Existing Methodologies and Tools for the Development and Implementation of Sustainable Energy Action Plans (SEAP)

Summary report II : Methodologies and Tools for CO2 inventories in cities

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INTRODUCTION

The Covenant of Mayors (CoM) is the commitment by signatory towns and cites to go beyond the EU objectives in terms of CO_2 reduction, through the implementation of Sustainable Energy Action plans (SEAPs). Signatories commit to submitting their local SEAPs, with concrete measures aiming at reducing the city's CO_2 and emissions within the year following adhesion. The SEAP should include a baseline CO_2 emission inventory and the CO_2 reduction target.

The JRC carried out a study with the aim of providing an overview of:

- Existing methodologies/tools for the development and implementation of SEAPs by municipalities (Part I)

- Existing methodologies/tools for the elaboration of baseline CO_2 emission inventory at municipal level (Part II)

The present document is a short (summary) version of part II of the report. The full report is available on the JRC website[1].

The list of the reviewed tools does not have the pretention to be exhaustive. There certainly exist other tools that may be suitable as well.

The overview exercise is concluded by a signposting table allowing visualising the main characteristics of each of the most relevant methodologies.

The aim of this report is not to identify or impose one tool or methodology that should be followed by all cities, but to provide guidance/recommendations to help local authorities to select the tools that best suit them, according to their own needs and characteristics. It is possible that some cities may actually decide to use several tools, taking advantage of the strengths of each of them.

Although it appears that some tools may be closer than others to the rules and principles set out in the context of the CoM, it is up to the cities to decide which tool they want to use.

Based on the evaluation presented here, guidelines have been be elaborated[2], providing detailed recommendations for SEAP elaboration and CO_2 baseline inventory. Following these guidelines will help local authorities to reach the commitments they have taken by signing the Covenant.

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[1]

http://re.jrc.ec.europa.eu/energyefficiency/pdf/CoM/Methodologies_and_tools_for_the_development_of_SEAP.pdf

[2] http://re.jrc.ec.europa.eu/energyefficiency/html/com.htm

1. Introduction to the research on CO2 inventories methodologies

The methodologies available for the estimation of CO_2 emissions and emission savings in cities were searched in the internet and based on contacts with local authorities' networks and tool developers. The *Workshop on methodologies for city Sustainable Energy Action Plans*[3] organized in Ispra, Italy, 18-19 May, 2009 provided important information for the purposes of this analysis. All the methods and tools presented during the Workshop are analyzed in this document. Furthermore, the topics that were identified at the workshop as being of particular importance when defining a Baseline Emission Inventory have been given particular attention.

The aim was to search for methodologies that are widely accepted and applied, in contrast to searching for methodologies used in a single country or by a single city. The focus of the search was in methodologies, instead of tools. Therefore, any tool that was chosen to be analyzed had to fulfil the criteria of being documented and the methodology used by the tool being clearly explained.

Some of the organizations, for example Climate Alliance and ICLEI, have developed different tools for different regions during the years. In this document, we aim at analyzing the latest methodology or tool of each organization.

The methodologies analyzed in this document are the following:

A. Emission tracker tool (Project 2 degree, Clinton Climate Initiative)

B. International Local Government GHG emission Analysis Protocol (ICLEI)

C. The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (WRI/WBCSD)

D. The Greenhouse Gas Protocol: The GHG Protocol for Project Accounting (WRI/WBCSD)

E. ADEME tools: Bilan carbone

F. California Climate Action Registry Project Protocols

G. GRIP tool

H. ECORegion (Climate Alliance)

In addition, there are a number of methodologies and tools developed in projects, or that are specific to a single country. These are not examined in detail in this document, except one methodology, inclusion of which was suggested by the EEA.

I. Local and regional CO_2 emissions estimates for 2005-2006 for the UK

The Sections describing the available tools and methodologies are organized as presented below. The items marked with an asterisk are later used for signposting of the methodologies.

- Name of the document
- Purpose
- Developed by
- Documentation available at
- Tool*
- Boundaries*
- Scope*

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[3] http://re.jrc.ec.europa.eu/energyefficiency/html/Workshop_CoM_Ispra_18-1905-2009.htm

- Sectors*

- Compounds*

- Methodology for stationary combustion*

- Methodology for transportation*

- Methodological levels

- Methodology for emission reductions

Institut Veolia Environnement and the College of Europe have carried out a *Comparative Analysis of Local GHG Inventory Tools*[4]. The aim of the work was to identify the most used, advanced or promising methodologies for city inventories and to analyze whether and how the results obtained using different tools can be compared. Altogether six different tools were analyzed. The results of that project are incorporated in our analysis to relevant extent.

All the tool developers were invited to comment on a draft version of this report, and the comments received are incorporated into this document.

2. AVAILABLE METHODOLOGIES FOR THE ESTIMATION OF CO₂ EMISSIONS/EMISSION SAVINGS

The analyzed tools typically use comparable emission factors and recommend comparable activity data sources. Instead, differences can be found in the treatment of indirect emissions from electricity produced outside the municipality; in the treatment of transportation biofuels; and the manner in which emissions from combined heat and power production (CHP) are allocated between heat and electricity. Other major differences can be found regarding which sectors and compounds are included and how the boundaries and scopes are set for the inventories.

The following Sections focus on these aspects of the existing methodologies.

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[4] http://www.coleurop.be/content/development/references-academiccooperation/GHGinventories_finalreport.pdf

A. Emission tracker tool (Project 2 degree, Clinton Climate Initiative)

Name of the document: Project 2° Administrators & Users Guidance Manual

Purpose: In the framework of Project 2° (launched by the Clinton Climate Initiative), to encourage cities to calculate their GHG emissions of both municipal operations and the entire community in a uniform way, and to enable cities to plan meaningful actions that save energy and money, and make a profound impact in the fight against climate change.

Developed by: Clinton Climate Initiative and ICLEI

Documentation available at:

http://www.project2degrees.org/Pages/Users_and_Administrators_Guidance_Manual.Version_1.doc

Tool: The emission tracker tool can be accessed from http://www.project2degrees.org

Boundaries: The method provided by the Project 2 degree divides emissions between *community* and *government* inventory. The *community* emissions occur inside a geographical region, and *government* emissions are those over which the local authority may exercise control. Thus the *community* emissions include also *government* emissions.

Scope: Scope 1 emissions are those occurring within the geopolitical boundary of the municipality (for example from road, rail, sea and air transportation within the geopolitical boundary). Scope 2 emissions, called indirect emissions, are emissions occurring in the production of electricity, steam, heat and cooling used within the geopolitical boundary, but produced outside it. Scope 3 deals with indirect emissions that occur as a result of an activity within the geopolitical boundary, for example rail, sea and airborne transportation departing from or arriving into the community.

Sectors: *Community inventory*: Energy Use, Grid Power Generation, Transportation, Solid waste and wastewater, Process Emissions, Agriculture, Forestry and Other Land Use, Other.

    Government inventory: Buildings & Other Facilities, Street Lighting & Traffic Signals, Grid Power Generation, Vehicle Fleet, Water Supply, Wastewater, Solid Waste, Other.

Compounds: all the Kyoto GHGs

Methodology for stationary combustion:

Input data for fuel use: Fuel type, activity area (such as industrial or power generation) and volume of fuel consumed. Sources: utilities, fuel tax records and fuel suppliers. In the case of small scale sources distributed at a highly local level, end user surveys may need to be performed.

Input data for electricity consumption: can be obtained from the grid power network, electricity suppliers, or other government entities that regulate electricity generation in the area.

Emission factor for electricity: The software is pre-loaded with emission factors and coefficients that vary by country, including emissions associated with electricity consumption. However, the default values may not be applicable to the particular circumstances of a city, so a review of the values is recommended.

CHP emission factor: Not mentioned

Green electricity purchases: For government inventories, information around any renewable electricity purchases the city has made above and beyond the standard renewable content of utilities in the area as well as any solar electricity generation on government's own facilities should be included.

Methodology for transportation:

Input data: In the *government* inventory emissions estimates should be based on information regarding the type of vehicle, fuel type (e.g. gasoline, diesel, biodiesel, etc.) and the distance travelled. The Emissions Tracker software has average fuel efficiencies by vehicle type, but specific fuel efficiencies for vehicles in the municipal fleet or in the community can be applied as well.

For c*ommunity inventories*, the tool can calculate emissions based on distance travelled, using assumptions about vehicle types. Information about the proportion of distance travelled by vehicle type needs to be gathered. The Emissions Tracker can also calculate emissions based on fuel use by vehicle type in the community.

The software is pre-loaded with emission factors and coefficients that vary by country, including the emissions per kilometres of automobiles.

Biofuels: not mentioned

Methodological levels: The report presents the general idea of different tiers, and applies "de minimis" threshold, i.e. that the least important emission sources do not need to be estimated (those less important than 3% together). The methods are based on IPCC 2006.

Methodology for emission reductions: The tool provides support for designing a "Climate Action Plan" and "GHG Reduction Measures", see

http://project2degrees.org/Help/Emissions%20Tracker%20Help.htm#_Toc212446053

B. International Local Government GHG emission Analysis Protocol

Name of the document: International Local Government GHG Emissions Analysis Protocol. Release Version 1.0

Purpose: to provide an easily implemented set of guidelines to assist local governments in quantifying the greenhouse gas emissions from both their internal operations and from the whole communities with their geopolitical boundaries.

Developed by: ICLEI

Documentation available at:

http://www.iclei.org/fileadmin/user_upload/documents/Global/Progams/GHG/LGGHGEmissionsProtocol.pdf

Tool: The ICLEI has developed the HEAT tool, which is available at

http://heat.iclei.org/ICLEIHEAT/portal/main.jsp

However, it may not be completely in accordance with the latest protocols, but updates are being made.

Boundaries: Two parallel analyses of emissions: one for *local government operations* and one for all sectors of the *community*, i.e. two boundaries, the organizational and geopolitical.

Scopes: *Government operations emissions*: Scope 1: direct emission sources owned by the local government; scope 2: indirect emission sources limited to electricity, district heating, steam and cooling consumption; scope 3: all other indirect and embodied emissions over which the local government exerts significant control or influence. In some cases emissions from contracted services should be included as well, e.g. if the contracted service is something that the local government usually does, or if it was before (base year) part of local government's operations.

   Community-scale emissions: Scope 1: all direct emissions within the geopolitical boundary; scope 2: indirect emission sources limited to electricity, district heating, steam and cooling consumption; scope 3: all other indirect and embodied emissions that occur as a result of activity within the geopolitical boundary.

Sectors: Stationary Combustion, Electricity / Heat Consumption, Mobile Combustion, Fugitive Emissions, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use, Waste. In the inventory of local government, the energy use is split to buildings and facilities, street lights and traffic signals and water/wastewater treatment and distribution.

Compounds: all the Kyoto GHGs

Methodology for stationary combustion:

Input data for fuel use: Data on total community fuel use should be gathered from the primary energy providers. Wherever possible this data should be segregated by the energy provider into sectors of the economy (residential, commercial and industrial). It is important that all fuel supplied for purposes of producing electricity or centralized heat or cooling (e.g. steam) that will be supplied to the grid (and could subsequently be reported as a Scope 2 emissions source) be tracked and reported separately.

Input data for electricity and heat consumption: Data on total community use of electricity and heat shall be gathered from the primary energy providers.

Emission factor for electricity: *Government inventory:* Electricity supplied from all electricity providers supplying the grid must be included in the analysis. It is good practice to gather the energy

data facility by facility. Emission factors for local governments can be developed e.g. if electricity generation facilities differ from that of a larger grid.

Community inventory: Local governments shall strive to adopt emission factors that most accurately model the impacts of the decisions that are made locally about the consumption of electricity or central heating/cooling. In some cases this will mean the use of a regional emission factor and in some cases it will mean use of an emission factor developed for a specific utility.

CHP emission factor: In CHP, fuel use is divided between electricity and heat based on the energy output. If district heating is based on 'waste heat', so that it is originating from a source that would already be in operation (such as waste incineration) it can be considered as carbon neutral, taken that it is included elsewhere in the inventory.

Green electricity purchases: not mentioned

Methodology for transportation:

Input data: In the *government* inventory, emissions from mobile combustion are calculated based on fuel used by vehicles owned or operated by the local government. Alternatively, emissions from transportation can be estimated based on distance travelled and using fuel efficiencies of the different vehicles. Also employee commuting and employee air travel can be included.

In the *community* inventory, emission estimate of mobile combustion should ideally be based on fuel consumption but usually data are not available. In that case, the emissions are to be calculated based on distance travelled (scope 1). Scope 3 emissions are either emissions of road vehicles used by community residents or emissions from transportation demand generated by local residences and businesses. For air travel, there are two options: (1) originating from the community or (2) serving the needs of the community's residents. For the first options, the fuel use in flights originating from the community is calculated. For the second one, all the airports in the region that may serve the needs of community residents have to be identified. Then, using fuel use and information of the share of community's residents in all the flights should be estimated. Marine transport: emissions occurring inside the geopolitical boundary of the community should be included. Marine transport originating from the community to be calculated as Scope 3 based on fuel loaded in the ships.

Biofuels: Life-cycle emissions of biofuels are not considered, but can be considered in scope 3 emissions. Local governments are encouraged to consider upstream emissions from the specific source of biofuels in making decisions about the use of those fuels.

Methodological levels: Three tiers described for emission factors. Tier 1: IPCC emission factors; Tier 2: country-specific emission factors; Tier 3: detailed emission factors using operating conditions, combustion technology etc. In the case of activity data, Tier 1 is e.g. national average fuel use/capita, Tier 2 is based on some more data, and Tier 3 is based on e.g. metered energy use.

Methodology to estimate emission reductions: Not available

C. The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (WRI/WBCSD)

Name of the document: The Greenhouse Gas Protocol. A Corporate Accounting and Reporting Standard. Revised edition.

Purpose: The purpose is to help companies[5] prepare a GHG inventory that represents a true and fair account of their emissions, through the use of standardized approaches and principles; to simplify and reduce the costs of compiling a GHG inventory; to provide business with information that can be used to build an effective strategy to manage and reduce GHG emissions; to provide information that facilitates participating in voluntary and mandatory GHG programs; to increase consistency and transparency in GHG accounting and reporting among various companies and GHG programs.

Developed by: World Business Council for Sustainable Development (WBSCD) and World Resources Institute (WRI)

Documentation available at: http://www.ghgprotocol.org/files/ghg-protocol-revised.pdf

Tool: Several tools are available for different industry sectors. For instance, there is a tool for calculation of emissions from purchased electricity, heat, or steam; a tool for allocation of emissions from a combined heat and power (CHP) plant; and a tool for calculation of GHG emissions from transport or mobile sources. The tools are available at

http://www.ghgprotocol.org/calculation-tools/all-tools

Boundaries: Two sets of inventory boundaries for companies: (1) Organizational boundaries: equity share or financial control method and (2) Operational boundaries.

Scope: Scope 1: Direct GHG emissions from sources owned or controlled by the company; scope 2: emissions from generation of purchased electricity, heat or steam; scope 3 (optional): other indirect emissions. Sales of own-generated electricity are not deducted from scope 1 emissions. Transmission and distribution losses are included in scope 2 if the company owns or controls the transmission/distribution network. End consumers do not report transmission and distribution losses. Purchased electricity that is re-sold is reported under scope 3, whereas purchased electricity used is reported under scope 2 and own-generated electricity used under Scope 1.

Sectors: All, but no detailed methodology for carbon sequestration.

Compounds: all the Kyoto GHGs

Methodology for stationary combustion:

Input data for fuel use: company-specific

Input data for electricity and heat consumption: company-specific

Emission factor for electricity: Recommended to obtain source or supplier specific emission factors for purchased electricity, if not available, to use grid averages.

CHP emission factor: not specified

Green electricity purchases: are accounted for as an emission reduction measure

Methodology for transportation:

Input data: Detailed data on company-owned vehicles.

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[5] Even though this protocol is not targeted to local governments, the description is included here because the clear and detailed descriptions in the document can be useful for the development of methodologies for CoM inventories. Also, the protocol has been used as a basis for the development of other protocols.

Biofuels: CO_2 from biomass/biofuels reported separately as an information item.

Methodological levels: Not relevant

Methodology for emission reductions: If the emission reductions occur inside the inventory boundaries, the emission reductions are captured by the inventory and there is no need to report them separately. An example of reduction that has to be reported separately is substituting fossil fuel with waste derived fuel, which reduces emissions from landfilling that would not otherwise be reported in the inventory of the company. Another example is establishment of a CHP plant that will increase the inventory emissions of the company but reduce emissions of other end-users of electricity from the grid.

Project based offsets: First, a baseline scenario is chosen, and then the project reduction is calculated as the difference between baseline and project emissions. Additionality has to be demonstrated. Then, relevant secondary effects have to be identified and quantified. Then, reversibility has to be considered (e.g. in the case of carbon sequestration, whether there is the risk that carbon is emitted back to the atmosphere). Finally, double counting has to be avoided, e.g. if the offsets are indirect, so that the direct emitter does not account for them as well.

D. The Greenhouse Gas Protocol: The GHG Protocol for Project Accounting (WRI/WBCSD)

Name of the document: The GHG Protocol for Project Accounting

Purpose: To provide a credible and transparent approach for quantifying and reporting GHG reductions from GHG projects; to enhance the credibility of GHG project accounting through the application of common accounting concepts, procedures, and principles; and to provide a platform for harmonization among different project-based GHG initiatives and programs.

Developed by: World Business Council for Sustainable Development (WBSCD) and World Resources Institute (WRI)

Documentation available at: http://www.ghgprotocol.org/files/ghg_project_protocol.pdf

Tool: There is no tool for projects, but reference is given to tools developed for corporate accounting and reporting standard (see above).

Boundaries: Project boundaries. GHG assessment boundary shall be clearly defined and reported. The GHG assessment boundary shall include the primary and significant secondary effects of all project activities.

Scope: Primary and secondary effects of the project.

Sectors: All the sectors relevant for the project. A separate guidance for LULUCF projects.

Compounds: all the Kyoto GHGs

Methodology for stationary combustion: Emissions from fuel and electricity consumed within the project boundary, including both primary and secondary effects. Change in stationary combustion emissions can be either a primary effect (specific changes in GHG emissions that a project activity is designed to achieve) or a secondary effect (an unintended change caused by a project activity) of the project.

Methodology for transportation:

Input data: Detailed fuel use etc data if the project involves transportation of materials, employees, products, or waste.

Methodological levels: Not relevant

Methodology for emission reductions: Yes, as this is a protocol for projects.

E. ADEME tools: Bilan carbone

Name of the document: Methodological Guide (Version 5.0): Objectives and Principals for the Counting of Greenhouse Gas Emissions

Purpose: A method for companies and local authorities to calculate their GHG emissions. Bilan carbone contains a methodological book; an emission factor guide; Excel tools for territory and organization approaches with databases of 1500 emission factors; a series of other Excel tools which, for example, help the user to generate data.

Developed by: ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie)

Documentation available at:

http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=15729&m=3&catid=22543

Tool: A tool is available.

Boundaries: In the module for local authorities there are two different approaches: territorial approach and "assets and services" approach. The territorial approach includes emissions that occur inside the geographical boundaries (direct emissions) and due to activities inside the territory (indirect emissions). The "assets and services" approach includes the emission sources which are in local authority's direct hold.

Scope: Includes all the emissions following a life cycle approach (scopes 1, 2 and 3).

Sectors: The territory approach includes GHG emissions from Production of energy; Industrial sector; Agriculture and fishing sector (including production of fertilizers); Commercial activities; Housing sector; Freight; Passenger travel; Construction sector (including roads); Waste treatment; Production of the wastes that are treated; Food consumption.

The "assets and services" approach evaluates all GHG emission under the operational control of the local authority

Compounds: All the Kyoto GHGs and CFCs

Methodology for stationary combustion:
Input data for fuel use: meter readings/utility bills (recommended); proxy year data normalized with heating or cooling degree days (alternative); or fuel estimates based on comparable facilities and square footage (alternative).
Input data for electricity and heat consumption: metered readings/utility bills (recommended); estimated electricity use based on comparable facilities and square footage (alternative). For housing, heating electricity and other electricity consumption are calculated separately.
Emission factor for electricity: Verified utility-specific emission factor or GRID national default emission factor.
CHP emission factor: There is not specific guidance.
Green electricity purchases: Green power purchases should be taken into account. This rule might change.

Methodology for transportation: Different approaches in the territorial module: (1) transport departing from or arriving at the territory; (2) transportation of the citizens of the territory; (3) transportation of the visitors (tourism, business, family visits)

Input data: Direct fuel consumption or average of consumption per type of vehicles (input data: vehicle-km), or average per type of travel (input data: passenger-km), or average per type/size of territory (input data: number of inhabitants and size of the territory)
Plane, boat, train, cars and urban public transport are taken into account.

<u>For freight:</u> Direct fuel consumption or ton-kilometres per category of trucks/plane/boat/train, or average per number of inhabitant (only for boat and trucks).

<u>Biofuels:</u> will be taken into account through the "national mix" for the transport sector. User can choose 100% biofuel if consistent with the reality ("assets and services" approach)

Methodological levels: Not relevant

Methodology for emission reductions: Not available

F. California Climate Action Registry Project Protocols

Name of the document: Climate Action Reserve Program Manual (and different documents for different sectors)

Purpose: To present the rules, policies and procedures for registering projects and creating offset credits with the Climate Action Reserve. It also describes the process used by the Reserve to develop protocols for determining the eligibility of, and quantifying reductions from, carbon offset projects.

Developed by: California Climate Action Registry

Documentation available at: http://www.climateregistry.org/tools/protocols.html

Tool: the CARROT tool is available at http://www.climateregistry.org/tools/carrot.html

Boundaries: project boundaries

Scope: emissions inside the project boundary

Sectors: Depends on the project. Guidance is currently available for certain project types in livestock, forest, landfills and urban forests sectors.

Compounds: depends on the project

Methodology for stationary combustion: not relevant (focus on other sectors)

Methodology for transportation: not relevant (focus on other sectors)

Methodological levels: not relevant

Methodology for emission reductions: Methodologies for projects reducing emissions in the following sectors: livestock, forest, landfill, urban forests

G. GRIP

Name of the document: Greenhouse gas Regional Inventory Protocol (G.R.I.P)

Purpose: A stakeholder orientated approach focused on mutual learning with three steps: (1) set up a regional greenhouse gas inventory; (2) develop 'Energy Scenarios'; (3) use the scenario outputs to inform plans

Developed by: The University of Manchester, Centre for Urban and Regional Ecology, School of Environment and Development

Documentation available at: http://www.grip.org.uk/Home.html

Tool: The tool can be accessed at http://www.carboncaptured.org.uk/

Boundaries: geopolitical boundaries of a region or municipality

Scope: Scopes 1 and 2. In addition, emissions associated with the treatment of waste when it is disposed outside the region (scope 3).

Sectors: Energy, industrial processes, agriculture and waste

Compounds: All the Kyoto GHGs

Methodology for stationary combustion:

Input data for fuel use: natural gas, solid fossil fuels, liquid fossil fuels, biomass

Input data for electricity and heat consumption: Fuels used in generation, output from generation, consumption by sector, losses.

Emission factor for electricity: Electricity is considered in three parts: that from the grid, that from CHP and that from onsite generation.

CHP emission factor: Emissions from CHP are allocated to the end user and divided into four parts: heat consumed, electricity consumed, electricity lost and heat lost.

The above refers to situations when activity data are available. If not, there are scaling factors available in GRIP for the estimation of activities, such as economic activity by sector, GDP, households, household expenditure on fuels and waste disposal methods.

Methodology for transportation:

Input data: fuel consumption by fuel type. If the data are available, scaling factors included in GRIP are used for the estimation of emissions. Such scaling factors are for example vehicle ownership and transportation miles by mode and person.

Methodological levels: Three different levels. The GRIP for Europe Level 1 approaches are the most accurate, with level 3 approaches having the highest level of uncertainty associated with them.

Methodology for emission reductions: scenario tool available to facilitate discussion.

H. ECORegion

Name of the document: ECORegion - Regional Energy- und Greenhouse Gas Balances (website)

Purpose: To offer local and regional authorities an easy and solid calculation method for energy consumption and CO_2 emissions. By providing the same methodology, the same national data and calculation parameters with centralized data update each year in an internet-based tool, a comparison of emission inventories of different cities is possible and inconsistencies coming from the use of individual tools are erased.

The tool offers the preparation of a so-called 'start balance', where CO_2 emissions of the city are calculated only proportional to the number of inhabitants and to the number of employees in a total of 19 economic sectors (top-down-approach). Based on this start balance, the 'end balance' can be calculated with individual data (bottom-up-approach). In the case that no local data are available, the values calculated in the start balance remain included, offering by this complete data sets for the emissions in the different sectors which are more or less adapted to the local conditions.

Developed by: Ecospeed in collaboration with Climate Alliance, European Energy Award, Swiss Cantons, Federal Office for Energy and Environment of Switzerland

Documentation available at:
http://www.ecospeed.ch/eco2region/data/ECORegion_Flyer_EN_20091001.pdf
http://www.ecospeed.ch/eco2region/data/ECORegion_Short_Instruction_EN_20091001.pdf
http://www.ecospeed.ch/eco2region/data/ECORegion_Communities_EN_20091001.pdf
http://www.ecospeed.ch/eco2region/data/ECORegion_Methodology_EN_20091001.pdf

Tool: Different versions of the tool can be purchased at

http://www.ecospeed.ch/

ECORegion[smart] is a monitoring tool for energy end use and CO_2 emissions divided into household, economic and transportation sector. ECORegion[pro] includes also industry, other non-energy sources and all greenhouse gases. ECORegion[premium] is an advanced version of ECORegion[pro] including scenario-calculations and measures. ECORegion[community] can be used to manage a portfolio of cities and municipalities which use ECORegion.

Boundaries: ECORegion calculates the final energy, the primary energy and the corresponding CO_2 emissions for cities and municipalities and also for "communities", which in this case are groups of local authorities like counties and regions, but could also be members of the same network or working group.

Scope: The core data of ECORegion are the final energy consumptions of a region (like in IPCC Category Nr. 1). In addition, ECORegion produces CO_2-emissions based on final energy, LCA for energy or CO_2-emissions based on LCA.

Sectors: Energy consumption in private households, agriculture, industry, energy (energy and district heating production at the local level) and service sector, the municipal buildings, the public lighting and the municipal infrastructure (municipal waste management, sewage treatment plants), passenger and freight transport for the modes: road, rail, shipping and aviation.

Compounds: All the Kyoto GHGs

Methodology for stationary combustion: The CO_2 balancing method is defined by the energy consumption in the municipality. ECORegion calculates the consumption of electricity or district heating and also the consumption of other energy carriers like gas, biogas, wood, coal, waste, heating oil and plant oil.

Emission factor for electricity and district heating: The municipalities and communities can calculate their energy consumption and CO_2 emissions with a national electricity and district heating mix, or develop their own local or regional mixes.

Methodology for transportation: The transport sector is calculated in four different categories: Private transport (motorbikes and cars), local public transport (bus, metro, suburban and regional railway), long distance transport (intercity rail traffic and aviation) and freight traffic (trucks, railway and ship).

Input data: The transport performance is calculated in person kilometres or in ton kilometres, using fuel mixes and per capita use or per ton use parameters to calculate the consumption from the different transportations modes. These mixes and per capita or per ton use parameters can be adjusted with local or regional data.

Methodological levels: (a) Top-Down-Approach: the national per capita and per employee key data (energy consumption per capita) and the local number of inhabitants and employees are used to calculate a first estimation of the local energy consumption. (b) Bottom-Up-Approach: All local data which are available can be implemented directly into ECORegion. These data replace all pre-calculated data of the top-down-approach. (c) Inter-/Extrapolation: If the local data are not available for every year, the missing years can be inter- or extrapolated between the available data directly in ECORegion. These data are more precise than the top-down-approach but less precise than the bottom-up-approach.

Methodology for emission reductions: scenario tool available

I. **Local and regional CO$_2$ emissions estimates for 2005-2006 for the UK**

Name of the document: Local and Regional CO$_2$ Emissions Estimates for 2005 - 2006 for the UK

Purpose: To provide a spatial disaggregation of the national CO$_2$ inventory on an End User basis in which emissions from the production and processing of fuels (including electricity) are reallocated to users of these fuels to reflect the total emissions relating to that fuel use.

Developed by: AEA Technology, Report to Department for Environment, Food and Rural Affairs

Documentation available at:
http://www.defra.gov.uk/environment/statistics/globatmos/download/regionalrpt/local-regionalco2-report06.pdf

Tool: No tool developed. This is a study providing spatial disaggregation of emissions in the UK, not meant to be a methodology for municipalities.

Boundaries: Spatial disaggregation of national CO$_2$ inventory based on End User basis, thus in contrast to 'at source' emissions.

Scope: 'at source' for point source emissions from industries (scope 1); other emissions allocated based on location of energy consumption (scope 2)

Sectors: Industry and Commercial Electricity, Industry and Commercial Gas, Industry and Commercial Large Gas Users, Industry and Commercial Oil, Industry and Commercial Solid fuel, Industry and Commercial Process gases, Industry and Commercial Wastes and biofuels, Industry and Commercial Non fuel, Industry Offroad, Diesel Railways, Agriculture Oil, Agriculture Solid fuel, Agriculture Non fuel, Domestic Electricity,. Domestic Gas, Domestic Oil, Domestic Solid fuel, Domestic House and Garden Oil, Domestic Products, A-Roads Petrol, A-Roads Diesel, Motorways Petrol, Motorways Diesel, Minor Petrol, Minor Diesel, Road Transport Other, LULUCF

Compounds: CO$_2$

Methodology for stationary combustion:

Input data for fuel use: Industrial and commercial gas consumption by local authority areas are based on metered data. Gas consumption uses a 17 year average weather correction.

Point source emissions for industries are treated as 'at source' estimates rather than those of the product end user. Site-specific data used for point-sources.

Emissions distribution maps for the small industrial combustion, public services, commercial and agriculture (stationary combustion) are based on data on employment at business unit level by Standard Industrial Classification (SIC) code; and on BERR Energy Consumption in the UK data on industrial and commercial sector fuel usage for 2005.

Input data for electricity and heat consumption: Local electricity consumption estimated based on actual or estimated meter readings.

Emission factor for electricity: Emissions from electricity consumption have been estimated using an average UK factor for the relevant year in terms of kt CO$_2$/GWh.

CHP emission factor: not mentioned

Green electricity purchases: the same EF is used for the entire country, i.e. green electricity purchases are not considered separately

Methodology for transportation:

Input data: The emissions of road transportation are based on the assumption that the fleet mix is the same everywhere in the UK road network (i.e. national estimates can be used) regarding age of the fleet and fuel mix. 6 different vehicle types are included. Fuel consumption maps for the UK are calculated from the speed related fuel consumption factors multiplied by vehicle flows. Traffic flow data for major roads available on a census count point basis. This census data are not available for minor roads, and therefore regional average flows by vehicle type have been applied. Vehicle kilometres data are calculated based on traffic flow rates, fuel splits and lengths of each road type. These estimates are then compared with national level fuel use data.

Biofuels: not mentioned

Methodological levels: not relevant

Methodology for emission reductions: not relevant

3. SUMMARY OF EXISTING METHODOLOGIES

Table 1 below summarizes the approach, boundaries, sectors, compounds and scopes of the different methodologies, for the purpose of the assessment of their suitability to the compilation of a Baseline Emission Inventory under Covenant of Mayors.

The following issues are summarized in Table 1:

- Approach: territorial or LCA.

- Boundaries: geographical, organizational/operational, project

- Sectors: energy, transportation, industrial processes, agriculture, land use, land use change an forestry (LULUCF) and waste

- Compounds: CO_2, CH_4, N_2O, f-gases (HFCs, PFCs, SF_6)

- Scopes: scope 1 (emissions within a municipality), scope 2 (indirect emissions due to production of electricity, heat/cooling/steam used in the municipality), scope 3 (all other indirect emissions)

Table 1. Summary of existing methodologies

Label	Approach		Boundaries			Sectors						GHGs				Scope		
	Territorial	LCA	Geographical	Organizational/ Operational	Project	Energy	Transportation	Industrial processes	Agriculture	LULUCF	Waste	CO_2	CH_4	N_2O	f-gases	1	2	3
A	X	X*	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
B	X	X*	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
C	X	X		X		X	X	X	X		X	X	X	X	X	X	X	X
D	X				X	X	X	X	X		X	X	X	X	X	X	X	
E	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X
F	X				X				X	X	X	X	X	X		X		
G	X		X			X	X	X	X		X	X	X	X	X	X	X	X**
H	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	
I	X		X			X	X					X				X	X	

*LCA only in scope 3

**scope 3 only regarding waste disposal outside the geographical area

Explanation of labels

A. Emission tracker tool (Project 2 degree, Clinton Climate Initiative)
B. International Local Government GHG emission Analysis Protocol
C. The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (WRI/WBCSD)
D. The Greenhouse Gas Protocol: The GHG Protocol for Project Accounting (WRI/WBCSD)
E. ADEME tools: Bilan carbone
F. California Climate Action Registry Project Protocols
G. GRIP tool
H. ECORegion
I. Local and regional CO_2 emissions estimates for 2005-2006 for 2005-2006 for the UK

4. INVENTORIES UNDER THE COVENANT OF MAYORS

The boundaries, scope and sectors of the Baseline Emission Inventory under Covenant of Mayors were defined and agreed based on the work of the JRC, DG TREN and Covenant of Mayors Office, and the two workshops organized with the practitioners group.

The CoM inventory can be described, using the same structure than above, as being the following:

Boundaries: geographical boundaries of the local authority

Scope: Direct emissions from use of fuels in the territory (scope 1); direct and indirect emissions due to production of electricity, heat and cold consumed in the territory (scope 1 and 2).

Sectors: Energy consumption (electricity, heating, cooling), urban road and rail transportation. Optional to include also landfills and other sources.

Compounds: At least CO_2, optional to include also other GHGs.

Methodology for stationary combustion:

Input data for fuel use: local fuel use (for instance for building-specific heating or transportation), fuel use in local heat/cold and electricity plants[6]

Input data for electricity and heat consumption: Amounts of imported heat and electricity are calculated as 'consumption minus local production', thus ignoring transportation losses.

Emission factor for electricity: either a national or European emission factor (following IPCC or LCA principles) is used as a basis. Local production and green electricity purchases of the local authority can be taken into account following specific rules.

CHP emission factor: based on energy outputs and efficiencies of separate production processes

Green electricity purchases: Purchases of certified green electricity by the local authority can be taken into account in the electricity emission factor.

Methodology for transportation:

Input data: estimated mileage driven on the street network of the local authority

Biofuels: If emission factors following the IPCC principles are used, biofuels produced in a sustainable manner are considered as CO_2 neutral. If emission factors following LCA principles are used, specific emission factors are applied.

Methodological levels: The local authority can choose whether to use emission factors based on IPCC principles or LCA emission factors. In addition, there is a certain degree of flexibility for the local authorities to decide which emission sources to include and which emission factors to use (e.g. local emission factors instead of the defaults provided in the guidelines).

Methodology for emission reductions: will be included in the guidelines for the most important measures.

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[6] When not included in EU emissions trading and not >20 MW of thermal input. The local authorities can decide to include also larger plants/units if they have carried out/are planning to carry out measures in these plants or units.

5. Signposting of existing methodologies

The existing methodologies are signposted according to their suitability for compilation of Baseline Emission Inventories under Covenant of Mayors. Each of the methodologies is evaluated against the signposting criteria, and is given one of the following marks:

- YES – method in agreement with and can be used for Baseline Emission Inventory

- PARTLY – the method is partly in agreement with specifications of Baseline Emission Inventory and can in certain circumstances be used for that purpose

- NO – method is not in agreement with specifications of Baseline Emission Inventory

The criteria used for signposting of existing methodologies are:

1. Tool – YES if a tool is available, NO if only description of methodology

2. Geographical boundaries

3. CO_2 emissions included

4. Scope for transportation

5. Methodology for transportation

6. Scope for energy sector (production and consumption of electricity, heat/cold, and other energy carriers)

7. Methodology for energy sector (e.g. electricity emission factor)

Table 2. Signposting of the existing methodologies

	Tool	Geographical boundaries	CO_2	Scope for transportation	Methodology for transportation	Scope for energy sector	Methodology for energy sector
A	YES	YES	YES	YES	YES	PARTLY	PARTLY
B	YES	YES	YES	YES	YES	PARTLY	PARTLY
C	YES	NO	YES	NO	PARTLY	NO	PARTLY
D	NO	NO	YES	NO	PARTLY	NO	PARTLY
E*	YES	YES	YES	NO	PARTLY	PARTLY	PARTLY
F	YES	NO	YES	NO	NO	NO	NO
G	YES	YES	YES	YES	YES	PARTLY	PARTLY
H*	YES	YES	YES	YES	PARTLY	PARTLY	PARTLY
I	NO	YES	YES	YES	PARTLY	PARTLY	PARTLY

*The tool developers plan to modify the tool in a manner that it is fully in line with the Covenant of Mayors inventories in 2010

A.   Emission tracker tool (Project 2 degree, Clinton Climate Initiative)

B.   International Local Government GHG emission Analysis Protocol

C.   The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard

D.   The Greenhouse Gas Protocol: The GHG Protocol for Project Accounting

E.   ADEME tools: Bilan carbone

F.   California Climate Action Registry Project Protocols

G.   GRIP tool

H.   ECORegion

I.   Local and regional CO_2 emissions estimates for 2005-2006 for 2005-2006 for the UK

As presented in the table, most of the methodologies are accompanied with a tool, and are thus practical for the users[7]. Furthermore, most of the tools would be suitable for compilation of the *Baseline Emission Inventory* from the point of view of boundaries, and all regarding inclusion of CO_2 emissions. Several tools are also suitable for the estimation of emissions from transportation in the *Baseline Emission Inventory.*

The methods used to estimate emissions from use and production of electricity, heat/cold and other energy carriers varies. Some of the methods do not include these emissions based on geopolitical boundary; some include only fuel combusted inside the geopolitical boundary, but not indirect emissions occurring due to production of electricity or heat outside the territory; and some include fuel combusted in the territory as Scope 1 emissions and electricity and heat used in the city as Scope 2 emissions, in which case summing up the two would lead to double counting.

As a conclusion, it appears that some tools are closer than others to the rules and principles set out in the context of the Covenant of Mayors[8]. However, there is no intention to impose or restrict the usage of any specific tool. Therefore, any of the tools presented here (and also other existing tools that are deemed to be suitable) may be used for compilation of the Baseline Emission Inventory. However, local authorities are recommended to ensure that the results of the Baseline Emission Inventory compiled using such tools are in line with the specifications given in the SEAP template, related instructions and the SEAP guidelines.

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[7] A detailed analysis of the practicability for users was not carried out.
[8] The developers of ADEME and ECORegion are planning to modify the tools so that they will be in line with Covenant of Mayors inventories in 2010.