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INVENTORY CO_2-BALANCING METHODS AND TOOLS IN 6 EUROPEAN COUNTRIES

IN FRAMEWORK OF BALANCE PROJECT

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June 2006

ECS05013

Content

1 Introduction

In a European project, called BALANCE, one of the aims is to develop and test tools to evaluate the energy and CO_2 saving potentials of municipalities. The third work package of the project concerns the search for a CO_2 balancing method and tool which can be used in the European Energy Award-method (EEA). This EEA method is already in place in more than 320 municipalities. A CO_2 balancing method is defined as a method to determine the CO_2 emissions caused by energy consumption within municipality borders (territory principle).

To be clear about the difference of the terms method and tool: A tool is the automation of the method. In most cases tools are programmed in excel or access or they are programmed as web-based applications.

This report presents the results of the investigation of existing methods and tools for energy and CO_2 balancing in the in BALANCE project participating countries (Austria, Czech Republic, Germany, Ireland, Lithuania, the Netherlands, Switzerland).

The *aim* of the investigation is to find out if there are already existing methods and tools in place that are suitable for CO_2 balancing within the EEA methodology.

2 Information gathering, structuralizing and outcomes

2.1 Regional workshops

In spring 2006 regional EEA workshops are held in the participating countries. During these meetings existing CO_2 balancing methods and tools are discussed. Another topic was the requirements of CO_2 balancing in framework of the EEA-methodology. As starting point Ecofys had delivered a draft list of these requirements. These requirements are discussed in more detail in paragraph 2.2.1.
The minutes of the regional workshops, including presentations are a separate deliverable within the BALANCE project. The main outcomes of the regional workshops, which are of importance for CO_2 balancing, are summarised in Table 1.

The results tell us that in many countries it is difficult to get data. There is also a difference in data quality at the various geograhic levels. In general the national data have a high quality, but the data at regional and local level are of less quality. Further it is not easy to find the right balance between accuracy and the cost to get the required information.

The municipalities in some countries are willing to use another tool than they are using at the moment. On the other hand other countries indicate that it is not likely that a prescription of a certain tool will be accepted.

Table 1 CO_2 balancing in the BALANCE project participating countries, status, outcomes and additional input for requirements

Country	Status	Outcomes discussions	Additional input for requirements
Austria	Several methods and tools in place	- Austrian experts think the Climate Alliance tool (expert mode) is the best Austrian tool - The evaluation-system (points) of the EEA or of E5 is very good international benchmarking method - Existing energy and CO_2-balancing tools in Austria are not too different, the main differences are in the level of detail and the consideration of traffic and electricity - It is hard to find the right balance between accuracy and the cost to get the right information	- Data quality guaranteed - Combination of top-down and bottom-up methodology - A not too specific and time/cost-intensive tool is adequate. - It is not realistic to renew the balance every year. An update is possible every 5 to 10 years. Between this period competition between the municipalities could be boost by using indicators.
Czech Republic	No tools in place, several useful sources to determine CO_2 balancing identified (National survey, REZZO, energy town, audits)		
Germany	- Several methods and tools in place - About 20% of the communities have an energy or CO_2 balance	- Standardisation of CO_2 balancing is worth having - Improvement of data quality at local level	- Applicable for all cities and towns, big and small ones - Based on easy and regular available data for example from the regional or national departments for statistics - Simple to use for example on excel basis - General estimations are used if detailed figures are not available (traffic sector)
Ireland	One national tool in place, and several energy agencies use energy balancing tool	- Extremely difficult to get the data - Local authorities and municipalities do not control energy - The real value of a balancing at county level: to raise awareness	- Try to have more than one data source (top-down and bottom-up) - Flexible methodology would be very welcome
Italy	Only few municipalities in Italy have got an energy balance: the CO_2 emissions are taken into account but there isn't a standardized methodology (tools in excel)	- Big difference between average national and each regional data	- Not reduce the reliability of the existing eea tools
Switzerland	Several methods and tools in place		- Solutions for small, medium and big communities - Top down - bottom up - Sustainability in all 6 areas of the eea@catalogue
the Netherlands	One tool in place, in principle used in 15-25 communities	- Carbase will be use in the pilot group of Dutch municipalities. - It is not likely that the market will accept a preferred CO_2 tool	

2.2 Inventory

Ecofys has made an investigation of the existing energy and CO_2 balancing methods and tools. This is done by sending an inquiry form to all the BALANCE partners. In total 14 tools were found in 6 European countries. A list of the CO_2 balancing tools are presented in Table 2.

Table 2 CO_2 balancing tools

Part of EEA assessment tool	CO_2 grobbilanz (Climate Alliance Austria)
CO_2 Rapid Assessment (Climate Alliance Switzerland)	EMSIG (Energy agency Waldviertel)
ECO_2 regio (ecospeed)	Standardized report CO_2 balance (E5)
CO_2 potential pro (Solar cities)	Tool + standardized report (E5 Voralberg)
Grrenhouse gas strategy software for cities (ICLEI)	CO_2 emission calculator (Ekostrategjia)
GEMIS	National energy balance (SEI)
CO_2 emission check and planning (E+U)	Carbase

2.2.1 Criteria and validation

To judge if tools are eligible to be used within EEA-methodology criteria, which have to be fulfilled, have to be formulated. For this formulation Ecofys has started to make a draft list of criteria including their validation, which is presented to all the BALANCE partners. They made some additions and agreed upon the requirements and the set up of the suggested validation system. The requirements and their validation are shown in Table 3. From a first preliminary judgement of the found tools it appears that about 5 tools fulfil the requirements. Actual final conclusions will be drawn later on (see also chapter 4).

Table 3 Requirements and their validation

Requirements for a good CO2 balancing method/tool so that it can be used within the EEA procedure

Topic	Level	Requirements
Programmed in	Minimal	electronical, software applicable for most used PCs excell, access
	Preferably	webbased
Used sources	Minimal	known
	Preferably	regular updated official sources
Used estimation	Minimal	known
	Preferably	based on official monitoring protocols
Method	Minimal	Bottom up
	Preferably	Combination bottom up, check with top down figures
Input	Minimal	Approximately level, default values, in case information is not available at municipal level
	Preferably	Two levels: approximately and detailed
Output	Minimal	energy use and CO2 emission of the municipality check with macro energy use figures
	Preferably	energy use and CO2 emission of the municpality total overview, but also zoom in per policy, measure, per sector
Detail level	Minimal	Municipality
	Preferably	Sector
Work load	Minimal	not more than two weeks per year
	Preferably	limited to few hours to a few days per year
Usability	Minimal	it takes half a day to a day work to understand the working
	Preferably	webbased and works intuitively
Systems boundaries	Minimal	known
	Preferably	based on official national and/or international agreements
Number of applications	Minimal	applied in several municipalities (at least 5)
	Preferably	applied in many municipalities in a several European countries
Cost	Minimal	limited cost (not above 1000 euro)
	Preferably	limited cost (less than 100 euro)
Flexibility	Minimal	easy to update/adjust information, connect to monitoring programmes
	Preferably	interactive with other planning, budget programs, monitoring program, set target(s) and outlooks

	For valuation
?	unknown (yet)
-	Tool does not fulfill minimal requirement
+	Tool fulfills minimal requirements
++	Tool fulfills preferable requirements

3 Analyses

3.1 Comparison Methods

After studying the delivered information about the tools in detail, we see that the used methods have many simularities.
The main differences are in applied detail level and how is dealt with transport and electricity. The detail level varies from overall community level to about 5 sectoral levels. Transport can be taken into account by asking of the facilities for public transport. Emissions from transport in more advances methods are based on number of vehicles, annual distance, specific energy use per distance.
IPCC uses the principle where emissions are caused to that geagrpahical point they are allocated. For electricity this means that emissions are allocated to the electricity producers. CO_2 balancing methods not often use this principle, emissions are allocated to electricity consumers. Some methods only look at the large electricity consumers and the electricity use for space heating and hot water is not considered.

The outlines of method for CO_2 balancing is graphically presented in Figure 1.
The input of a CO_2 balancing method consists of figures of the energy consumption and the corresponding supply of fuels of the whole community or of sectors within the municipality (agriculture, households, industry, public buildings, services, transport, waste, etc.). In general also additional input is required about the size of the municipality and its energy consuming activities. Furthermore, to calculate CO_2 emissions from energy amounts, emission factors and energy content of the used fuels are needed. Some models take temperature into account (heating degree days). This is done to facilitate accurate comparison of the space heating demand between various years. Depending on the detail level of input data, the CO_2 emission of the entire community and the CO_2 emission per sector are calculated. In advanced models the output is often related to monitoring and forecast purposes.

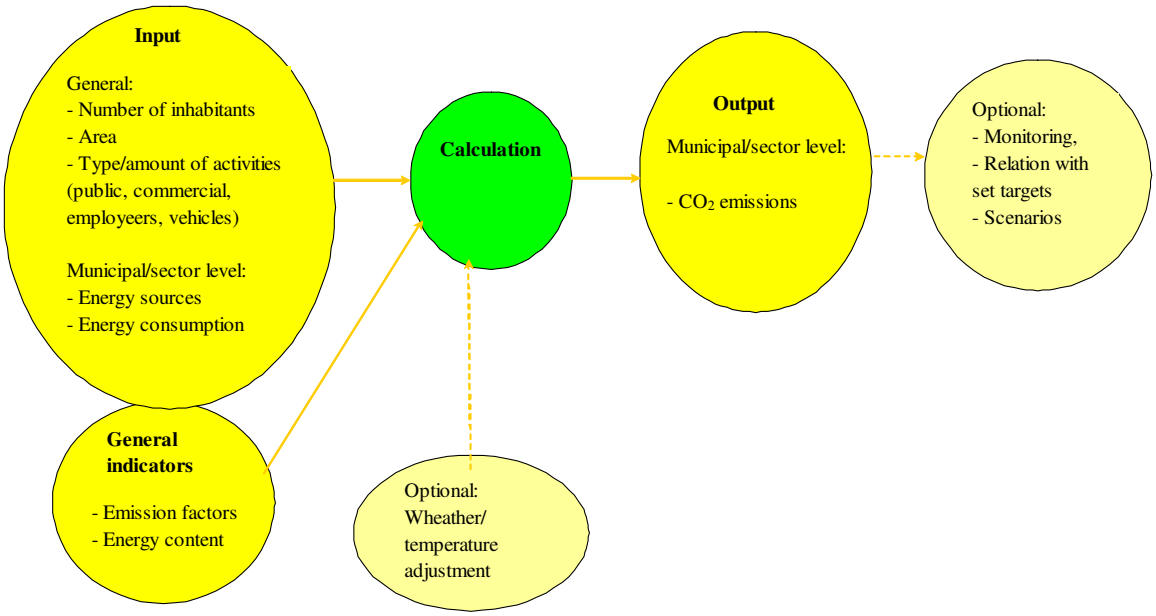


Figure 1 Main characteristics of CO_2 balancing method

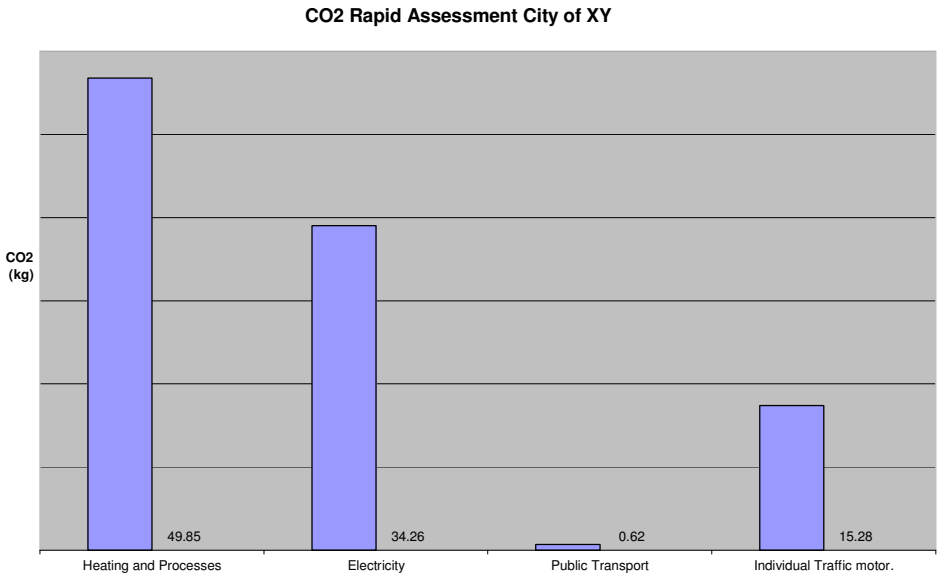
Globally there are three main approaches:

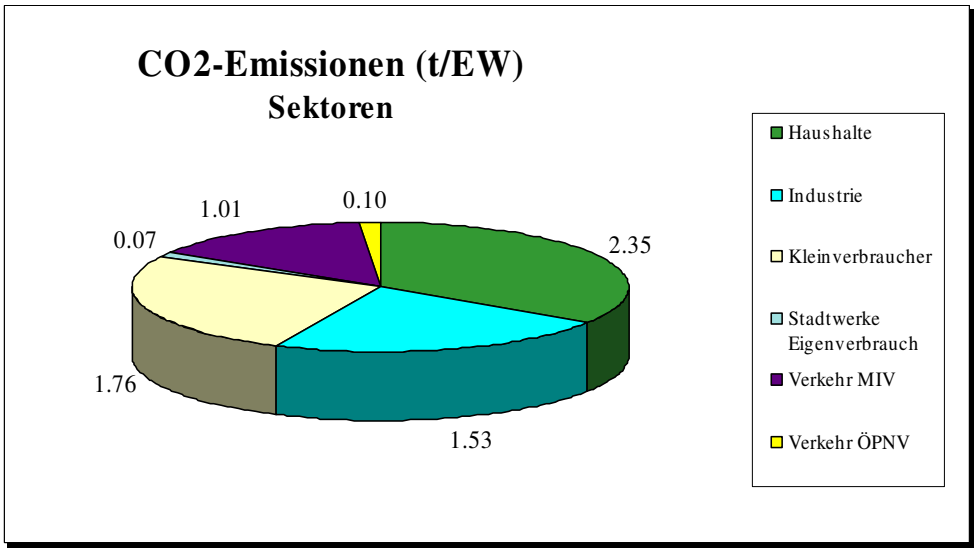
1. Top down approach, using international and national statistics to allocate emissions over municipalities.
2. Bottom up approach, using specific municipal data to determine emissions in the municipality
3. Combination of top down with bottom up approach, using default values based on (inter)national statistics, unless better data at regional and/or local are available.

Regarding the observation in paragraph 2.1, that it is important to pay attention to the price performance (data quality) ratio, the third approach is a good compromise. In fact several CO_2 balancing method are using this approach already (such as Carbase, Austrian climate alliance tool etc.).

3.2 Comparison Tools

Most tools are programmed in excell (e.g. CO_2 Rapid assessment, EEA assessment tool and EMSIG), some are already webbased (Carbase, ECO_2-regio, Austrian climate alliance tool, Lithuanian Ekostrategija tool). Main differences are related to the detail level of the data input and the presented output. Some examples of characistic output are shown in Figure 2.


CO2 Rapid Assessment City of XY
CO2 (kg)
49.85
34.26
0.62
15.28
Heating and Processes
Electricity
Public Transport
Individual Traffic motor.


CO2-Emissionen (t/EW)
Sektoren
0.10
1.01
0.07
2.35
1.76
1.53
Haushalte
Industrie
Kleinverbraucher
Stadtwerke Eigenverbrauch
Verkehr MIV
Verkehr ÖPNV

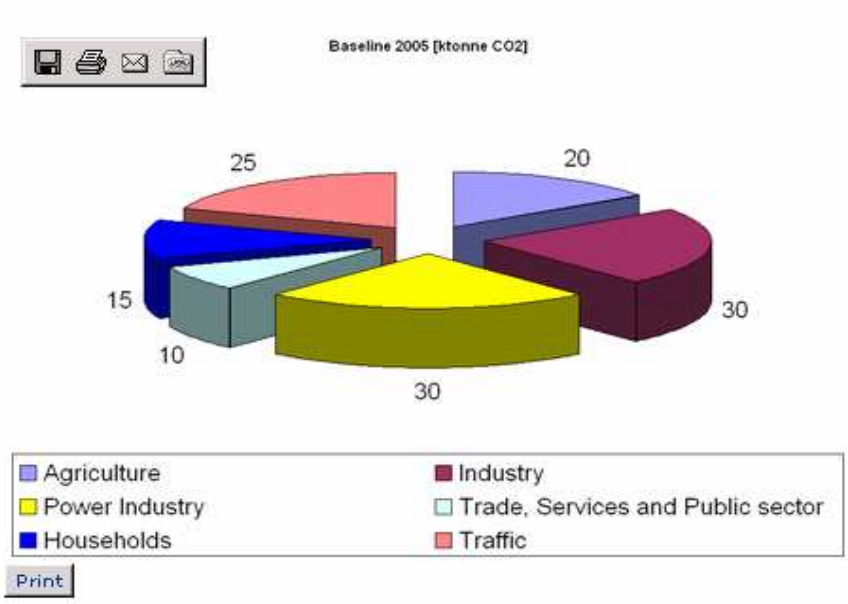


Figure 2 Some examples of output

4 Outcome discussion second meeting and decision further activities

Some first conclusions about CO_2 balancing

The outcomes of as well the inventory as the minutes of the regional workshops are discussed during the second Balance project meeting, 31 May and 1 June 2006 in Prague. Several important conclusions were drawn about the requirements for the CO_2 balancing within the BALANCE project:

- Final energy consumption has to be reported (in addition to primary energy consumption). This has to done to avoid misunderstandings about for instance system boundaries and conversion factors.
- The sum must cover all energy related sectors, the balance has to be complete.
- The combination of the top-down and bottom-up approach - use natioanl data and default values, but if better municipality data are available they can be filled in
- It is not necessary to update the content of CO_2 balancing every year, an update every 5 year is satisfactory.
- The tool has to be flexible, for instance adding and eliminating sectors must be easy.
- The confidence in the EEA-method may not be disturbed.
- The target should be the comparability on national level, because this is in the interest of the communities. In addition, with the use of EU emission factors, the comparability on international level should be assured.

The discussion has lead to a unanimous decision to select a ***methodology*** for energy and CO_2 balancing in the EEA-framework rather than one specific tool. An important underlying reason for this decision is that several good quality tools are already in place and used by municipalities. In addition it is not likely that every participating country will accept one selected tool.

Further activities

As said before, the consortium decided during the last meeting to work out a methodology rather then a tool. During this meeting it is also decided that the methodology should describe the requirements for a CO_2 balancing method, the necessary data (tables) and a list of recommended existing tools.

In the next months the requirements will be drawn up into a kind of "Cooking book" for CO_2 balancing tools. The cooking book should serve as an information guideline when purchasing CO_2 balancing tool. This will be done by Ecofys with the feedback of all involved Balance project partners. To illustrate what can be expected from this Cooking book a concept of the table of contents is given.

Table 4 Draft table of contents Cooking book

Introduction
Recipe: CO_2 balancing method (general characteristics)
Ingredients: input variables (requirements 1)
Needs for cooking: tool (requirements 2)
Presentation end-result: output variables (requirements 3)
Cooking competition: Validation of CO_2 balancing
The top 5: fulfilling tools
Exchanging recipes: main differences between recommended tools and their transferability