

# Energy consumption at urban level: The case of the town of Bologna in Italy

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## 1. SYNOPSIS

Urban energy consumption and carbon emissions at city level in the eighties are analysed in order to obtain important informations for the development of a urban CO<sub>2</sub> reduction plan

## 2. INTRODUCTION

The difficulties of the international ecodiplomacy on the global warming issue have induced to a mobilization of local actions (in a minor way a similar uprising of municipalities was present in the States for the ozone crisis). Hundreds of towns have been involved in programs to define strategies to reduce greenhouse gases (GG) through international networks, like the Climate Alliance and the Urban CO<sub>2</sub> Project of Iclei, or national efforts, like the "Cities against global warming" program in Italy co-ordinated by the environmental organization Legambiente.

The first efforts in the goal of developing a framework of actions to reduce GG have been devoted to the identification of the major sources of carbon dioxide emissions, in evaluating the projected emissions at a target year in a business as usual scenario and then in developing analytical and policy tools to assess the feasibility of carbon reductions.

## 3. ENERGY CONSUMPTION AND CARBON EMISSIONS

The energy analysis at the urban level is a quite complex task due to a certain level of uncertainties (city boundaries, availability of statistical data, gasoline consumption of crossing cars ...), but recently a number of towns have elaborated energy balances and emissions inventories for a base year (in many cases 1990).

The town of Bologna, located in the northern part of Italy, ten years ago prepared a very detailed analysis of the energy consumption (Best, 1984). The final uses in the residential and in the industrial sector have been evaluated through an energy audit of a representative sample of buildings and industries. The fuels used in the transportation sector have been calculated directly from the sales (normalized in order to exclude long distance travellers).

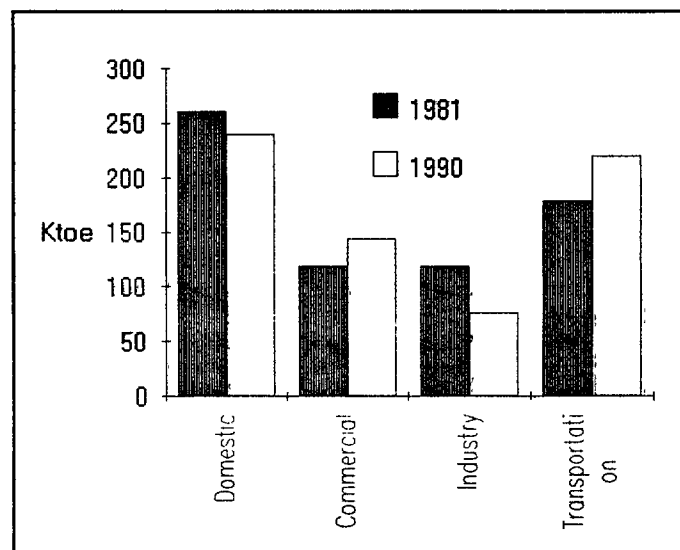


Figure 1. Final energy consumption in Bologna

A new analysis has been made on the 1990 energy demand and carbon dioxide emissions (all data have been normalized to avoid the weather fluctuations interference). The most important aspect of the energy consumption evolution during the eighties (considering that from 1981 to 1990 the population decreased by 10% reaching a value of 412 thousand people) are the following (Fig. 1): electricity use increased by 39% due to a fast growing demand in the commercial sector following a similar national trend (Fig. 2) and transportation fuel demand increased by 29%. Total final energy consumption was only 2% higher, due to a reduction of the thermal uses in the civil sector (retrofits) and especially in the industrial sector. Primary energy consumption increased a little more than the final energy (8%), due to the higher importance of the electricity demand in 1990 compared to 1980.

Carbon emissions have been calculated considering also the "up-stream" emissions, using the Temis

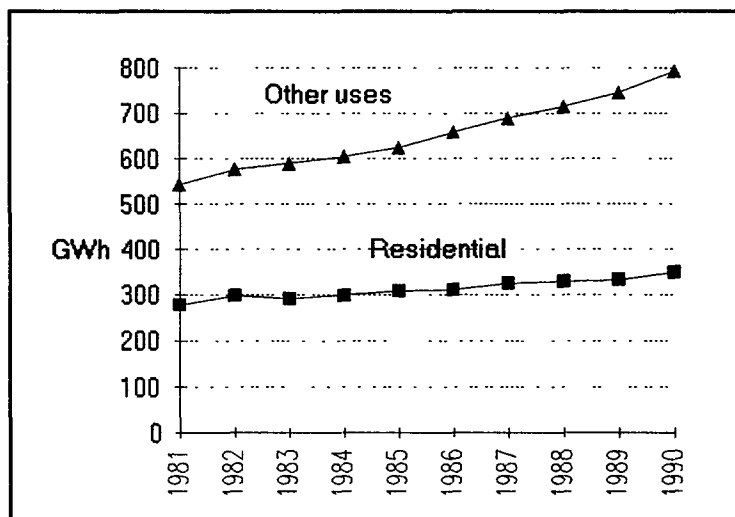


Figure 2. Electricity demand in Bologna

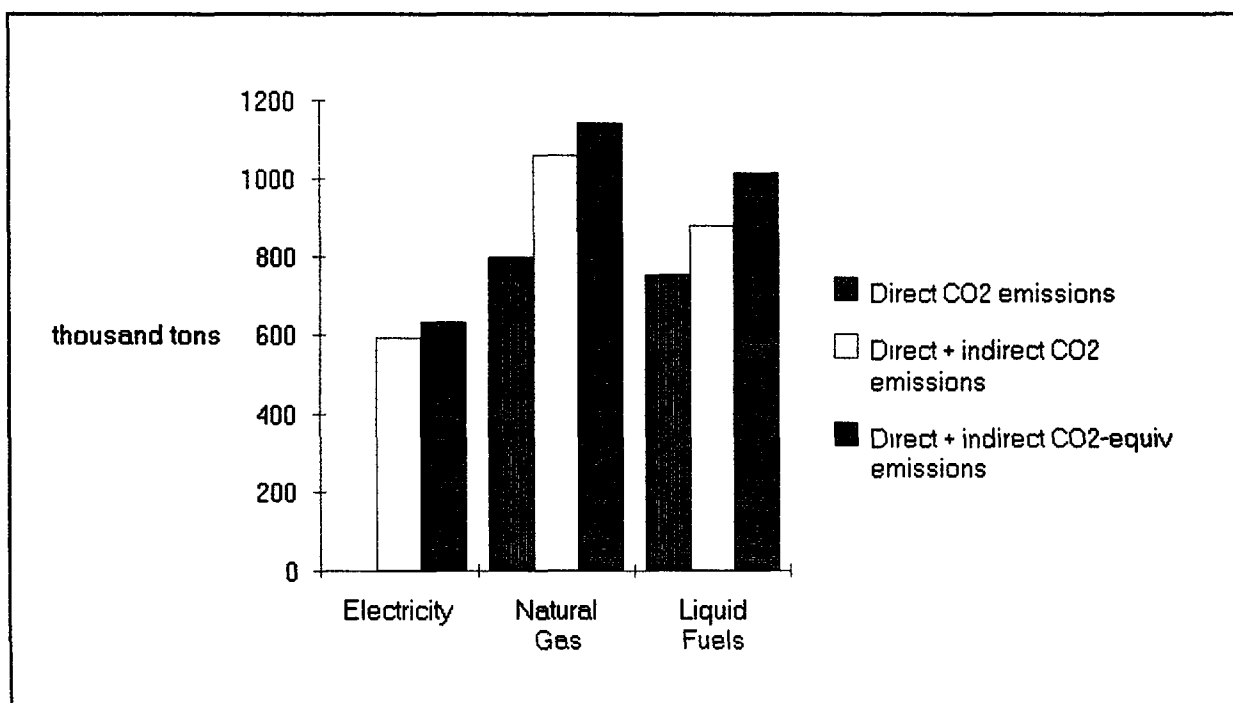


Figure 3. Greenhouse gas emissions related to energy consumption in Bologna, 1990

model ( Fritsche, 1991) that allows a full fuel cycle analysis of methane and carbon emissions associated with both fuel and electricity use. In figure 3 both "direct" and "indirect" emissions for different energy use are represented: the large share of indirect carbon emissions for natural gas is connected with the importations from Russia through very long pipelines (more than 6.000 km). The same figure considers also the data for all the greenhouse gases associated with the energy use, calculated in term of carbon dioxide equivalents, using the Global Warming Potentials values on a 100 years time horizon developed by the IPCC (Houghton, 1990). Global carbon emissions increased by 6% in the 1981-1990 period, a rate of growth

lower than for the primary energy, due to a shift of the fuel mix from oil to methane (less carbon intensive) in the civil sector.

The pro capite value of the carbon emissions is much lower than for the other towns of the Urban CO<sub>2</sub> Project, as shown in the fig. 4 (Iclei, 1992). This data, common to many Italian towns, is mainly due to the relatively lower importance of transportation and to the large use of natural gas.

#### 4. CONCLUSIONS

The analysis of the 1990 energy consumption and carbon emissions data for the town of Bologna and the comparison with the 1980 data has permitted to draw some important conclusions.

The larger growth has been experienced by the commercial electric use and by the private transportation (the last one in spite of an attempt to reduce the use of car circulation in the city center). Natural gas has greatly substituted oil in space heating, but there is little space left for further fuel switching. There is almost no cogeneration power in town, but this is an area that could be expanded in connection with district heating (projects that could lead to a saving of 69 ktoe are in discussion). Private car use could be greatly reduced.

According to these data, it seems quite possible to develop an action plan aimed to a reduction of the carbon emissions by the year 2005. The reduction target and the policy portfolio, that are presently being evaluated, will be presented in June 1993 in Toronto at the end of the "Urban CO<sub>2</sub> Project". Preliminary estimates show a possible carbon reduction of 20% compared to 1990 values.

#### REFERENCES

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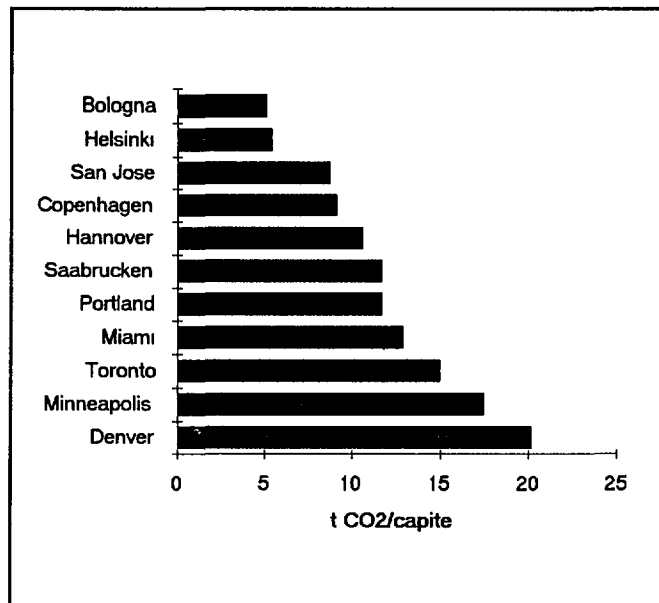


Figure 4. Per capita carbon emissions for the cities participating in the CO<sub>2</sub> project of Iclei.

