

# How to prepare a Sustainable Energy Action Plan: ***Baseline Emission Inventory***

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*Federica Paina*  
European Commission  
Joint Research Centre (JR)

- 1. What is a Baseline Emission Inventory (BEI)?**
- 2. Why starting by preparing a BEI?**
- 3. How to prepare a BEI:**
  - i. Which sectors to include;
  - ii. Which Baseline Year to choose;
  - iii. The two approaches for GHGs accounting;
  - iv. Data sources;
- 4. Reporting in the SEAP template;**
- 5. Focus on two topics:**
  - i. Local Electricity Production (and consumption);
  - ii. Heat distributed on the territory as a commodity.

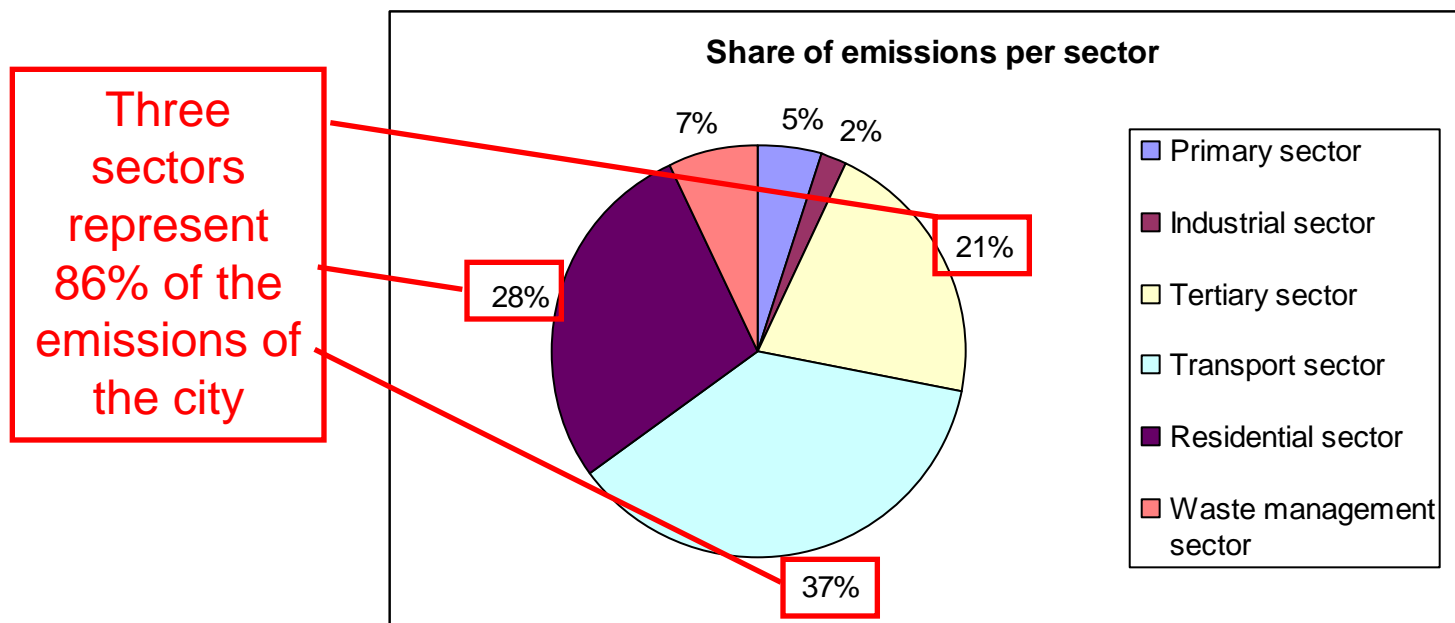
# **1. Baseline Emission Inventory: definition and reason why**

**A Baseline Emission Inventory (BEI) is a quantification of the amount of CO<sub>2</sub> emitted due to energy consumption in the territory of a Local Authority (e.g. a Covenant Signatory) within a given period of time.**

***Preparation of the BEI:  
a PRE-REQUISITE to SEAP elaboration***

## The importance of the BEI

1. The BEI allows identifying the main CO<sub>2</sub> sources on the municipality's territory, thus helping to select the appropriate actions to curb emissions



**Example: Castelldefels (Spain)**

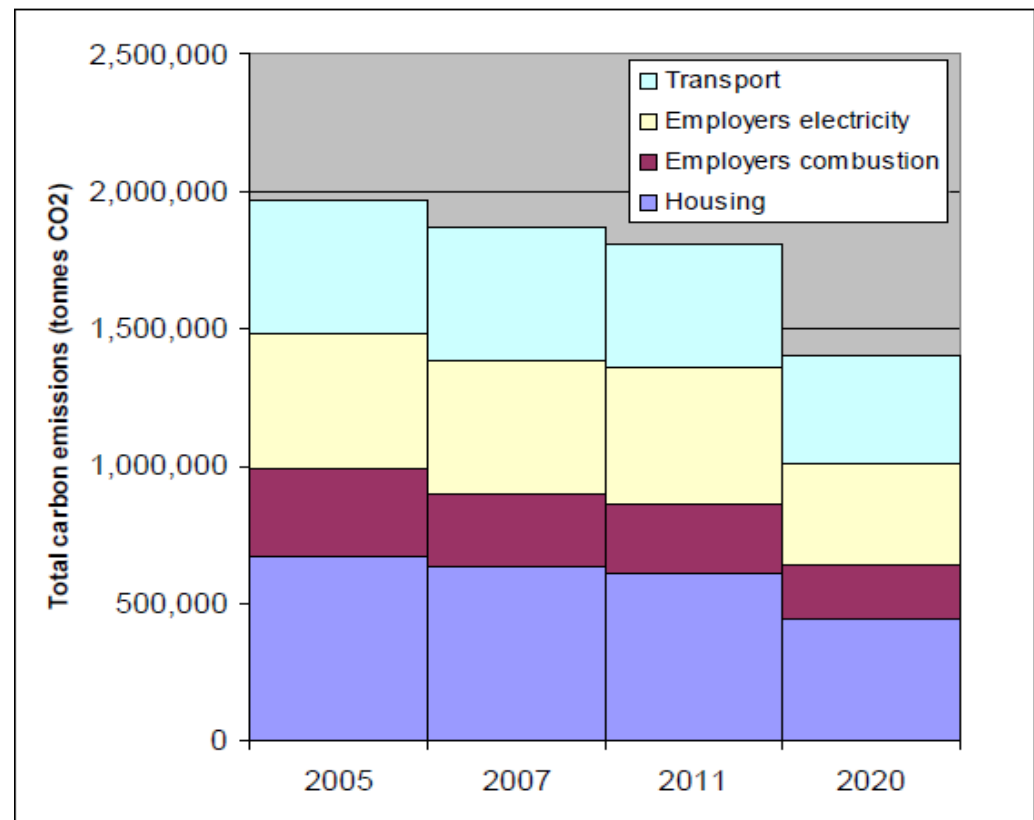
## The importance of the BEI

2. Thanks to the BEI it's possible to measure the impact of the actions: it shows where the local authority is at the beginning, and the successive monitoring inventories will show the progress towards the objective.



Emission inventories help maintaining the motivation of all stakeholders, allowing them to see the results of their efforts!

**Example:  
Sunderland, UK**



## **2. How to prepare a Baseline Emission Inventory**

## ...the key commitment:

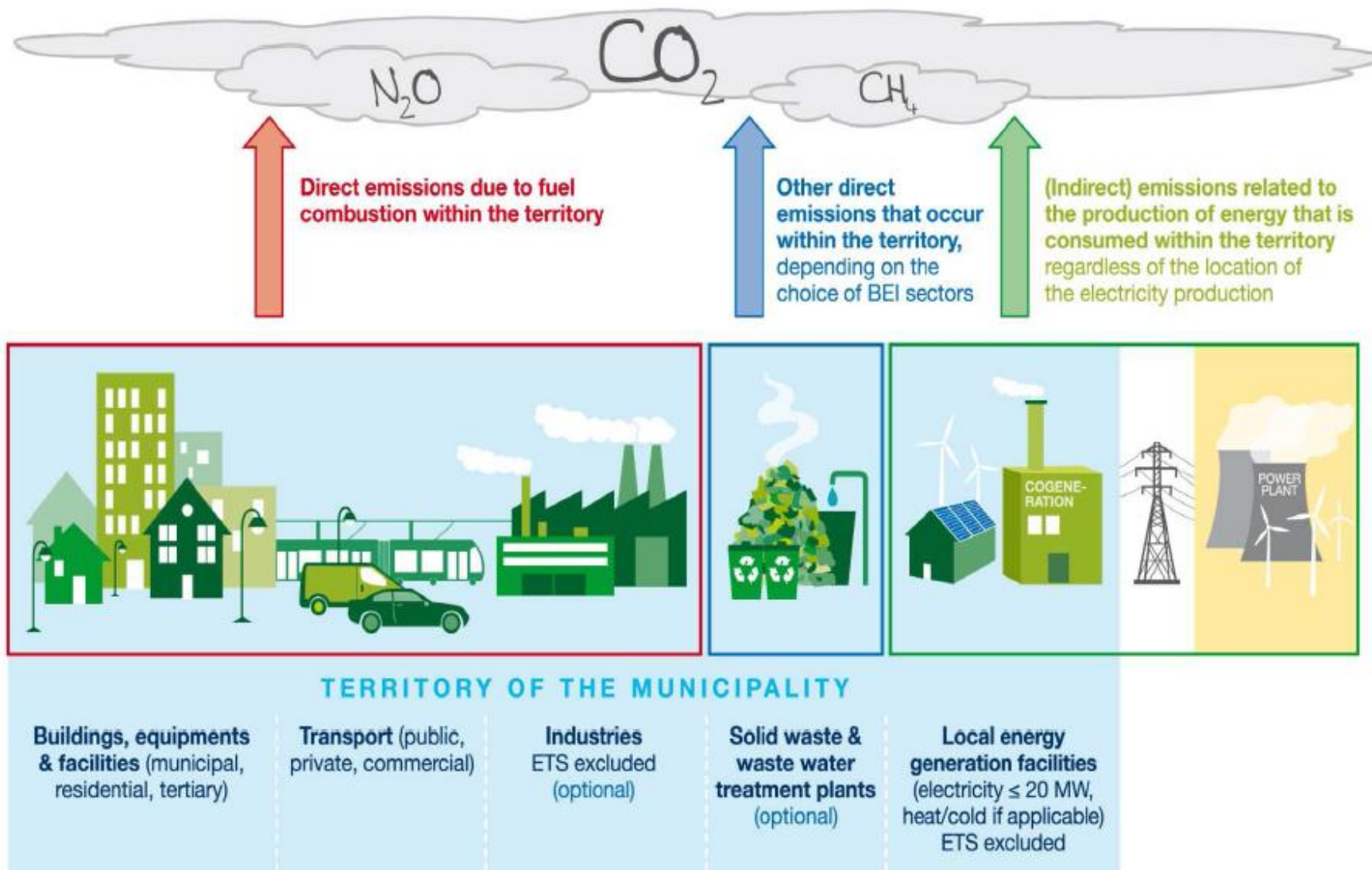
“ WE, THE MAYORS, COMMIT TO:

Go beyond the objectives set by the EU for 2020, reducing the CO<sub>2</sub> emissions **in our respective territories** by at least 20%, through the implementation of a **Sustainable Energy Action Plan** for those areas of activity relevant to our mandates. [...] ”

## ➔ Two key principles:

- ✓ The Covenant follows *essentially* (but not exclusively) a territorial approach, looking at the emissions occurring on the territory of the local authority
- ✓ The focus of the Covenant is on Energy

# A territorial approach...



1. **Final energy consumption**
    - **in buildings, equipment/facilities and industries**
    - **in transport**
  2. Other emission sources not related to energy consumption (e.g. waste ...)
  3. **LOCAL Energy production (electricity, heat, cold)**
- Focus of the Covenant*
- Not mandatory*
- Not mandatory, considered indirectly, via emission factors (for heat, electricity or cold)*

# Where to find more details

TABLE 1. SECTORS INCLUDED IN THE BEI/MEI

**3 possible answers**

SECTOR

INCLUDED?

NOTE

**Final energy consumption in buildings, equipment/facilities and industries**

Municipal buildings, equipment/facilities	YES	These sectors cover all energy consuming buildings, equipment and facilities in the territory of the local authority which are not excluded below. For example, energy consumption in water and waste management facilities is included in this sector. Municipal waste incineration plants are also included here if they are not used to produce energy. For energy producing waste incineration plants, see Sections 3.4 and 3.5.
Tertiary (non-municipal) buildings, equipment/facilities	YES	
Residential buildings	YES	
Municipal public lighting	YES	
Industries involved in EU ETS	NO	
Industries not involved in EU ETS	YES if in SEAP	

**SEAP Guidebook: p. 57**

- ✓ Municipal buildings, equipment/facilities
- ✓ Residential buildings, equipment/facilities
- ✓ Tertiary buildings, equipment/facilities
- ✓ Transport

**STRONGLY  
RECOMMENDED**

- ✓ Industries not involved in the EU ETS
- ✓ Other road transportation (e.g. highways)

**RECOMMENDED  
IF IN SEAP**

- ✓ Industries involved in the EU ETS
- ✓ Aviation
- ✓ Agriculture (for enteric fermentation, fertilizers, etc...)
- ✓ Land use, land use change, forestry

**NOT RECOMMENDED**

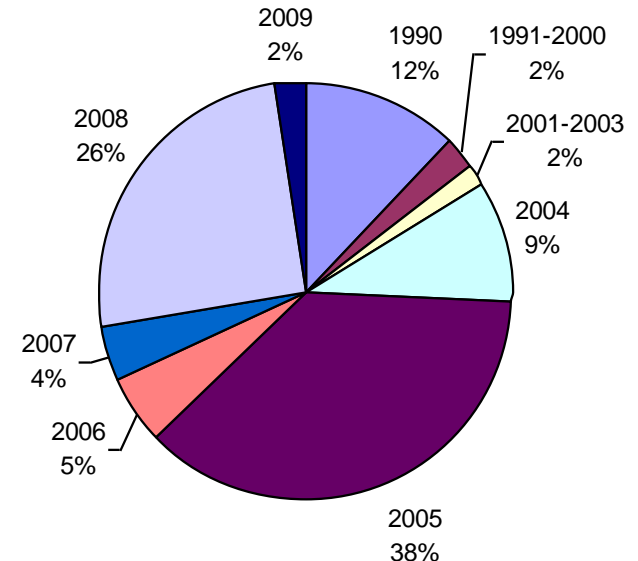
**The Baseline year is the reference year for setting the objective!**

**The Covenant's goal is to contribute to the EU commitment to reduce the emissions of 20 % by 2020 compared to 1990.**

**1990 is recommended.**

However, if the local authority does not have data to compile a CO2 inventory for 1990, then it should choose the closest subsequent year for which the most comprehensive and reliable data can be collected

Choice of baseline year

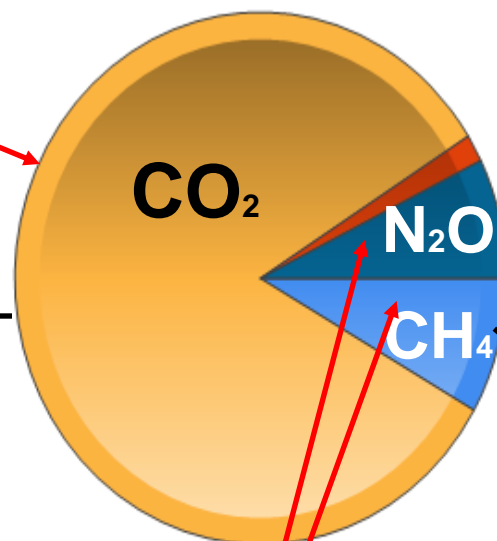


Choice of baseline year

## Share of greenhouse gases (%) - EU27 (EEA, 2009)

**Mandatory**

**Combustion & usage  
of fossil fuels**



~~Agriculture (77%)~~  
Industry (8%)



~~Agriculture (49%)~~  
Waste (31%)



**Fugitive emissions  
(15%)**

**Inclusion recommended if action in  
these sectors is possible and  
planned in the SEAP**

# Which greenhouse gases?

If GHGs other than  $\text{CO}_2$  are included in the BEI, then it is necessary to convert them into  $\text{CO}_2$  equivalents:

TABLE 3. CONVERSION OF $\text{CH}_4$ AND $\text{N}_2\text{O}$ TO $\text{CO}_2$ -EQUIVALENT UNITS	
MASS OF GHG AS T COMPOUND	MASS OF GHG AS T $\text{CO}_2$ -EQUIVALENT
1 t $\text{CO}_2$	1 t $\text{CO}_2$ -eq
1 t $\text{CH}_4$	21 t $\text{CO}_2$ -eq
1 t $\text{N}_2\text{O}$	310 t $\text{CO}_2$ -eq

(SEAP Guidebook: table 3, p. 60)

## Two options for greenhouse gas accounting:

### 1. IPCC approach:

- (Intergovernmental Panel on Climate Change)
- Based on the Carbon content of the fuels.
- Advantages:
  - ✓ Simple;
  - ✓ In line with international reporting (UNFCCC, Kyoto protocol...).

### 2. LCA approach:

- (Life Cycle Analysis)
- Includes embodied emissions that occur upstream (e.g. emissions required to extract, transform transport the fuel up to the city).
- Advantage:
  - ✓ Gives a better view of the global impact of the activities occurring in the territory.

**Note: The approaches differ particularly in the case of biomass!**

**It is just a multiplication !**

$$\text{Emissions} = \text{Activity data} \times \text{Emission factor}$$

e.g. Quantity of natural gas consumed (MWh)      Value (tCO<sub>2</sub>/MWh)



**Find the proper  
data related to  
your local  
authority**



**Most emission  
factors can be found  
in the literature**

- ✓ Energy consumption data have to be relevant to the particular situation of the municipality (national averages will not help)!
- ✓ The data collection process may require some time and resources
- ✓ Sources of data:
  - Invoices (e.g. for the own buildings of the local authority)
  - Market operators (energy suppliers, grid operators, ...)
  - Ministeries (energy, statistics, environment), agencies, regulatory authorities
  - Inquiries addressed to energy consumers
  - Estimates based on partial data (Get help of a statistician!)
- ✓ Recommendation : pay attention to document the data sources and ensure consistency through the years!

- 3. Reporting in the template**
- 4. Evaluating local energy production**

The data have to be reported in the «Emission Inventory» section of the SEAP template, which is divided in 4 parts:

- ✓ Table A: Final energy consumption data
- ✓ Table B: CO<sub>2</sub> emissions
- ✓ Table C: Local electricity production
- ✓ Table D: Local heat/cold production

# Practical Guide: how to report?

*In table A,  
insert energy  
consumption data*

And for each energy carrier

For each sector:

Buildings,  
equipment/facilities  
and industries

Transport

## A. Final energy consumption

Please note that for separating decimals dot (.) is used. No thousand separators are allowed.

Category	FINAL ENERGY CONSUMPTION [MWh]															Total
	Electricity	Heat cold	Fossil fuels								Renewable energies					
			Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	
BUILDINGS, EQUIPMENT / FACILITIES & INDUSTRIES																
Municipal buildings, equipment/facilities	9793	43415	34162		3382									350		91102
Tertiary (non municipal) buildings, equipment/facilities	16519															16519
Residential buildings	408189	278785	418968		989788											20957
Municipal public lighting	1096															1096
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	119443		31361													15080
Subtotal	555040	322200	484491	0	993170	0	0	0	0	0	0	0	0	350	0	23552
TRANSPORT																
Municipal fleet						1693	4274									5967
Public transport	15781		8985			25150	393									50309
Private and commercial transport			160			37077	439180									47647
Subtotal	15781	0	9145	0	0	63920	443847	0	0	0	0	0	0	0	0	53265
Total	570821	322200	493636	0	993170	63920	443847	0	0	0	0	0	0	350	0	28877

Municipal purchases of certified green electricity (if any) [MWh]:

Save

*In table B,  
indicate  
CO<sub>2</sub> emissions*

## Same energy carriers

### B. CO<sub>2</sub>-Emissions

Please note that for separating decimals dot (.) is used. No thousand separators are allowed.

Category	CO2 emissions [t]/ CO2 equivalent emissions [t]															
	Electricity	Heat cold	Fossil fuels								Renewable energies					Total
			Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	
BUILDINGS, EQUIPMENT / FACILITIES & INDUSTRIES																
Municipal buildings, equipments/facilities	879	7052	6764		896											
Tertiary (non municipal) buildings, equipments/facilities	1483															1483
Residential buildings	36648	45281	82956		262294											42715
Municipal public lighting	98															98
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	10724		6209													16933
Subtotal	49832	52333	95929	0	263190	0	0	0	0	0	0	0	0	0	0	46128
TRANSPORT																
Municipal fleet						449	1133									1581
Public transport	1417		1779			6665	104									9965
Private and commercial transport			32			9825	116383									12624
Subtotal	1417	0	1811	0	0	16939	117620	0	0	0	0	0	0	0	0	13778
OTHER																
Waste management																
Water management																
Please specify																
Subtotal																
Total	51249	52333	97740	0	263190	16939	117620	0	0	0	0	0	0	0	0	59905
Corresponding CO2-emission factors in [t/MWh]	0.08978	0.1624	0.198	0	0.265	0.265	0.265	0	0	0	0	0	0	0	0	

$$CO_2 = Energy * Emission Factor$$

Same sectors

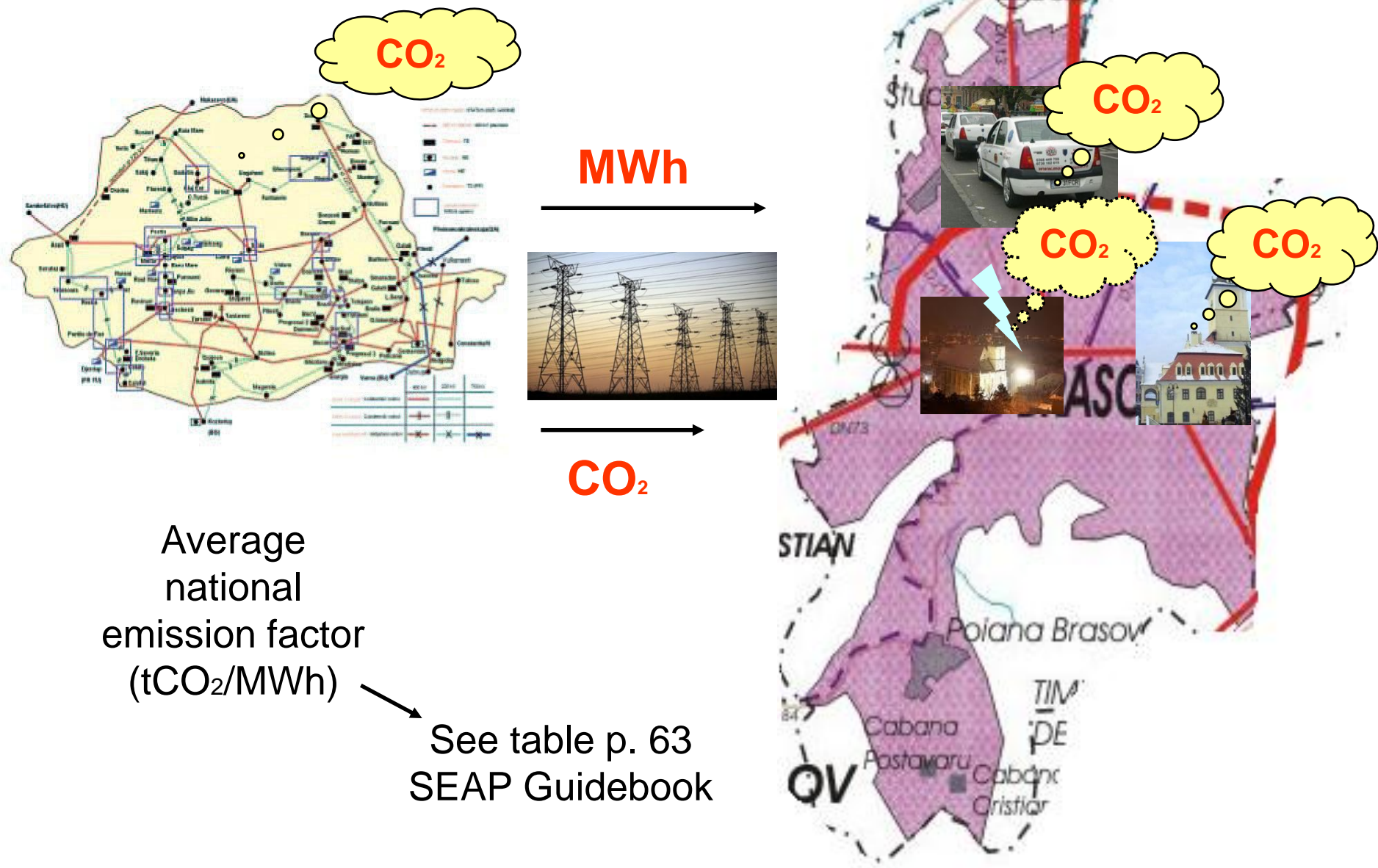
+ other

Remember the Emission Factors

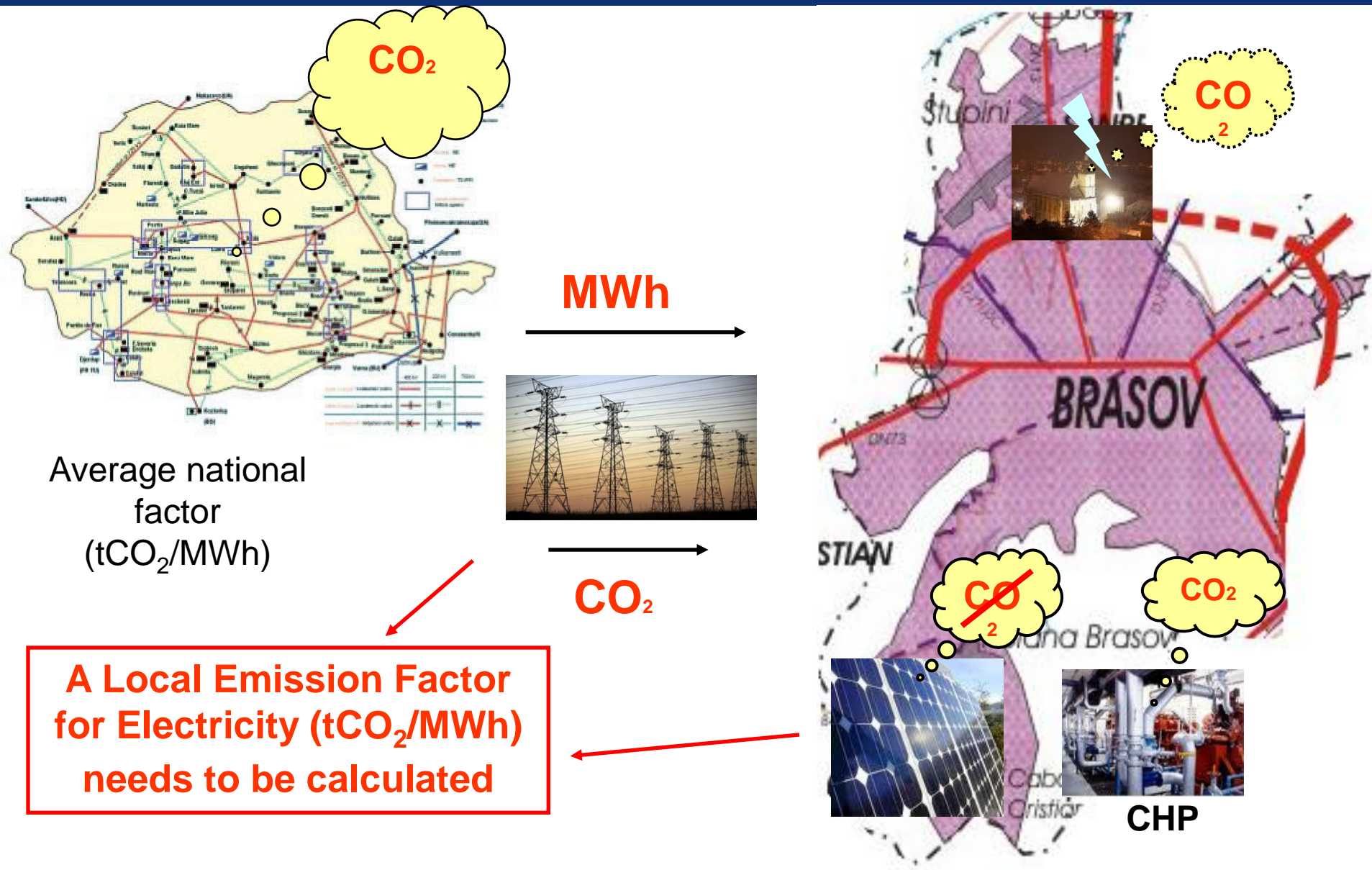
CO<sub>2</sub> emission factor for electricity not produced locally [t/MWh]

0.05

# Electricity consumption

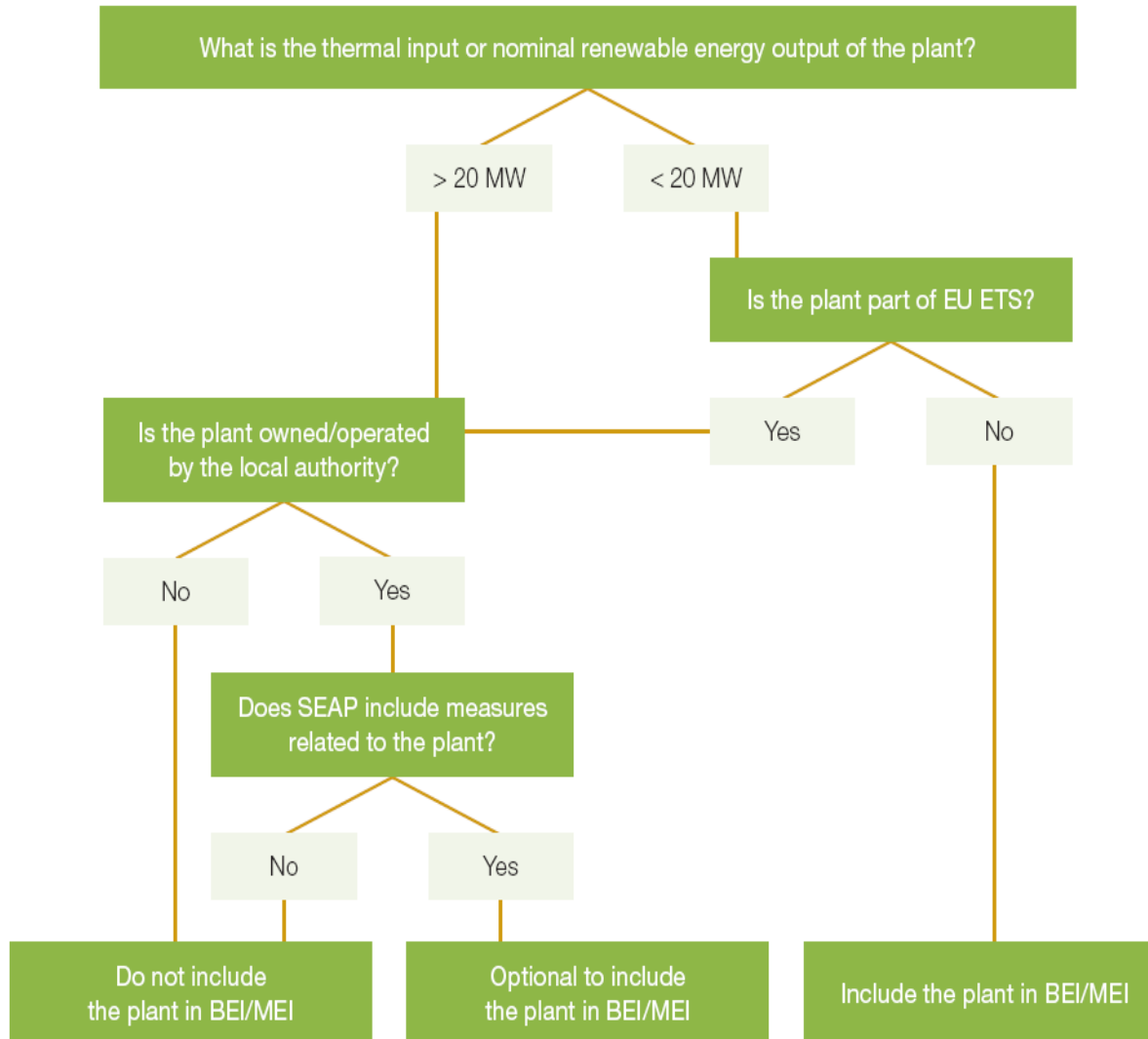


# Local Electricity Production



# What is Local Production?

Large (> 20 MW) Plants / Installation that are not owned/operated by the local authority are not considered to be «local»



**Refer to  
decision tree in  
SEAP Guidebook,  
p. 64**

**...a local Emission Factor needs to be calculated**

$$\text{EFE} = \frac{[(\text{TCE} - \text{LPE} - \text{GEP}) \times \text{NEEFE}] + \text{CO}_2\text{LPE} + \text{CO}_2\text{GEP}}{\text{TCE}}$$

**EFE = Local Emission Factor for Electricity**

**TCE = Total Consumption of Electricity**

**LPE = Local Production of Electricity**

**GEP = Green Electricity Purchased by the LA**

**NEEFE = National (or European) Emission Factor  
for Electricity**

6. Use the formula to calculate the local emission factor for electricity.

OTHER															
Waste management															
Water management															
Please specify															
Subtotal															
Total	51249	52333	97740	0	263190	16939	117620	0	0	0	0	0	0	0	59907
Corresponding CO2-emission factors [t/MWh]	0.08978	0.1624	0.198	0	0.265	0.265	0.265	0	0	0	0	0	0	0	

CO2 emission factor for electricity not produced locally [t/MWh]

0.05

Save

### C. Local electricity production and corresponding CO2 emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

2. Indicate what they produce

1. List the main plants/installations (grouping them if necessary)

Locally generated electricity (excluding ETS plants, and all plants/units > 20 MWh)	Locally generated electricity [MWh]	Energy carrier input [MWh]											CO2 emissions [t] CO2eq emissions [t]	Corresponding CO2-emission factors for electricity production [t/MWh]
		Fossil fuels					Steam	Waste	Plant oil	Other biomass	Other renewable	Other		
		Natural gas	Liquid gas	Heating oil	Lignite	Coal								
Wind power													0	0
Hydroelectric power	156684												0	0
Photovoltaic	62												0	0
Combined Heat and Power	36133	448500											37474	0.198
Please specify													0	0
Total	192879	448500	0	0	0	0	0	0	0	0	0	0	37474	

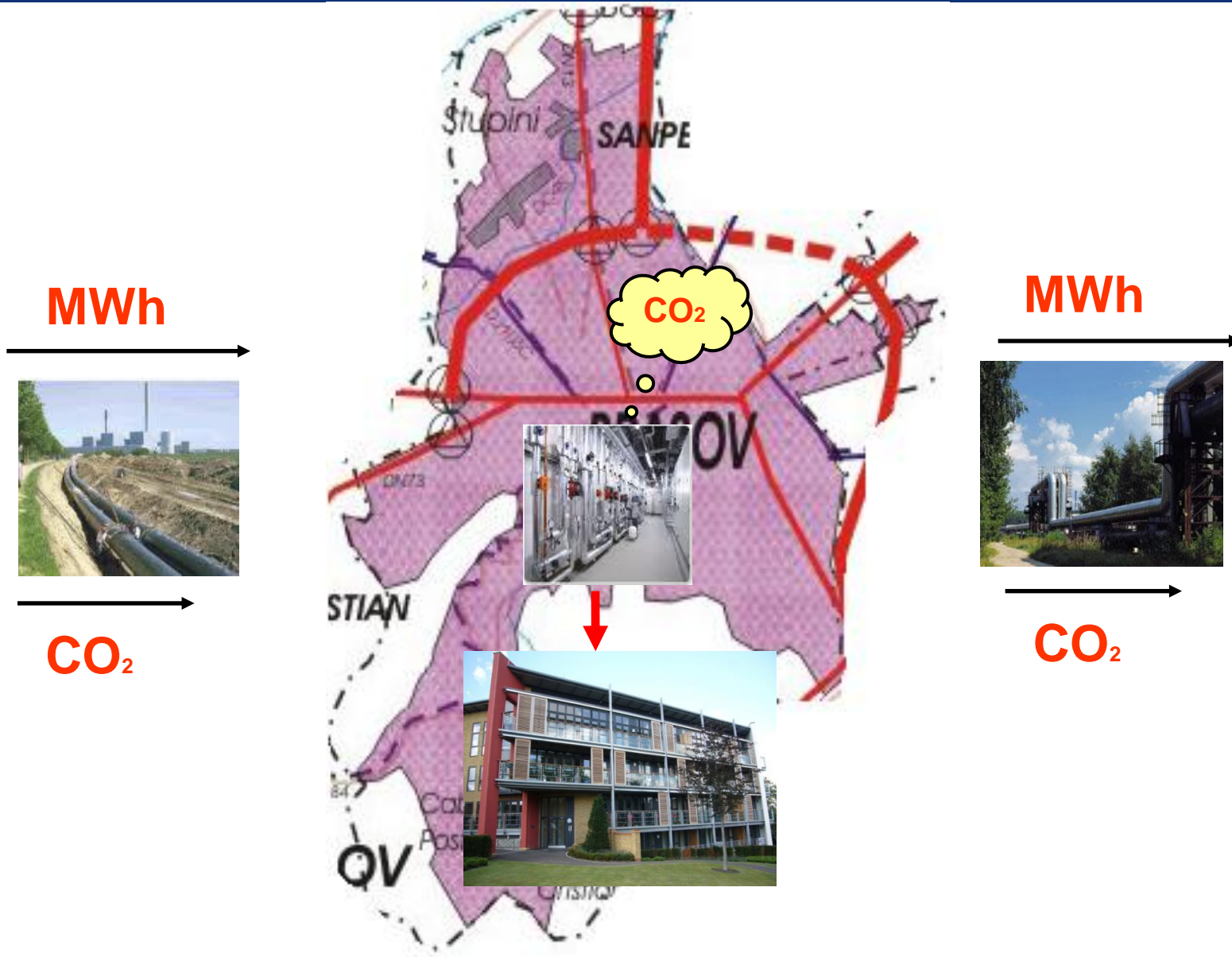
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5. Calculate the totals

3. Indicate what they consume (if applicable)

4. Indicate the emission factor and the CO<sub>2</sub> emissions

# If heat is distributed as a commodity...



## ...a local Emission Factor needs to be calculated

$$EFH = \frac{CO_2LPH + CO_2IH - CO_2EH}{LCH}$$

**EFH = Local Emission Factor for Heat**

**LPH = Local Production of Heat**

**LCH = Local Consumption of Heat**

**IH = Imported Heat**

**EH = Exported Heat**

6. (Use the formula to) calculate the local emission factor for HEAT.

Subtotal	1417	0	1417	0	0	16939	117620	0	0	0	0	0	0	0	0	12
OTHER																
Waste management																
Water management																
Please specify																
Subtotal																
Total	51249	52333	97740	0	263190	16939	117620	0	0	0	0	0	0	0	0	5990
Corresponding CO <sub>2</sub> emission factors in [t/MWh]																
	0.08978	0.1624	0.98	0	0.265	0.265	0.265	0	0	0	0	0	0	0	0	

### 3. Indicate what they consume

4. Indicate the emission factor and the CO<sub>2</sub> emissions

### C. Local electricity production and corresponding CO<sub>2</sub> emissions

**D. Local heat/cold production (district heating/cooling, CHPs...) and corresponding CO2 emissions**

 Please note that for separating decimals dot (.) is used. No thousand separators are allowed.

2. Indicate what they produce

1. List the main plants/installations (grouping them if necessary)

Locally generated heat/cold	Locally generated heat/cold [MWh]	Energy carrier input [MWh]										CO <sub>2</sub> emissions [t] / CO <sub>2</sub> -eq emissions [t]	Corresponding CO <sub>2</sub> -emission factors for heat/cold production in [t/MWh]
		Fossil fuels					Waste	Plant oil	Other biomass	Other renewable	Other		
		Natural gas	Liquid gas	Heating oil	Lignite	Coal							
Combined Heat and Power												0	0
District Heating plant(s)	379000	259236		3790			99298			16676		0	0.1624
Please specify												0	0
Total	379000	259236	0	3790	0	0	99298	0		16676	0	0	0.1624

5. Calculate the totals

## 1. The importance of the Baseline Emission Inventory (BEI):

- i. For the definition of the *status quo*;
- ii. For the identification of the most promising areas of action;
- iii. To identify a basis on which progress can be tracked.

## 2. How to prepare a BEI:

- i. Key sectors to include are buildings, equipment/facilities (residential, tertiary, municipal) and transport;
- ii. GHGs accounting: focus on CO<sub>2</sub> emissions; high Baseline Year to choose;
- iii. GHGs accounting: the choice between the IPCC and the LCA approach;
- iv. How to deal with indirect emissions from Electricity Production and with Local Production of Electricity;
- v. How to report heat distributed on the territory as a commodity.

*Thank you for your attention!*

**Federica Paina**

**+39 0332 78 5368**

**[Federica.Paina@ec.europa.eu](mailto:Federica.Paina@ec.europa.eu)**

**IET - Institute for Energy and Transport**

*Petten - The Netherlands & Ispra - Italy*

<http://ie.jrc.ec.europa.eu/>

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