CommitClimate CO_2 Simulator

SECTOR: ENERGY

interreg-baltic.eu/project/commit-climate

Interreg Baltic Sea Region
Co-funded by the European Union
ENERGY TRANSITION
CommitClimate

Goal of the presentation

- What is included in the sector
- Calculation rationale
- Technical assumptions
- What can the user change? What cannot the user change? Linkages with other sectors
- List of policy measures
- Policy measures working principle

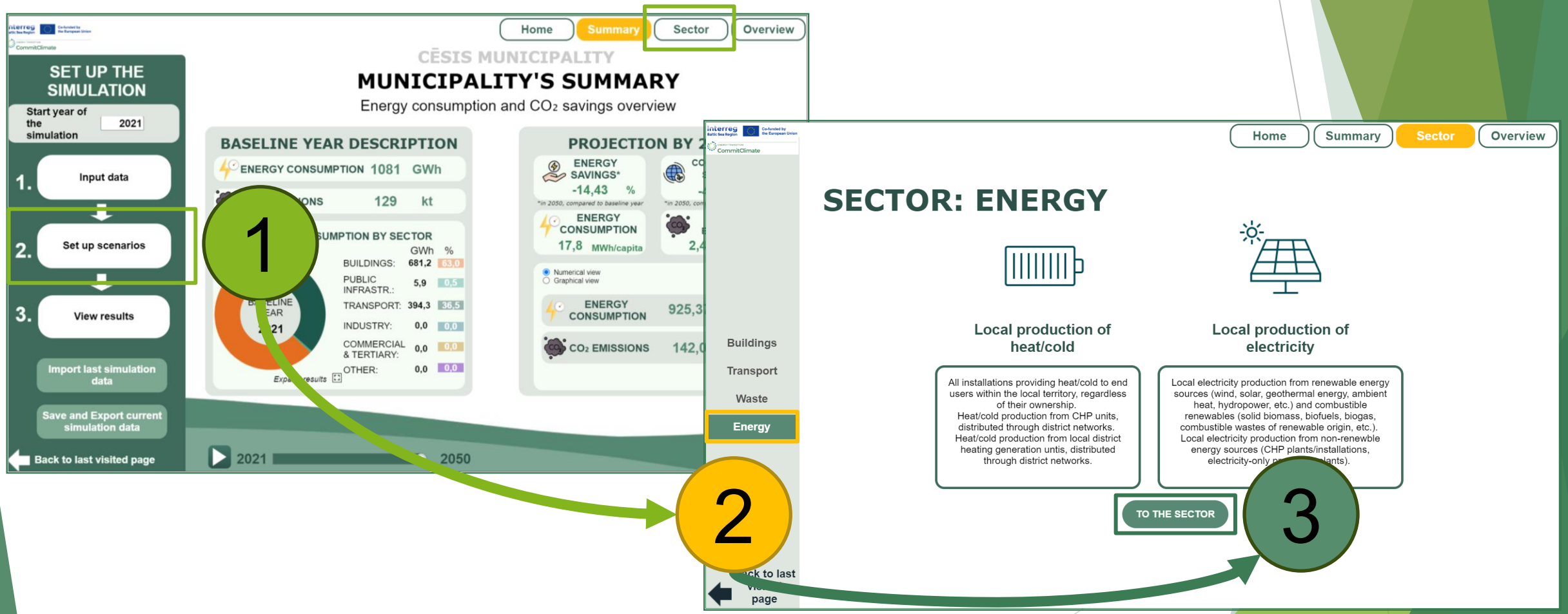
Energy Sector

- The local energy production sector contains two categories:
  - Local production of heat
  - Local production of electricity

NB! *The local energy production sector differs from other sectors in that it represents energy supply rather than energy demand. The 2050 scenario without energy-production-specific policies therefore reflects the energy demand generated by all other sectors after their respective policies are applied, but before any policies targeting local energy production are introduced.*

Approach to calculating emissions in local energy production

Navigation to energy sector



Approach to calculating emissions from local energy production I

- The calculation of emissions is based on three variables:
  - Energy production (MWh)
  - Emission factor (tons CO_2 /MWh)

$$E = EP \times EF \quad ,$$

where

E	*- CO_2 emissions (tons CO_2 /year)*
EP	*- Energy production (MWh/year)*
EF	*- emission factors (tons CO_2/MWh)/1000*

Approach to calculating emissions from local energy production I

The energy sector in the model can be defined at two levels of detail, depending on data availability.

- If no specific data is provided, the model automatically calculates energy demand based on inputs from other sectors (e.g., buildings, transport). This demand, expressed in MWh, together with distribution losses, is used for emission calculations and is multiplied by default emission factors defined in the Technical Assumptions section.
- If more detailed data is available, the user can specify:
  - Energy imports and exports (heat and electricity),
  - Energy carrier inputs for different technologies (CHP, boiler house, electricity-only plants),
  - The amount of energy produced from renewable energy sources (RES), including wind, hydropower, photovoltaic, geothermal, and other.

Approach to calculating emissions from local energy production II

- The following energy carriers can be defined in the model:
  - Natural gas
  - Liquid gas
  - Heating oil
  - Lignite
  - Coal
  - Waste
  - Plant oil
  - Other biomass
  - Biogas
  - Other renewables
  - Other
- For each energy carrier and technology (CHP, boiler house, electricity-only), the user can define efficiency parameters, allowing for more accurate representation of local energy systems.

Energy balance and validation I

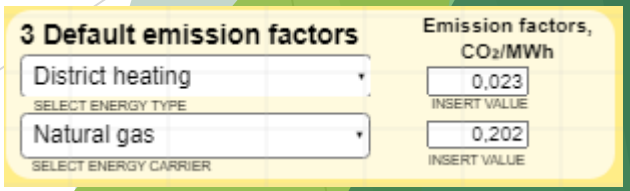
- The Energy balance section allows the user to compare the defined energy supply with the calculated energy demand.

Heat balance

- Defined demand represents the total heat demand calculated from other sectors (e.g., buildings).
- Defined supply represents the net heat available from local production, imports, and exports based on user inputs.

The difference indicates whether supply meets demand:

- If positive → excess heat is not included in emission calculations.
- If negative → the remaining demand is covered using default emission factors (defined in Section 3, technical assumptions page) and is included in heating-related emissions.



Energy balance and validation II

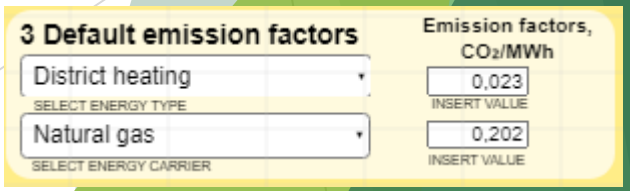
- The Energy balance section allows the user to compare the defined energy supply with the calculated energy demand.

Electricity balance

- Electricity demand represents total demand across all sectors.
- Defined supply includes local production, imports, and exports based on user inputs.

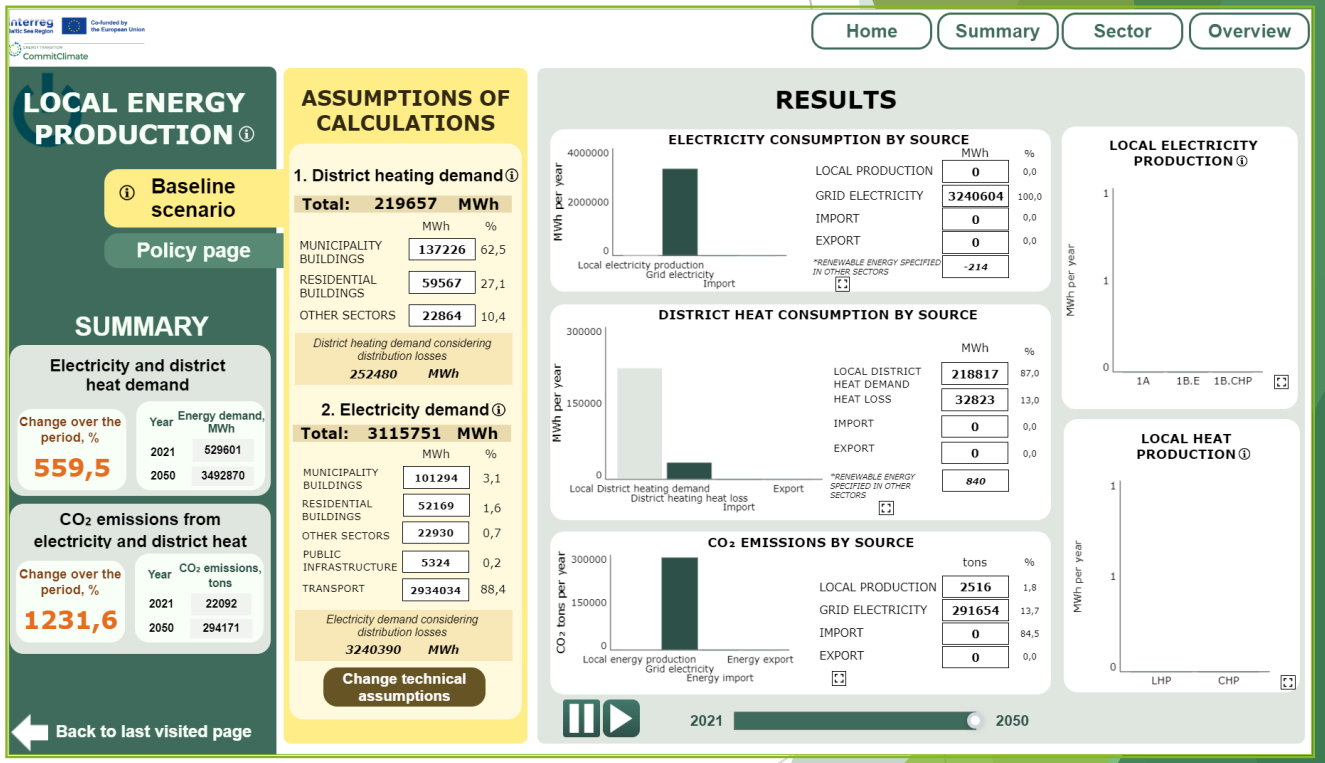
The difference indicates whether supply meets demand:

- If positive → excess electricity is not included in emission calculations.
- If negative → the remaining demand is covered by grid electricity using default emission factors (defined in Section 3, technical assumptions page) and is automatically balanced using default assumptions..



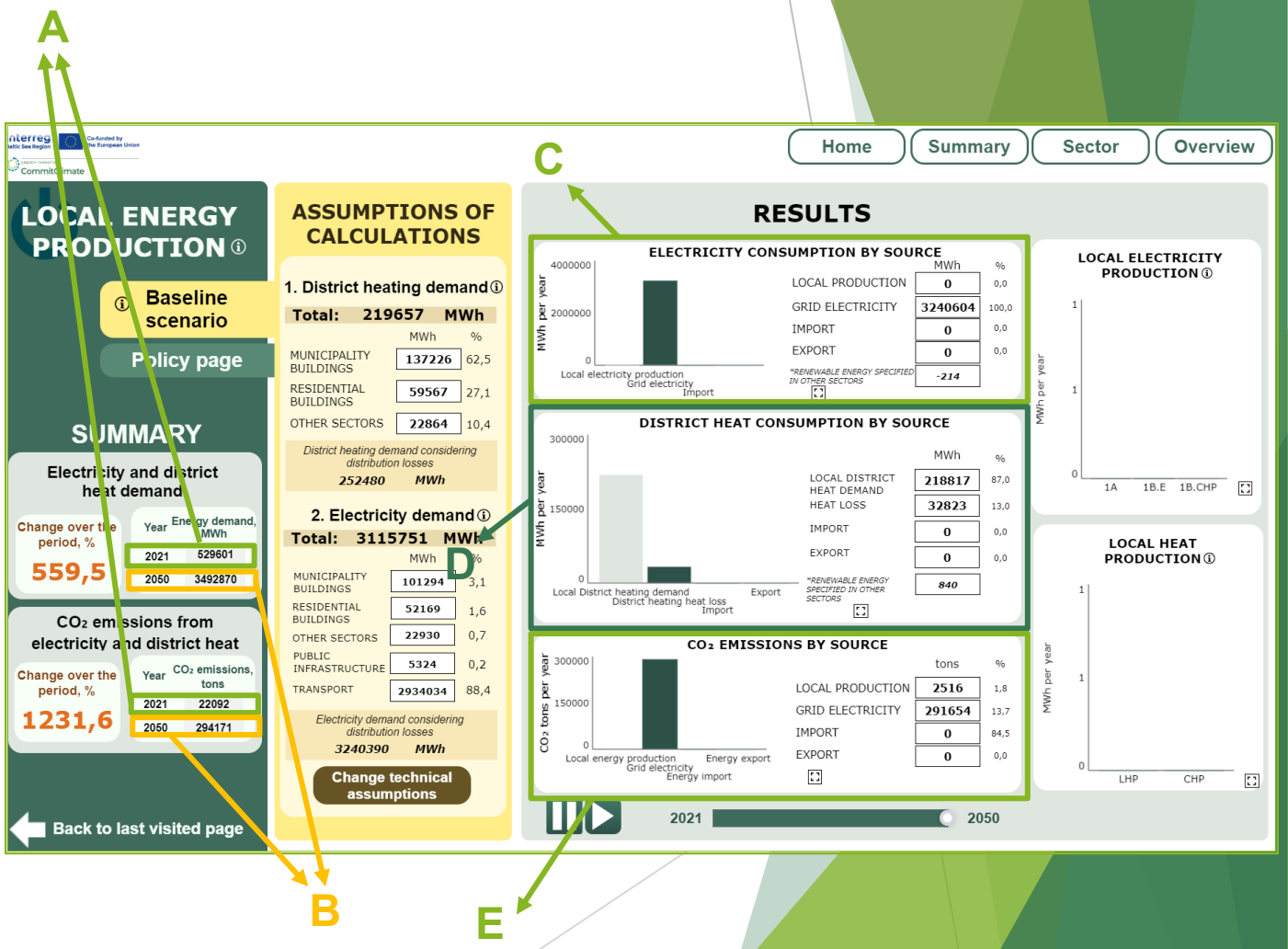
Baseline scenario for local energy production I

- After the user has input data for other sectors throughout the Simulator and specified technical assumptions (optional), the Simulator can calculate the energy consumption and associated CO_2 emissions of the energy sector in the baseline scenario.
- The baseline scenario describes the continuation of the current situation (in the base year) considering changes in energy demand (if applicable).
- The baseline scenario is visible in the first view after opening the sector page.



Baseline scenario for local energy production II

- The baseline scenario is visible in the first view after opening the sector page
- In the baseline scenario, it is possible to view the results for:
  - Energy demand and GHG emissions in the Baseline year (A)
  - Energy demand and GHG emissions in 2050 (B)
  - Electricity consumption breakdown by electricity source (C)
  - District heating consumption breakdown by source (D)
  - GHG emission breakdown by source (E)



Policy measures in local energy production I

- The user can analyze the impact of several policy measures on GHG emissions in the energy sector:
  - District heat loss reduction
    - The user specifies in the Policy Assumptions view the heat loss reduction limit, policy implementation speed (%/year) and policy implementation start and end year
    - The current emission factor is displayed as an informational value, while the target emission factor is defined by the user (tCO_2/MWh). When the policy is active, the emission factor decreases linearly from the current value to the target value over the selected implementation period, reducing CO_2 emissions associated with district heating supply.
  - Waste heat recovery
    - This policy represents the use of recovered waste heat to meet part of the district heating demand.
    - The user defines the share (%) of heat demand covered by waste heat. When active, this share replaces conventional heat production, reducing energy demand and emissions, while distribution losses remain unchanged.

Policy measures in local energy production II

- The user can analyze the impact of several policy measures on GHG emissions in the energy sector:
  - District heating / local electricity production / grid electricity decarbonization
    - These policies represents a gradual reduction in the emission factor of locally produced electricity through the deployment of renewable and low-carbon technologies.
    - The user defines a target emission factor (tCO_2/MWh), and when the policy is active, it decreases linearly over time, reducing emissions from locally generated electricity.
  - Installed energy capacity adjustment
    - The user specifies in the Policy Assumptions view target installed capacities of various fuel types in CHP plants, Electricity plants, Boiler houses and Renewable electricity production, as well as the policy implementation start and end year.

NB! This policy applies to all capacity values shown in the section.
The user must define values for all technologies, including those that should remain unchanged.
If no value is provided, default assumptions are applied, which may lead to unintended reductions in installed capacity.
Multiple capacity tables are available and can be accessed via the drop-down menu.

Caution!

- ***The "Installed Energy Capacity Adjustment" policy represents a more detailed approach to modelling energy system changes. Therefore, it cannot be used simultaneously with the simplified decarbonization policies.***
- ***When selecting policies, the user must choose either:***
  - ***the "Installed Energy Capacity Adjustment" policy, or***
  - ***the simplified decarbonization policies, that include:***
    - ***District heating decarbonization***
    - ***Local electricity production decarbonization***
    - ***Grid electricity production decarbonization***
- ***These policy options are mutually exclusive and cannot be applied at the same time.***

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To view information on the emission calculation approach in other sectors, go to the sections “Transport”, “Waste”, “Buildings”

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