

# **Sustainable Energy and Climate Action Plan Municipality of Milan**

## **Executive Summary**

**December 2009**

Milano



Comune  
di Milano

**Sustainable Energy and Climate  
Action Plan  
Municipality of Milan**

*Executive Summary*

**Edition**

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## **Executive Summary**

### ***Context of the Sustainable Energy and Climate Action Plan***

Climate change is a global phenomenon, but cities can effectively contribute to reduce GHG emissions: local authorities can directly implement emission reduction projects and engage stakeholders in reduction efforts. The Municipality of Milan acknowledges the role local authorities can play in climate change mitigation and has committed to develop a local mitigation strategy. This policy is part of the “General Development Plan 2006-2011” (*“Piano Generale di Sviluppo 2006-2011”*) and has been confirmed adhering to the following international agreements, which overall set a comprehensive framework of reduction targets.

The Municipality has joined ICLEI’s “Cities for Climate Protection” campaign and signed the “World Mayors and Local Governments Climate Protection Agreement” during the Conference of the Parties of the Convention on Climate Change that took place in Bali (COP13) in 2007. Moreover, Milan belongs to the Eurocities network and joined at the beginning of 2009 the “Covenant of Mayors” initiative, promoted by European Commission. The Covenant sets mitigation goals for European local authorities that are coherent with the “20, 20, 20” energy and climate package. This voluntary agreement has been called upon in the Action Plan on Energy Efficiency of the European Union, which defines as a priority issue an agreement among representatives of local authorities, acknowledging the role cities can play in complying with Member States’ national reduction targets.

For its potential impacts on food production at a global and local level, climate change is amongst the main topics of Expo 2015, which will take place in Milan. “Expo” will give the chance to implement integrated policies in the city, which promote clean technologies, infrastructural development and diffuse sustainable practices in the urban environment. Furthermore, Expo will be an occasion to foster international cooperation through projects, which may be registered under the flexible mechanisms of the Kyoto protocol.

The Sustainable Energy and Climate Action Plan (hereafter the Climate Plan) is a synthesis and strategic framework for the environmental and energy policy of Milan, in regard to these engagements and targets: it will provide information to define coherent measures and streamline synergies within different sectors.

### ***Emission reduction target: - 20% by 2020***

The main goal of the Climate Plan is to achieve a 20% reduction of Milan’s overall CO<sub>2</sub> emissions by 2020, below the 2005 emission level (reference year). Among GHGs that are regulated at international level, the Climate Plan considers only CO<sub>2</sub>, as it constitutes the majority of city emissions (92%). The reduction of other GHGs, namely CH<sub>4</sub> and N<sub>2</sub>O, is dealt with in regional and national policies.

Overall emissions include direct emissions, derived from fuel consumption and production of electricity from plants located within city boundaries, and indirect emission, derived from the production of imported electricity from plants located outside city boundaries. Estimating indirect emissions consists in evaluating CO<sub>2</sub> that is linked to the production of electricity needed to satisfy the city’s electricity demand, regardless of the location of the plants. Appraising indirect emissions leads to higher emissions in absolute terms, although more consistent and representative of the real impact of the population’s emissive levels of carbon dioxide into the atmosphere.

Nonetheless, in order to define targets and reduction measures in the Plan, it is necessary to consider that indirect emissions do not depend strictly on local policies, as power plants have to comply with binding and specific emission reduction targets under the EU-Emission Trading Scheme.

### **Estimates of CO<sub>2</sub> emissions for the reference year (2005) and Business as Usual Scenario**

Estimates of Milan's overall CO<sub>2</sub> emissions, baseline year 2005 were based on elaborations produced by the Agency for Mobility, Environment and Territory (Agenzia Mobilità Ambiente e Territorio, AMAT) for the "City's Emissions Inventory", which quantify direct emissions of the city in the year 2005. CO<sub>2</sub> calculations have been further elaborated and updated, in order to integrate the estimates of indirect emissions.

Emissions have been partitioned in 4 main sectors:

- **civil sector** (direct emissions from combustion for space heating in residential buildings, tertiary and public buildings)
- **energy sector** (direct emissions from energy production in CHP plants and waste to energy plants located within city boundaries and indirect emissions attributable to imported electricity)
- **transportation** (emissions from public, private and freight transport)
- **industry and tertiary** (emissions from industrial processes and non-combustion emissions of the tertiary sector)

**Table 1: Total direct and indirect emissions in the year 2005**

<b>Emission inventory 2005 (ktCO<sub>2</sub>)</b>	<b>Civil Sector</b>	<b>Energy Sector*</b>	<b>Transport Sector</b>	<b>Industrial and Tertiary Sector</b>	<b>TOTAL 2005 (ktCO<sub>2</sub>)</b>
<b>Direct emissions</b>	3,035	194	1,432	134	<b>4,795</b>
<b>Indirect emissions</b>		2,252			<b>2,252</b>
<b>Overall emissions</b>	<b>3,035</b>	<b>2,446</b>	<b>1,432</b>	<b>134</b>	<b>7,046</b>

Source: Analysis by IEFE-Avanzi on AMAT data

\* Direct emissions included in the energy sector account only for emissions produced by plants located within city boundaries not subject to the EU-ETS system. Indirect emissions account for emissions from imported electricity and electricity produced within city boundaries in plants that have targets under the EU-ETS system.

In order to estimate the reduction effort that is needed to comply with the 20% target, it is necessary to predict how emissions may evolve by 2020 without the Climate Plan's reduction actions (Business as Usual scenario). Reduction actions include not only those that have been defined specifically in the Climate Plan, but also measures of other planning tools, already approved by the Municipality at present state (2009), which may contribute to the reduction of CO<sub>2</sub> emissions.

Medium-long run CO<sub>2</sub> emissions are strictly determined by trends in energy demand in different sectors. As the number of inhabitants increase, and thus the demand for energy increases for several

end-uses (heating, transport, electricity for everyday life, jobs or spare-time), a heavier pressure on certain resources is expected. The growing energy demand, both electrical and thermal, implies the combustion of fossil fuels and, as a consequence, the release of CO<sub>2</sub> emissions in the atmosphere. Lacking a comprehensive model, which may account for all variables influencing the energy system and their interactions, a sector-based approach was used. Relevant drivers have been selected for every sector included in the BAU scenario. Data on relevant drivers were either available from historic series or have been estimated according to the contents of sectorial plans of the Municipality. The variables that are taken into account for the projection of emissions are population and new housing for the residential sector, electricity demand for the energy sector and mobility demand for the transport sector.

### *Civil sector – BAU scenario*

Estimates on the evolution of population and new housing are based on forecasts of the year 2020, elaborated by AMAT, in line with the contents of the new Master Plan of the Municipality of Milan (*Piano di Governo del Territorio, PGT*), which is under approval by the local Administration. Development activities foreseen in the Master Plan are particularly relevant in terms of new built surfaces, for residential and non residential purposes, with a significant increase of city residents (+10%).

In the civil sector, BAU emissions have been calculated using data on fuel consumption for space heating and other domestic end uses (water heating and food preparation), in correlation with the projected increase of built surfaces in the period 2005-2020, for both residential and non residential buildings. Conclusions for the civil sector, reference period 2005-2020, predict an increase of 4% of emissions, a rate that is more contained in respect to population growth. This rate is mainly due to the substitution of old heating oil boilers with natural gas boilers. Emissions from district heating are not comprised in these trends as they are accounted for in the “Energy” and “Waste” sector.

### *Transportation sector – BAU scenario*

The BAU scenario has been forecasted according to demand in mobility for the period 2005 – 2020, assuming that there will be no changes in infrastructure supply for private and public transportation. Mobility estimates have been calculated by AMAT, taking into consideration population increase and new housing by 2020. Projections show a growth in demand of both private and public transport, due to a relevant increase of trips. Overall emissions increment by 15% in the period 2005-2020.

### *Energy sector – BAU scenario*

The BAU scenario for the energy sector is based on electricity demand, as estimated through TERNA’s provisional data on annual variation rates of electricity consumption: +0.8% in the period 2007-2012, +1.2% in the period 2012-2020. In the BAU scenario, electricity demand will be satisfied partly by internal production, namely cogeneration plants located within city boundaries, and partly by import of electricity. The share of internal production of total electricity consumption has been estimated at about 6.3% and it is assumed that it will remain steady throughout the period 2005-2020. Forecasts for this sector demonstrate a 26% increase in emissions, in comparison to the year 2005.

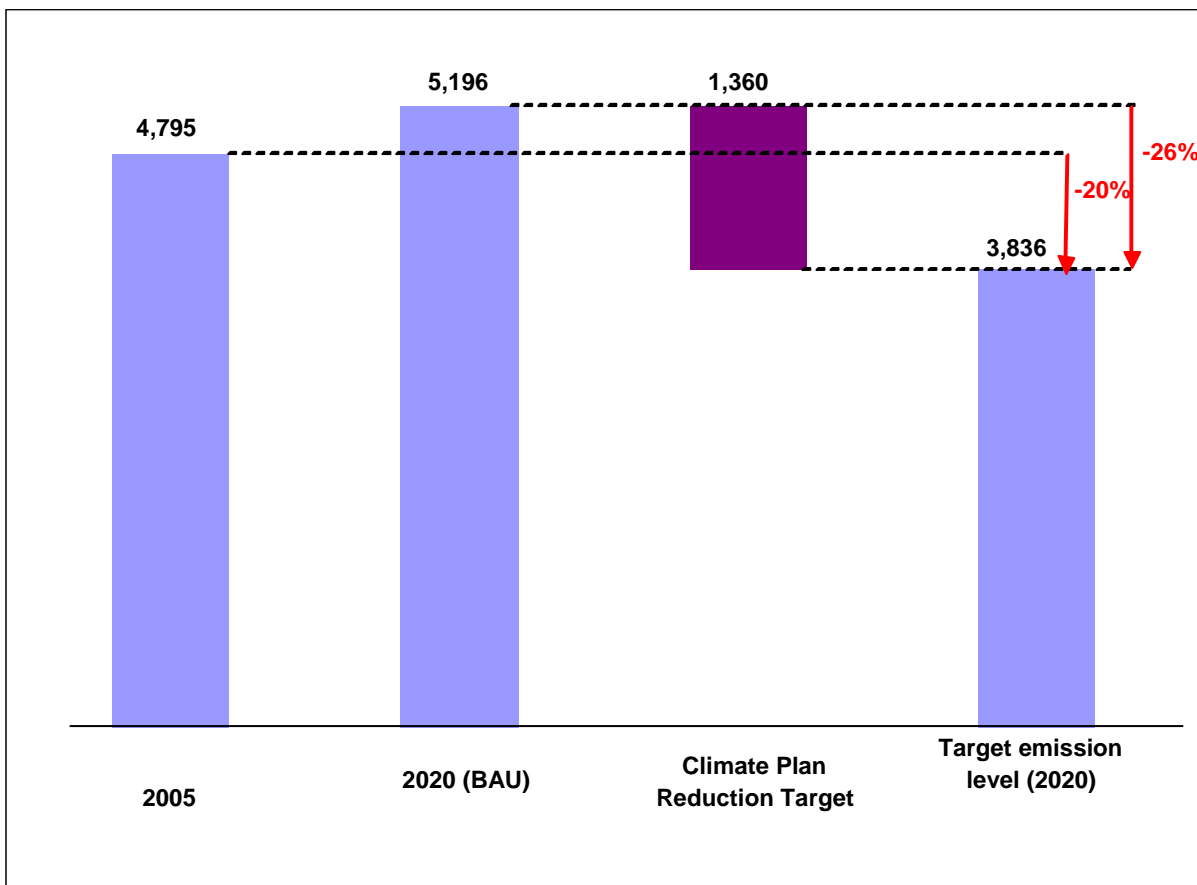
### *Overall projections*

Considering results in all sectors, the BAU scenario to 2020 shows an increasing trend in Milan’s CO<sub>2</sub> emissions. Direct emissions increase from 4,795 ktCO<sub>2</sub> in 2005 to 5,196 ktCO<sub>2</sub> in 2020 (+8.3%). Overall emissions increase from 7,046 ktCO<sub>2</sub> in 2005 to 8,034 ktCO<sub>2</sub> in 2020 (+14%).

## Quantification of the reduction effort and strategic fields of actions

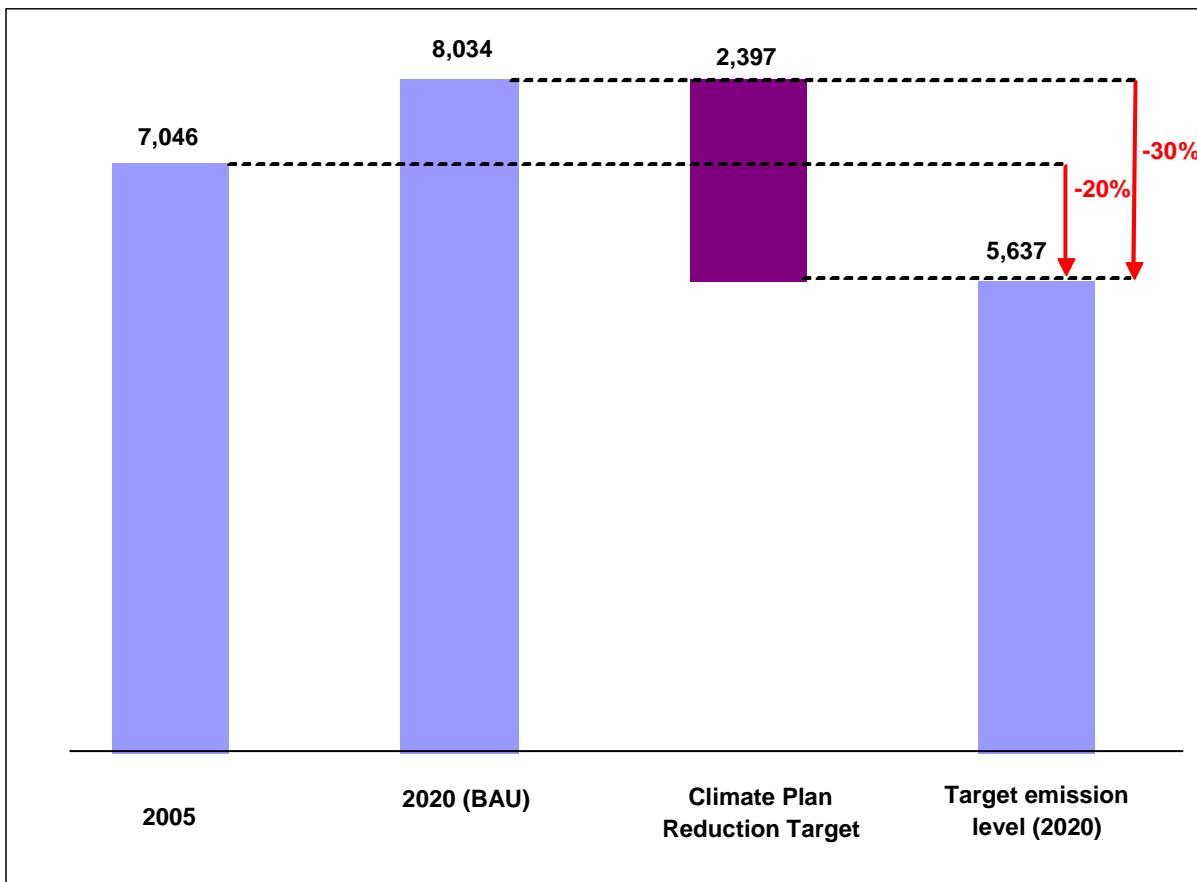
The reduction target of 20% consists in reducing direct emissions from 4,795 ktCO<sub>2</sub> in 2005 to 3,836 ktCO<sub>2</sub> in 2020, a reduction effort of 959 ktCO<sub>2</sub>. As shown in Figure 2, the increasing trend of emissions in the BAU scenario implies that the effort will be more challenging, namely 1,360 ktCO<sub>2</sub>. Including indirect emissions, the reduction effort that is needed to comply with the 2020 target is 2,397 ktCO<sub>2</sub> (Figure 2).

**Figure 1: Emission reductions relative to BAU scenario – only direct emissions (ktonCO<sub>2</sub>/year)**



Source: Analysis by IEFE-Avanzi, AMAT

**Figure 2: Emission reductions relative to BAU scenario – overall emissions (direct and indirect) (ktonCO<sub>2</sub>/year)**



Source: Analysis by IEFE-Avanzi, AMAT

To identify fields of action and quantify emission reductions that may be obtained from each single “reduction measure”, an approach inspired by Pacala and Socolow’s “stabilization wedges” methodology has been used.

The proposed methodology is based on the thesis that in order to bridge the gap that will be produced between level trend and reduction objective, it is necessary to consider a range of possible actions for trimming emissions and low carbon-technologies, already experimented and diffused in several experiences at international level. The totality of the measures identified, assessed in relation to the local context and adapted to the realities of the Municipality of Milan, falls within the following main categories:

- **T - Transports**
- **R – Residential**
- **Z - Tertiary (offices, shops)**
- **E – Public buildings, owned by the Municipality**
- **P – Energy production**
- **R - Waste**
- **A – Agriculture and urban green spaces**

Measures comprised in plans of the Municipality and new measures have been evaluated and their reduction potential has been estimated. Measures with the highest potentials have been further deepened and elaborated.

The reduction potential is expressed as contribution from each single measure, regardless of the implementation of others. In Table 2, all 27 measures are listed according to sectors. Furthermore, the overall reduction potential is shared between “domestic” measures and those that have an effect outside city boundaries.

After having estimated reduction potentials, an internal-coherence check has been developed, in order to identify “synergies” in the simultaneous implementation of several measures and to avoid double-counting of emissions.

**Table 2: Synthesis of emission reductions – single measures**

	Sector	Measure Description	Emission reduction (kt CO <sub>2</sub> /year)	
			Domestic measures	Measures outside city boundaries
T1+T2	Transports	Development of transit (underground, bus and streetcar system)	111	
T3	Transports	Bicycle mobility	76	
T4	Transports	Car sharing	8	
T5	Transports	Car pooling	11	
T6	Transports	Demand-response transit system	in T2	
T7	Transports	Improvement of private cars' efficiency	405	
T8	Transports	Other measures to reduce private car use	44	
T9	Transports	Increase of motorcycle use (private car replacement)	18	
T10	Transports	Freight transport management	72	
T11	Transports	Improvement of commercial vehicles' efficiency	99	
T12	Transports	Improvement of public transport efficiency	18	
R1	Residential	Improvement of energy efficiency in existing residential flats	156	
R2	Residential	Improvement of energy efficiency in new residential flats	97	
R3	Residential (tertiary and municipal)	Fuel switch of boilers (from heating oil to natural gas)	54	
R4	Residential	Energy saving and energy efficiency in end-uses (residential)	113	
Z1	Tertiary	Improvement of energy efficiency in existing commercial buildings	23	
Z2	Tertiary	Improvement of energy efficiency in new commercial buildings	24	
Z3	Tertiary	Energy saving and energy efficiency in end-uses (commercial)	65	
E1	Public Buildings (municipality MI)	Improvement of energy efficiency in existing municipal buildings	6	
E2	Public Buildings (municipality MI)	Energy saving and energy efficiency in end-uses (municipal buildings)	6	
E3	Public Buildings (municipality MI)	Energy saving and energy efficiency in end-uses (public lighting)	13	
P1	Energy Production	Improvement of efficiency in energy production		454
P2	Energy Production	Photovoltaic solar power	26	
P3	Energy Production	District heating	73	
W1	Waste	Waste-to-energy plant	19	57
A1	Agriculture	Conservation agriculture	5	
A2	Agriculture	Tree planting	2	
		<b>Totale riduzioni emissioni</b>	<b>1.546</b>	<b>511</b>

Source: Analysis by IEFÉ-Avanzi

The main results of these estimations and coherence check demonstrate that the 20% target can only be achieved if all measures of the Climate Plan are entirely enforced (Table 3). In particular, domestic measures, that have direct effect within city boundaries, would enable Milan to abate 1,388 ktCO<sub>2</sub> and fully reach the 20% target, calculated on direct emissions. Considering overall reductions, due both to domestic measures and to measures proposed by the Climate Plan, that should be enforced in a wider regional context, emissions would be abated by 1,874 ktCO<sub>2</sub>. These reductions would enable to cover only 78% of the target, calculated on overall emissions. The remaining 22% of the target may be offset by “emission credits” from projects under the flexible mechanisms of the Kyoto protocol (CDM, JI): this option will be specifically considered by the Municipality.



**Table 3: Synthesis of emission reductions expected from the implementation of the Climate Plan**

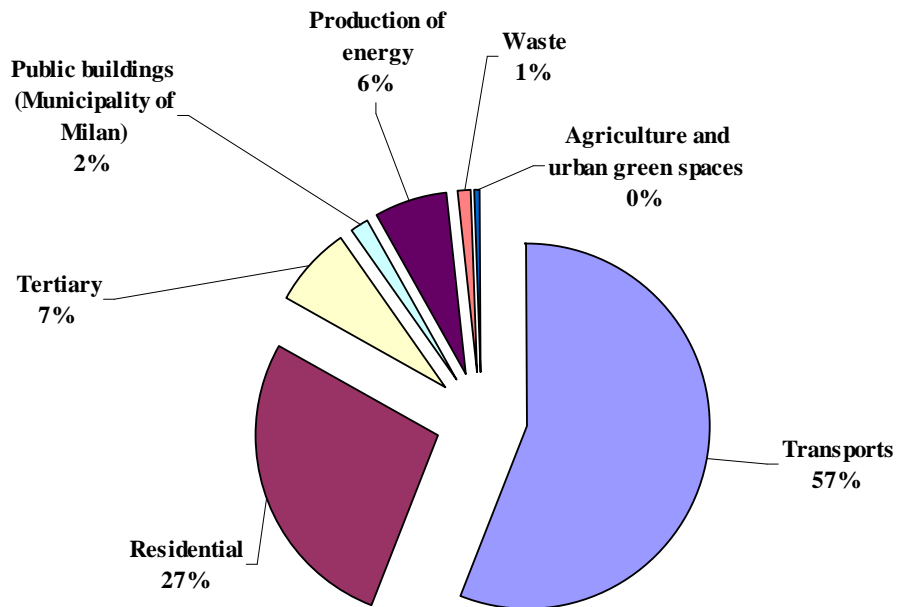
<b>Domestic Reduction Measures</b>	
	Reduction (ktCO <sub>2</sub> /year)
Transports	862
Residential	421
Tertiary	112
Public buildings (Municipality of Milan)	25
Production of energy	99
Waste	19
Agriculture and urban green spaces	7
<b>Total reductions</b>	<b>1.546</b>
<b>Double counting emissions</b>	<b>158</b>
<b>Actual reductions</b>	<b>1.388</b>
<b>Target for direct emissions</b>	<b>1.360</b>
<b>Distance to target</b>	<b>+ 28</b>
	<b>+ 2%</b>

<b>Total Reduction Measures</b>	
	Reduction (ktCO <sub>2</sub> /year)
Transports	862
Residential	421
Tertiary	112
Public buildings (Municipality of Milan)	25
Production of energy	554
Waste	76
Agriculture and urban green spaces	7
<b>Total reductions</b>	<b>2.057</b>
<b>Double counting emissions</b>	<b>183</b>
<b>Actual reductions</b>	<b>1.874</b>
<b>Target for total emissions</b>	<b>2.397</b>
<b>Distance to target</b>	<b>-523</b>
	<b>-22%</b>

Source: Analysis by IEFE-Avanzi

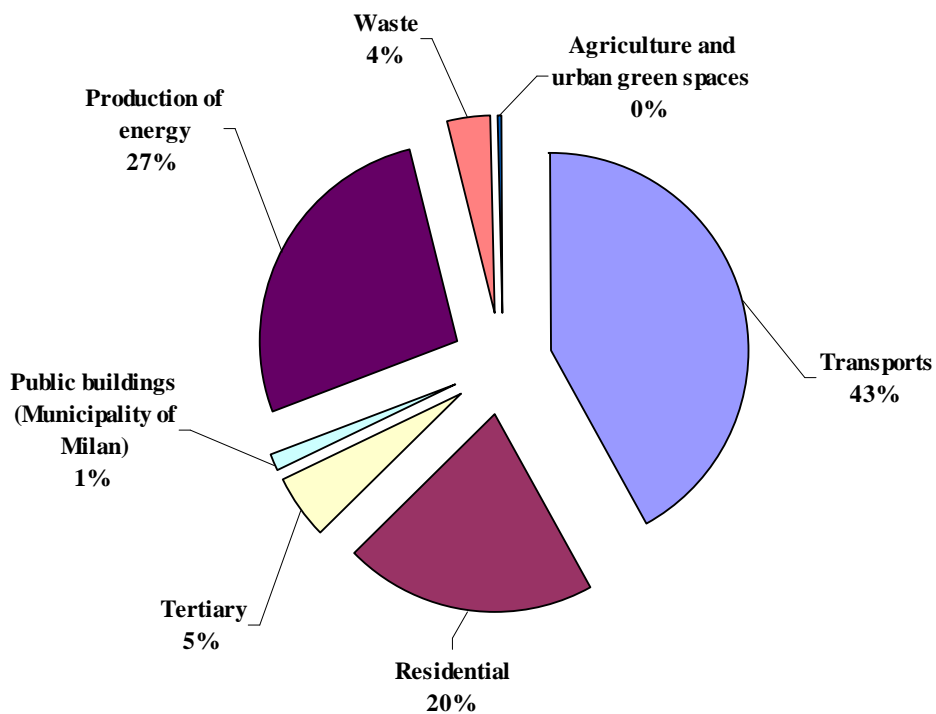
It is interesting to observe the different contributions of the diverse macro implementation sectors to emission reductions both in direct emissions only (Figure 3) and the overall (Figure 4). As for reductions of direct emissions, the transportation sector is dominant with 57% of the reductions, followed by macro-sector housing with 27%, the third sector (7%) and energy production (6%). As for the reductions in total emissions, the transport sector is still predominant with 43% of the reductions followed by energy production (27%) and residential (20%), the third sector (5%) and waste (4%).

**Figure 2: Reductions from domestic measures subdivided in macro-sectors (% on total reductions)**



Source: Analysis by IEFÉ-Avanzi

**Figure 3: Reductions of overall emissions subdivided in macro-sectors (% on total reductions)**



Source: Analysis by IEFÉ-Avanzi

## ***Preliminary cost assessment of reduction measures***

Cost assessment of emission reductions expected from the Climate Plan is rather complex and it would require the use of a model, for example “Markal”, which has been applied for the Italian energy system by ENEA. In lack of a specific model, an approach based on the evaluation of “extra-costs” necessary to obtain emission reductions has been applied. Similar experiences have been conveyed, among others, by McKinsey, in order to evaluate the costs of “emission reduction levers” for mitigation policies at national and international level. This approach considers the extra-costs associated to a set of actions that may be considered as representative of the climate plan measures. The extra-costs are investment costs, fixed and variable, and may both refer to the purchase of new technologies and to infrastructural and renovation projects. Costs are expressed as marginal costs over the BAU assumptions and they are net of benefits associated with the implementation of the action (i.e. energy savings). The considered costs refer to the overall community and not only to the single decision-maker, local administration or citizen, bearing the expenditures of the action.

Average cost per abated tonne of CO<sub>2</sub> (€/tCO<sub>2</sub>) has been calculated as the difference between costs of the action, as it would be implemented in the Climate Plan scenario, and the costs of action in the BAU scenario, divided by the emission abatement potential that has been estimated for the measure each action refers to. When the average abatement cost is negative, it is implied that the benefits associated with the implementation of the action are greater than extra-costs of implementation.

For several measures of the transportation sector, it has not been possible to provide an estimation of abatement cost. This is mainly due to difficulties in identifying single specific actions for each measure in a rather complex system as urban mobility, where different modes of transport coexist and interact. Furthermore, there are difficulties in attributing investment costs of local transport infrastructures to GHG emission abatement, as GHG reduction is only one among all purposes underlying these investments.

Estimation of abatement cost for the other measures followed these alternatives:

1. Average abatement costs have been taken from literature, when estimates concerning cases similar to Climate Plan Action were available;
2. Where possible, specific actions have been simulated (with reference to the case of Milan) and its costs (annual investment costs and running costs) and benefits have been approximately estimated.

Actions are listed in Table 4 by increasing abatement cost.

**Table 4: Mitigation Actions listed by increasing abatement cost**

Measures	Description	Reduction potential (ktCO <sub>2</sub> /year)	Mean abatement cost (Euro/tCO <sub>2</sub> )
T3	Bicycle mobility	76	-402
R3	Fuel switch of boilers (from heating oil to natural gas)	54	-396
R4	Energy saving and energy efficiency in end-uses (residential)	113	-320
E3	Energy saving and energy efficiency in end-uses (public lighting)	13	-202
T4	Car sharing	8	-191
T9	Increase of motorcycle use (private car replacement)	18	-138
R2	Improvement of energy efficiency in new residential flats	97	-89
T7	Improvement of private cars' efficiency	405	-65
T11	Improvement of commercial vehicles' efficiency	99	-65
Z3	Energy saving and energy efficiency in end-uses (commercial)	65	-60
E2	Energy saving and energy efficiency in end-uses (municipal buildings)	6	-60
R1	Improvement of energy efficiency in existing residential flats	156	-33
Z1	Improvement of energy efficiency in existing commercial buildings	23	-33
E1	Improvement of energy efficiency in existing municipal buildings	6	-33
A1	Conservation agriculture	5	-30
Z2	Improvement of energy efficiency in new commercial buildings	24	35
W1	Waste-to-energy plant	19	40
P3	District heating	73	40
P2	Photovoltaic solar power	26	191
A2	Tree planting	2	8.872
T1 + T2	Development of transit (underground, bus and streetcar system)	111	to be quantified
T5	Car pooling	11	to be quantified
T6	Demand-response transit system	included in T1+T2	to be quantified
T8	Other measures to reduce private car use	44	to be quantified
T10	Freight transport management	72	to be quantified
T12	Improvement of public transport efficiency	18	to be quantified
P1	Improvement of efficiency in energy production	454	to be quantified

Source: Analysis by IEFE-Avanzi

Looking at Table 4, actions in the transport and residential buildings enforce the most relevant benefits. For transport, in particular, the most notable actions in terms of benefits per abated tonne are bicycling developments and Car Sharing (respectively, -402 €/tCO<sub>2</sub>, -191 €/tCO<sub>2</sub>). The most eminent actions for the residential sector are replacing fuel-oil boilers with more energy-efficient natural gas boilers and improvement of energy efficiency in end-uses (- 396 €/tCO<sub>2</sub>, - 320 €/tCO<sub>2</sub>). For the public sector, actions to improve public lighting show a particularly beneficial negative abatement cost (-202 €/tCO<sub>2</sub>).

On the contrary, actions with higher costs belong to energy production, in particular investments in solar photovoltaic panels, and in agriculture and urban green areas. Tree planting has the highest expenditure among all actions, as no energy savings can be specifically related with it. Nonetheless, what should also be taken into account whilst evaluating actions that should be implemented within the Climate Plan, are co-benefits on quality of life and urban environment.

## **Implementation and monitoring**

The implementation of such a complex plan requires the integration of goals and measures in the planning tools of the Municipality, in its programs and legislative acts. Furthermore, it requires that organisational, operational and financial aspects shall be defined by the Municipal Administration and by structures that may be potentially involved, for each measure and action. Preliminary activities that are necessary to proceed to the implementation of the Plan, will regard in particular:

- sharing the contents of the Climate Plan within the Municipality and with citizens, through communication tools that shall be adequate for different stakeholders and for the purposes of communication;
- defining a structure within the Local Administration, that will coordinate all activities linked to the Climate Plan and that shall exert functions of implementation, management, control and verification of the Plan;
- finding financial resources, in order to enable implementation of measures;
- monitoring activities, data and scenarios, also through constant updating of emission series and verification of expected reductions

The monitoring system of the Plan will be developed in three phases:

- 1) Verification – The status of implementation of the Climate Plan’s measures will be verified according to progress obtained towards target
- 2) Update – the distribution of the objectives of the Plan among the measures, in relation to new information available to different policy choices or changes in the economic and technological environment.
- 3) Communication – Progress and results of the Plan’s implementation will be shared with stakeholders by publishing a periodical monitoring report.

### ***Final remarks and further developments of the Climate Plan***

The reduction target Milan has committed to is certainly ambitious, but as showed, achievable using available technologies and enabling relevant energy savings, which the whole community shall benefit from. The Climate Plan provides a preliminary framework for Milan’s climate strategy, but the following elaborations may be useful to its development:

- 1) Further elaboration of the cost assessment of measures, also through the use of a model, to identify least-cost solutions in regard to the CO<sub>2</sub> emission reduction target;
- 2) Quantification of co-benefits on urban quality of life that can be related to the measures of the Plan;
- 3) Evaluation of available alternatives to offset emissions with reference to the 20% target calculated on overall emissions (i.e. credits from Kyoto Protocol’s projects or other types of credits)

An increasing number of cities is developing measures to face climate change impacts. At the local level, mitigation and adaptation strategies share the same policy levers and they may be implemented through common tools (i.e. urban planning, building regulations). Furthermore, typical features of cities, such as high density of population and built stock, may cause vulnerabilities in relation to local impacts of climate change (i.e. frequency increase of in heavy rainfalls or heat waves). To draw an adaptation strategy, specific analysis on the context of Milan may thus be useful, such as:

- 1) Analysis of the main meteorological and climate variables, in order to verify medium-long run trends;
- 2) Vulnerability assessment, in order to define adequate response measures.

## **Reduction measures**

### **Transportation sector**

#### **T1, T2 – Further development of public transport**

##### **Description:**

This measure comprises an additional development of public transport over the BaU scenario (underground, bus and streetcar system) by 2020 that is consistent with municipal planning tools. Emission reduction from this measure derives from a decrease of private vehicle trips in favour of transit trips, with a relevant increase of public transport passengers (+ 97 million passengers/year by 2020).

The number of passengers shall increase thanks to the infrastructural development of the underground, bus and streetcar network and to an increase in load capacity of the existing supply.

The effect of this measure may be strengthened by an extension of the pollution charging system (Ecopass), regulated parking and pedestrian areas (for further reference on these policies: measure “T8”).

**Abatement potential: 111 ktonCO<sub>2</sub>/year**

##### **Implementation options:**

- Increase of public transport supply
- Operational improvements in the existing network (service optimisation, increase in the frequency of journeys, fleet renewal, busways and dedicated lanes)
- Incentives for public transport use (comfort improvement, integration among pricing systems, financial incentives in the purchase of subscriptions)

**Average abatement cost: to be quantified**

##### **Co-benefits:**

- reduced traffic congestion
- improvement of air quality
- improvement of accessibility to infrastructures
- improvement of accessibility to commercial areas
- increase in the value of estates

##### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Urban Mobility Plan 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)
- Master Plan of the Municipality of Milan (*Piano di Governo del Territorio, PGT*), under approval by municipal administration
- Three-year Program for public transport Service 2004 – 2006 (*Programma Triennale di Servizi di trasporto pubblico*) and following updates

### **T3 – Development of bicycle mobility**

#### **Description:**

This measure consists in the development of bicycle travel, through an extension of the bicycle path network, improvement in the connection among existing paths and use of the new bike-sharing system. The emission reduction achievable with this measure derives from a decrease of private vehicle trips in favour of bicycle trips for journeys taking place within Milan's city area (+ 98 million trips/year by 2020, additional over BaU scenario).

The effect of this measure may be strengthened by an extension of the pollution charging system (Ecopass), regulated parking and pedestrian areas (for further reference on these policies: measure "T8").

**Abatement potential: 76 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- Re-organization of the existing bicycle path network and removal of obstacles to bicycling (i.e. signals for low-traffic and safe paths)
- New bicycle paths and parking areas
- Development of the bike-sharing program
- Incentives for the purchase of bicycles
- Bike-transit integration
- Communication and promotional activities (i.e. educational courses on urban bicycling)

**Average abatement cost: -402 €/tCO<sub>2</sub>**

#### **Co-benefits:**

- reduced traffic congestion
- improvement of air quality
- reduced noise pollution
- improvement of accessibility to infrastructures

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Urban Mobility Plan, 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011 (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)
- Master Plan of the Municipality of Milan (*Piano di Governo del Territorio, PGT*), under approval by municipal administration
- People Mobility Survey in Milan, 2005-2006 by AMAT (*Indagine sulla mobilità delle persone nell'area milanese*)
- Charter of Brussels (commitment of the Municipality of Milan)

#### **T4 – Development of “car sharing”**

##### **Description:**

Car sharing (CS) systems allow registered users to rent vehicles from a common fleet, available in affiliated parking, with charges that are proportional to the actual use of vehicles (time, km). At present, two car sharing services are operating in Milan, “Milano Car Sharing” and “Guidami”. The Municipality foresees an extension of both, in terms of affiliated parking and number of vehicles. The measure proposed in the Climate Plan is a further development of CS services (+ 11,600 new registered users by 2020), that enables an emission reduction due to two effects: car-sharing users travel on average for minor distances than private-vehicle owners; car-sharing vehicles are more emission-efficient than the average owned-vehicle.

**Abatement potential: 8 ktonCO<sub>2</sub>/year**

##### **Implementation options:**

- Development of the existing car sharing system
- Replacement of the municipal vehicle fleet and shift to car sharing
- Promotional activities (citizens, business)

**Average abatement cost: -191 €/tCO<sub>2</sub>**

##### **Co-benefits:**

- reduced traffic congestion
- improvement of air quality
- reduction in the number of on-road parked vehicles

##### **References within municipal plans and reports**

- Urban Mobility Plan 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell’ambiente*)
- Guidelines for implementation of Car Sharing service development project of the municipality of Milan 2008 (*Indirizzi per l’attuazione del progetto di sviluppo del servizio di Car Sharing della Città di Milano*)

#### **T5 – Development of “car pooling”**

##### **Description:**

Car pooling systems enable users to plan a journey together and share an owned-vehicle, therefore reducing car circulation. The measure proposed in the Climate Plan foresees that a car pooling platform, operating at Municipal level, is put in place and that 5,000 vehicles/year will be shared by 2020.

**Abatement potential: 11 ktonCO<sub>2</sub>/year**

##### **Implementation options:**

- Collaboration with the Province of Milan and suburban municipalities, to put into operation an online car pooling platform that meet commuters travel needs
- Time-planning at city level (“*Piano del tempo e degli orari*”)



- Promotion of mobility management and flexible work hours program

**Average abatement cost: to be quantified**

**Co-benefits:**

- reduced traffic congestion
- improvement of air quality

**References within municipal plans and reports**

- Urban Mobility Plan, 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)

**T6 – Development of Demand Responsive Transport**

**Description:**

As highly flexible systems, Demand Responsive Transport services complete conventional public transport, both in terms of services operating hours and its territorial coverage. Since 2000, a demand-response system called “Radiobus”, by ATM (the Municipal Public Transport Company), has been operating in Milan; a further development of Radiobus may induce citizens to reduce private vehicle use and transport emissions.

**Abatement potential:** included in T1 and T2’s potential.

**Implementation options:**

- Extension of Radiobus (territorial coverage, operating hours, number of operating vehicles)
- Fleet Radiobus Renewal

**Average abatement cost: to be quantified**

**Co-benefits:**

- reduced traffic congestion
- improvement of air quality

**References within municipal plans and reports**

- Urban Mobility Plan, 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)
- Three-year Program for public transport Service, 2004 – 2006 (*Programma Triennale di Servizi di trasporto pubblico*) and following updates

**T7 – Improvement of private cars’ efficiency**

**Description:**

Several policy levels influence the renewal of private vehicle fleet: policies at national and European level set emission performance standards and limits for vehicles, policies at regional and municipal levels may encourage the purchase of low-emission vehicles (hybrid cars, LPG, natural gas, electric cars). In this measure, interaction among these policies improving average CO<sub>2</sub> efficiency has been estimated, assuming that additional measures will be taken at local level to support efficiency improvement.

**Abatement potential: 405 ktonCO<sub>2</sub>/year**

**Implementation options:**

- Incentives to purchase low-emitting vehicles, in collaboration with Regione Lombardia
- Incentives for the renewal of taxi vehicle fleet with low-emitting vehicles
- Extension of pollution charging system
- Increase the number of stations delivering alternative fuels
- Pilot projects to diffuse electric cars

**Abatement cost: -65 €/tCO<sub>2</sub>**

**Co-benefits:**

- improvement of air quality
- reduction of respiratory diseases

**References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Urban Mobility Plan, 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)
- Agreement with taxi drivers, 2008 (*Accordo con taxisti*)
- Agreement for a pilot project to diffuse electric cars within municipal boundaries, 2009- 2010 (*Accordo per un progetto pilota di diffusione delle auto elettriche sul territorio comunale*)

**T8 – Other measures to reduce private car use**

**Description:**

Coordination among policies aimed at reducing car use and promoting low or zero-emission modes of travel is necessary to enhance their effectiveness. In this measure, the combined effect of several policies has been estimated, such as actions to promote walking and bicycling, pollution charging, extension of regulated parking, establishing pedestrian areas and diffusion of “telework”. These policies shall reduce car use, in comparison with the BaU scenario, and increase trips by public transport, bicycles and on foot. These emission reductions are partly accounted for in the previous measures and partly included in this measure.

**Abatement potential: 44 ktonCO<sub>2</sub>/year**

**Implementation options:**

- Establishment of low-traffic zones and pedestrian areas
- Renovation of streets and sidewalks to facilitate walking and bicycling and improve road safety
- Traffic monitoring
- Update of parking regulations and provision of incentives to facilitate circulation of low-emitting vehicles (i.e. discounted parking tariffs; dedicated lanes)
- Extension of the pollution charging system, in terms of covered area, categories subject to payment, fee rise
- Time-planning at city level (“*Piano del tempo e degli orari*”)
- Sustainable transport programs (i.e. initiative to promote safe home-to-school paths)

### **Average abatement cost: to be quantified**

#### **Co-benefits:**

- reduced traffic congestion
- improvement of air quality
- reduced noise pollution

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Urban Mobility Plan, 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)
- Urban Program for parking (*Programma Urbano dei Parcheggi*)
- Other municipal provision (Parking Regulation, Ecopass, Establishment of low-traffic zones and pedestrian areas)

### **T9 – Increase of motorcycle use in place of cars**

#### **Description:**

In the last years, the circulating fleet of private cars has been partly replaced by motorcycles (5% per year during the period 2002-2007 according to ACI data). These vehicles are characterised by a lower emission factor per unit of travelled distance, in comparison with cars. In the Climate Plan, emission reduction relative to this replacement has been estimated, assuming that the car-motorcycle replacement rate will be slightly lower than ACI data (1.7% per year during the period 2005-2020).

**Abatement potential: 18 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

Co-effects of measures encouraging motorcycle use should be carefully assessed by the Municipality, as they may produce benefits on traffic (i.e. reduced emissions, reduced congestion), but they may also imply negative effects on sustainable transport policies, such as shifting passengers away from public transport.

**Abatement cost: -138 €/tCO<sub>2</sub>**

#### **Co-benefits:**

- reduced traffic congestion

## **T10 – Freight transport management**

### **Description:**

Access to the city and circulation of commercial vehicles are currently regulated by a set of measures defining restricted zones and entrance-hours. In this measure of the Climate Plan, new regulations are considered and their effect in terms of reducing distances travelled by commercial vehicles within the city has been estimated, in comparison to the BaU scenario (estimated reduction of distances: 136 million km/year, almost 20% of 2020 distances).

**Abatement potential:** 72 ktonCO<sub>2</sub>/year

### **Implementation options:**

- Update of regulations on freight loading and unloading; definition of new criteria enabling access to restricted zones
- Logistic platforms
- Pilot projects on alternative modes of freight distribution within the city (i.e. vehicle sharing)

**Average abatement cost: to be quantified**

### **Co-benefits:**

- reduced traffic congestion
- improvement of air quality
- reduced noise pollution
- reduction in the number of on-road parked vehicles

### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Urban Mobility Plan, 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)

## **T11- Improvement of commercial vehicles' efficiency**

### **Description:**

In this measure, emission reduction is linked to an improvement of CO<sub>2</sub> emission factor of the commercial vehicles circulating fleet. This improvement is due to fleet renewal and is driven by European policies and incentive policies of the local administration to promote the purchase of low emission vehicles.

**Abatement potential:** 99 ktonCO<sub>2</sub>/year

### **Implementation options:**

- Update of regulations on freight loading and unloading and definition of new criteria enabling access to restricted zones (i.e. preferential access to zones for environmental-friendly vehicles)
- Provision of further incentives for the purchase of low-emitting vehicles, in collaboration with Regione Lombardia

**Average abatement cost:** -65 €/tCO<sub>2</sub>

**Co-benefits:**

- improvement of air quality

**References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Urban Mobility Plan, 2001-2010 (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)

**T12- Improvement of public transport efficiency****Description:**

ATM's development program foresees a reduction of public transport energy use of 7.5% in the period 2008-2010, to be enforced through actions on vehicle fleet and on infrastructures. Further actions to improve the efficiency of public transport vehicles are included in this measure; the estimated emission factor reduction is almost 20%, with reference to 2005.

**Abatement potential: 18 ktonCO<sub>2</sub>/year**

**Implementation options:**

Collaboration with ATM to support actions improving fleet efficiency and renewal

**Average abatement cost: to be quantified**

**Co-benefits:**

- improvement of air quality

**References within municipal plans and reports**

- Urban Mobility Plan, 2001-2010, (*Piano Urbano della Mobilità – PUM*)
- Sustainable mobility strategy for health and environmental protection, 2006-2011. (*Strategia per la mobilità sostenibile al fine della tutela della salute e dell'ambiente*)
- Three-year Program for public transport Service, 2004 – 2006 (Programma Triennale dei Servizi di trasporto pubblico) and following updates
- Sustainable Report by ATM, 2007 (*Rapporto di sostenibilità di ATM, Azienda Trasporti Milanesi*)

## Residential sector

### **R1 – Improvement of energy efficiency in existing residential flats**

#### **Description:**

The Municipality of Milan has set a package of regulations to promote energy efficiency in the residential sector, among them:

- reduction of infrastructure charges for operations that enhance energy savings and use of renewable sources in new buildings or in existing buildings under renovation or enlargement, in force as of 2007;
- incentives for operations enhancing energy efficiency in private buildings, that are being introduced in the new planning tools under approval by the Local Administration (Master Plan of the Municipality of Milan, Building Regulation);
- financial incentives to replace or renovate heating plants and promote infrastructural operations on the building system.

In this measure of the Climate Plan, the overall effect of these operations by 2020 has been estimated, i.e. a reduction of energy consumption for heating in almost 150,000 existing flats (60 kWh/m<sup>2</sup>/year).

**Abatement potential: 156 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- Effective implementation and further enforcement of existing regulations and incentives; provision of new incentives
- Communication activities and counselling to citizens within the “Sustainable Energy Point”, to diffuse information on incentives and give advice on administrative procedures to access them; awareness campaigns tailored to stakeholders (homeowners, landlords, tenants ...)

**Average abatement cost: -33 €/tCO<sub>2</sub>**

#### **Co-benefits:**

- improvement of air quality
- improvement of thermal comfort
- increase in the value of estates

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Building Regulation (*Regolamento Edilizio*), under review
- Reduction of infrastructure charges for operations that enhance energy savings and use of renewable sources in new buildings or in existing buildings under renovation or enlargement, in force as of 2007
- Voluntary protocol of understanding for technological renovation of centralized heating plants, 2006 – 2010 (*Protocollo d'intesa volontario riguardante la riqualificazione tecnologica degli impianti termici centralizzati*)

## **R2 – Improvement of energy efficiency in new residential flats**

### **Description:**

As the new building regulation will soon enter into force and a set of regulations is already in operation (i.e. reduction of infrastructure charges), it is possible to foresee that new flats will be more energy efficient, in comparison with performance they would have had under previous regulations.

The measure includes efficiency improvements in approximately 51,000 new flats in the period 2010-2020. Emission reduction from this measure has been calculated according to a reduction of energy consumption for heating, assuming that these flats will be built in accordance with energy efficiency parameters of B class, as foreseen in the regional law (energy consumption: 29 – 58 kWh/m<sup>2</sup>/year).

**Abatement potential: 97 ktonCO<sub>2</sub>/year**

### **Implementation options:**

- Introduction of high energy efficiency standards in the new developments foreseen in the Integrated Programs for Intervention (PII), in the calls for competitive bids concerning the new Social Housing Program
- Evaluate the option of including minimum energy efficiency standards for new flats in the new building regulation, that shall be stricter than current regional law

**Average abatement cost: -89 €/tCO<sub>2</sub>**

### **Co-benefits:**

- improvement of air quality
- improvement of thermal comfort
- increase in the value of estates

### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Master Plan of the Municipality of Milan (*Piano di Governo del Territorio, PGT*), under approval by municipal administration
- Building Regulation (*Regolamento Edilizio*), under review
- Reduction of infrastructure charges for operations that enhance energy savings and use of renewable sources in new buildings or in existing buildings under renovation or enlargement, in force as of 2007
- Social Housing Program, 2007 – 2010 (*Programma di edilizia residenziale pubblica*)

### **R3 – Boiler Fuel switch (from heating oil to natural gas)**

#### **Description:**

Fuel switch from fuel oil to natural gas in heating plants is already taking place in Milan, also as an effect of incentives provided by the Local Administration; this measure foresees that fuel switch of heating plants will continue with a higher replacement rate than the BaU rate, under effect of regulations, incentives and financial aids that the Local Administration will further enforce to sustain plant renovation. In this measure, CO<sub>2</sub> emission reduction by 2020 is estimated from fuel switching of plants that would serve for heating 6 million m<sup>2</sup> of built surfaces, additional over the BaU scenario.

**Abatement potential: 54 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- Further implementation of monitoring campaigns on heating plants
- Provision of incentives to replace and renovate heating plants
- Evaluate if a ban on installation of new fuel-oil heating plants should be introduced in the new building regulation
- Communication activities and counselling to citizens within the “Sustainable Energy Point”, to diffuse information on incentives to renovate heating plants and current laws

**Average abatement cost: -396 €/tCO<sub>2</sub>**

#### **Co-benefits**

- improvement of air quality

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Voluntary protocol of understanding for technological renovation of centralized heating plants 2006 – 2010 (*Protocollo d'intesa volontario riguardante la riqualificazione tecnologica degli impianti termici centralizzati*)

### **R4 – Energy saving and energy efficiency in end-uses (residential)**

#### **Description:**

If families changed a few everyday habits, in the use of electrical appliances and lighting and replacing existing appliances with more efficient ones, a relevant amount of emissions could be abated through electricity savings. In this measure, emission reduction has been estimated according to the potential effect that awareness and information campaigns promoted by the Municipality of Milan may have, in terms of electricity-saving behaviours by families. This measure has been quantified in the Climate Plan, even if it enables to abate indirect CO<sub>2</sub> emissions, attributable to electricity produced by plants that may be included in the ETS scheme, as this amount of emission reduction is strictly determined by a local policy and efforts of citizens.

**Abatement potential: 113 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- Communication activities and counselling to citizens within the “Sustainable Energy Point”, aimed at diffusing:
  - hints to increase efficiency and energy savings in household end-uses



- information on available technologies and best practices on smart energy use
- information on training courses on energy and awareness events

**Average abatement cost: -320 €/tCO<sub>2</sub>**

**Co-benefits**

- improvement of air quality
- longer term security for local power supply

**References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)

**Tertiary sector**

**Z1 - Improvement of energy efficiency in existing commercial buildings**

**Description:**

The Municipality of Milan has set a package of regulations to promote energy efficiency in the building sector, among them:

- reduction of infrastructure charges for operations that enhance energy savings and use of renewable sources in new buildings or in existing buildings under renovation or enlargement, in force as of 2007;
- incentives for operations enhancing energy efficiency in private buildings, that are being introduced in the new building regulation;
- financial incentives to replace or renovate heating plants, promote infrastructural operations on the building system and install heat metering systems.

In this measure of the Climate Plan, the overall effect of these operations by 2020 has been estimated, i.e. a reduction in energy consumption for heating in almost 15,000 existing commercial-tertiary buildings (60 kWh/m<sup>2</sup>/year).

**Abatement potential: 23 ktonCO<sub>2</sub>/year**

**Implementation options:**

- Effective implementation and further enforcement of existing regulations and incentives; provision of new incentives
- Communication activities and counselling to commercial activities within the “Sustainable Energy Point”, to diffuse information on incentives and give advice on administrative procedures to access them
- Communication campaigns and awarding programs, such as:
  - setting up a brand (es. “Sustainable Milan”) which shall identify commercial and tertiary activities that are very energy efficient
  - setting up a prize on “innovation for climate”, following initiatives of other European cities (i.e. Paris)

**Abatement cost:: -33 €/tCO<sub>2</sub>**

**Co-benefits:**

- improvement of air quality
- improvement of thermal comfort
- jobs
- longer term security for local heat supply

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Building Regulation (*Regolamento Edilizio*), under review
- Reduction of infrastructure charges for operations that enhance energy savings and use of renewable sources in new buildings or in existing buildings under renovation or enlargement, in force as of 2007
- Voluntary protocol of understanding for technological renovation of centralized heating plants 2006 – 2010 (*Protocollo d'intesa volontario riguardante la riqualificazione tecnologica degli impianti termici centralizzati*)

## **Z2 – Improvement of energy efficiency in new commercial buildings**

### **Description:**

As the new planning tools will soon enter into force (PGT, building regulation) and considering that a set of regulations is already in operation (i.e. reduction of infrastructure charges), it is possible to foresee that new commercial buildings will be more energy efficient, in comparison with performances they would have had under previous regulations.

The measure includes efficiency improvements in approximately 10,500 commercial buildings in the period 2010-2020. Emission reduction from this measure has been calculated according to a reduction of energy consumption for heating, assuming that these buildings will comply with energy efficiency parameters of C class, as foreseen in the regional law.

**Abatement potential: 24 ktonCO<sub>2</sub>/year**

### **Implementation options:**

- Introduction of high energy efficiency standards in projects of new buildings (i.e. certification system LEED's)
- Evaluate the option of including minimum energy efficiency standards for new commercial buildings in the new building regulation, that shall be stricter than current regional law

**Average abatement cost: +35 €/tCO<sub>2</sub>**

### **Co-benefits:**

- improvement of air quality
- improvement of thermal comfort
- longer term security for local heat supply

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Master Plan of the Municipality of Milan (*Piano di Governo del Territorio, PGT*), under approval by municipal administration
- Building Regulation (*Regolamento Edilizio*), under review

- Reduction of infrastructure charges for operations that enhance energy savings and use of renewable sources in new buildings or in existing buildings under renovation or enlargement, in force as of 2007

### **Z3 - Energy saving and energy efficiency in end-uses (commercial)**

#### **Description:**

If employees and workers changed a few everyday behaviours, in the use of electrical appliances and lighting and replacing existing appliances with more efficient ones, a relevant amount of emissions could be abated through electricity savings. In this measure, emission reduction has been estimated according to the potential effect that awareness and information campaigns promoted by the Municipality of Milan may have, in terms of electricity-saving behaviours in offices and commercial activities. This measure has been quantified in the Climate Plan, even if it enables to abate indirect CO<sub>2</sub> emissions, attributable to electricity produced by plants that may be included in the ETS scheme, as this amount of emission reduction is strictly determined by a local policy and efforts of end-users.

**Abatement potential: 65 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- Communication activities and counselling to commercial activities within the “Sustainable Energy Point”
- Awarding programs for commercial activities achieving relevant energy-savings

**Average abatement cost: -60 €/tCO<sub>2</sub>**

#### **Co-benefits:**

- improvement of air quality
- longer term security for local power supply

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)

### **Public buildings (Municipality of Milan)**

### **E1 - Improvement of energy efficiency in existing municipal buildings**

#### **Description:**

Improving energy efficiency of public buildings can contribute not only to reduce energy consumption and emissions, but also towards the diffusion of best practices and innovative solutions within the city. In this measure, emission reduction has been estimated in relation to energy savings for heating, which may derive from energy efficiency improvement of 300 municipal buildings (non-residential).

**Abatement potential: 6 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- Further enhancement of the energy audit campaign on public buildings, in collaboration with other municipal departments and subsidiaries

- Set up of an energy efficiency program on municipal buildings and heating plants
- Evaluation of options for financing, such as E.S.C.O.
- Communication campaigns and awarding programs, such as:
  - setting up a brand (i.e. “Sustainable Milan”) which shall identify public buildings that are particularly energy efficient
- implementation of innovative practices on public buildings that are representative of certain building typologies

**Average abatement cost: -33 €/tCO<sub>2</sub>**

#### **Co-benefits**

- renovation of public buildings
- improvement of thermal comfort
- improvement of air quality
- longer term security for local heat supply

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Energy Service Contract for Municipal buildings, 2008-2013 (*Contratto di servizio energia relativo agli stabili di proprietà comunale*)

## **E2 - Energy saving and energy efficiency in end-uses (municipal buildings)**

#### **Description:**

If employees of the Municipality changed a few everyday routines, in the use of electrical appliances and lighting, and if existing appliances were replaced with more efficient ones, a relevant amount of emissions could be abated through electricity savings. In this measure, emission reduction has been estimated according to the potential effect of internal awareness information campaigns promoted by the Municipality of Milan, in terms of electricity-saving behaviours in 500 municipal buildings. This measure has been quantified in the Climate Plan, even if it enables to abate indirect CO<sub>2</sub> emissions, attributable to electricity produced by plants that may be included in the ETS scheme, as this amount of emission reduction is strictly determined by a local policy and efforts of end-users.

**Abatement potential: 6 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- Awareness initiatives within the Municipality, its departments and subsidiaries and activities under the supervision of Energy Manager
- Implementation of Environmental Management Systems
- Communication campaigns and rewarding programs (i.e. brand “Sustainable Milan” to identify municipal initiatives achieving relevant energy savings)

**Average abatement cost: -60 €/tCO<sub>2</sub>**

#### **Co-benefits:**

- improvement of air quality
- longer term security for local power supply

#### **References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)

### **E3 - Energy saving and energy efficiency in end-uses (public lighting)**

#### **Description:**

This measure foresees a renovation of public lighting in accordance with the “Plan for lighting”. In particular, emission reduction has been estimated in relation with electricity savings that may be obtained by replacing or refurbishing existing plants with energy efficient ones and replacing mercury lamps.

**Abatement potential: 13 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

- broadening the testing phase of LED installation on traffic lights to the whole city
- implementation of the “Plan for lighting”

**Average abatement cost: -202 €/tCO<sub>2</sub>**

#### **Co-benefits:**

- improvement of air quality
- longer term security for local power supply

#### **References within municipal plans and reports**

- General Development Plan, 2006 – 2011 (*Piano Generale di sviluppo*)
- Plan for lighting, in force as of 2007 (*Piano Luce*)
- Agreement for traffic lights, 2007 – 2009 (*Accordo impianti semaforici*)

## **Energy Production**

### **P1 – Improvement of efficiency in energy production**

#### **Description:**

This measure plans an improvement of efficiency in electric energy production of A2A plants located outside city boundaries. The Municipality of Milan (together with The Municipality of Brescia) is the main shareholder of the local energy operator (A2A) and aims at promoting policies and strategies to reduce indirect emissions, i.e. emissions related to production of imported electricity. For example, an increase of renewable energy sources in energy production could lower the emission factor of electric energy production, in accordance with EU-ETS and “20-20-20” Climate and Energy Package.

**Abatement potential: 454 ktonCO<sub>2</sub>/year**

#### **Implementation options:**

Considering the relevant reduction potential of this measure, the Municipality and A2A shall evaluate the role of the local electric supplier within the Italian electric market and how the Municipality could take part in A2A’s emission reduction strategy.

**Average abatement cost: to be quantified**

**Co-benefits:**

- improvement of air quality
- longer term security for local power supply

**P2 – Photovoltaic solar power for building uses****Description:**

Within the city of Milan, several photovoltaic projects have recently been started up (i.e. ATM's depot in Precotto, renovation of the "School for Tourism" building). Incentive measures of new building regulation could promote a further development of investments in this field, based on projects that have already been planned up to now.

In this measure, emission reduction has been estimated assuming that 300,000 m<sup>2</sup> photovoltaic panels will be built by 2020 (+300% in comparison to 2005), equivalent to 39 MWp of power and 85 GWh/year of annual electricity production, which will enable to avoid the consumption of grid electricity.

**Abatement potential: 26 ktCO<sub>2</sub>/year**

**Implementation options:**

- Assessment of suitable areas for the installation of photovoltaic systems
- Development of photovoltaic programs on specific typologies of buildings (i.e. schools)
- Simplification of administrative procedures and legislative framework pertaining to the installation of photovoltaic systems

**Average abatement cost: +191 €/tCO<sub>2</sub>**

**Co-benefits:**

- improvement of air quality
- longer term security for local power supply

**References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Building Regulation (*Regolamento Edilizio*), under review
- Reduction of infrastructure charges for operations that enhance energy savings and use of renewable sources in new buildings or in existing buildings under renovation or enlargement, in force as of 2007.

**P3 – District heating****Description:**

The Municipality of Milan promotes the development of district heating with Combined Heat and Power and systems to produce energy from renewable sources. A2A group has developed a plan for the enlargement of the city's district heating network, which aims at serving 730,000 people (1,450 MWt capacity)

The measure proposed in the Climate Plan prefigures to increase capacity of existing plants and build new CHP plants with heat pumps, as defined in A2A's "Plan for the development of district heating".

**Abatement potential: 73 ktCO<sub>2</sub>/year**

**Implementation options:**

- Promote coordination among plans concerning underground works, to speed up authorisation procedures
- Connect municipal buildings to district heating network, assessing available options;
- Participate actively in the evaluation of suitable areas that shall be devoted to the installation of new plants

**Abatement cost:** +40 €/tCO<sub>2</sub>

**Co-benefits:**

- longer term security for local heat supply
- enhancement of safety in homes (replacement of individual thermal plants)

**References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Master Plan of the Municipality of Milan (*Piano di Governo del Territorio, PGT*), under approval by municipal administration
- Plan for the development of district heating for the city of Milan by A2A, 2009 – 2015 (*Piano di sviluppo del teleriscaldamento di A2A per la città di Milano*)

**Waste****W1 – Waste to energy plant connected with district heating****Description:**

Elaborations developed within planning tools of the Municipality (i.e. Waste Plan 2006-2011) have highlighted that a second waste to energy plant should be built to satisfy waste disposal needs of the city. Its location is still to be finalised. A new plant could be associated with a further increase of energy supply through district heating over 2020 BaU scenario. In this measure, waste disposed through incineration is projected to double by 2020 (250,000t MSW) and to serve 4 million m<sup>2</sup> of new built surfaces. Emission reduction has thus been estimated from heat production replacing natural gas use (abatement of direct emissions), serving both existing and new buildings, and from cogeneration (abatement of indirect emissions), which enables a highly efficient electricity production if compared with conventional plants.

**Abatement potential:** 19 ktCO<sub>2</sub>/year (direct emissions); 57 ktCO<sub>2</sub>/year (indirect emissions)

**Implementation options:**

Evaluation of the proposal concerning the new waste to energy plant

**Average abatement cost:** +40 €/tCO<sub>2</sub>

**Co-benefits:**

- longer term security for local heat and power supply

**References within municipal plans and reports**

- Waste Plan 2006-2011 (*Piano Rifiuti*)

## Agriculture and green areas

### A1 – Conservation agriculture

#### Description:

Conservation agriculture makes use of techniques which minimise tillage and maintain organic soil content throughout the year, using mainly crop rotations. It enables to increase the amount of CO<sub>2</sub> that can be stocked in soil, in comparison with soils treated with traditional techniques. Conservation agriculture is taking place nearby the City of Milan; in this measure, estimates on the sinking potential of agricultural soils within the area of Milan have been assessed, assuming that conservation agriculture would be applied in 75% of cultivated land.

**Abatement potential:** 5 ktCO<sub>2</sub>/year

#### Implementation options:

Partnerships with farmers, in order to diffuse conservation agriculture techniques, i.e. within the “100 Blue kilometers” initiative promoted by AIGACOS (Italian Association for Agronomic and Conservation management of soil), that will disseminate results on CO<sub>2</sub> absorption during Expo 2015.

**Average abatement cost:** -30 €/tCO<sub>2</sub>

#### Co-benefits:

- soil erosion management

### A2 – Increase of public urban green areas (tree planting)

#### Description:

Tree planting has many benefits on the liveability of cities, reducing also the “heat island effect”, that is typical of very dense areas; furthermore, trees can absorb atmospheric CO<sub>2</sub>. In this measure, the potential to absorb CO<sub>2</sub>, attributable to the implementation of the “Green Plan” of the Municipality, has been estimated (+ 500,000 new trees by 2020).

**Abatement potential:** 2 ktCO<sub>2</sub>/year

#### Implementation options:

- Improvement of existing green areas (accessibility, safety)
- Enlargement of existing green areas and connection among them (“Green Radius” and “Green belt” projects, Green Plan)
- partnerships with private entities/individuals for funding

**Average abatement cost:** +8,872 €/tCO<sub>2</sub>

#### Co-benefits:

- increase of usable and accessible green public areas
- increase of bicycle and walking paths
- reduction of the “heat island effect”
- soil erosion management
- creation of habitats and corridors for fauna



**References within municipal plans and reports**

- General Development Plan, 2006- 2011 (*Piano Generale di sviluppo*)
- Master Plan of the Municipality of Milan (*Piano di Governo del Territorio, PGT*), under approval by municipal administration
- Building Regulation (*Regolamento Edilizio*), under review
- Green Plan, 2008 – 2015 (*Piano del Verde*), under review