SUSTAINABLE ENERGY ACTION PLAN

Porto

Executive Summary (ENG)

October 2010

EXECUTIVE SUMMARY

The Porto's Sustainable Energy Action Plan (SEAP-P), aims to respond to the commitments assumed under the Covenant of Mayors, although the Municipality together with AdEPorto had already previewed an Action Plan following the energy diagnosis and CO_2 emissions inventory, the Energy Matrix, published in 2007 but with data refereed to 2004.

The Covenant of Mayors is considered one of the most ambitious challenges for a European medium term responsible and sustainable energy policy, against global warming and having CO_2 emissions reduction more than 20% by 2020 as its main objective, through measures supported on sustainable energy action plans related to energy efficiency and promoting renewable energy.

Covenant of Mayors is a followed and monitored initiative of cooperation and accountability of local governments and their leaders, which create a set of commitments by making Cities, become Driving forces of sustainable energy.

In order to achieve that, signatories cities commit themselves to:

- go beyond the objectives set by the EU for 2020;
- establish a baseline emission inventory as a basis for the Sustainable Energy Action Plan;
- submit the Sustainable Energy Action Plan within one year after the Covenant of Mayors signing date;
- adapt municipal structures and allocate sufficient human resources in order to carry out necessary actions;
- submit an implementation report at least every second year after submission of the Action Plan for evaluation, monitoring and verification purposes;
- share the experience and know-how with other territorial units;
- mobilize civil society in their geographic areas to participate in developing the action plan;
- organize Energy Days or City Covenant Days in cooperation with the European Commission and other stakeholders, allowing citizens to benefit directly from the opportunities and advantages offered by a more intelligent use of energy, and to regularly inform the local media on developments concerning the action plan;
- attend and contribute to the annual EU Conference of Mayors for a Sustainable Energy Europe;
- spread the message of the Covenant of Mayors, encouraging other local authorities to join the initiative;
- Accept termination of our membership of the Covenant, subject to prior notice in writing by the Secretariat, in case of either:

- failing to submit the Sustainable Energy Action Plan within the year following formally signing up to the Covenant;
- non-compliance with the overall CO_2 reduction objective as set in the Action Plan, due to failure to implement or insufficient implementation of the Action Plan;
- failing to submit a report in two successive periods.

Based on the Energy Matrix diagnosis, priority areas for intervention are identified and actions listed, organized and balanced according to their CO_2 emissions reduction impact.

The organization of the measures has into account a set of methodological steps guided by energy efficiency criteria and assessed by their potential contribution to the reduction of CO_2 emissions, namely:

- Characterization of Porto's quantitative and qualitative (electricity, heat, etc.) specific energy needs, in line with the Energy Matrix (2007);
- Integration of energy issues within an urban sustainability framework, as defined in the " Porto's Sustainability Strategy" (2009);
- Identification of the Porto energy carriers (final energy), needed for buildings and their activities; mobility and transport; and general productive activities (industry, commerce, etc.);
- Definition of the final energy options according to useful energy: heat for cooking, domestic hot water and environmental comfort; electricity and fuel for transport; electricity for artificial lighting, appliances, etc. Example are solutions for domestic hot water, representing about 25% of the consumption for a Portuguese average household, with solar systems using natural gas as back up, or the promotion of district heating and cooling networks on natural gas, the cleanest fossil fuel for the paradigm change;
- Assign high priority to the demand management and to the access to more efficient technologies. Demand management examples are the improvement gained from higher insulation of either rehabilitated or new buildings, better management of solar gains (shading,...) and public transportation promotion as the alternative that overcomes any individual using energy vehicle. Examples of access to more efficient technologies are the exploitation of the potential intelligent natural lighting; the spread of low consumption, public and interior, artificial lighting; the expansion of very efficient electrical appliances; but, also the perspectives for new urban mobility paradigms.

Porto's Sustainable Energy Action Plan elaboration follows the methodology proposed by the Covenant of Mayors, adapted to local the socio-economical reality and making the best estimation of its evolution until 2020 and the consequent reflection used on the energy,

either in nature or in quantity, with the simplifications and risks associated with this type of study.

In spite of the time line and the uncertainty about financial available resources for promoting all proposed measures for this Plan, the objectives and goals to achieve are undeniable, and therefore, there is the expectation that in time the necessary conditions will be created for the implementation of this Plan and, most probably, to its overcome having in mind much more demanding goals in 2050.

Meanwhile, the City, as an energy system or a cluster of energy systems, is not isolated, it's part of the North Region and of the Country what can bring benefits, such as the contribution of national renewable electricity program to the decarbonisation of the electricity mix developed in the last decade, but also constraints and barriers not negligible, here and now, onto the path for sustainability. Examples of constraints are the national policies in terms of energy prices and taxation on everything involving the energy chain from source to use, which may inhibit - and in fact inhibits - the promotion of municipal initiative plans such as SEAP-P.

SEAP-P lists concrete measures quantifying the energy involved and the corresponding CO_2 emissions, planned basically according to rules and specific practices from the energy sector being organized in 'supply' and 'demand' side, where the first broadly refers to 'final energy carriers supply' and the second to the 'end uses of the final energy'.

Baseline control year is 2004, which refers to the first Energy Matrix.

On the 'supply' side, the actions are of three types: change of energy carrier (3.3.1.), when it privileges the use of an energy carrier or final energy that, for the same purpose, emits less CO_2 and can also be associated with the use of more efficient technologies (like Combined Heat and Power); and the utilization of potential endogenous energies (solar, mainly, and some biomass) for either heat (3.3.2) or electricity production (3.3.3).

On the 'demand' side, actions are naturally separated by prevalent activity sectors that were identified as the most 'energivorous' in the Energy Matrix: buildings (3.4.1.), transport (3.4.2.), street and traffic lighting (3.4.3.) and water supply (3.4.4). Notice that in Porto there is almost no industry.

The identified measures are integrated not only within best practices and new technologies, but also with expectations of behavioural changes, that will allow energy efficiency gains.

Assumptions were defined for each action that allow the quantification of the energy involved: avoided energy, when rationalization and efficiency measures are adopted, and specific energy (electrical or other) 'produced', when local conversion is present.

The related CO_2 emissions are calculated disaggregating the different energy carriers. Secondary carriers, such as electricity and hot/chilled water from district heating and cooling networks are reported to primary energy according to the national electricity mix[1], ranging

[1] The electricy mix is the breakdown expression of primary energy sources, involved in the national grid electricity production. It is considered the annual average value according to renewable energy sources

the respective CO_2 emission factor with the expected evolution of the ratio of renewable sources and fossil fuels according to PNAER (National Renewable Energy Action Plan) numbers.

Porto's CO_2 reduction in 2020 compared to 2004 will be achieved by two paths: locally, object of this Plan, expressed in avoided emissions by not using energy as a result of the energy efficiency, by the change of energy carrier or rational management; and nationally, cumulative with the local, resulting from the last decade national energy policy translated into the electricity mix evolution towards in reducing its carbon content due renewable sources inclusion and the incorporation of biofuels in diesel.

Regarding the electricity mix evolution, REN – Redes Energéticas Nacionais (National Energetic Grid Lines) – draws two expectable evolution scenarios of the national electricity production system in the period 2009-2013 and until 2020 (1):

- Reference Scenario[2], which includes energy efficiency measures of PNAEE – National Energy Efficiency Action Plan;
- Efficiency Scenario[3] – 20%, assuming a total CO_2 emissions reduction by 20% in 2020, compared to the ones verified in 2005.

The most conservative scenario is chosen for this plan, i.e. "Reference Scenario". This choice is made taking in to account a published reference by a recognised institution with knowhow in this matter, being aware that the values estimated under this Plan are also affected by uncertainty, particularly due to the electricity 2020 mix in Portugal.

All assumptions and simplifications to the model prediction are explained action by action.

The starting value for this plan definition is 1 376 300 tCO_2, referred to the year 2004 including the corresponding city waste incineration emissions by Lipor, which were missing at the time.

Overall results include the effect of the:

- Best estimates for 'supply' and 'demand' side considering legitimate aspirations, from large sections of population, to a higher comfort, the technological development and the expected positive pressure effects, related to renewable energy and energy efficiency;
- positive contribution of national energy policies:
    a) Electricity mix decarbonisation as a successful result of the renewable energy program implemented in the last decade, which should continue until 2020 (1); and
    b) biofuels incorporation in the diesel.

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contribution. The corresponding CO_2 emission factor also varies annually depending on the different sources contribution.

[2] Reference scenario electricity *mix* emission factor – 0,132 t CO_2/MWh (1)
[3] Efficiency scenario electricity *mix* emission factor – 0,114 t CO_2/MWh (1)

As mentioned above, it is assumed that in the concerned period, energy demand growth will occur due not only to a greater demand for comfort, but also to the recovery and the evolution of economic activity. The estimated increase of energy consumption and its impacts on CO_2 emissions, based on PNAER (2) forecasts will be of 3% until 2020 of the global energy consumption, referred to 2004. An approximately 10% reduction from 2004 to 2008 was verified according to 2.2., so it is plausible to assume a 3% growth in relation to 2004 for Porto.

The results for this Plan are presented in table 1, and point to a potential reduction in CO_2 emissions of 625 340 tonnes of which 302 730 tonnes are due to national contributions and 322 610 tonnes to the SEAP-P effects.

Table 1 – Final energy and CO_2 emissions reduction by the application of all the actions proposed by 2020

		Final energy reduction	CO_2 emissions reduction	
		[MWh]	National [t CO_2/year]	Local [t CO_2/ year]
Supply	Shift from electricity to natural gas for heat uses (includes CHP)	75 400	-	49 700
	Solar DHW	38 300	-	17 400
	Waste-to-energy	-	-	46 000
Demand	Buildings	265 980	243 770	124 950
	Transport (includes biofuel)	520 900	49 700	99 020
	Other	21 000	9 260	10 280
	Forecast energy consumption increase	-121	-	-24 740
Total		**800 240**	**302 730**	**322 610**

Considering the objectives indicated and assumed under the Covenant of Mayors, aware of the main axis of the "Porto's Sustainability Strategy", namely the axis for 'Environment', 'Urban Renewal' and 'Mobility', and taking in consideration the policy and technology assumptions presented, it is possible to underline the following conclusions, which are essential to the Plan's understanding and credibility:

1. Porto, faced with the obligations under the Covenant of Mayors, identifies that CO_2 reduction values for 2020 can reach 45%, what appears globally achievable within the time line of a decade;

2. The fact that this numbers indicate about 45% reduction in relation to 2004, overcoming the European Commission target, is a remarkable result which should be seen above all as a guarantee that Porto could face with confidence the fulfilment of the assumed commitment;

3. The restricted interpretation that what is aimed in the SEAPs is the CO_2 reduction due to the actions within the City's sphere, framed or engaged, encouraged or induced by the Municipality, lows that value to about 24% which authorizes to keep confidence in the Plan results;

4. Anyway, is important to highlight the significant role of national policies concerning renewable electricity, over the last decade, with obvious benefits to Porto, given the strong imprints as an 'electric' City for almost half a century;

5. Final energy reduction values resulting from direct actions from the City and indirect from other actors in the City are, in turn and according to the followed method, divided in 12% final energy reduction due to 'supply' side and 88% due to 'demand';

6. It is clear that the energy issue in the City is, first of all, a question of 'demand', particularly in buildings (67% of CO_2 emissions total reduction) and transport (16%);

7. The results clarify that Porto, as expected for any existing and compact city, has a larger intervention area on the 'demand' side than on the 'supply' one in a, perhaps, too disproportionate relation. This reflects the historical energy and urban context conditions, of a compact city, and the activities structure, where industry has practically no expression, which will not be the most favourable to final energy renewable sources "production" *in loco*;

8. The district heating and cooling network project can be a contribution to the increase of the local energy carriers 'production' but, without any doubt that, even if part of the primary energy for CHP is based on biomass, remains remarkably low the share of renewable energy;

9. In terms of 'supply' by renewable energy sources it's obvious and challenging the promotion of solar thermal collectors to produce domestic hot water, pointing to figures that, is recognized, are yet too discreet. As to solar power, its development should follow the national experience without considering it a determinant City objective by 2020, as is the case of solar thermal collectors, except to enhance the achievement of a more expressive production of energy carriers from renewable sources, as soon as this becomes evident with the expected quick drop in the photovoltaic cells cost;

10. National and European political context conditions would lead favourably to be more ambitious. It is assumed that Porto in the 2020 time line and perhaps 2050 may, finally, return to the renewable energies improving them component, either for heat use (solar thermal collectors, architecture/construction with high performance, biomass; heat pumps) or electricity (photovoltaic). It will be the explosion of the designated 'microgeneration' in various facets. In this time frame it seems possible

to achieve these objectives accommodating a peaceful transition natural from a difficult time and condescending with the widespread lack of energy culture;

11. New buildings to be permitted have great potential in the improvement of thermal energy performance, even beyond national standards the incorporation of a number of measures beyond the national legislation in "SIM-Porto" (Multicriteria Information System) should help and will be consistent with SEAP-P following the experience of the "Observatory of the Energy-environment Sustainability of Buildings". There is also a huge potential for improving energy efficiency in the City's building stock rehabilitation, given the accumulated experience of the "Reference Guidelines for the Energy Efficient Rehabilitation of the Porto's Historical Centre", adapting and generalizing it to the proper rehabilitation of the rest of the city;

12. In transport it's about going forward with the public transport program. The results verified since 2005, especially with the Metro do Porto, are eloquent about public transport potential in the CO_2 reduction. Anyway it is also important, in addition, to promote new mobility paradigms by improving intermodality and valuing the 'soft' options, such as the use of bicycle, beyond simple leisure and the pedestrian sidewalks in the City.