

## **A framework to take account of CO<sub>2</sub> restrictions on municipal urban planning**

### **1. Introduction**

Recently, more and more cities and regions are increasing their interest in sustainability, specifically on the issues related to climate change. Clear evidence is the big amount of European cities (576, in July 2009), which have already joined the Covenant of Mayors.

The Covenant of Mayors is a voluntary agreement to fight against climate change at municipal level, with which the signatory cities are committed to reduce their CO<sub>2</sub> emissions by at least 20% by 2020.

To tackle climate change at local level it is necessary to research into local strategies which allow reducing global CO<sub>2</sub> emissions. The first step of this research consists of identifying which emissions should be taken into account and how they should be measured.

In the work set out below, we approach these questions from the point of view of urban planning, since we consider urban planning as one of the most important tools that municipalities have to intervene in the territory.

The discussion of this paper is based on a report commissioned by the Catalan Environment and Housing Department entitled "*Validació de criteris en la consideració de l'eficiència energètica del planejament*".

### **2. Urban Planning and sustainability**

The interest on sustainability showed by the administrations of urban regions is not always followed by a reflexion about the urban condition in face of ecological sustainability as a long-term goal. Such a reflexion, however, is urgent to support new frameworks for urban planning.

Sustainability means satisfying needs in the short and long term (Brundtland, 1987). In this sense, while discussing urban planning for sustainability should be reminded that the main need satisfied by cities and urbanization is accessibility.

The market generates the city as a form of reducing costs of mobility, increasing accessibility between producers and consumers. Accessibility represents the possibility of achieving goods, services and information at a low cost, consisting on the main utility of urban space and also on the main difference between cities and rural space.

Mobility, sometimes pointed out as the origin of cities, is in reality only a mean to reach accessibility. Proximity and connectivity are the other means to provide accessibility, and both depend on the location of activities on space.

Location of activities on space establishes a balance between agglomeration (until the limits of congestion) and dispersion (until the limits of mobility efficiency). Urban planning while locating activities on space, defines levels of accessibility. However, this location is also strongly affected by policies and by the economy.

On the one hand, location of activities depends on the markets and on the other hand, it interferes with them. However, being it defined by planning; being it defined by policy or by the market, the location of activities provides accessibility giving priority to short term needs. But what about the long term?

In the context of the externalization of mobility costs, the limits of congestion and of dispersion, which once benchmarked the location of activities on space, were overlapped.

Accessibility as the urban utility is since then threatened: urban centres become blocked by road traffic and urban regions dispersed by fragmented urban networks (Marvin; Graham, 2001).

This scenario is consequence of the industrial process based on a linear metabolism that allows markets, urban networks and urbanization, growing without limits. Congestion and sprawl are the results.

When several authors refer to sprawl and to dissolution of the urban cohesion, they refer to the spreading of high levels of accessibility further on the territory, which are supported not by proximity but by mobility. This kind of accessibility has been provided at an apparently low cost, supported by stabilized oil prices and by the externalization of environmental costs, in particular by contamination.

While not closing material cycles, the industrial linear metabolism generates contamination and incentivises patterns of location of activities that intend to maximize profit and to delocalize effects of industrialization, rather than solving or reducing them. CO<sub>2</sub> emissions are a major form of such contamination.

Contamination is not only produced by the industrial activity, it is in big part generated by the use of urban territories, and by the need of accessibility satisfied through mobility. We can identify urban non-industrial emissions from transport, residential and services sectors. Such emissions depend on urban infra-structure and buildings, and of the accessibility and habitability provided by cities and urbanization.

Because of this interdependency, restrictions on CO<sub>2</sub> can regulate the urbanization process, as they can regulate the economic process. This indicator, even not expressing all the dimensions of the ecological sustainability, when used properly has the power of reshaping certain urban activities that are strongly responsible for it: buildings, mobility and supply of urban services (energy, water, and waste treatment). Mostly it has the potential to regulate forms to provide accessibility, what represents a relevant opportunity for urban sustainability.

The contradiction between the industrial globalized urban dimension and sustainability goals can be faced by this indicator, because it leads to the acceptance of contamination as mobility cost, redefining accessibility patterns and giving a new role to proximity and connectivity.

Urban growth, since the industrial revolution, has been accelerated by an increasing accessibility based not only on the geographic location of activities or on the technology, but mostly on the low price of fossil fuels and contamination externalities. And beneath low mobility costs urban scale tends to become global.

At this global scale, restricting contamination and CO<sub>2</sub> emissions means not only to act on cities, but also on the "planetary economy". And this is much more than urban planning is capable to do. What urban planning is able do is to optimize location of activities on space, at multiple scales, seeking to regulate the urban metabolism and to control local parts of the global net. And this is not few.

While aiming to achieve sustainability goals, urban planning faces a double problem: globalization of urbanization and networks; and, lack of the right tools to introduce "change" and to internalize environmental costs in its decision making process.

The first problem will be managed by the conditions imposed by the "peak oil", since industrial urban condition tends to full globalized urbanization only while mobility costs are very low. Otherwise, on what concerns to the lack of tools solutions can be proposed through research, experiments and construction of an alternative vision of urban planning.

### 3. A Framework to define “municipal urban emissions”

Conventional urban planning has strong limitations on acting on emissions because it is not thought from the point of view of sustainability. When some questions appear, answers are not available: Over which activities and how urban planning acts? What means sustainability in the city, in energy and emissions? We try to approach these interrogations.

This paper, as the research behind it, seeks a suitable way to join the structure of urban planning with urban sustainability, taking into account the main phases and main sectors of planning where to include CO<sub>2</sub> emissions.

Planning main phases answer to three questions:

- How are we (Diagnosis)?
- Where do we want to go (Objectives)?
- How to get there (Planning evaluation)?

These questions fit perfectly to the low carbon challenge: How much do we emit? How much we want to reduce? How to achieve and verify such reductions?

On what concerns to the sectors, having in perspective carbon reduction we select three planning sectors: buildings, mobility and urban services. All of them have a significant share of the urban emissions and are part of the main domains of intervention of urban planning.

	DIAGNOSIS ACTUAL STATE	STRATEGIC OBJECTIVES	PLANNING EVALUATION
BUILDINGS			
MOBILITY			
URBAN SERVICES			

Table 1 – Phases and sectors of physical urban planning

As table shows there are 9 areas where emissions restrictions can be introduced, but this restriction has to be driven by consistent criteria of urban municipal emissions measurement.

Social use of an urban municipality implies the production and consume of utilities. A good is produced (P) to allow utilities to be developed (U) and to be consumed by inhabitants (C). Throughout the production of goods, greenhouse gas emissions are emitted. These emissions can be produced during the extraction process of raw materials, during the manufacture process, during the transport of the products, etc. and also during the use or consumption.

CO<sub>2</sub> emissions of the economic process can be considered in two different ways. The first one consists of attributing the emissions where they are physically emitted (P) and the

second one consists of attributing the emissions, which were emitted in order to obtain a good or service, to its utility (U-C).

The “Kyoto Protocol” (1997) is an example of the first case, since it attributes to each country the emissions physically produced in the country. Otherwise, the carbon footprint concept is an example of the second case, since its methodology considers that the final utilities (consumer goods or services) are responsible for all those emissions which have been necessary to make possible their existence.

From the point of view of sustainability, the second way to measure emissions is more appropriate than the first one since the second one considers the environment impact associated with final utilities, i.e. the environment impact associated with human needs. Measuring and limiting this impact is the right way to achieve “sustainable development” as it is defined in “Our Common Future” (1987).

In this paper, we set out three alternatives, with different meanings and results, to define municipal emissions: According to the territorial productive boundary (P); according to the activities or utilities created (U); and, according to the community of consumers (P).

It is clear that these three phases of the economical process do not always occupy the same geographical areas and rarely are within the same administrative boundaries. That is why the correspondent emissions are so different.

### 3.1. P Scenario

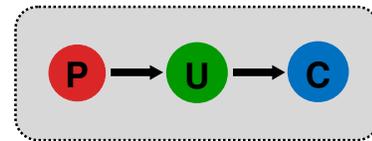
[P] In first place we approach the “territorial” dimension of the municipal emissions.

This first scenario would take into account only the emissions that are physically produced in the municipality. The emissions would be associated to all the energy that is there produced at all the existing buildings and infra-structures. In this scenario places with electric centrals or polluting industries for exportation assume the emissions that other places “consume”.

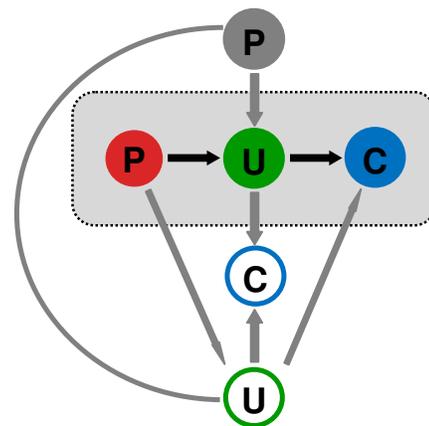
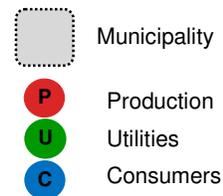
The emissions here counted are related to the local metabolism of the area in analyse, ignoring the import-export flows of the urban society.

This means that the emissions associated to the final utilities are not counted, what is inappropriate to implement sustainability.

Observing the figure, only the emissions related to the internal Production would count.



Figures 1-4:



### 3.2. U Scenario

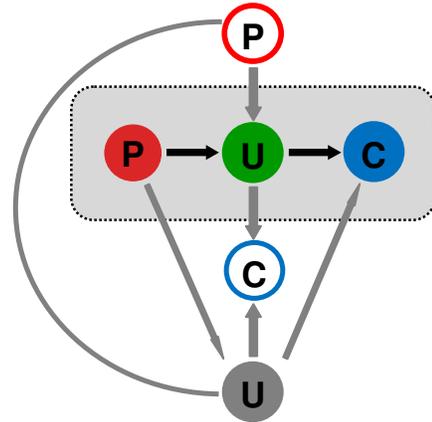
[U] The second scenario approaches the “functional” dimension of the municipal emissions.

This scenario takes into account the emissions included in the utilities provided in the limited territory. The emissions of the utilities within the municipality count independently from the origin of the consumers of these utilities or of the products used.

For example, the electrical energy consumed to provide habitability inside a municipality has associated emissions that can be produced outside from its limits.

However, in this scenario these emissions are attributable to the municipality which provides the final utility, i.e. habitability. This seems appropriated to the responsibilities that a municipality has over its jurisdiction area.

Observing the figure, only the emissions related to the internal Utilities would count.



### 3.3. C Scenario

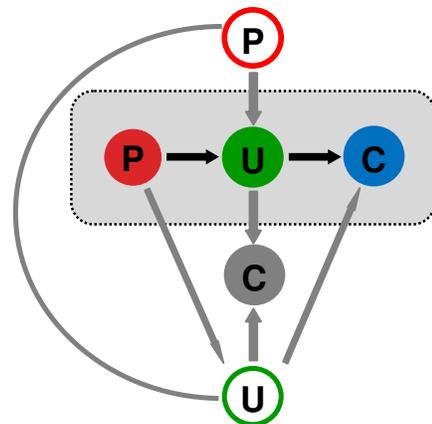
[C] The third scenario approaches the “social” dimension of the municipal emissions.

This last scenario takes into account the emissions related to the consumption by the inhabitants of the municipality. The emissions depend on the behaviours of the municipal community, inside and outside from the area in analyses.

This approach is related to the individual and social choices and does not have a direct correspondence on the physical limits of the municipality, in this sense it is only applicable per capita basis.

In this case, the emissions associated with a second house, for example, would be attributable to the consumer who uses the house and not to the town where the second house is located.

Observing the figure, this means that only the emissions related to Consumers would count.



We can organize these three scenarios according to the type of metabolism, the target of action and the ways and instruments of control. The table on the next page offers a full view of the scenarios and its relations with forms of acting for sustainability.

Scenarios	Metabolism	Target	Ways of control	Instruments of control
<b>P</b> -PRODUCTION	Territorial (industry)	emission focus (processes)	Auditing	Polluter-payer & Kyoto Protocol
<b>U</b> -UTILITIES	Functional (city)	Space (infra-structure)	Designing, Planning and regulating	Covenant of Mayors
<b>C</b> -CONSUMPTION	Social (people)	behaviors (consumption)	Personal limited emissions	Personal Carbon credits

Table 2 – Scenarios of measuring and controlling municipal emissions

In conclusion the U scenario is the best to define urban municipal emissions, since it is focused on the utilities provided by urbanization. These needs are satisfied inside the urban territory but can be produced outside, and consumed by inhabitants that don't belong to the city. In reality, this is the essence of the urban phenomena: to import and export products and consumers, to make them accessible to each other at a low mobility cost.

However, few inventories of CO<sub>2</sub> emissions of urban territories assume this scenario totally. On what concerns to energy, in some cases emissions are already counted where there are the utilities that imply them (where final energy is consumed), rather than where they are produced (primary energy). However, on what concerns to mobility this approach is harder to put in practice.

Mobility occurs to provide accessibility, so it is a “secondary utility” that serves other utilities such as housing, employment, education, etc. Mobility emissions should be then allocated to the utilities that imply them. This exercise is complex because mobility circuits generally serve several activities at the same time.

Most of the inventories on mobility emissions are done on the “P” model, counting focus of emissions inside the urban areas, ignoring the activities on which they are implied and if they were related or not with the urban planning decisions. So, in reality, what we have available is a Scenario P+U.

This point of view has consequences on urban planning for sustainability because implies to see planning not only as science of location of activities, but also as a science that estimates the demand of utilities associated to these activities, as also the contamination implied.

One relevant instrument to apply this point of view is the recent “Covenant of Mayors” (2009), which will be discussed in the next section. This Covenant, even being innovative and ambitious, faces big methodological challenges on measuring and controlling municipal urban emissions.

#### **4. Problematic of defining municipal urban emissions at the Covenant of Mayors**

##### ***4.1. Political Homogeneity, real heterogeneity: a unified target***

Like several other European actions devoted to the 27 different State Members, the covenant of mayors, while committing all the cities on 20% of CO<sub>2</sub> emissions reduction, implies homogeneity.

On the one hand such homogeneity gives strength and unity to the pact, but on the other hand it turns hard to establish comparisons while joining all the regions “over the same hat”.

The fact that the target of 20% is equal for all 27 members of UE is remarkable, once it is known for long that Northern Europe has a much longer tradition of counting and mitigating CO<sub>2</sub> emissions than Southern Europe. Furthermore, northern Countries have higher energetic demand, what gives them a higher potential of reduction. To remind these conditions is important to understand the meaning that the pact will have in different Member States, and in particular in Southern Countries.

For example, in some Portuguese municipalities the pact was used as a motivation for changing practices and to legitimate the work already developed by environment and energy agencies. Technical teams at these municipalities while assuming that it will be impossible to achieve the target, stand that it is important and relevant to join the pact, yet.

For Portugal, the scenario is particularly interesting: under the Kyoto Protocol, the Nation was allowed to increase on 27% of emissions over the values of 1990 from 2005 until 2012, but at the same time, the Portuguese municipalities which signed the pact committed their territories to reduce emissions on 20% from 2005 till 2020.

In reality, these are not contradictory commitments, considering the time lap and the differences between the emissions that Kyoto accounts and the ones that the Covenant aims to account. Kyoto has for target all the emissions of a Nation, while the Covenant is focused on municipal urban emissions, related with the metabolism of cities.

#### ***4.2. Territorial and Globalized Infra-structure: local targets for a global reality***

Due to globalized capitalism, urban networks are not any more provided by state local monopolies, rather than by globalized companies of energy, telecommunications, transports, waste, and even regional companies of water. This splintering of the urban networks is fundamental to understand the urban condition of nowadays and to discuss the role of urban planning (Marvin & Graham, 2001).

Almost the totality of the world territories has been urbanized, but the control of infrastructures of urbanization belong to few enterprises, international corporations that supply municipalities on energy, water, roads and telecommunications and over cross the power of the states.

Water in Portugal can be supplied by a French company and energy by a Spanish one, through networks that are not neither national nor local, allowing the liberalized market of urban networks to design the globalized territory and the new urban landscape.

With the exception to rarely self built local infra-structures, the networked infra structure is globalized and often even out of local jurisdiction. Some residual control can be operated by municipalities, but suppliers are out of their frontiers and out of their commitments.

In this scenario, most of the emissions that a city “consumes” are not emitted inside its borders, neither controlled by its forms of governance. This is a clear consequence of the urban revolution that is arriving to its full accomplishment (Lefebvre, 1983).

To deal with the global urban scenario a big quantity of information is needed to inform on direct and indirect urban emissions. This information is hard to achieve, to manage and to select, because it is still complex to define which emissions “belong” to an urbanized municipality or region.

The idea of focalizing carbon emissions on a municipality which the Covenant embraces, encourages municipality autonomy, but is quite in opposition to the dominant economic trend of globalized infra-structure. This local commitment is an interesting base to discuss the

contradiction between global urbanization and local sustainability. In our opinion this contradiction would not exist if local sustainability would be considered on the point of view of the U scenario, where emissions are associated to utilities.

#### ***4.3. Which kind of municipal planning can implement the targets?***

Adding to the complexities of globalization, the implementation of the Covenant also lacks basic guidelines for planning and action. Municipalities started acting by themselves through municipal energy agencies, urban planning, strategic development plans and laws, without knowing which ways would be more efficient.

Within the Portuguese municipalities some energy agencies have been implementing the Covenant; however, such agencies have a very restricted power of action, since that effective plans on structuring the territory come still from an urban planning with few links to environmental or energy agencies.

Conventional urban planning, more than a way to implement the targets of the Covenant is sometimes a barrier to achieve more sustainable and less carbon intensive uses of the territory and cities. In exceptional cases, municipal urban laws helped to make possible to implement the covenant not only through punctual actions, but also through the current urban management that regulates daily the local building activity.

There is not a common agreement, neither enough experience about how municipal urban planning could adapt to the covenant of mayors to achieve at least partially its targets. This uncertainty results from the problems arising from unified and local targets for a diversified and global reality, but also from the absence of a framework to the integration of carbon emissions in municipal urban planning. Without this framework the strategic and urban planning actions, such as diagnosis, definition of objectives and evaluation of measures, lack trustful orientation for reducing CO<sub>2</sub> emissions.

The framework presented is based on the identification of the differences between the scenarios P,U, and C, and on the recommendation of the U scenario as the central approach to select municipal urban emissions on a trustful way. Once accepted this point of view it can be applied to strategic objectives and to urban planning evaluation.

## **5. Conclusions**

Everything on current urban planning points to an increase of emissions instead of reduction: amplifying of road and parking infrastructures emitting more and damaging public space; soil sealing reducing emission absorption and damaging ecosystems. When urban planning faces the challenge of 20% of CO<sub>2</sub> emission reduction, in few more than 10 years, it can only "turn around 180°" on its methods and practices.

One of the main conclusions of this paper is that conventional urban planning is not prepared to restrict CO<sub>2</sub> emissions of a municipality, partially due to its loss of control over the urban reality, and partially due to the absence of tools and visions for measuring and controlling urban municipal emissions on a trustful way.

Planning evaluation tools have to be reshaped in sight of restriction of contamination, in particular of CO<sub>2</sub> emissions. The framework here established identifies and organizes the urban utilities that can be ruled by urban planning, preparing a basis where to apply sustainability objectives and actions.

Another relevant conclusion of this paper is that sustainability – and specifically CO<sub>2</sub> emissions - should be measured and that the way they are measured and controlled is determinant on the results.

Measuring and controlling are necessary tasks for diagnosing actual state like for estimating results and evaluating planning options. For all the phases feasible tools of accounting and reliable sources of information are needed.

This paper has shown that the appropriated methodology to measure municipal emissions should tend to consider all the emissions attributable to final activities instead of the emissions physically produced inside the municipal borders.

Furthermore it was also remarked that sustainability can only be achieved if specific strategic objectives are defined and verified, to conduce planning decisions to the reduction of CO<sub>2</sub> emissions on the territory or city.

Finally, we observed that an important international commitment as the Covenant of Mayors had a remarkable acceptance, even based on a strategic target (20% - 2020) defined without enough detail and without reliable tools to achieve it, and for which the framework presented can be particularly useful.

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