Energy Policy 38 (2010) 4838–4847

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Emission inventory: An urban public policy instrument and benchmark

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ARTICLE INFO

Article history:
Received 23 February 2009
Accepted 1 October 2009
Available online 25 November 2009

Keywords:
Greenhouse gases
Municipalities
Inventory

ABSTRACT

Global concern with climate change has led to the development of a variety of solutions to monitor and reduce emissions on both local and global scales. Under the United Nations Framework Convention on Climate Change (UNFCCC), both developed and emerging countries have assumed responsibility for developing and updating national inventories of greenhouse gas emissions from anthropic sources. This creates opportunities and incentives for cities to carry out their own local inventories and, thereby, develop air quality management plans including both essential key players and stakeholders at the local level. The aim of this paper is to discuss the role of local inventories as an urban public policy instrument and how this type of local instrument may bring advantages countrywide in enhancing the global position of a country. Local inventories have been carried out in many cities of the world and the main advantage of this is that it allows an overview of emissions produced by different municipal activities, thereby, helps decision makers in the elaboration of efficient air quality management plans. In that way, measures aimed at the reduction of fossil fuel consumption to lower local atmospheric pollution levels can also, in some ways, reduce GHG emissions.

1. Introduction

The increasing emission of greenhouse gases (GHG) is believed to be responsible for global warming and recently it has been attracting the attention in many different parts of the world, resulting in increased legislative requirements on a global basis. Although localized effects are not directly generated by GHG, wherever they are emitted in the world, they cause climate alterations (Baede et al., 2001). So, the concerns about global climate change have resulted in the development of a variety of solutions to monitor and reduce emission in global and local scales. In local scale, air pollution has also been one of the major environmental problems in big cities, affecting health of thousands of urban residents (Jain and Khare, 2008; Kimmel and Kaasik, 2003; Peng et al., 2002; Venegas and Mazzeo, 2006). Other environmental impacts include damages to buildings and structures, agriculture crops, and vegetation and forests; reduced visibility; and even increasing greenhouse gas emissions (Kojima and Lovei, 2001). Therefore, the possibility of the quantification of local emissions has become an important element in understanding the problem and searching for solutions.

Under the United Nations Framework Convention on Climate Change (UNFCCC), both developed and emerging countries have assumed responsibility for developing and updating national inventories on GHG from anthropic sources. In accordance with the principle of common but differentiated responsibility, only the countries listed in Annex I of the Convention currently have commitments to reducing or limiting emissions. However, it is recognized that the countries not belonging to this group will contribute to the increase in greenhouse gases emission in social and economic development. So, amongst the commitments assumed by Brazil under the UNFCCC is the regular development and updating of national inventories of anthropic emissions and removals through sinks of the greenhouse gases not controlled by the Montreal Protocol. The first Brazilian National Communication prepared in accordance with the Intergovernmental Panel on Climate Change (IPCC) was released in 2004 at the 10th Conference of the Parties of the UNFCCC in Buenos Aires. The document contained the first Brazilian greenhouse gases inventory and covered the period of 1990–1994 (MCT, 2004).

In the methodology from IPCC, the sectors are inventoried from a national perspective and it does not allow the particularities associated with cities and metropolitan regions to be identified. The inventory produces information in an aggregate form on the energy, residue, forestry, agriculture, livestock, industrial processes and product use sectors. The desegregation of these sectors in relation to municipalities would create opportunities and it stimulates cities to carry out their own local inventories, allowing the identification of the most effective areas of action and the preparation of more feasible public policies,

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doi:10.1016/j.enpol.2009.10.002

leading to the development of effective and efficient local air quality management plans including essential key players and stakeholders.

The aim of this paper is to discuss the role of local inventories as an urban public policy instrument and to know how this may benefit countries and cities by diminishing local pollution levels and contributing to reduce, in some ways, GHG emissions whilst helping local public administration. This analysis was made based on the examples of two important Brazilian cities: Rio de Janeiro and São Paulo.

2. The climate problem and cities

The Fourth Report of the Intergovernmental Panel on Climate Change (AR-4, IPCC) states that CO_2 concentrations have reached 370 ppm, an increase of more than 35% in relation to the beginning of the Industrial Revolution (IPCC, 2007). According to AR-4 it is almost certain that this increase is associated with the greenhouse effect caused by man, i.e., anthropic effects, due to GHG emissions and economic activities.

At the present moment developing countries do not have any obligation to reduce their emissions of greenhouse gases; however, the commitments and goals finish in 2012. They are currently being re-negotiated and countries without goals, i.e. Brazil, may have to reduce their emission levels if a second commitment period for the Kyoto Protocol is agreed in Copenhagen.

In general the proposals that deal with the participation of developing countries accept that different types of countries must have distinct types and/or levels of commitment. Different criteria for setting goals have been advanced, such as per capita income, emissions, emissions per GDP unit, historical population emissions and current emissions, amongst others. These criteria demonstrate that annual emissions do not represent a good approach to responsibility for climate change, and they further suggest alternative applications of the principles of common but differentiated responsibilities and the 'polluter pays' when considering the establishment of limits for GHG emissions from countries listed in Annex I of the UNFCCC due to their responsibility for the temperature increase in the planet. Another proposal to be discussed in the negotiations for the second commitment period is the subdivision of the Non-Annex I countries in order to allow a greater differentiation of responsibilities and capacities among the countries that form this group as a motivating factor in the negotiation process. Something that has also been stressed is a new form of active participation of Non-Annex I countries related to the attribution of qualitative and not quantitative targets, notably in relation to policies and measures aimed at the reduction of GHG emissions.

Due to the concentration of population in major urban centers in developing countries, cities consume most of the energy produced to meet transport, commercial and industrial activities, heating and cooling demands. Consequently, solid wastes and residential, commercial and industrial effluents are mostly produced in urban agglomerations, as well as urban air pollution has also became an increasing problem (Carnevale et al., 2006; Dubeux and Rovere, 2007; Kimmel and Kaasik, 2003; Peng et al., 2002; Venegas and Mazzeo, 2006). Anthropogenic air pollution originates from a variety of sources, including households, vehicles, large stationary sources, small and medium-size industries, agriculture, and forest burning (Kojima and Lovei, 2001). According to Kojima and Lovei (2001), pollution from many of these sources is closely related to the production and consumption of energy, specially the combustion of fossil fuels, just like GHG emission are mainly produced from these sources. So, some of the same combustion processes that emit gases which locally affect human health, ecosystems and agricultural productivity—such as sulfur dioxide (SO_2), nitrous oxide (NO_x), suspended particulate matter, volatile organic compounds (VOC) and carbon monoxide (CO)—also cause the emission of gases that have impact on climate—such as carbon dioxide (CO_2), methane (CH_4) and nitrogen oxides (N_2O). This is because fossil fuels are not only the main source of many local and regional pollutants but also of greenhouse gases (GHG). According to Wilbanks and Kates (1999), global changes in climate, environment, economies, populations, governments, institutions, and cultures converge in localities. Changes at a local scale, in turn, contribute to global changes and also are affected by them. Therefore, measures aiming to reduce fuel consumption in order to lower local atmospheric pollution levels may, at the same time, reduce GHG emissions, or vice versa.

Most developing cities may lack the data and resources to carry out initiatives for mitigating air pollution. So, policymakers often have to choose among alternative measures without having the necessary information about them. Under these circumstances, there is often a temptation to import standards and technologies from developed countries without assessing their costs, their benefits, and the feasibility of operating and maintaining them, which is seldom the answer (Kojima and Lovei, 2001). However, with the support of local research institutions, as the university, it is possible to develop adaptations to these standards and methodologies to fit local needs.

Politically, suggestions for GHG mitigation measures in developing countries are often received warily and can be perceived as a denial of these countries' basic right to economic growth and improvement of wellbeing (Kojima and Lovei, 2001). According to Kojima and Lovei (2001), the keys to changing this perception are (a) to link GHG mitigation to emission-reducing policies whose goals are of far greater immediate relevance than GHG mitigation and (b) to facilitate financial assistance from industrial countries to reward developing countries for the global benefits of accelerating the introduction of such local measures. GHG mitigation strategies have specific positive effects on public finances through savings in health and the avoidance of damages caused by local pollutants (Garg et al., 2002; Kimmel and Kaasik, 2003; Lin and Rosenquist, 2008; Peng et al., 2002; Ramanathan, 1999; Wang et al., 2005; Yedla et al., 2005). Kousky and Schneider (2003) list many efficiency projects with a high potential for GHG mitigation and a positive internal rate of return that can lead to improvements in local finances. Kojima and Lovei (2001) also mention that the enormous gains made in improving fuel economy in the 1970s and the first half of the 1980s have contributed to decreasing both local and global pollution in industrial countries. Another possibility for emerging countries is the use of financial resources from the carbon market to upgrade environmental management systems.

However, there are not always synergies between measures to reducing local pollution and those for mitigating GHG emissions. For example, diesel is a particularly efficient fuel, and hence favorable from the point of view of reducing GHG emissions. However, recent scientific findings suggest that diesel emissions are more damaging to human health than emissions from other fuels (Kojima and Lovei, 2001). There are a variety of measures that provide the positive association between GHG reductions and improvement in environmental local conditions, especially in Brazil through biofuel, energy efficiency and waste management, for instance. Table 1 shows some of the possible measures that can be taken after the inventory measurement has been carried out.

3. Emission inventories and cities

Local GHG inventories have been carried out in many cities of the world with different goals, and their principal advantage is