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# GHG emission assessment *in LEAP*

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# Basics

## Greenhouse gases (GHGs)\*

*Direct:* CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, PFCs, HFCs, SF<sub>6</sub>

*Indirect:* SO<sub>2</sub>, NO<sub>x</sub>, CO, NMVOC

## Emission factor\*

The average emission rate of a given GHG for a given source, relative to units of activity

## Global Warming Potential\*

A measure of the total energy that a GHG absorbs over a particular period of time (100 or 500 years), compared to CO<sub>2</sub>. It is established as a method for comparing the climate effects of emissions of different GHGs.

\*Sources:

[http://unfccc.int/ghg\\_data/ghg\\_data\\_unfccc/items/4146.php](http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php),

[http://unfccc.int/ghg\\_data/online\\_help/definitions/items/3817.php](http://unfccc.int/ghg_data/online_help/definitions/items/3817.php)

[http://download.springer.com/static/pdf/122/art%253A10.1007%252Fs10584-009-9647-6.pdf?auth66=1425913923\\_b9ffa1015d194e1d96b1462c80e9d679&ext=.pdf](http://download.springer.com/static/pdf/122/art%253A10.1007%252Fs10584-009-9647-6.pdf?auth66=1425913923_b9ffa1015d194e1d96b1462c80e9d679&ext=.pdf)



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# Concept

- All devices in Demand analysis, and all feedstock/auxiliary/output fuels in Transformation analysis are potential sources of emissions.
- Total emissions are calculated as the product of energy consumption or energy production and an emission factor.

$$(energy\ consumed/produced) \times (emission\ factor)$$

- Emissions are specified at the point where they occur, i.e.
  - emissions are specified for Demand devices that consume all fuels except for heat or electricity *in Demand side*
  - emissions for heat and electricity occur *in Transformation side* (during their generation) and can be modeled in LEAP's Transformation calculations



# Choose the basic parameters

**Basic Parameters**

Scope & Scale | Years | Default Units | Calculations | Loads | Optimization | Stocks | Internet | Charts | Folders | Security

**Area**

Name: Name of Area

Description:

**Scope**

- Transformation & Resources
- Statistical Differences & Stock Changes
- Costs
- Energy Sector Environment Loadings
- Non-Energy Sector Environment Loadings
- Indicators
- [Edit List of Result Variables to Save](#)

**Scale**

- Global
- Multi-national
- National
- Sub-national

Country:

**User Information: from COMMEND**

Property	Value
Organization	KEPA
Organization Type	Academic Organization
City	Athens
Country	Greece
Email	promitheas@kepa.uo...
Web	http://www.kepa.uoa...
License Expires:	10/21/2016

[Visit COMMEND to edit your user profile](#)

Close  Help



# Switch to Current Accounts

The screenshot shows the LEAP: Freedonia software interface. The 'Scenario' dropdown menu is highlighted with a red box and set to 'Current Accounts'. The 'Variable' dropdown is set to 'Activity Level'. The 'Branch' dropdown is set to 'All Branches'. The 'Activity Level' variable is selected, and its definition is shown: 'Activity Level: A measure of the social or economic activity for which energy is consumed. [Def]'. Below this, a table lists the branches and their corresponding activity levels:

Branch	Expression
Household	8
Industry	
Transport	40
Commercial	100



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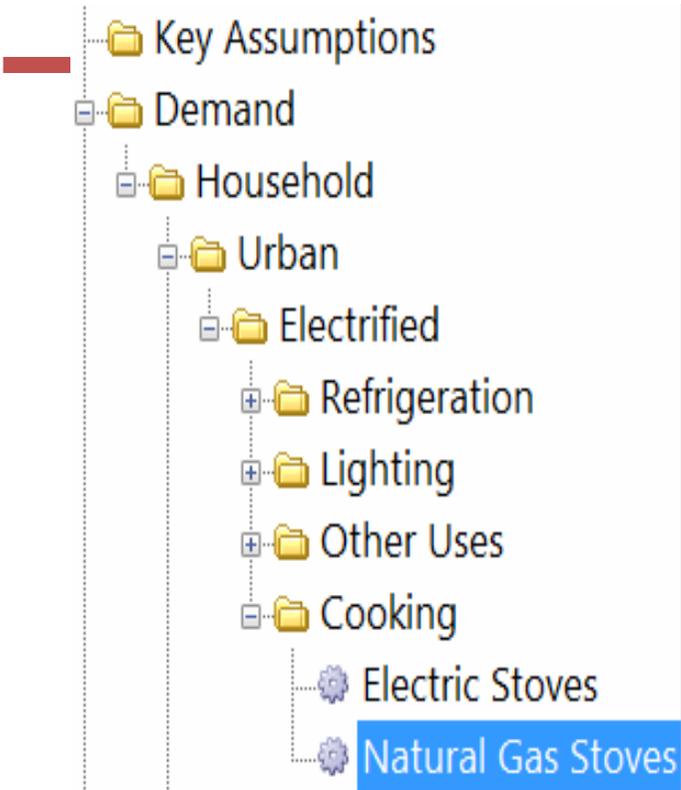
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# Insert emission factors

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- Define the technologies/fuels
    - Demand: technology branches (except for electricity and heat)
    - Transformation: feedstock fuels (except for RES, except for Transmission & Distribution or mining))
  - Link to TED
- or*
- Enter directly





Activity Level Final Energy Intensity **Environmental Loading** All Variables

Activity Level: A measure of the social or economic activity for which energy is consumed. [Default:

Branch	Expression
Household	8
Urban	30
Electrified	100
Cooking	100
Electric Stoves	30
Natural Gas Stoves	Remainder(100)



# Link to TED

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- TED contains emission factors for energy consuming/producing technologies, including the default emission factors suggested by the IPCC for use in climate change mitigation analyses.
- many of the emission factors stored in TED are expressed as formulae: function of the chemical composition of the fuel being burnt.
- To create a link to TED,
  - click on the TED button (🔗),
  - use the subsequent dialog box to select a technology from TED that closely matches the technology in your Area.
  - click on the button (🔗) to go directly to TED and view the full information about the TED technology and its emission factors.

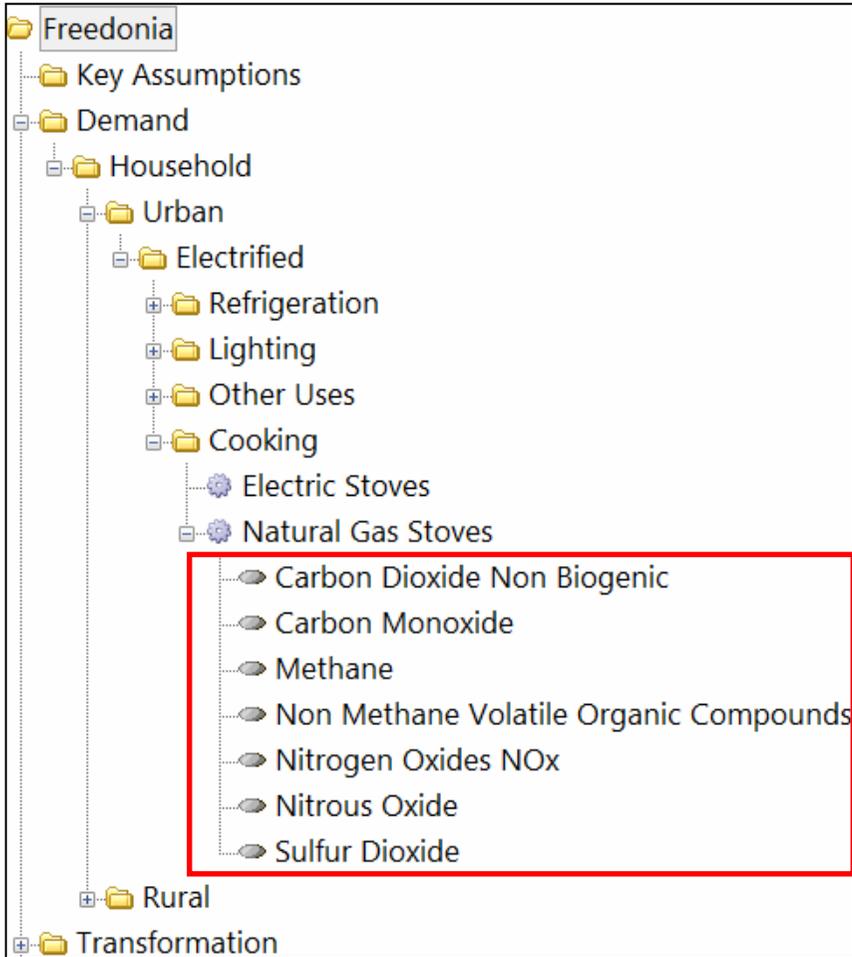


# Enter directly

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- Enter manually your own emission factors, or override the default factors by TED, adding your own country- or technology-specific factors.
- Emissions factors can be specified as simple numbers or as mathematical formulae.

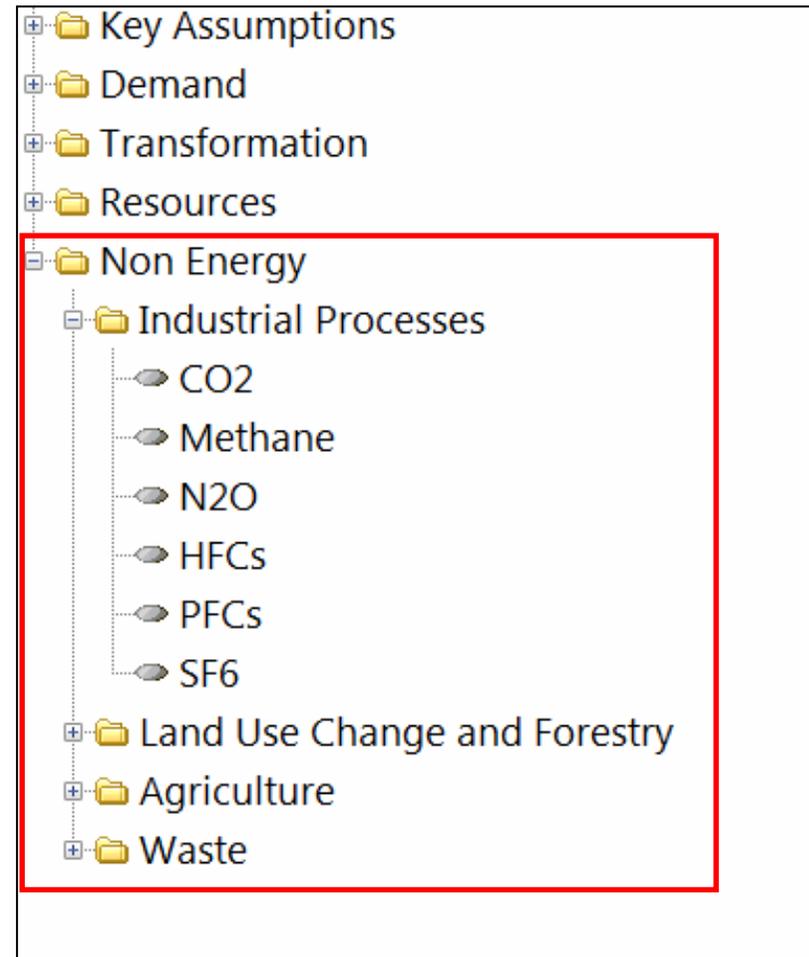




# Non-Energy sector

Non-energy related effects

1. Check the **Non-Energy Sector Environmental Loadings** box in **Basic parameters**
2. Go to additional tree branch **Non-Energy**
3. Add **Process** branches
4. Add **Effect** branches
5. Enter data: total annual emissions



# Add Effects

The screenshot shows a software window titled 'Effects'. At the top, there is a toolbar with a 'Show: Effects Used in Area' dropdown, a 'Find:' search box, and several icons for adding, removing, and navigating effects. Below the toolbar are two tabs: 'All Effects' (selected) and 'One Effect'. The main area contains a table with the following columns: Color, Effect Name, Abbrev., Category, and Unit.

Color	Effect Name	Abbrev.	Category	Unit
Blue	Carbon Dioxide Non Biogenic	CO2	Major GHGs and local air pollutants	Metric Ton
Brown	Carbon Dioxide Biogenic	CO2 Bio	Major GHGs and local air pollutants	Metric Ton
Yellow	Methane	CH4	Major GHGs and local air pollutants	Kilogramm
Grey	Nitrous Oxide	N2O	Major GHGs and local air pollutants	Kilogramm
Orange	Carbon Monoxide	CO	Major GHGs and local air pollutants	Kilogramm
Purple	Non Methane Volatile Organic Compoun...	NMVOC	Major GHGs and local air pollutants	Kilogramm

Below the table, there are two sections: 'Notes on: Carbon Dioxide Non Biogenic' and 'References:'. The notes section contains the text: 'Carbon dioxide (CO2) is the most common greenhouse gas produced by anthropogenic'. The references section has a text input field with 'Author (Year)' and a search icon. At the bottom right, there are 'Close' and 'Help' buttons.



# Show Results (1/2)

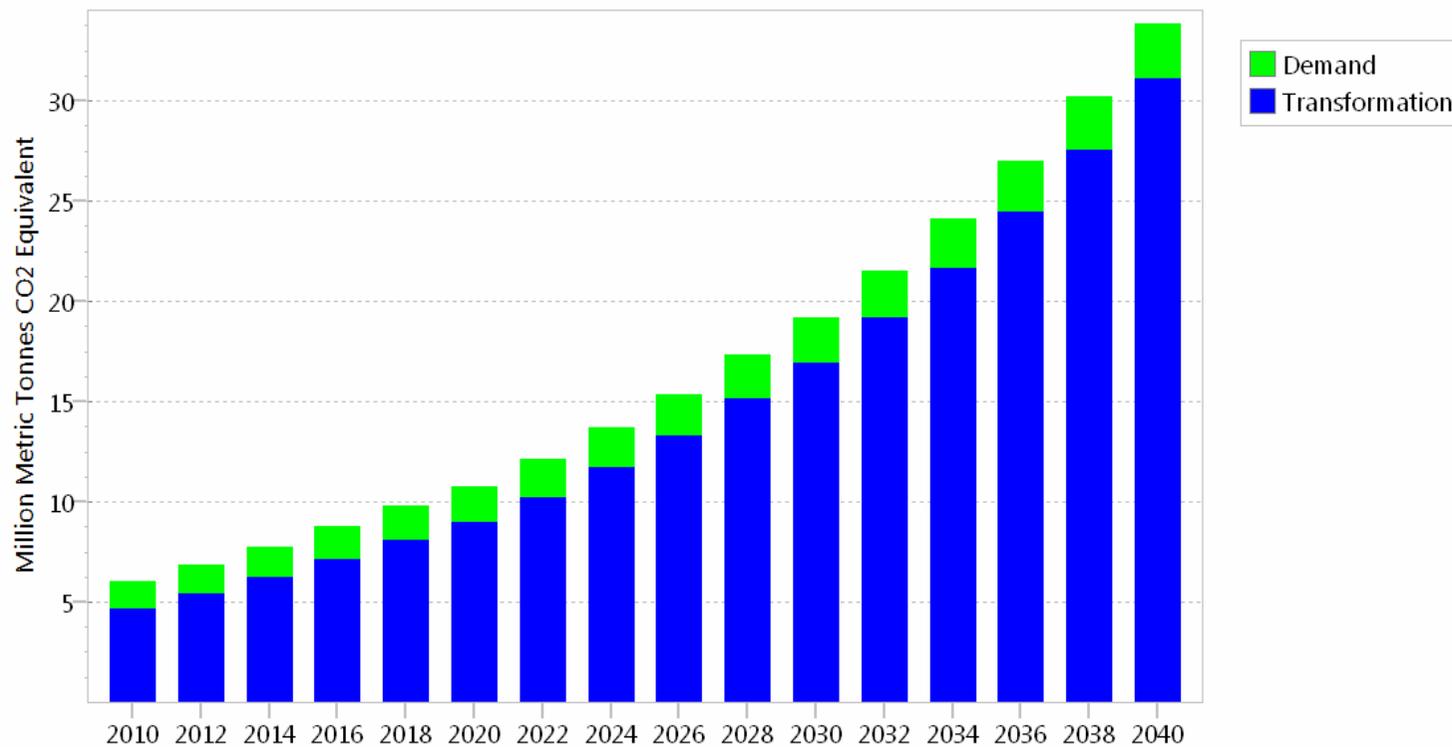
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- Go to Results View
- Choose
  - Results category: Environment
  - Tree branch
  - Formatting
- Results can be shown
  - organized by branch, fuel, scenario, year and region (in multi-regional areas).
  - measured in two different ways: in terms of the equivalent amount of Carbon (C) or Carbon Dioxide (CO<sub>2</sub>).



# Show Results (2/2)

Environment: OneHundred Year Global Warming Potential  
Scenario: Reference, Fuel: All Fuels, GHG: All GHGs



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# Let's practice!

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