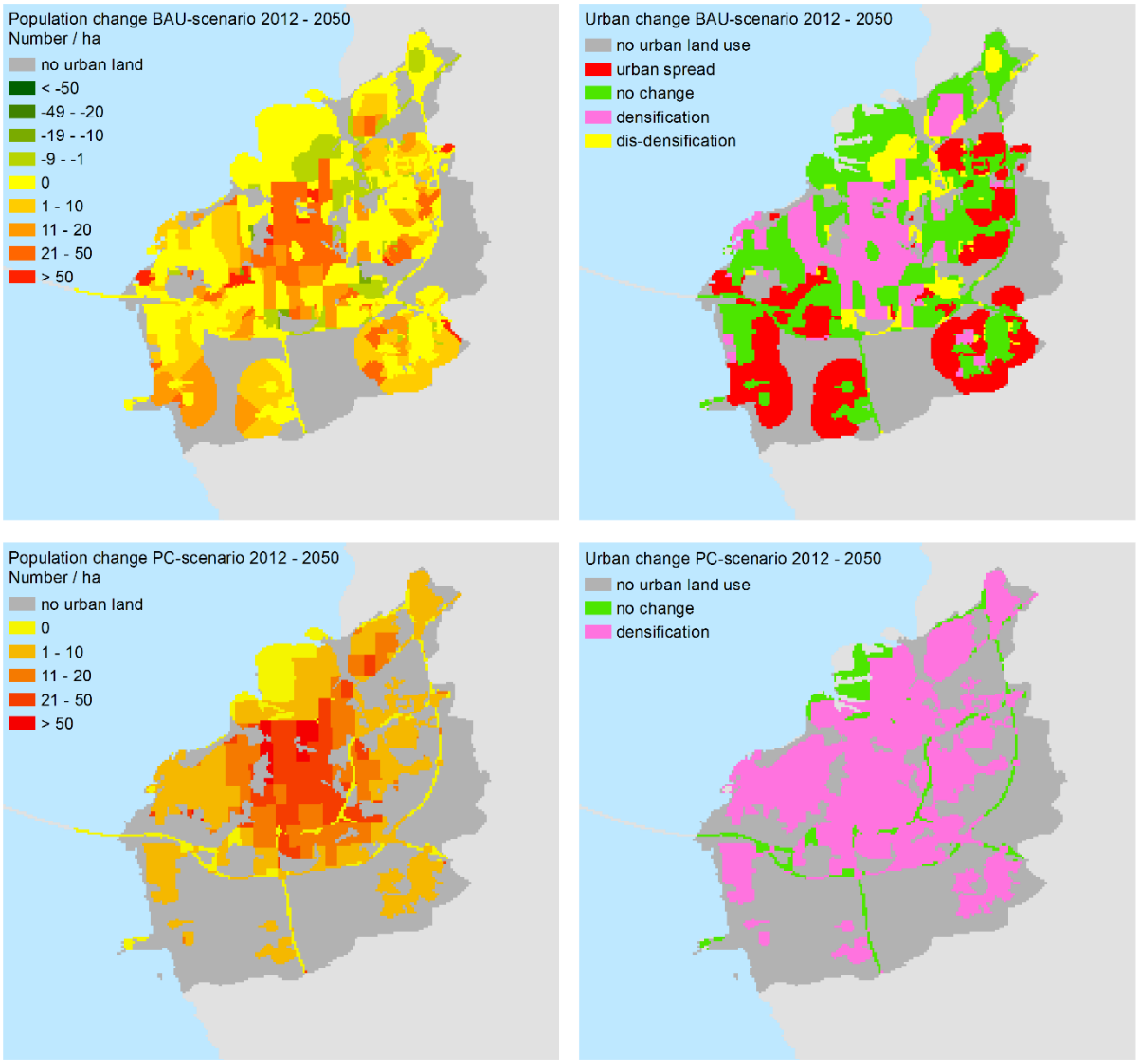
In order to completely remove all fossil fuels from the energy profile enough additional renewable energy capacity is needed to supply 2995 GWh (this is assuming further energy efficiency measures are not taken). If this were all supplied by wind energy then 869 MW of capacity would be required which the equivalent of 8 Lilligrunds. Therefore measures to reduce energy use through energy efficiency measures should be high on the agenda to reduce the investment and effort required to supply adequate energy.

Transport and the cessation of using fossil fuels is probably one of the biggest challenges. Under PC2050 currently, transport accounts for 36% of GHG emissions, due to 50% of the transport still being powered by fossil fuels.

URBAN SPRAWL

Under BAU urban sprawl covers an additional 37.4 km^2, which is of concern, and although we have assumed no urban sprawl occurs under PC2050, this aspect needs careful attention in strategic planning. This also has ramifications for private and public transport, which could increase more than projected in the scenarios if urban sprawl remains unchecked.

Figure 5: Urban change and population change in BAU and PC scenarios 2012-2050.



INEQUALITY

Currently the PC2050 scenario fails to adequately address segregation and the dangers of inequality. The poverty level of 14% is also high. Inequality is a growing challenge in many cities and hence needs an adequate strategy, actions and indicators to monitor progress.

CIRCULAR ECONOMY

Within the PC2050 scenario there is an emphasis on the circular economy and local produce. Hence there is a requirement to plan for urban gardens and agricultural space, as well as space and opportunities for facilities for the circular economy (for reuse, repair, refurbishment and remanufacturing). This should include supporting innovative local businesses that seek to facilitate reuse, repair and remanufacturing. It should include working closely with the national government to ensure policies on trade, industry, innovation and the environment align with the goals of a circular city.

A STAKEHOLDER VISION FOR THE CITY

The storyline of the main stakeholder vision was as follows:

> ”We are on our way home in Malmö, a city of networking and cooperation. We travel on our bike while dinner is being delivered to our home by a company using cluster logistic services. We have ordered pick up of our children with the ‘bicycle bus’, while the teenager uses the driverless taxi that also picks up the ecological laundry at the local drycleaner.
>
> Our new job as ‘Transformation coach’ takes us to a common workshop with city actors in the democratic roofed outdoor meeting place.
>
> We optimise the use of arable land by producing food in a resource efficient and large scale manner outside the city and in small scale inside the city. This enhances green space in the city. The excess energy from large scale and resource efficient industrial production is taken care of and generates new services like greenhouse growing of energy demanding crops. Apart from farming, green plants have taken over roofs, walls and public spaces and help reduce noise in our quiet city.
>
> The city is dense, green and diverse and used around the clock. There is reduced demand for individual travel and car ownership. Travels take place in driverless electric vehicles that are coordinated with transport of goods and take us to nodes for rail bound traffic. These station nodes have become the backbone of the city, enabling meeting places, investment in new housing and services. The biking lane network has a high priority and invites to biking for all citizens year round since the lanes are roofed.
>
> By sharing our consumption and standardizing our products we have reduced the input of virgin resources. We use open grid solutions with standardized connections and input of renewable energy where all excess resources are used and recycled.
>
> All this new development creates new jobs that are distributed equally among the citizens. We work less and hence have more time for meeting each other. The growing numbers of roofed outdoor meeting places improve social integration in all climates. They also encourage consumption and development of culture, which becomes the meaning of life in the new including social space. Everyone *are friendly and encourage each other to grow and develop.”*

The following sectors/topics were covered in the city vision:

- Energy, with focus on renewables
- Transport sharing & smart logistics
- Food production
- Efficient, ecologic consumption
- Circular and sharing economy
- Green areas including city farming, green roofs and walls
- Social inclusion, safety and networking
- Dense city structure
- Quality of life, the value of time, outdoor activities and culture

- Smart technology and open grid solutions

ACHIEVING THE VISION

Below is a list of milestones, in some cases connected to existing or suggested strategies/plans, to achieve post carbon in Malmö by 2050. The table is a combination of results from the backcasting workshop and suggestions based on the gap analysis. It was further developed by stakeholders during the roadmap workshop. It is divided into four main areas.

SECTOR/MILESTONE (MS)	TARGET DATE	STRATEGY TOWARDS MILESONE
ENERGY, CARBON AND TRANSPORT		
MS I: Fossil free district heating system	**2025**	**Updated energy strategy/action plan for Malmö** Shift to biofuels?
MS II: Malmo City Municipality operations carbon neutral	**2025**	**Updated energy strategy/ action plan for Malmö (ongoing)**
MS III: Transport 40% electric	**2030**	Offshore wind park inaugurated 2030. Carbon Rationing per person introduced 2040. Updated traffic program for Malmö (current program expires 2017)
MS IV: Fossil fuelled transport reduced to 50%	**2035**	Large biogas plant inaugurated 2020
MS V: Average building energy reduced to 50 kWh/m^2	**2035**	Energy consumption tax is introduced per m^2 of living space and person. Reduce the amount of bought energy.
MS VI: Fossil fuelled transport reduced to 10% within outer city and 0% in city centre.	**2050**	Trams and subway + Malmö ring inaugurated 2020 – 2025, or probably later; 2030?. Residents use car pools/ mobility pools more.
SOCIAL		
Rejuvenation and revitalisation plan for segregated/socially challenged areas	**2025**	Already existing plans/programs: Strategic Development Plan for Anti-Discrimination Work in the City of Malmö Security program Cultural strategy Malmö Commission report on health, welfare and justice[3]
Child poverty level halved by 2020	**2020**	Target from the Malmö Commission report.
Tertiary level education of culturally diverse/segregated areas within 3% of average	**2035**	To reduce segregation in housing, two large demonstration projects are suggested in the Malmö Commission report.

Health and life expectancy in Segregated areas within 5% of rest of Malmo	**2035**	
Tackle homelessness	**2016**	300 apartments dedicated to homeless people (target from the Malmö Commission report, now probably outdated due to the immigration situation)
Poverty level reduced to 2% for all residents	**2050**	
Tertiary level education of culturally diverse/segregated areas within 3% of average	**2050**	
Health and life expectancy in segregated areas within 2% of rest of Malmo	**2050**	Addressed in the Malmö commission report [3]
Population size 500 000 and constant	**2050**	400 000 inhabitants by 2035. This target was questioned in the roadmap workshop, in the light of recent high immigration numbers. It was also stated that the quality of life is more important than the number of inhabitants.
LAND USE		
No new land is built on	**2035**	Regulated today by Malmö comprehensive plan (targets to 2030) and Malmö green plan (updated plan under development) Important to focus on densification in businesses as much as in housing!
35% increase in recreational value per ha at municipality level * (240.000sek/ha)	**2050**	This target was questioned by the roadmap workshop since they did not understand the basis for valuation. The issue as such could be handled by the plan for green and blue environment in Malmö.
CIRCULAR ECONOMY		
Circular Economy strategy	**2020**	Carbon footprint calculation including consumption
Collection points and logistic systems for reuse and remanufacturing in place	**2030**	Resource management plan (part of CE strategy)
Local produce accounts for 20% of food sold	**2050**	Government subsidy of fossil-free and sustainable agriculture is introduced 2025
Local reuse, refurbishment and remanufacturing companies recover 75% of collected materials/products for which there is a market.	**2050**	Resource management plan (part of CE strategy) Support entrepreneurs with new business models.

Reduce the amount of waste to incineration	**2020**	The municipal waste management company (SYSAV) has a waste plan that should govern this[2].

**Transferred site values of today range from 177.000SEK per ha in Malmö municipality to 6.000 SEK per ha in Skurup municipality.*

ASSESSMENT OF NEEDS

The following section should also be further developed during the roadmap workshop. It outlines stakeholders' assessment of the next steps. What can the city administration do, what should the national authorities do and what should the EU do to achieve post carbon in Malmö and other European cities?

CITY ADMINISTRATION:

The administration should develop and follow up strategies, targets and KPIs for the areas:

- Energy: the energy strategy document is under revision...
- Public transport: this is governed by the local traffic- and mobility plan. It is important to define how transport efficiency should be measured: as fuel per person km or in other terms?
- Goods transport is also important to measure with the aim to develop more efficient logistic solutions. The goods transport plan is an important document for this.
- Local food production.
- Social sustainability: the report from the "Malmö commission on social sustainability"[3] governs many of the social issues relating to the gaps in health due to differences in education, housing standards, income and employment etc. It suggests a number of actions related to these areas that need to be followed up continuously.
- Green and blue space: there is ongoing work on a plan for the green and blue environment in Malmö. This is an important document with regard to recreational values and urban sprawl.
- Circular economy – this should include supporting local innovative businesses that seek to reuse, refurbish, repair and remanufacture products. This could involve capturing some emerging technologies and techniques such as 3D printing, product 'hacking' (combining components from products to form innovative new products) and using the internet for increased knowledge of product design and engineering. It should include working closely with the national government to ensure policies on trade, industry, innovation and the environment align with the goals of a circular city.

[2] SYSAV (2015).Kretsloppsplan 2016 - 2020
http://www.sysav.se/Om-oss/Om-foretaget/Regionens-avfallsplanering/kretsloppsplan-2016-2020/
[3] The Malmö Commission, 2013. "Malmös väg mot en hållbar framtid – hälsa, välfärd och rättvisa"
http://www.slideshare.net/fullscreen/rodaberget/malmkommissionen-slutrapport-digital130225/5

The city administration should also continue to showcase good examples, e.g. demonstration projects of different kinds.

NATIONAL AUTHORITIES AND GOVERNMENT:

The national authorities need to provide clear, consistent and long-term economic incentives to promote post carbon activities. Some examples of incentives are:

- Tax shifts
- Higher energy prices
- Carbon rationing
- Investment support for new business models
- Refund systems for new fractions

There is also a need for clear national goals/targets for environmental and social development.

Furthermore, the national government has a key role in setting clear and ambitious policies that support and foster the circular economy in cities. This requires ensuring that the many sectors and areas that are related to the circular economy, including trade, industry, innovation and environment. It also requires that the government works with industry and sets policies to support business models that facilitate the circular economy. But also that it encourages product design and knowledge transfer that provides SME's with the ability and knowledge to perform circular functions such as repair and remanufacturing.

EU:

The EU governs much of national legislation in the member states today. There is a need to operationalise legislation that leads to a more circular and less carbon intensive economy. Examples of such legislation include:

- The waste directive and end of waste criteria (and their national implementation)
- Standards for recycled materials
- Incentives for resource efficiency (such as reuse and use of secondary raw materials)
- Incentives for energy efficiency that makes it possible to overcome the barrier of high investment costs
- Higher ETS (European Trading System) prices for carbon
- Policy connected to new, innovative business models

The Malmö stakeholders emphasised the need for a clear long-term vision to work towards, and clarity on policies and incentives that provide the framework for their authority. The Malmö stakeholders emphasised that some nations should be allowed to be 'forerunners' and set goals that exceed EU levels. Individual countries should be able to develop and advance from their own level.

INDUSTRY/BUSINESS:

The industry should act as forerunners and make investments in renewables and circular business models wherever possible. These early adapters act as inspiration and show cases for the rest of society on how to progress towards a sustainable society.

APPENDIX

This section utilises the indicators developed within WP3 of POCACITO to provide a semi-quantitative and qualitative assessment of how Malmö performs under both BAU and PC2050.

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 below.

Legend	Explanation for scenario projection compared to current situation
++	Likely very positive
+	Likely progress
0	Likely neutral or similar to current situation
-	Likely negative
--	Likely very negative

Table 3 summarises the current trends of the KPI and provides a projection of the likely outcome and performance under each of the scenarios (where possible and applicable).

It shows that Malmö is performing quite well for most indicators under the BAU scenario but performs noticeably better under the PC2050 scenario.

Table 3: Semi quantitative assessment of the POCACITO KPI's under BAU and PC2050 for Malmo

	SUB-DIMENSION	INDICATOR	UNIT/INFO	Quantity	Trend	BAU 2050	PC 2050
ENVIRONMENT	*Biodiversity*	Variation rate of ecosystem protected areas	*2007* *2013*	*2.1%* *4.5%*	*Doubled in 6 years*	+	++
	Energy	Energy intensity variation rate	*Toe/euro (000)* *2003-2013* *Toe (000)*	*0.06 -0.45* *561-616*	*-25%* *+9.7%*	+	++
		Variation rate of energy consumption by sectors	*Percentage* *Total 2003-2012= 571.7-618.8 KToe (9,5% increase)*	*2003-2012 %* *Household 33-31* *Building industry 11-11* *Ag, forestry & fish 0-0* *Public sector 9-9* *Transport 27-28* *Other services 20-21*	*Household -2%* *Building industry 0* *Ag, forestry & fish 0-0* *Public sector 0* *Transport +1* *Other services +1*	*0*	+
	Climate and Air Quality	Variation rate of carbon emissions intensity	*2000-2011* *Ton CO_2* *Ton CO_2($x10^{-3}$)/ euro*		*1.38M-1.75M: +26.8%* *0.166-0.127: -23.5%*	+	+
		Carbon intensity per person	*Population: 262,000 (check for 2002) 313,000*	*5.62 t/cap* *5.59 t/cap*	*0% change*	+	++
		Variation rate of carbon emissions by sector	*Ton CO_2* *Total 2000-2012 1319-1606 kton (22% increase)*	2000-2012 Total (up 22%) Work machines and tools: 4-5% Industry and energy 56-72%	*Work machines and tools: +48.0%* *Industry and energy +57.8%* *Road transport: -28.8%* *Transport, other: -44.5%*	*See below*	*See below*

	SUB-DIMENSION	INDICATOR	UNIT/INFO	Quantity	Trend	BAU 2050	PC 2050
				Road transport: 37-22% Transport, other: 3-2%			
		Exceedance rate of air quality limit values	*Nº*	*No notable change*	-	+	+
	Transport and mobility	Variation share of sustainable transportation	*Percentage (2003-2008-2013)*	(2003-2008-2013) Car: 52-41-40 Bus: 10-10-14 Train: 3-4-7 Bicycle: 20-23-22 Walking: 14-20-15 Other: 1- 2-2	*Car: -12%* *Bus: +4%* *Train: +4%* *Bicycle: +2%* *Walking: +1%* *Other: +1%*	+	+
	Waste	Variation rate of urban waste generation	*Kg/person/year*	*2007: 370.2* *2012: 329.3*	- *11%*	+	++
		Variation rate of urban waste recovery	*Percentage*	*2011, 2012 and 2013* *27%, 36% and 38%*	*Positive improvement*	++	++
	Water	Water losses variation rate	*m^3/person/year*	*Not available*	*Not available*	*N/A*	*N/A*
	Buildings and Land Use	Energy-efficient buildings variation rate	*Percentage*	*Not available*	*Not available*	*N/A*	*N/A*
		Urban density variation rate (population)	*Nº/ km^2 (2005-2010)*	*3458-3527*[4]	*+ 1.97%*	+	+
ECONOM	*Sustainable*	Level of wealth variation rate	*eur/person*	*2003-2011*	*+26.1%*	++	++

[4] http://www.scb.se/Statistik/MI/MI0810/2010A01Z/01_Localities2010_land_area_pop_density_2005_2010.xls

	SUB-DIMENSION	INDICATOR	UNIT/INFO	Quantity	Trend	BAU 2050	PC 2050
	economic growth			*35990-45400 Euro*			
		Variation rate of GDP by sectors	*Percentage*	*Pg 22 Malmo snapshot*	*A positive long-term development can be noted within business services, IT and computer consultancies, hotels and restaurants, education and commerce ´A downward trend can be seen within manufacturing and agriculture/forestry/fishing*	*N/A*	*N/A*
		Employment by sectors variation rate	*Percentage*	*Pg 22 Malmo snapshot*	*From 09-2013 Largest were: Hotels and restaurants Law, econ, sci and tech Civil author. and defence >10% were Healthcare & social services Transport and warehouse*	*N/A*	*N/A*
		Business survival variation rate	*Percentage*		*68%*	*N/A*	*N/A*
	Public Finances	Budget deficit variation rate	*Percentage of city's GDP*	*2003=2.8% down to 1.9% in 2006 and then up to 2.8% 2011 Is equalised by tax finance*	*No change*	++	++
		Indebtedness level variation rate	*Percentage of city's GDP*	*2003=4-4% 2006=3.3%*	*No change*	++	++

	SUB-DIMENSION	INDICATOR	UNIT/INFO	Quantity	Trend	BAU 2050	PC 2050
				2011=4.1%			
	Research & Innovation dynamics	R&D intensity variation rate	*Percentage*	*Data only for 2011 for Malmo.*	*4.5% (2011)* *For Skåne: 3.6-3.3%*	++	++
SOCIAL	*Social Inclusion*	Variation rate of unemployment level by gender	*Percentage* *1996-2014* *2008-2014*	*Male / Female* *-5% / -4.5%* *+6,5 / + 4,8*	*Male / Female* *-5% / -4.5%* *+6,5 / + 4,8*	++	++
		Variation rate of poverty level	*Percentage*	*14%*	*0%*		
		Variation rate of tertiary education level by gender	*Percentage* *(2003-2012)*	*Men: 32%-40%* *Women: 34.5-44.5%*	*Men: 8%* *Women: +10%*	+	+
		Variation rate of average life expectancy	*Average Nº* *(2003-2011)*	*80.2-81,7*	*+1.5*	++	++
	Public services and Infrastructures	Variation rate of green space availability	*Percentage*	*2000-2005* *55-55%*	*+5%*	++	++
	Governance effectiveness	Existence of monitoring system for emissions reductions	*Yes/No* *Description*	*Yes*		++	++

Table 4: Semi quantitative assessment of the POCACITO PCIA (Sensitivity Model) indicators

PCIA indicators	Current trend/situation	BAU	PC2050	BAU	PC 2050
Segregation of housing /inequality	Currently there are pockets of cultural segregation within Malmo, as well as	Malmo currently has projects to reduce segregation by opening up corridors to increase connectability. But this may not be enough to reduce social and cultural segregation and	Currently the PC2050 scenario also fails to adequately address segregation and the dangers of inequality.	+	+

		inequality. However, the social aspects were a prominent feature of the 2014 Comprehensive Plan for Malmö and so there is good potential for a positive outcome, with improved social spaces, meeting points and consideration of experiences and needs of people in urban planning.			
Land use	This concerns the balance between urban development, green space and agriculture. With a high population growth there is a risk of urban sprawl.	There is some urban sprawl notable under the BAU scenario (see land use section below).	Within the PC2050 scenario there is an emphasis on the circular economy and local produce. Under the PC2050 there is assumed no urban sprawl. But there is a requirement to plan for urban gardens and agricultural space, as well as space and opportunities for facilities for the circular economy (for reuse, refurbishment and remanufacturing).	+	++
Public transport and bike network	The last ten years have seen a reduction in car use and an increase in public transport, by modal balance.	Under BAU total car use is expected to rise although the overall modal balance will reduce. Bicycle use rises only 1-2%.	An increased emphasis on electric mobility could improve the transport energy outlook.	0	+

ANNEX. STAKEHOLDERS: MALMO

WORKSHOP 1: Vision

Name and Surname	Institution
Per-Arne Nilsson	Malmö city, Head of Environmental dep.
Kerstin Rubenson	Malmö city, Environmental dep.
Tor Fossum	Malmö city, Energy strategy
Jan Rosenlöf	City building council, city planning
Mattias Zaunders	Sigma IT and management, Business manager
Johan Bergström	Sigma Civil AB, Head of department for planning, landscape and traffic
Hans Söderling	NCC Construction Sverige AB, Project leader
Annika Hansson	NCC Construction Sverige AB, Project leader
Yuliya Voytenko	International Institute for Industrial Environmental Economics, Lund University, Postdoc PhD
Boel Lagerwall	Pågen AB (bakery company), Communication manager
Iris Rehnström	Skånetrafiken AB (public transport) Environment- and sustainability strategy
Hanna Ljungkvist	IVL
Jeanette Green	IVL

WORKSHOP2: Back casting

Name and Surname	Institution
Per-Arne Nilsson	Malmö city, Head of Environmental dep.
Kerstin Rubenson	Malmö city, Environmental dep.
Tor Fossum	Malmö city, Energy strategy
Mattias Zaunders	Sigma IT and management, Business manager
Hanna Ljungkvist	IVL
Jeanette Green	IVL

WORSHOP 3: PCIA

Name and Surname	Institution
Jan Rosenlöf	City building council, city planning
Tor Fossum	Malmö city, Energy strategy
Jenny Holmquist	MKB real estate, Environmental strategy
Sara Pettersson	Thesis worker, IVL (food banks)
Annika Hansson	NCC Construction Sverige AB, Project leader

Hanna Ljungkvist	IVL
Jeanette Green	IVL

WORSHOP 4: Roadmap

Name and Surname	**Institution**
Kerstin Rubenson	Malmö city, Environmental dep.
Tor Fossum	Malmö city, Energy strategy
Annika Hansson	NCC Construction Sverige AB, Project leader
Helena Tillborg	Energy council Skåne
Hanna Ljungkvist	IVL
Jeanette Green	IVL