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An assessment of the principle of subsidiarity in urban planning to face climate change

The case of Martellago, Venice Province

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Abstract

Purpose – The purpose of this paper is to present a case study, showing a local government's capacity in addressing energy consumptions and local greenhouse gases (GHG) emissions in its administration areas. This case demonstrates some strengths and weaknesses in the actions of local institutions to complement the national and European efforts in addressing climate change problems.

Design/methodology/approach – The paper starts by considering the need to address global changes by a multi-level governance system, in line with the subsidiarity principle proposed by the European Commission for the implementation of its policies. According to this principle, different institutional levels should intervene through control and reduction of GHG emissions from their operational scale. In particular, this paper reports an ongoing activity of urban planning carried out by a local municipality of Northern Italy, Martellago (Venice Province), that has focused on the energy and GHG reduction as a priority.

Findings – The analysis identified some topics to be addressed by urban plans; their higher or lower effectiveness in respect to the climate change adaptation and mitigation needs; and some constraints to be addressed by an enforced integration of different administrative levels of governance.

Originality/value – This paper shows the importance of local planning in climate change issues, which is seldom considered, particularly in practice. In fact, while the elaboration of energy and urban plans is not mandatory for small municipalities, some voluntary actions – like for Martellago – show that their wide applications could contribute importantly to the efforts to decrease GHG emissions.

Keywords Climate change, Italy, Local government, Global warming, Energy management, Sustainable development

Paper type Case study

1. Introduction

Climate change represents one of the main threats to mankind and has been addressed primarily by the United Nations Framework Convention on Climate Change (1992), having the Kyoto protocol (1997) as a milestone, and enforced by following international mechanisms (Clean Development Mechanism, Joint Implementation and Emissions Trading) and agreements, either bilateral, or through other international conventions (on biological diversity, to combat desertification, etc.). Widespread actions have been

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taken at the different institutional levels. At the international level, the EU has a leading role in combating climate change and for stimulating other countries to take consistent action as well. There is a general awareness that if the problem of local greenhouse gases (GHG) emissions reduction is not tackled seriously, the consequences will be very damaging for the global environment, the economy and the international security (European Commission, 2005).

Mitigation and adaptation efforts respect to climate change issues need a multi-level governance, by cooperative actions at the different institutional scales. National institutions in fact delegate some functions to regional and local governments, to support and contribute to the overall effort to reduce GHG through their own policies and actions. There are a number of ways in which regional and local authorities can influence the amount of GHG emitted on their territory, e.g. through their spatial planning and transport policy, by encouraging energy-efficient construction and the renovation of energy-wasting buildings and by promoting renewables.

Italy is also adopting measures to control GHG sources: particularly carbon dioxide (CO_2), contributing 85.5 per cent to the total national GHG emissions expressed in CO_2 equivalent, but also nitrous oxide, 7.4 per cent and methane, 6.1 per cent (Italian Report, 2007). Nowadays, Italy contributes for nearly 2 per cent of the earth emissions, and 13 per cent of the European Union's actual emissions (Italian Report, 2007).

New rules and institutional settings have been introduced as a follow up to the European strategy on Climate Change, such as the Legislative Decree n. 112, 1998, the Veneto Regional Law of 2001, and the creation of decentralised Energy Authorities. Moreover, pre-existent regulations in the energy field, which were involving local government authorities but yet insufficiently applied, have been enforced. An example, related to the urban planning field, is Law n. 10 (1991), stipulating that comprehensive urban plans must contain municipal energy plans (MEP), with the aim to utilise the energy component as a means to ameliorate the environmental state of the towns, by influencing either settlements, transport or environmental choices, and by promoting the rational use of resources and the use of renewable sources. Although this norm is not recent, it is only recently that local institutions have effectively started complying with it.

The next section will present an overview of these changes, to clarify the relation between the Italian national legislation and the lower institutional level. In particular, urban planning tools will be considered, as the most effective means to govern the territory and control GHG emissions from residential and urban traffic sources. One particular experience of urban planning in Martellago (Venice Province, Italy) will be presented, aiming to reduce energy consumptions and to mitigate GHG emissions from its internal sources.

2. Methods and description of the case study

The first analysis is devoted to the legal and institutional framework, to assess how the subsidiarity principle works in climate change adaptation and mitigation policies. A particular focus will be given to the legal and institutional framework in Italy and to the distribution of responsibilities between national and local authorities.

The second analysis focuses particularly on a current experience of urban planning coupled with energy demand control in Martellago, to assess how local government authorities in Italy can operate to achieve the GHG emissions reduction goals.

Local authorities at the lowest levels are practically engaged in addressing energy consumptions and GHG emissions through the MEP, although their tools encounter several limitations as they intersect domains of competence of other institutions. Opportunities, but also constraints, will be considered.

2.1 Legal and institutional analysis

The subsidiarity principle is one of the key principles of the European Community legal framework introduced by the Maastricht Treaty in 1992 (Art. 5 of the EC Treaty and Art. 2 of the EU Treaty) and by the Amsterdam Treaty in 1997. This principle is intended to ensure that decisions are taken as closely as possible to the citizen. Specifically, it is the principle whereby the Union does not take action, except in the areas which fall within its exclusive competence, unless it is more effective than action taken by Member States (CdR 191, 2006).

In Italy, policies on climate change over the years have shifted from voluntary commitment to obligatory GHG emissions reduction (Massetti *et al.*, 2007). In fact, following the ratification of the Kyoto protocol, Italy has a legally binding commitment to reduce GHGs emissions by 6.5 per cent below the 1990 levels (equal to 519.75 million tons –Mt- of $C0_2$equation), over the period of 2008-2012 (Parliamentary Act n. 120, 2001). The main sector to be included in domestic policies is the energy sector, accounting for 83.7 per cent of total national GHG emissions, followed by industrial processes (6.9 per cent), agriculture (6.8 per cent) and waste (2.2 per cent).

The current national strategy, developed in compliance to the European legislation and international agreements, is still under review, and this influences the effectiveness of measures already taken and those not yet in action to be adopted. In 2006, Italy was part in a group of seven countries, which would not be able to attain their Kyoto targets through the planned additional domestic policies and measures; therefore, in 2007, it planned to compensate the gap by using carbon sinks and Kyoto mechanisms (Environmental Agency Report, 2007). The Italian *National Action Plan for 2003-2010 for the Reduction of GHG Emissions* (Parliamentary Act n. 120/2002 and CIPE resolution, 2002) appears quite fragmented and suffers from significant implementation delays which, according to the central government, is mainly due to the opposition by local authorities in approving the industrial and infrastructure projects at the basis of these policies (*Italian Forth National Communication*, 2007).

On the contrary, as this paper explores, local commitment towards GHG emissions reduction is on the increase and a deeper understanding of consequences and of climate change is undergoing more research. The pro-active role of local authorities is due to the following reasons:

- *Political drivers*. Local decision makers are getting closer to the citizens and influenced by their opinions, which are more and more environmentally sensitive and aware about the relation between local behaviours and global effects. The problem of global warming, diffused through national media and worldwide events, is well present in public debates and affects the daily practices of the citizens, who are willing to contribute by energy-saving measures.
- *International promotion*. The most active local authorities get linked to international networks and campaigns (such as ICLEI, the European network Energie-Cités, or the Sustainable Energy Europe Campaign), that give high visibility to local best practices in sustainable development.

- *Technical expertise*. Environmentally sensitive consulting firms, cooperatives and research groups are playing a role in the design of sustainable projects to be implemented by local administrations. They provide important technical supports, as well as influences, towards better environmental performances in urban centres.
- *Economic drivers*. Local municipalities have a direct interest in abating their energy costs in public buildings under their administration (such as offices, libraries, swimming pools, childcares, maternal and primary schools); and to promote the energy efficiency in the residential buildings of their territory. As for private residences, besides an incentive system based on tariffs, a positive impulse to invest in energy saving is given by the calculations of the "pay back time", showing that the recuperation of renovation costs is possible in few years (Fabbrica del Sole, 2006).

The MEP of Martellago is just one of the virtuous examples of local initiatives to seriously tackle climate change, aiming at introducing the energy factor as a fundamental aspect of the entire planning and management of the urban territory.

Law n. 10 of 9 January 1991 on urban planning is relevant in our perspective. Many local administrations redesigned their internal rules and regulations, according to a redistribution of responsibilities among regions, provinces and municipalities. In general terms, the regional governments maintain the functions of establishing guidelines and coordinating all activities, while the planning and management functions are transferred to the next lowest administrative level (Regional Law n. 11, 2001). Within the same time period, the regions have to adopt, in agreement with local entities and industries, the regional energy plan on the use of renewable energy sources (art. 5 (2) of Law 10/1991). The Veneto Regional Law n. 25 of 27 December 2000 envisages the norms for regional energy planning, incentives for energy saving and the development of energy renewable sources.

Law n. 10 of 1991 also prescribes that the general urban plans for city areas of more than 50,000 inhabitants must define a specific municipal planning tool, which should also include the regulation of use of renewable sources of energy that is the MEP. The general aim of the MEP is the integration of energy factors in territorial planning, to promote strategic choices for the amelioration of the environmental state of the urban area and for the promotion of the rational use of resources, in line with sustainable development principles. This approach, which is still rarely applied in Italy, significantly changes the procedures of territorial planning and management, as it does not only respond to dimensional limitations, but it is a new entry point of planning from its earlier stages, by innovating decision processes methods, to respond to settlement, environment and transport needs.

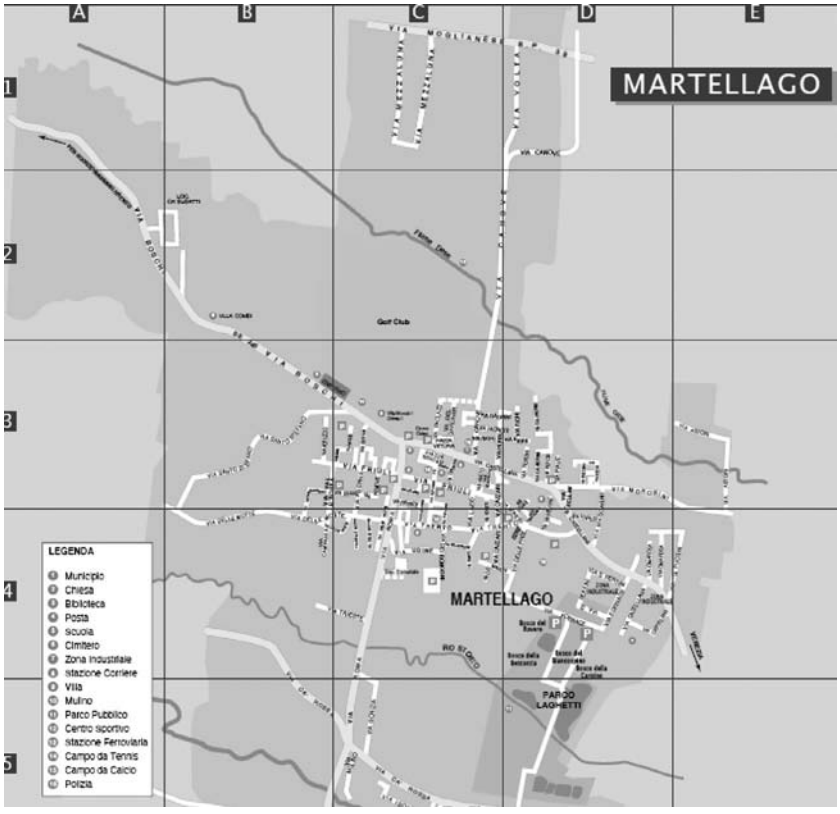
These mentioned rules have stimulating effects also for smaller administrative units. This is the case for Martellago, about 20,000 inhabitants, which – together with other proactive municipalities of the same dimension, in other regions (e.g. Collesalvetti, Livorno Province, and Melegnano, Milan Province), is defining its policy on climate change based on both adaptation and mitigation measures and in the framework of an highly integrated sustainable urban development including economic, social and spatial elements, as well as environmental aspects.

2.2 Urban planning tools

The Martellago case is a first experience of coupling the urban development needs with the environmental needs, by mainstreaming the energy-climate change policies in the whole planning process. The MEP will offer greater efficiency of the national GHG decrease and climate change mitigation efforts, and a more coherent harmonization of adaptation efforts at national and local level.

Martellago (Figure 1) is characterised by a growing urbanisation trend, a marginalisation of the agricultural activities and by an intensification of the road traffic. Its area is part of the drainage basin flowing into the Venice Lagoon (Figure 2) and, therefore, it is integrated in a wide and relevant environmental system, managed by the plan of lagoon wide area and Venetian area (*Piano d'Area della Laguna ed Area Veneziana*).

The territorial government of the municipalities of the Veneto region are generally ruled by the Plan of Territorial Order (*Piano di Assetto del Territorio* – PAT), a planning scheme foreseen by the Regional urban Law 11/2004. For the preparation of the PAT 2006, the local administration of Martellago considered to enrich the planning tool with indicators responding to the sustainable development principles. The PAT of Martellago needed to consider two primary factors: the territorial positioning as urban belt, favouring



Source: Areagroup Editore (2007)

Figure 1.
Map of Martellago

Figure 2.
Location of the study area

Source: SEAT (2007)

a low-density expansion and hosting a reallocation of tertiary functions from the Venice central area; and the proximity to the lagoon, posing peculiar environmental values. Therefore, and in line with a recent urban planning debate (Oliva, 2004; ICLEI, 2007), the GHG emissions have been considered as the main indicator for the intrinsic quality of the plan; also coupled with another local priority need, to enhance the natural river drainage systems towards the lagoon.

Two strategic goals have been set: the first one is to decrease the CO_2 emissions, respecting the main targets of the Kyoto protocol for Italy (reduction of the total GHG emissions, equivalent to 6.5 per cent of the 1990 levels by the period 2008-2012) for the local share; while the second one is to implement a settlement development at "zero impacts", in order to couple urban growth without depleting the environmental conditions.

To achieve these goals, a focus was given on three sectors, where the municipality could have better performances: the residential sector, the green areas, and the streets network. The respective outcomes can be summarized as follows:

(1) amelioration of energy efficiency in new buildings as well as in buildings under restoration, in line with the Directive 2002/91/EC;

(2) establishment of new green areas to compensate emissions from all new GHG sources and to enhance the green-belt protecting the Venice Lagoon and constituted by the Laghetti Park; and

(3) optimization of street networks in order to reduce the traffic and the relative emissions, and insertion of intensive vegetation belts along the streets in order to absorb the produced GHG (Shackley *et al.*, 2007) and to control pollution from PM10 (Air Quality Expert Group, 2007).

3. Main results of the planning exercise

The plan for Martellago is formed by five main components:

(1) analysis of thermal needs of the final users, particularly in the building sector;

(2) assessment of the capacity of the present vegetation to absorb CO_2 shares;

(3) analysis of traffic mobility and other localized GHG production factors;

(4) production of a municipal energy balance and definition of needed actions, also by comparative economic evaluations; and

(5) transfer of competences to the relevant technical administration offices.

It is important to highlight that the planning process is still ongoing; while it has finalized the first three components, the other two are still under discussion within the responsible authorities.

The next sections summarize the three main chapters that the PAT has elaborated, aiming to rule the following sectors: the residential sector, the green areas and the road network.

3.1 Emission control from the residential sector

An assessment of the current GHG emission from this sector has been implemented comparing the 2006 levels with those of 1990. Each building of the municipal area has been geo-referenced and grouped according to their construction period. Each age class shows a different pattern of energy transmittance and yearly thermal need. This estimation has been realized through the attribution of transmittance values (expressed in W/mq K°) and of annual thermal needs values (expressed in kWh/m^2 year) to the different clusters of residential buildings.

The assessment relieved the physiological amelioration of the energy characteristics of the buildings (Autorità per l'Energia Elettrica ed il Gas, 2004), by considering the house covering and the utilization of different heating systems (Balaras *et al.*, 2007).

The application of provisional models (Della Ragione *et al.*, 2005) allowed to evaluate, for the year 2012, the levels of CO_2 emissions as 10.307 tons, while the data for the reference year 1990 marked emissions of 11.807 tons. Therefore, the forecast, only attributable to the technological amelioration, is equal to 12.7 per cent, but it is even more significant if we consider the population growth from 18.506 inhabitants in 1990 to estimated 21.055 units in 2012 (+13.8 per cent). In this perspective, the evaluated CO_2 emissions per capita will drop from 0.64 to 0.49 t/year.

Such result will not only be ensured by the change of energy values and by improved heating technologies, but also by a larger application of new building regulations introducing a mandatory energy certification for each building. As reported by other international experiences, economic considerations (e.g. tariffs decrease) have to be made clear to the public in order to provide incentives to renovate the households in line with energy labels (Gram-Hanssen *et al.*, 2007).

3.2 The vegetation capacity to fix consistent CO_2 shares

The green component can counterbalance the anthropic emissions of CO_2 produced by heating plants, transport means and new real estates. This is done by the absorption capacity of the vegetation biomass and organic substances to the soil (McPherson, 1998).

The first step is the calculation of the added emissions, encompassing the following inputs:

- the primary energy need (kwh/m^2 year) of the new building areas;
- the number of equivalent inhabitants;
- the superficies (in m^2) of the new buildings;
- the energy vectors utilized for heating purposes and their CO_2 contribution; and
- the relocations generated by the new settlements and caused by added number of population.

The second step is aimed to assess the available green areas within the municipal area, both in order to evaluate its compensation capacity with respect to the current emissions, and to draw strategic indications for new interventions. Three main green structures are observed in the territory of Martellago:

(1) forest areas of great dimension;

(2) trees outside forest areas (e.g. hedges, hedgerows, plantations); and

(3) private green in areas of low-inhabited density (Paletto *et al.*, 2006).

The third step regards the assessment of the atmospheric CO_2 fixation capacity of the vegetation systems as a function of plant density, superficies of vegetation units, parcel types and annual efficiency, respect to the urban planning for the expansion areas. In this way it has been possible to establish the extension of green areas to be assigned to the municipal administration, and to give punctual indications for the realization of private green areas that can be functional to the objective of decreased emissions. Positive synergetic aspects are also considered with respect to the goal of air quality amelioration (Air Quality Expert Group, 2007).

3.3 Emissions control and fixation within the local road network

This sector has two main components: one related to the analysis of the emissions depending on the vehicles stock, and the other related to the absorption capacity within the physical street network, either in terms of traffic rationality, but particularly through insertion of vegetation belts.

A first step was to quantify the current CO_2 emissions derived by the local transport means, then to estimate the future emission trends by a traffic increase due to the demographic growth; and finally to set up a target objective to reduce the emissions.

Data on emissions have been obtained comparing the population increase with some economic coefficients recorded by the Venice Province Chamber of Commerce for the years 1991-2001 (Sistema Informativo Camerale, 2001). For the analysis of future trend for the year 2010, the reference model is based only on a correlation index between the vehicle stock improvement, related to a GDP growth of 2 per cent, and the population, with a light decrease in the growing trend of the car stock (Berta *et al.*, 2000). To evaluate the per capita emissions originated by the local residents' mobility, the planners have excluded the relative values for the heavy vehicles > 3.5 t, which have to be calculated within the burdens of their respective economic sectors. The obtained value was then divided by the 2010 estimated population. The result for the municipality of Martellago is an emission charge of about 1,050 kg CO_2eq per year per inhabitant.

This reference value has been compared with a series of alternative viability solutions, capable of reducing GHG and having different social, economic and landscape impacts. The selected solution is foreseen to allow a significant decrease from 8,819 t/year (do nothing scenario) to 4,856 t/year.

These values only consider the emissions from the control of the primary transport network referring to the Municipality; while the total transport emissions caused by wider networks, like motorways and other roads, and causing impacts on the same municipal area, will reach a level of 54,000 t/year by 2012. This is one of the main constraints to a more effective impact of policies decided at the local governmental level.

The other proposed interventions are based on a choice among vegetation structures to be inserted along the principal viability axes and for protection of the main residential areas streets, and that were also considered as functional when capturing the suspended particulates: PM10 in particular, which is dependent on vehicles emissions, suspended dusts, organic material dispersed by vegetations, inorganic material produced by natural agents, industrial processes and combustions in general. As seen in the previous section, leaves operate as air filters by fixation of the atmospheric dust particles. The depuration effectiveness is certainly linked to the volume of the foliage, but also to other intrinsic and extrinsic characteristics of the plant, allowing absorption of polluting agents, modification of atmospheric characteristics and separation of the source and the recipient entities (Pirani, 2004).

4. Remarks and future steps

This research is in line with the "sustainability sciences", integrating research and action and spanning spatial scales and diverse phenomena such as global changes and local consumption practices (Lahsen and Nobre, 2007). According to this approach, production and diffusion of knowledge are not limited to the analytical aspects but have a planning scope; in fact a first result has already been seen: the formulation of an urban plan for Martellago, aiming to the minimization of the local GHG emissions. This cutting-edge experience, particularly since Martellago is a small town for which the MEP is not mandatory, has allowed to bridge the traditional gap between policy makers and scientists. Moreover, an interdisciplinary effort has been undertaken by encompassing legal, urban, geographical and environmental sciences.

The first analysis has regarded the legal and institutional framework regulating the distribution of responsibilities and tasks towards decentralised bodies, in order to achieve the GHG decrease in line with the commitments made by the Italian Government with the EU and with the Kyoto signatories states. Policies at all levels are critical in providing incentives to virtuous habits and to promote technological changes, in order to reduce the consumption of fossil fuels and, therefore, GHG emissions. The cooperation among different levels of governance, as an application of the subsidiarity principle, can overcome policy constraints that might appear at the various scales.

Small centres can play – and actually play – a great role in the mitigation of effects related to global changes. Even in small administrative centres, there are relevant responsibilities and capabilities that can lead towards the achievement of regulations and strategies at the national and European level.

Local planners and institutions can evaluate what sectors can be better regulated locally and by which planning tool. The energy sector, in the Venice Province like at

the national level, is the main contributor to the current emissions levels; therefore under the local circumstances, the most relevant tool to be formulated is the MEP. This is based on an analysis of the baseline emissions that the plan aims to regulate and decrease according to set targets.

However, local centres have clear limitations, in case of sources spatially located in their territory but belonging to higher administrative pertinence, such as, for example, industrial and power plants, state roads, etc. For these sources, the considered local authority has no suitable means to contrast the emissions' loads. The road transport sector is the weakest sector to be ruled by a public administration, despites its responsibility for growing emissions in the entire EU (European Commission DG Environment, 2007). Means like congestion changes, public transportation, support for biofuels, etc. are being addressed by the province level and not by the municipal level. It is then necessary that the local levels can strengthen their capacities for monitoring/alert for those emissions that they do not directly control.

In a next step, indicators will be proposed to assess the effective impacts of this planning exercise in 3-5 years, and mechanisms will be designed (e.g. through databases and decision support systems) showing the consistency of policies at the different institutional level and improving mutual cooperation.

Expanding the results outside the municipal area will strengthen the effects of this plan in terms of reduction of GHG, particularly for those sources that originate outside Martellago. Finally, the process will need to be further enforced by a knowledge sharing with the local populations, to strengthen awareness about the need to decrease the emissions depending on their energy consumption behaviours in daily life.

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