

12th International Annual Conference and General Assembly
of the Climate Alliance
14 and 15 October 2004 in Brussels



CLIMATE ALLIANCE
KLIMA-BÜNDNIS
ALIANZA DEL CLIMA e.V.

Guidelines for the preparation of CO2 emissions inventories by Climate Alliance member municipalities

At its 2004 Annual Conference, the Climate Alliance will present a proposal for a joint commitment. All member municipalities will be called upon to prepare a CO2 emissions inventory for 2005. The proposal is based on the current Climate Alliance target of a 50% reduction in CO2 emissions and the resolution of Bolzano, where member municipalities agreed to set their own ambitious, yet realistic medium-term CO2 reduction targets.

The question of CO2 emissions inventories has been under discussion within the Climate Alliance for some time. Meanwhile, further experience from individual municipalities and from the MedClim project is available. Against this background, the framework for the strategy is outlined below.

1. Aims and objectives of CO2 emissions inventories

CO2 emissions inventories at a municipal level aim to provide a baseline for municipal reduction targets. Municipal CO2 emissions inventories represent a continuation of EU or national CO2 emissions inventories down to a "lower" level. Such inventories aim to stimulate discussion about local targets, strategies and measures. Depending on the degree of detail provided, the CO2 emissions inventory can also be used as a basis for identifying priority measures.

However, it is very important to note that, for annual reduction rates (or indeed increases in emissions) of the order of a few percent, it is NOT possible or expedient to ascertain the success of specific measures directly from municipal CO2 emissions inventories. Instead, municipalities should use project-related reports and plant or building monitoring as evidence of success. In addition to the CO2 emissions inventory, it is therefore useful to establish "benchmarks" such as installed PV capacity per resident, electricity from CHP per resident etc.

At the same time, a clear distinction should be made between the CO2 emissions inventory and the preparation of a municipal climate protection strategy or individual packages of measures. Example: the fact that in certain municipalities electricity has a low CO2 factor (e.g. electricity from nuclear power plants or hydroelectricity) does NOT mean that efficiency measures would make little sense. This is because municipalities often have little influence on which types of power generation are substituted by the municipality's specific measures. Strategies should therefore be based on a CO2 emissions inventory, but should also consider further criteria and aims (e.g. reduction of primary energy). For the resulting bundle of measures, the Climate Alliance can offer a comprehensive catalogue from which municipalities can determine their particular priorities.

2. Basic CO2 emissions inventory strategy

The wide range of approaches can be split into two groups: top-down or bottom-up. With bottom-up, the aim is to create an overall inventory based on the energy consumption of a large number of energy consumers. This approach is very complex and hardly feasible in practice.

European Secretariat

Galvanistraße 28

D- 60486 Frankfurt am Main

Phone: +49-69 71 71 39-0

Fax: +49-69 71 71 39-93

europa@climatealliance.org

www.climatealliance.org

We would therefore propose a top-down strategy: The municipality is examined using a "cheese dome" model. CO2 emissions are primarily calculated from the consumption of "imported" energy carriers. (Exception: internal "energy sources", e.g. from municipal timber, are also taken into account).

Data acquisition

By and large, only the following data are required in the first instance:

delivery of natural gas, fuel oil, coal, electricity, wood,... into the municipality.

The data are based on information provided by the respective energy companies, network operators or deliveries to industry, with the latter having to be ascertained separately.

Further conversion of these energy carriers, such as gas, coal into electricity or heat in CHP plants does **not** have to be considered at this level.

Note: In contrast to natural gas, municipality-based fuel oil consumption data are usually difficult to obtain from dealers. Where possible, consumption should be extrapolated and estimated from heating system statistics (e.g. in Germany from information provided by chimney sweeps) plus consumption data from larger (oil-fired) industrial and commercial heating systems. Consumption can then be estimated using the following equation, for example:

$$\text{Oil consumption} = \text{total capacity of oil heating systems (kW)} * 2000 \text{ h.}$$

Based on the emission factors for the different energy carriers, a CO2 emissions inventory can thus be prepared with relatively few data.

Emission factors

Climate Alliance will provide generally applicable emission factors, if required in consultation with national coordinators. This particularly applies to Europe-wide factors for natural gas and fuel oil, where no distinction is made in terms of origin of the natural gas or specific calorific values. With regard to electricity, national values for the respective national power mix will be provided. For Europe as a whole, a uniform value for the EU power mix is used.

The CO2 factors take account of the upstream production and conversion chain, following the approach used in the GEMIS software. In addition to CO2 factors, CO2 equivalents are provided.

Selection of the emission factor for electricity

Even though in some cases an individual power mix can be determined from purchasing contracts with local companies, for reasons of harmonization and comparability between municipalities a uniform power mix factor will be used. Usually, it will not be possible to determine an "individual" electricity CO2 factor from all purchasing contracts.

Generally, the national CO2 factor provided by Climate Alliance will be used. The CO2 emissions can be calculated (for information only) using the European electricity CO2 factor provided by Climate Alliance.

In specially substantiated cases (e.g. unambiguous supply by local companies from specific power plants), a local electricity CO2 factor may be used as a third parameter (for information only).

Since the CO2 factors for other fuels are the same everywhere, the CO2 emissions inventory will provide the following information:

- total CO2 (with national power mix)
- total CO2 (with European power mix)
- if required: total CO2 (with local power mix, CHP plants, electricity produced in nuclear power plants or green electricity)
- these values may also be quoted as CO2 equivalents, both as total values and per resident.

On this basis, a CO2 emissions inventory can be prepared by determining a small number of sales or purchasing figures from energy and other companies, and by multiplying these values with associated CO2 factors.

This procedure enables both large and small municipalities to prepare compatible CO2 emissions inventories, which are relatively easy to update, both retrospectively and in the future. It is important to note that this top-down approach avoids the need for complex calculations, e.g. for apportioning emissions from CHP plants, at this level!



CLIMATE ALLIANCE
KLIMA-BÜNDNIS
ALIANZA DEL CLIMA e.V.

3. Detailing – differentiation

In addition, it is often useful to distinguish between different sectors such as residential, commercial, industrial etc. However, it should be noted that different local energy companies may use different definitions for the individual consumer groups. For example, since the year 2000, in Germany households are no longer exclusively classified under so-called "general" tariffs, but (larger consumers in particular) may enter "special agreements", which means that they will be listed in the same category as small and medium-sized companies. Any differentiation therefore can and has to be based on local conditions.

Differentiation by consumer groups cannot be used for comparisons between municipalities!

Differentiation according to consumer groups is NOT imperative for preparing a CO2 emissions inventory. Municipalities wishing to differentiate in this way may use the following schematic procedure as guidance for considering the conversion of different forms of energy supplied to the municipality. CHP plants can and should be considered AT THIS LEVEL.

(This is a schematic table to illustrate the principle. It is not complete.)

Input:	natural gas 1000 MWh	fuel oil 500 MWh	electricity 2000 MWh	Total final energy	
	400 MWh	500 MWh	200 MWh	1100 MWh	heating buildings
	200 MWh		1800 MWh	2000 MWh	total electricity
	300 MWh			300 MWh	district heat
	100 MWh			100 MWh	losses

This matrix can be refined, e.g. by splitting electricity consumption or heating energy consumption into different consumption sectors.

To consider municipal buildings, however, it is recommended to prepare a SEPARATE table with energy consumption data and associated CO2 emissions based on municipal energy management figures.

To this end, local CO2 emission factors for local electricity supplies from local companies may be prepared (in consultation with these companies) showing, for example, the mix of external supplies and internal production via CHP. Municipalities may determine plant-specific CO2 factors for electricity production in local/municipal co-generation plants. In this case, a credit will be given to account for emissions avoided by replacing heating systems with district heat supplies.

For the purpose of the actual CO2 emissions inventory, all these calculations and tables or diagrams are "for information only". For comparisons between municipalities only the total values can and may be used.

4. Benchmarking – comparison of parameters

The following values may be used to provide statistical evidence of the performance of measures undertaken and plants constructed:

Installed capacity (kW) or electricity production (kWh) of CHP plants, biomass plants, PV systems, solar thermal systems (sqm), wind turbines per resident.

It is recommended to use the benchmarks and tables from the Climate Alliance AIM project as guidance.

In future, according to the EU Directive on Energy End Use Efficiency and Energy Services, evidence of "savings" (minus 1%, public facilities -2% per annum) is expected to be required. It is recommended to also document efficiency projects (energy saved).

Note: In Germany, local electricity production systems using renewables are not considered as part of the CO2 emissions inventory of the respective municipalities. The



CLIMATE ALLIANCE
KLIMA-BÜNDNIS
ALIANZA DEL CLIMA e.V.

reason is that electricity supplied based on the German Renewables Feed-In Act is apportioned to all electricity customers nationally. On the one hand, this is "correct" for inventory purposes, since local differences (e.g. locations with wind power or more hydroelectricity or biomass plants) are levelled. On the other hand, municipalities like to take credit for local systems, especially in cases where the municipality was the driving force behind such systems. For reasons of compatibility of the CO2 emissions inventories, such systems are NOT considered as part of the inventory.

At a benchmarking level, these systems (or their capacity) are listed separately. Municipalities are free to prepare a list of special plants (renewables, CHP) as an appendix to the CO2 emissions inventory.

5. Transport

The discussions and approaches for dealing with the transport sector (emissions from which continue to rise) have not yet led to a simple and generally applicable methodology. In some cases, existing methodologies have been abandoned. Depending on the organizations drawing up transport-sector inventories, methodologies were not necessarily comparable between different municipalities.

The basic approach for the transport sector is therefore:

$$\text{CO2 emissions from transport} = \frac{\text{national CO2 emissions from transport}}{\text{total population}} * \text{population of the municipality}$$

i.e. a national average value for all municipalities within a country.

This value includes emissions from cars, lorries and air traffic.

Based on national statistics, the total value can be split into emissions from cars, lorries and air traffic.

These values are fed into the total CO2 emissions inventory.

For the purpose of local differentiation, correction factors may be established:

Factor for emissions from cars according to number of registrations:

$$\frac{\text{local number of cars/resident}}{\text{national number of cars/resident}}$$

Additional information should be provided for the purpose of benchmarking, i.e. not for CO2 value correction, for example the modal split – walking, cycling, car use, public transport. Other parameters should be discussed.

Summary

Using a simple procedure based on a small number of data that municipalities should be able to obtain relatively easily in principle, CO2 emissions inventories can be prepared and updated consistently for the purpose of comparison with other European municipalities. The inventory can and should therefore not be too detailed. This also limits the costs for preparing the inventory, both for work carried out internally or by third parties!

The CO2 emissions inventory may be differentiated at a local level (although this is not compulsory) according to consumption sectors. In this case, local features and approaches should be identified. Text fields should be used to identify local factors (commercial, industry, etc.) that may be responsible for higher CO2 emissions compared with other municipalities.

Benchmarks and evidence of particular types of energy-producing installations are further important factors for the purpose of public presentation and discussion.

It should be noted that it is not possible to automatically derive a CO2 reduction strategy from a CO2 emissions inventory.

It is difficult to provide evidence of individual measures and successes as part of CO2 emissions inventories – politicians should be made aware of this fact. Such successes and projects should be presented in the form of individual reports or overview lists.

*Prepared by
Dr. Werner Neumann
City of Frankfurt am Main – Energiereferat (Energy Department)*



CLIMATE ALLIANCE
KLIMA-BÜNDNIS
ALIANZA DEL CLIMA e.V.