

# 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

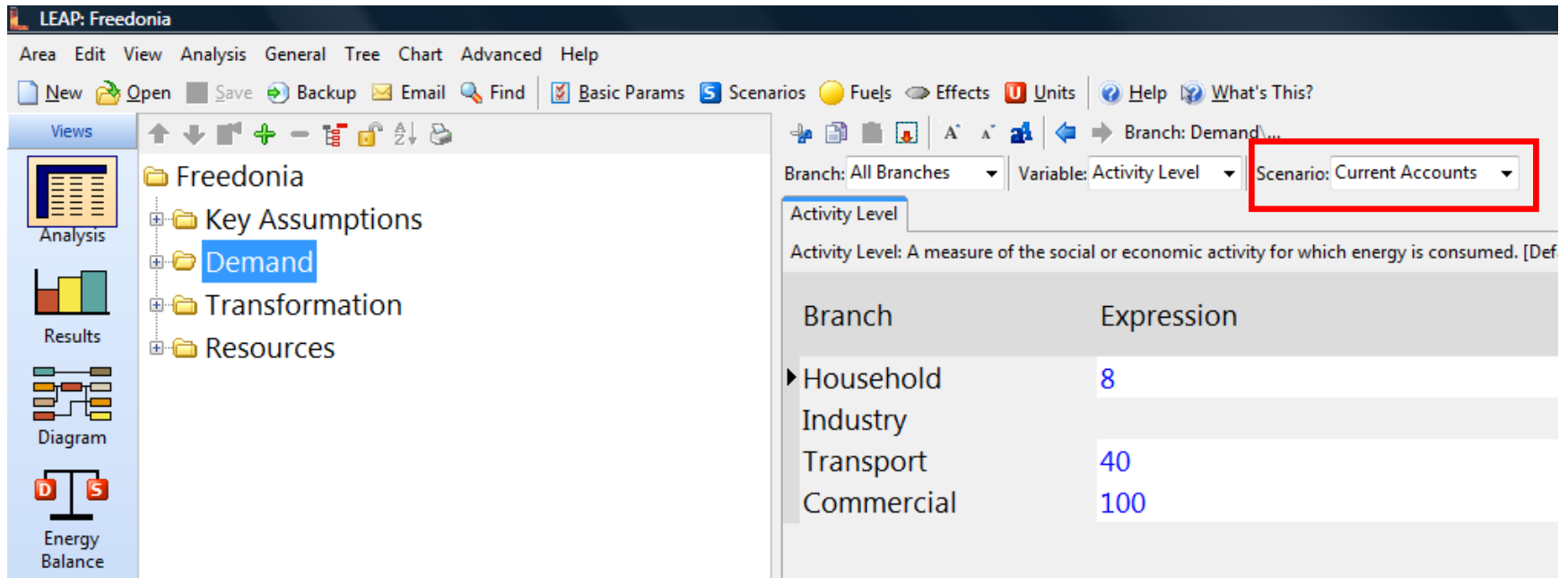
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Country	Greece
Email	promitheas@kepa.uo...
Web	http://www.kepa.uoa....
License Expires:	10/21/2016

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

Close Help



# Switch to Current Accounts



The screenshot shows the LEAP: Freedonia software interface. The 'Views' panel on the left lists 'Analysis', 'Results', 'Diagram', and 'Energy Balance'. The 'Analysis' view is selected, showing a tree structure with 'Freedonia' as the root, and sub-items: 'Key Assumptions', 'Demand' (highlighted), 'Transformation', and 'Resources'. The main window displays the 'Activity Level' variable, with a description: 'Activity Level: A measure of the social or economic activity for which energy is consumed. [Def]'. A table lists the branches and their expressions:

Branch	Expression
Household	8
Industry	
Transport	40
Commercial	100

The 'Scenario' dropdown menu is highlighted with a red box, showing 'Current Accounts' selected.



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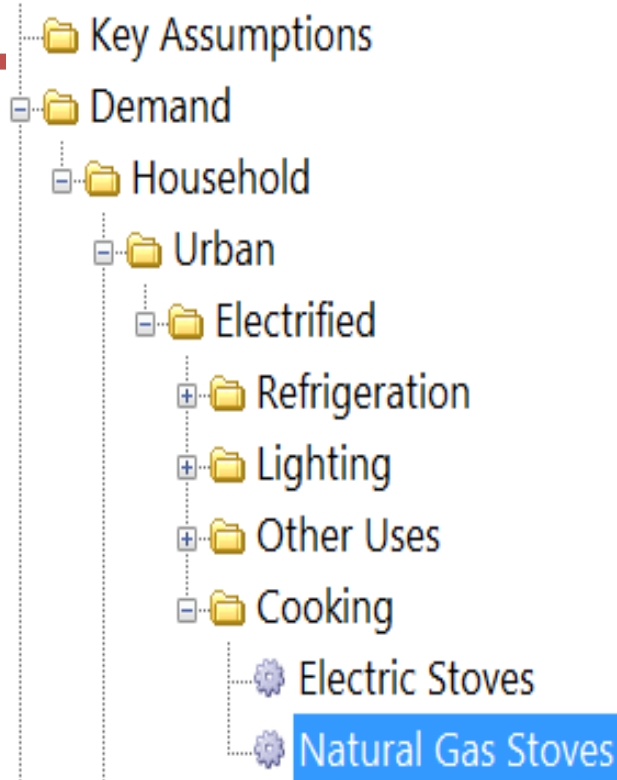


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# Insert emission factors

- 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

- 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.



Effects for branch: Natural Gas Stoves



Activity Level Final Energy Intensity Environmental Loading All Variables

Environmental Loading: Environmental Loading Factor (Pollutants per unit of energy consumption) [Default="0"]

Branch	Expression	Units	Per	Method
Carbon Dioxide Non Bic	$15.3 * \text{FractionOxidized} * (\text{CC}$	Metric Tonne	Terajoule	Per unit energy consumed
Carbon Monoxide	50	Kilogramme	Terajoule	Per unit energy consumed
Methane	5	Kilogramme	Terajoule	Per unit energy consumed
Non Methane Volatile C	5	Kilogramme	Terajoule	Per unit energy consumed
Nitrogen Oxides	50	Kilogramme	Terajoule	Per unit energy consumed
Nitrous Oxide	0.1	Kilogramme	Terajoule	Per unit energy consumed
Sulfur Dioxide	0	Kilogramme	Kilogramme	Per unit energy consumed

Oil Residential



Ok



Cancel



Help



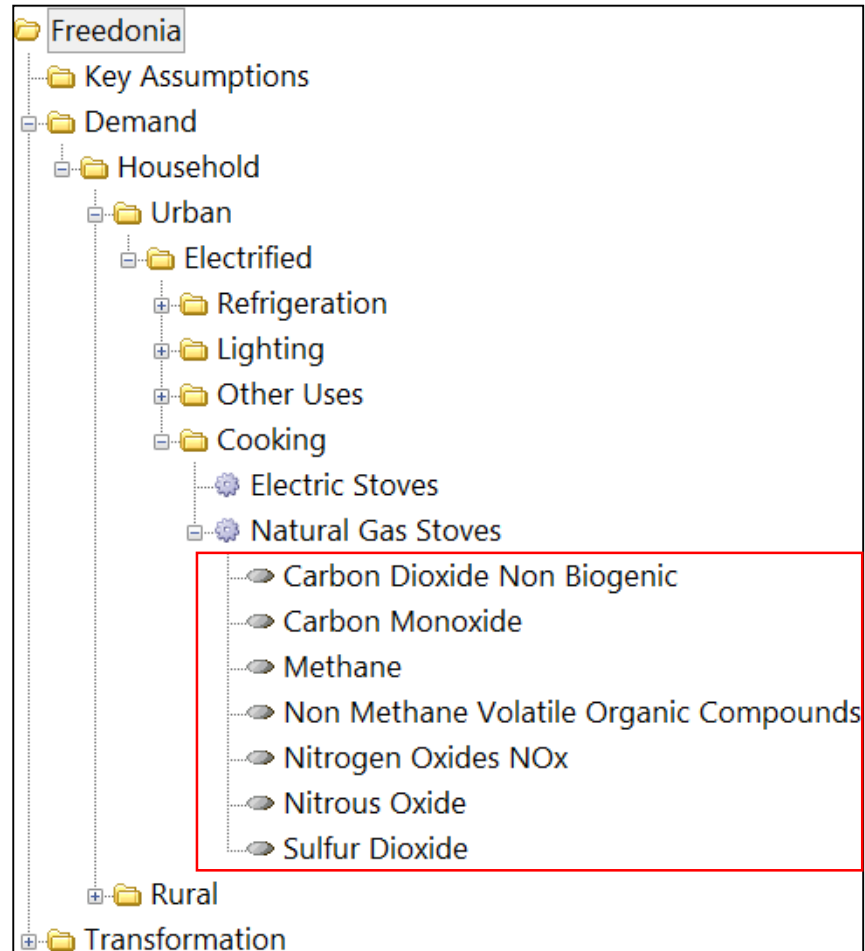
# Enter directly

- 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.



Activity Level	Final Energy Intensity	Environmental Loading	All Variables	
Environmental Loading: Environmental Loading Factor (Pollutants per unit of energy consumption) [Default="0"] ?				
Branch	Expression	Units	Per	Method
► Carbon Dioxide Non Bic	15.3 * FractionOxidized * (CC	Metric Tonne	Terajoule	Per unit energy consumed
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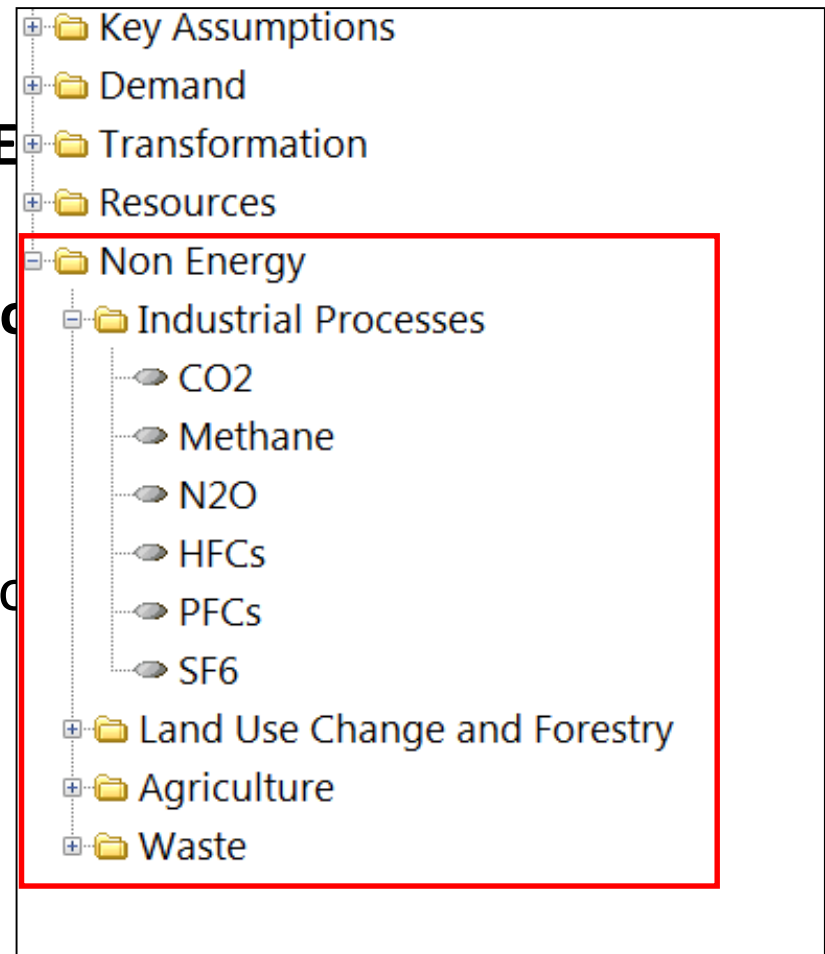




# Non-Energy sector

Non-energy related effects

1. Check the **Non-Energy Sector Emissions** 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

Effects

Show: Effects Used in Area

Find:

+

-

↑

↓

Apply IPCC GWP Values

All Effects

One Effect

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

Notes on: Carbon Dioxide Non Biogenic

Carbon dioxide (CO2) is the most common greenhouse gas produced by anthropogenic

URL: [http://en.wikipedia.org/wiki/Carbon\\_dioxide](http://en.wikipedia.org/wiki/Carbon_dioxide)

References:

Author (Year)

+

-

Close

Help



# Show Results (1/2)

- 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>).

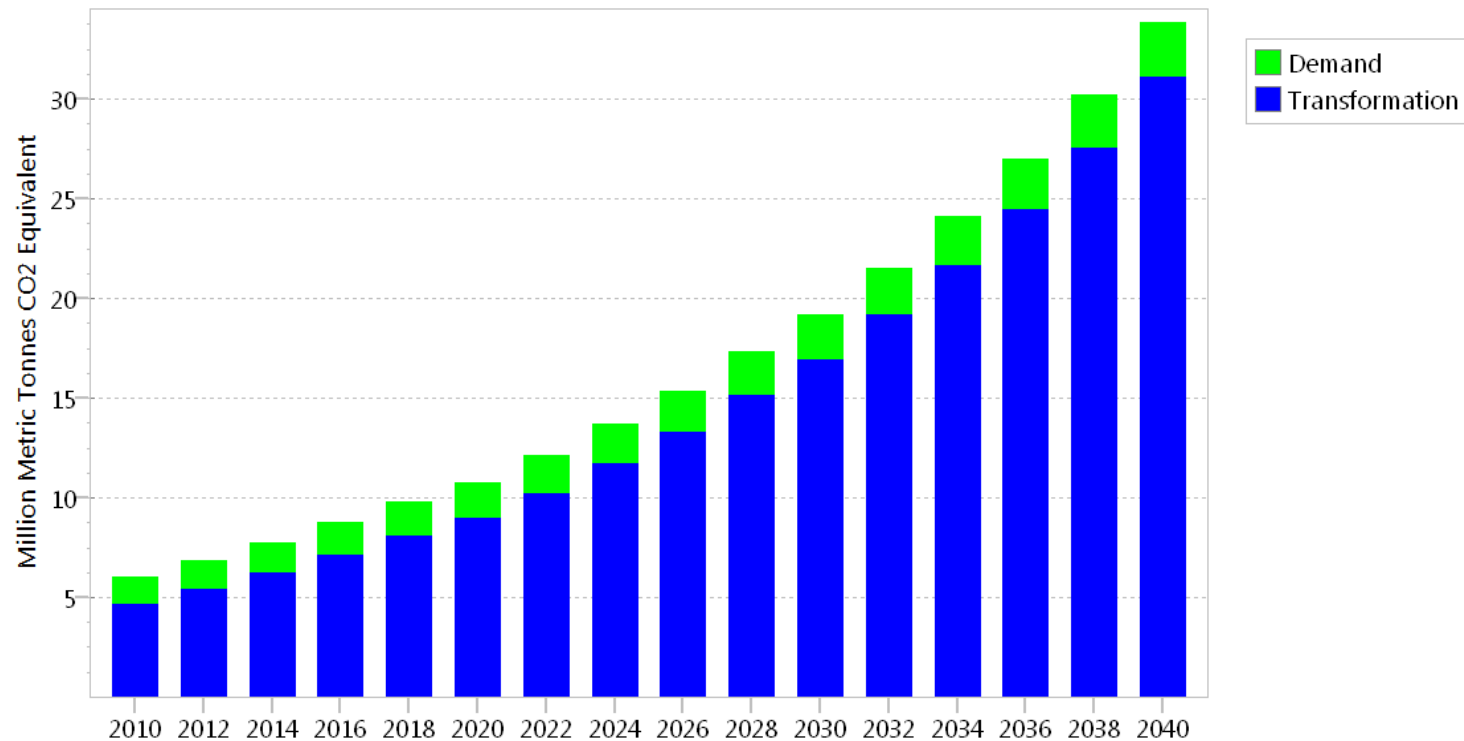




# Show Results (2/2)

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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