ASSESSING CO₂ EMISSIONS OF REGIONAL POLICY PROGRAMMES: AN APPLICATION OF CO₂MPARE TO EMILIA - ROMAGNA 2007 - 2013 Operative Regional Program

Extended abstract

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Background

CO₂MPARE is a model designed to support regional governments in the implementation of low-carbon policies, through the quantification of the effects of the various project interventions funded and defined in the operational programs for regional development. As it is well known, one of the main objectives of the "Climate and Energy 2020" package is the reduction of emissions of greenhouse gases. The EU policy on climate change in fact defines a target of reducing greenhouse gas emissions by 20% in 2020 (compared to 1990 levels) and 80-95% in 2050. As a consequence, in order to achieve these objectives, it is required that the intensity of greenhouse gas emissions into the atmosphere by the socio-economic and production activities is reduced considerably and in a short time. In addition to particular technical and political tools specifically dedicated to this (such as, for example, the Emission Trading System and the Directive on energy performance of buildings), the European Commission is now seeking to adopt, and include, climatic and environmental considerations and evaluations of policy instruments even within plans, such as the regional operational programs, so that EU policy could be internally consistent with respect to the overall objectives for contrasting climate change (CO₂MPARE, 2013a,b,c). For example, within its actions of financing of regional public investment, with specific targets on agriculture, business, environmental protection and so on, the EU is trying to include emission budgets within the procedure of approval of individual Regional Operational Programs (ROP). The choice of particular alternative options may in fact have very different consequences depending on the individual areas of development, such as industrial growth or job creation in agriculture. Depending on the various types of specific investment, greenhouse gas emissions into the atmosphere may vary significantly. In this context it can be used "CO₂MPARE", a computational model aimed at assessing and quantifying the emissions of the main greenhouse gas, carbon dioxide (CO₂). This model allows comparing different programmatic alternatives in the regions of the European Union. In practice this is an advanced decision support operating tool designed, on behalf of the European Commission - Directorate General for Regional Policy, by a consortium of 6 European partners (Energy research Centre of the Netherlands - ECN, ENEA, Energies Demain, University College of London, ENVIROS and CRES). ARPA Emilia-Romagna has supported the consortium in the test phase of the model CO₂MPARE applying it to the evaluation of the 2007-2013 ROP of Emilia-Romagna, quantifying the various programming scenarios and their resulting impact in terms of CO₂ emissions. With the model it was possible to compare the emissions of several alternative scenarios in order to identify the best performing program even from the perspective of CO₂ emissions.

Functionality

The CO₂MPARE model starting from the individual measures financed by an operational program allows quantitatively assessing the resulting emissions of carbon dioxide. Each program is based on funding allocations

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related to the main themes, sub-themes and operational actions. The CO2MPARE user must first of all include in the model the distribution of financial resources from economic budget allocations of funding. In practice, each regional program contains themes, structured in measures, in turn structured in more different actions that in the model are represented by a set of "Standardized Investment Components" (SICs) that are common across all regions. In the model these SIC are predefined by default, but thanks to the possibility to modify the specific calculation parameters within each SIC, these are then changeable by the user in such a way that the evaluation of the specific program may be significantly adapted to the regional characteristics, and therefore the model can provide better and more reliable and informative results. On the basis of the input of the economic characteristics and physical properties of these SIC, the model then calculates indicators, the physical quantities and related emissions of carbon dioxide for each individual activity. Emissions are then added together to get the total emissive aggregates, of each main topic and therefore complete program. The model allows preparing different versions of a ROP (for example, with different funding schemes within the same total budget) by comparing them with each other in terms of CO2 emissions.

The alternative within the model the alternative versions (actual or potential) of a program are called "scenarios". In the last instance it is therefore possible to compare the results of two or more scenarios to choose the best one and/or to build other better scenarios on the base of the results of output. To properly configure the scenarios, the user needs to have a good knowledge of the financial model of the operational program to assess the type of projects funded (Fig. 1). From the results it is possible to: (i) identify investments that give rise to higher CO2 emissions, both in the construction phase and during the operational management of the works over years; (ii) verify the results of the investment programs in physical terms (for example, length of the roads built, surface of buildings, renewable power plants installed capacity etc.); (iii) evaluate the effect of eco-criteria to be prescribed in funding programs (e.g. the criterion of funding only buildings with high levels of energy performance).

![Fig. 1. Steps of disaggregation of financial resources and aggregation of impacts in terms of CO2 emission that form the general principle of the model CO2MPARE](image)

**Multi-regional applications and intended users**

CO2MPARE, through the simple insertion of financial data as only input, enables regional authorities to evaluate their own programs (ex-ante, in-progress, ex-post) and to assess their consequences in terms of physical outputs and related CO2 emissions. Depending on the region in which one evaluates the operational programs, the technological indices used are different and the evaluation of the program thus leads to different results. These results, however, are comparable between them thanks to the use of the same conceptual system, structured with the same SIC. For example, a building built from scratch in Sweden or Italy cannot have the same energy performance, and therefore has different carbon emissions, but the use of the model CO2MPARE allows comparing the performance of ROPs in the two regions. However, it is also important to remind that CO2MPARE is not born to compare ROPs of different regions but for the comparison within the same ROP of different financial allocations, and thus of different types of "themes and actions", that is for comparing different scenarios of the same ROP. Each region should independently define its own calibration of the technological indices.

To take these issues into account, the chain of calculation adopted in the model uses two types of parameters (called “ratios”): (i) Global-RATIOS, which are independent of geographic detail; it is assumed that they will always remain the same, regardless of the region in which one adopts and evaluates the operational program (e.g. the carbon dioxide emission factor for the raw material "steel", measured in tons of CO2 emissions per ton of used steel); (ii) Regional-RATIOS, which vary from one region to another (e.g. the cost of construction of a building in €/m²); (iii) Initially, the model offers options with default values for both the Global and Regional RATIOS. It is however strongly advisable to adjust the default RATIOS values in order to better adapt to the regional characteristics. This process of regionalization requires technically trained staff with a good knowledge of Life Cycle Analysis (LCA) and data collection. After regionalization, the model is fully operational, and can be easily used by management authorities, policy makers, environmental agencies etc. in the preparation of operational programs. To best meet these various needs of users, two different modes of use of the model are available:
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- a "basic mode" for users who exclusively want to analyze and compare the effect of different investment schemes about the impact of a carbon ROP, without going into management and redefinition of the coefficients of the scientific-technical life cycles materials and operability or useful life of the works realized;
- an "expert mode", which allows users to drill the calibration of the model and the ROP on the basis of technical more reliable and responsive scientific coefficients to the degree of local technology.

Examples of application in Emilia-Romagna

The model CO2MPARE has been used for the Strategic Environmental Assessment (SEA) of the 2007-2013 ROP of Emilia-Romagna. The model was produced in 2012, during the final management of the program, and has been used to evaluate on-going and ex-post performances, offering the opportunity to calibrate data and indices (RATIOS) pre-structured by default at the regional level. The use of the model has led to the identification of an "allocation of funds" into the different categories of expenditure provided for by the EU. A "man month work" was needed to verify the distribution of funds, to identify the progress, and place them in the appropriate items of the model. This distribution of funds has constituted the first scenario on which to run the algorithms (SIC) and the components of the model CO2MPARE. The model runs on Excel and provides results in both tabular form and in graphs. The tables allow a direct quantitative estimate, can be exported, and of course managed by the user (typically an expert of regional institutions, or an expert of the scientific community as a consultant of the institution). Graphics are useful to have a quick summary view readable by policy makers, in the different technical phases of design evaluation and / or the performance of the ROP. As an example below are shown some Tables and Figures taken from the SEA (Strategic Environmental Assessment) report of the 2007-2013 ROP (Arpa Emilia-Romagna, 2011, 2012). As it can be seen the model CO2MPARE allows a clear emissive comparison between different investment alternatives. The reading of graphs and tables in the experience made on the SEA of the POR 2007-2013, implied a joint analysis between the experts who had entered the financial data and other experts who had expertise in the thematic "emissivity" inherent the actions financed, that are the material projects put in place, and experts from various fields involved in the actions of financing, such as roads and viability sector rather than the public housing sector (Regione Emilia-Romagna, 2007, 2013). The comparison over the period of life-supported interventions shows that the greenhouse gas emissions of the evaluated alternatives are negative, that is, the overall impact of the interventions financed under the ROP translates into a certain amount of carbon dioxide emissions avoided in Emilia-Romagna. It is therefore important to point out two important considerations: (1) Any type of development program leads to additional emissions; (2) These additional emissions are not quantitatively univocally imposed, but can be modulated (decreased and/or increased) depending on the type of actions that are financed, that is the type of works and their energetic performance. The use of CO2MPARE, and its design methodological peculiarity composed of flexible output to the client (decision maker) conducts, however, the decision maker to a third consideration, which is derived from the graphs in a visual way, and from the tables in math mode; (3) The emissions are not consistently negative, but they compensate themselves in the phase of "management of the works", so you do have to end the lives of themselves, not only a compensation with respect to the additional emissions created during the construction phase of the works themselves, but, applying criteria of energy efficiency, there is a reduction in emissions compared to works not "energetically efficient." In fact, if on the one hand the actions of building construction have a positive contribution, on the other hand they are largely offset, mainly due to financing for energy efficiency. The model then quantifies and shows neutralizing activity "carbon-positive" with other activities "carbon-negative": the budget is more than positive, in the sense that the ROP saves and thus avoids more CO₂ than it generates. Table 1 shows how CO2MPARE, applied in Emilia-Romagna in the experimental stage, has allowed to evaluate, at a reduced cost, different alternative financial scenarios, all contained in the envelopes of the ROP in force, different both for developmental effects that in the estimation of emissions-related effects.
Table 1. Example Table about comparison of alternative funding in Emilia-Romagna for 2007-2013 ROP

<table>
<thead>
<tr>
<th>AXES</th>
<th>Original financial plan</th>
<th>Alternative financial editing</th>
<th>Variations (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total costs (€)</td>
<td>Weight of the total (%)</td>
<td>Total costs (€)</td>
</tr>
<tr>
<td>1 - Industrial research and technology transfer</td>
<td>114,328.164</td>
<td>32.96%</td>
<td>119,328.164</td>
</tr>
<tr>
<td>2 - Entrepreneurial development and innovation</td>
<td>69,591.056</td>
<td>20.06%</td>
<td>91,680.706</td>
</tr>
<tr>
<td>3 - Energetic environmental improvement and sustainable development</td>
<td>79,532.635</td>
<td>22.93%</td>
<td>79,532.635</td>
</tr>
<tr>
<td>4 - Development and qualification of the cultural and environmental heritage</td>
<td>69,591.056</td>
<td>20.06%</td>
<td>84,591.056</td>
</tr>
<tr>
<td>5 - Technical assistance</td>
<td>13,876.788</td>
<td>4.00%</td>
<td>15,630.523</td>
</tr>
<tr>
<td>TOTAL</td>
<td>346,919.699</td>
<td>100.00%</td>
<td>390,763.084</td>
</tr>
</tbody>
</table>

Figs. 4 and 5 also show how a region can allocate funding in measures particularly negative (additional emissions), but can also, at the same time compensate with the positive effects (reduction of emissions) up to a total compensation. This assessment process, put in place with the model CO2MPARE allows the decision maker to implement alternately sustainable development actions, even within economic contingencies, such as those derived from the current crisis, financially supporting energy-intensive sectors (emissive), provided they are accompanied by other funding to sectors with high emissions reduction potential.

Concluding remarks and key success factors

The model CO2MPARE has several features that make it a very interesting tool for the management authorities, environmental agencies and all other involved parties in regional development policymaking. The model provides information on the carbon emission effect of a program at various levels of detail and in the various phases (ex-ante, in-progress, ex-post). It is fast and easy to use, operate in the basic mode only requires the input of planned financial contributions and their disassembly in percentage of standardized investment components (SIC). Currently the model is being used for the preparation of the ROP of Emilia-Romagna Region 2014-2020.

Keywords: CO2 model, emissions of carbon dioxide, operational program assessment

Acknowledgements

The model (software) CO2MPARE together with all related deepening documents are freely available online at the link: http://ec.europa.eu/regional_policy/newsroom/detail.cfm?id=673&LAN=EN

References


