Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Creating a world fit for the future

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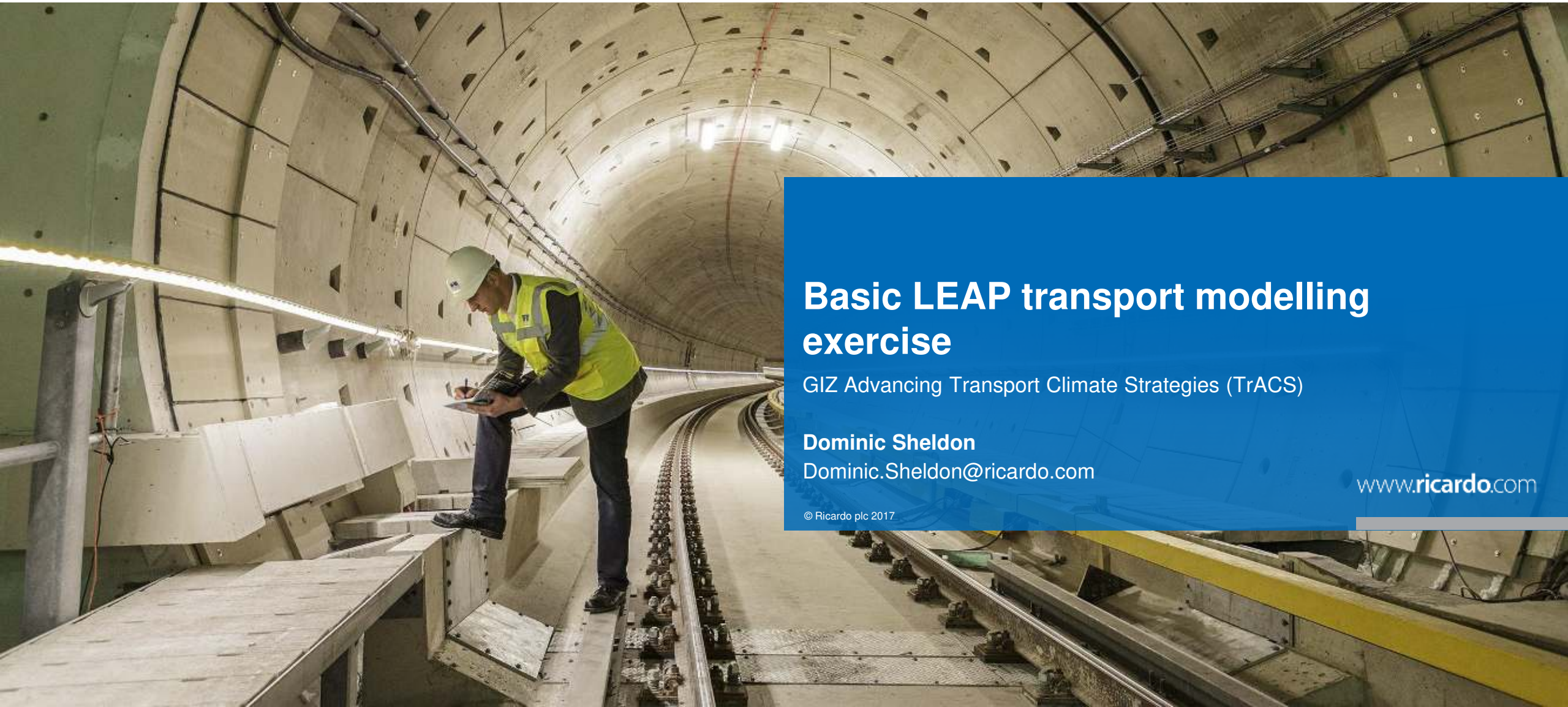

Basic LEAP transport modelling exercise

GIZ Advancing Transport Climate Strategies (TrACS)

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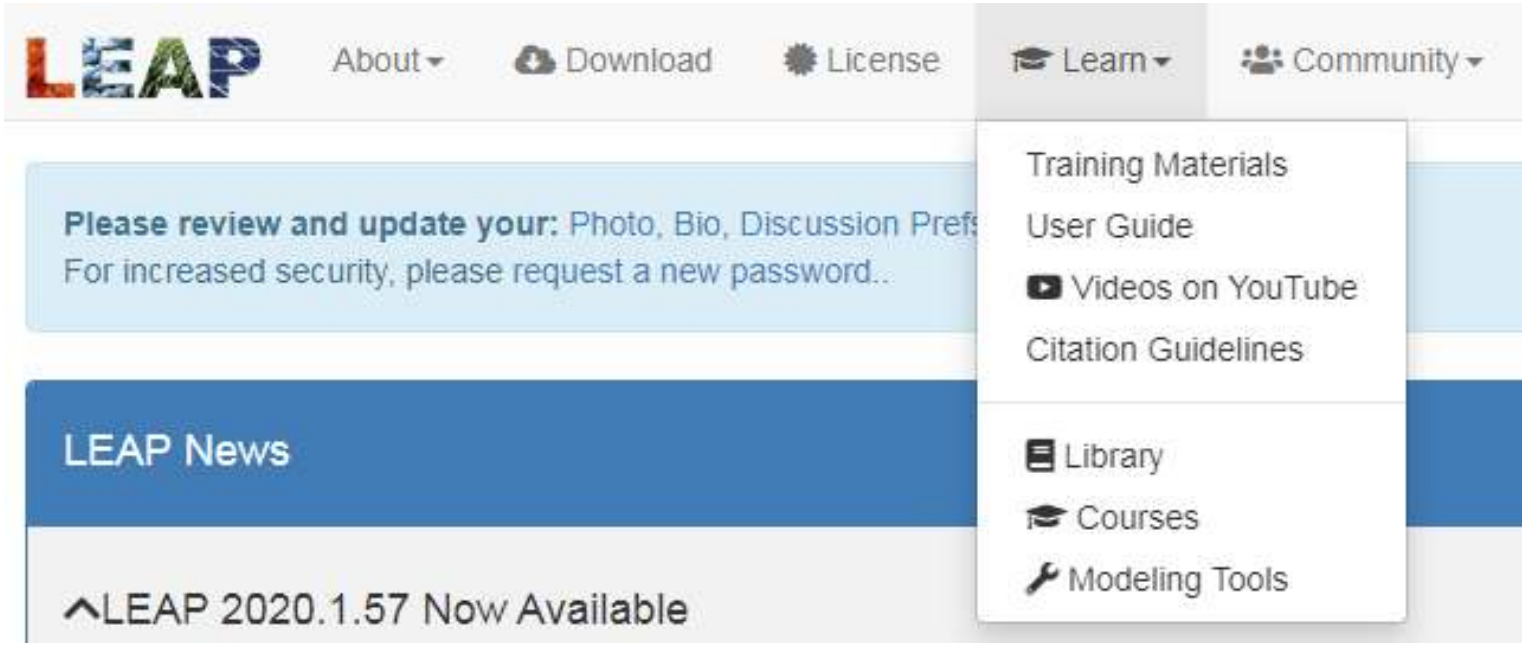
Introduction to LEAP

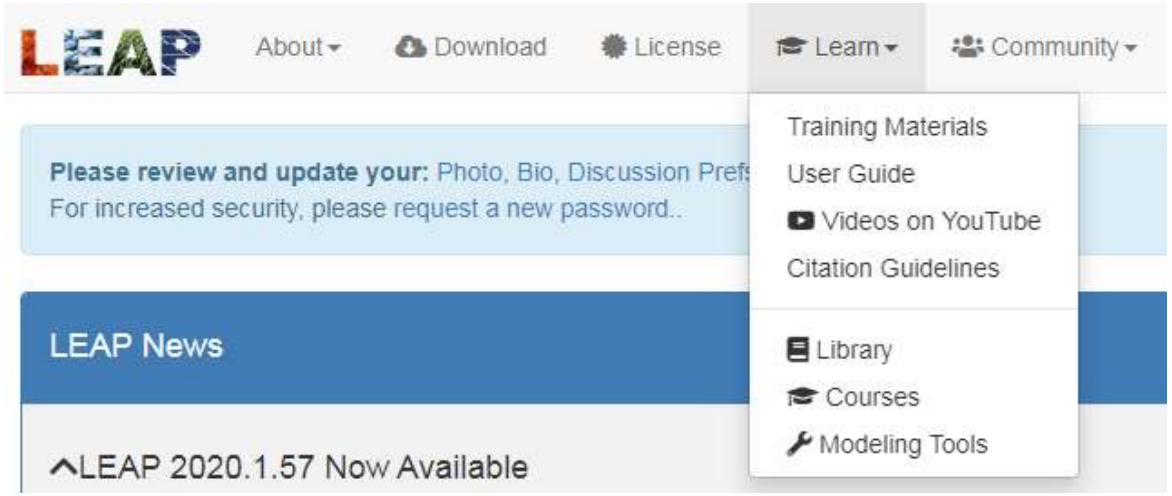
In order to develop the scenarios described in the previous section, a pre-existing model, the Low Emissions Analysis Platform (LEAP), was used. LEAP is an integrated, scenario-based modelling tool that can be used to track energy consumption, production and resource extraction in all sectors of an economy. The benefits of using LEAP in this project are:

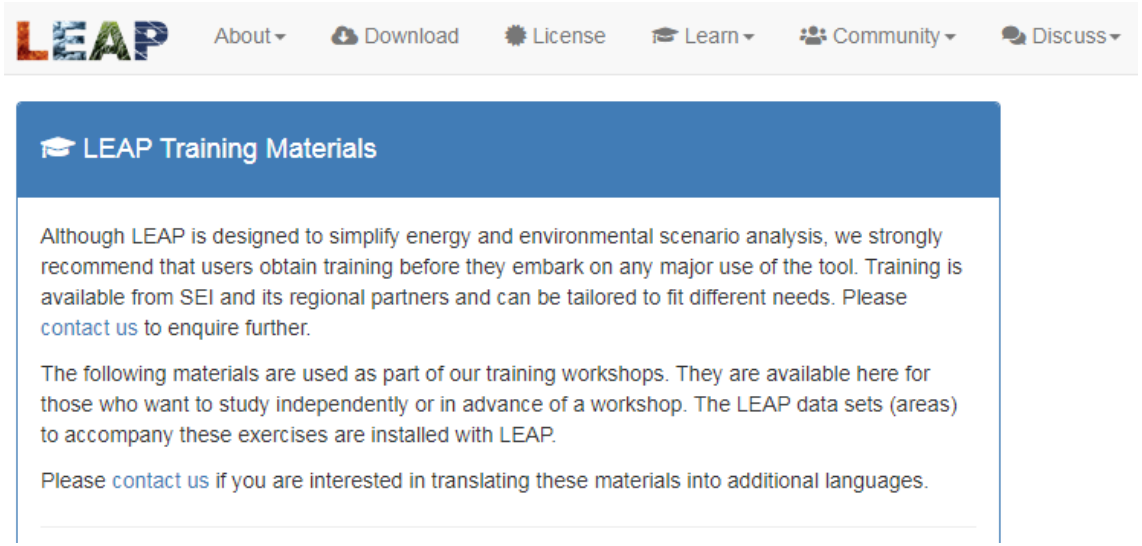
- It is a model that is **familiar to many stakeholders**
- The model **is relatively simple to use**.
- The **model is free for developing countries to use**
- Its **low initial data requirements** are well suited to a country where accessing robust data has been, and will continue to be, a challenge.
- It presents outputs in a **transparent and intuitive** way.

LEAP resources available



LEAP resources available: Training materials





Main Training Exercises

The first four of these exercises teach basic LEAP skills including energy demand modeling, energy supply (Transformation) modeling, electric system simulation modeling, emissions analysis and cost-benefit analysis. The fifth exercise examines modeling of non-energy sector greenhouse gases. The sixth exercise focuses on the transport sector: showing how to create a vehicle stock-turnover model. The seventh exercise demonstrates the use of LEAP's optimization features for least-cost electric generation modeling.

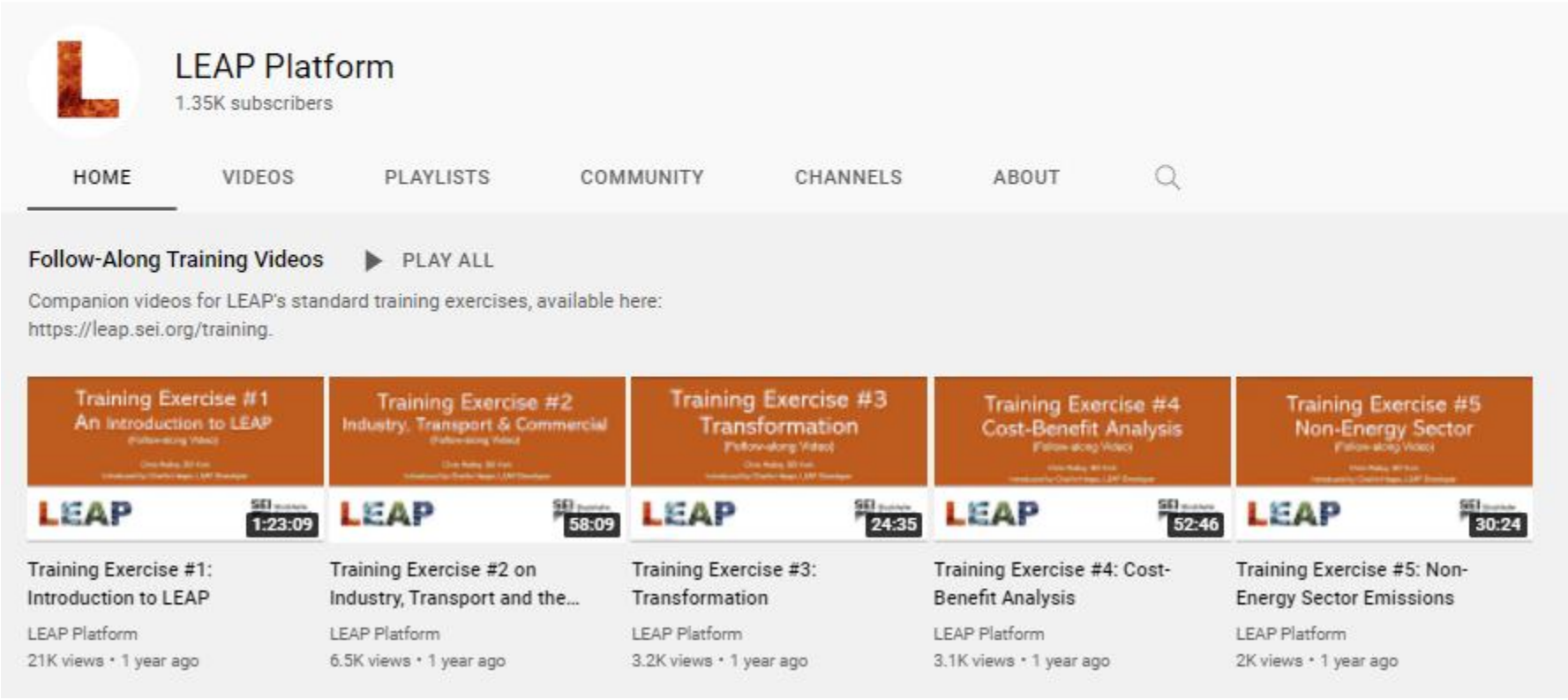
GHG Mitigation Analysis Exercises

These exercises introduce techniques used in a Greenhouse Gas (GHG) Mitigation Assessment. In a first exercise, you use a spreadsheet-based tool to conduct a screening of mitigation options, including analyzing the costs and mitigation potential for each option and displaying these on a standard Marginal Abatement Cost (MAC) curve. In a second exercise, you examine additional important criteria using a multi criteria assessment (MCA) approach. In a third exercise you create a mitigation scenario within LEAP based on your preferred options and compare it to a baseline scenario.

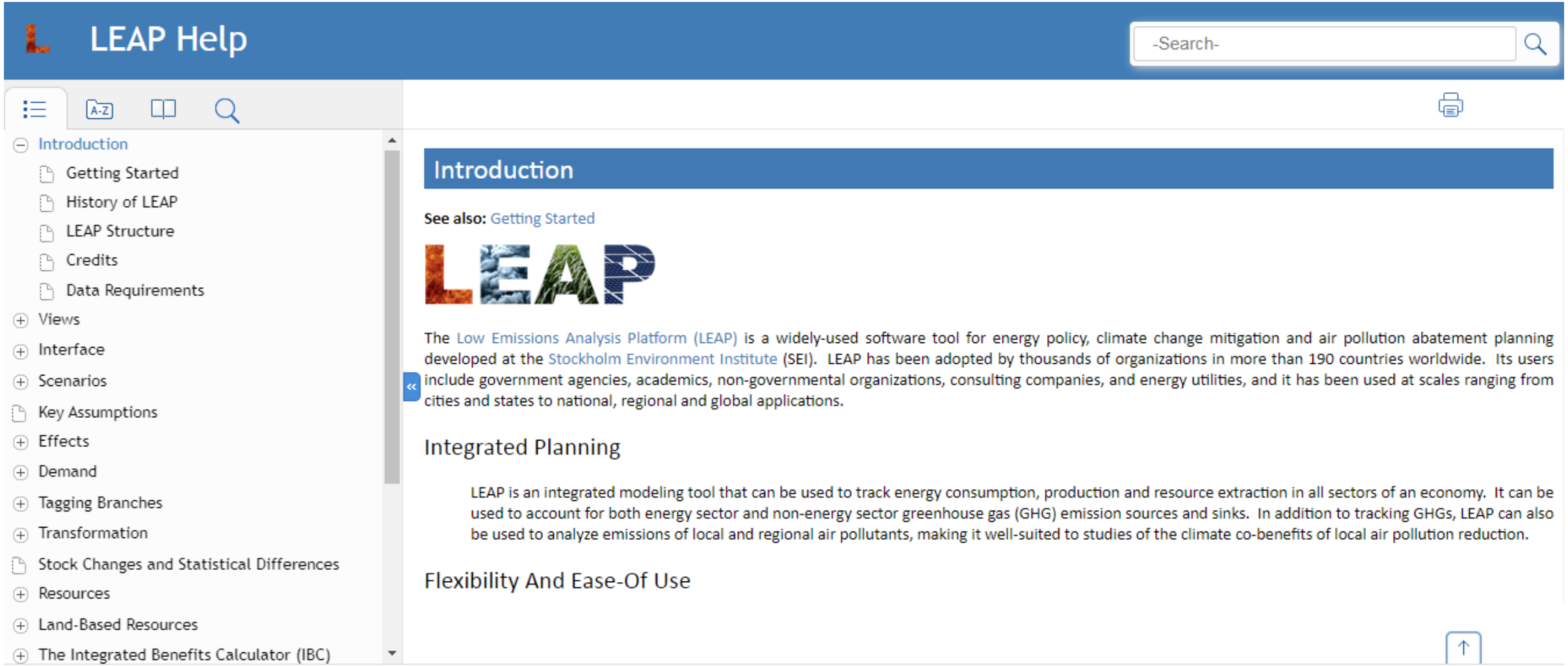
- GHG Training Exercises (English: PDF)
- Excel Screening spreadsheet: Partial, Complete

LEAP resources available: YouTube training videos

The Low Emissions Analysis Platform



LEAP resources available: User guide



How do you calculate GHG emissions?

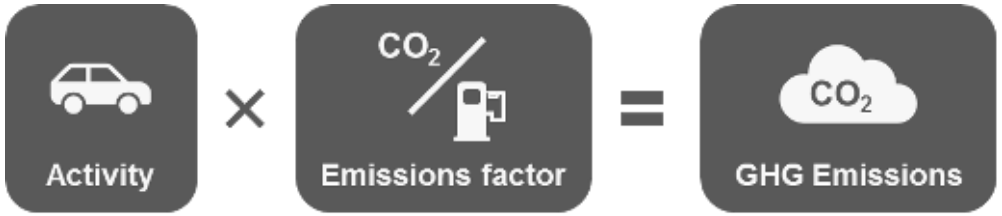
How do you calculate GHG emissions?

The three constituent parts are:

- **Activity**: This is the action that results in GHG emissions
  - For transport this is the travel taking place
    - **Unit example**: Distance a person travels in a vehicle

- **Emissions factor**: This is the amount of emissions produced for each unit of activity
  - For transport this is the CO_2 emitted when fuel/electricity is consumed in order to travel
    - **Unit example**: KG of CO_2 produced per litre of fuel consumed in order to travel

- **GHG emissions**: Total GHG emissions resulting from the activity (often given in megatons of CO_2 equivalent, or MT CO_2e)



How do you model future GHG emissions?

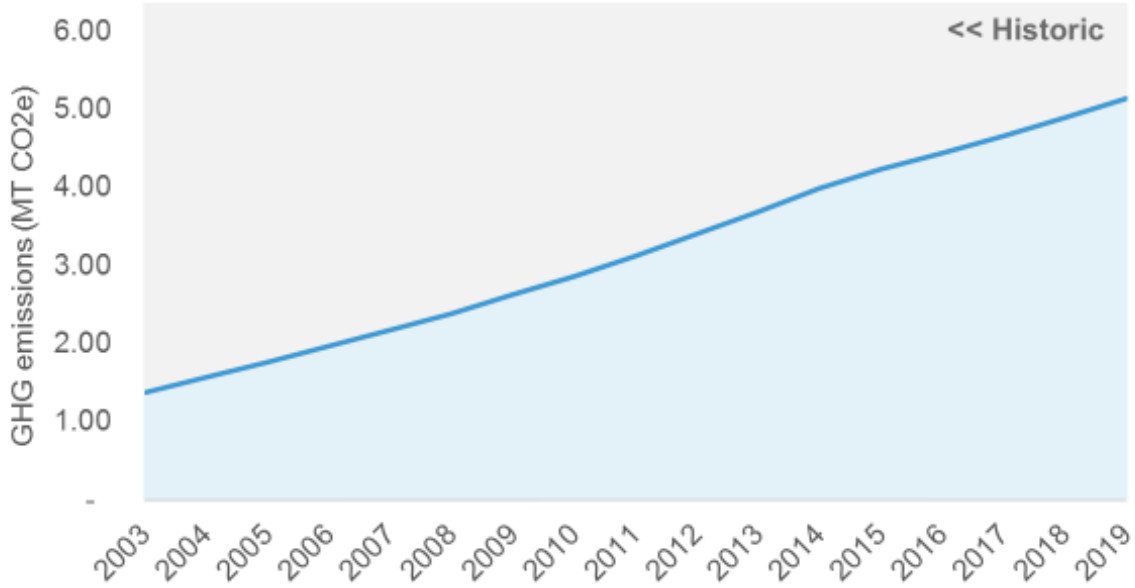
How do you model future emissions?

The process of developing a mitigation potential analysis model is formulated of three steps:

1. Model historic emissions
2. Model baseline scenario
3. Model mitigation scenarios

1. Model historic emissions

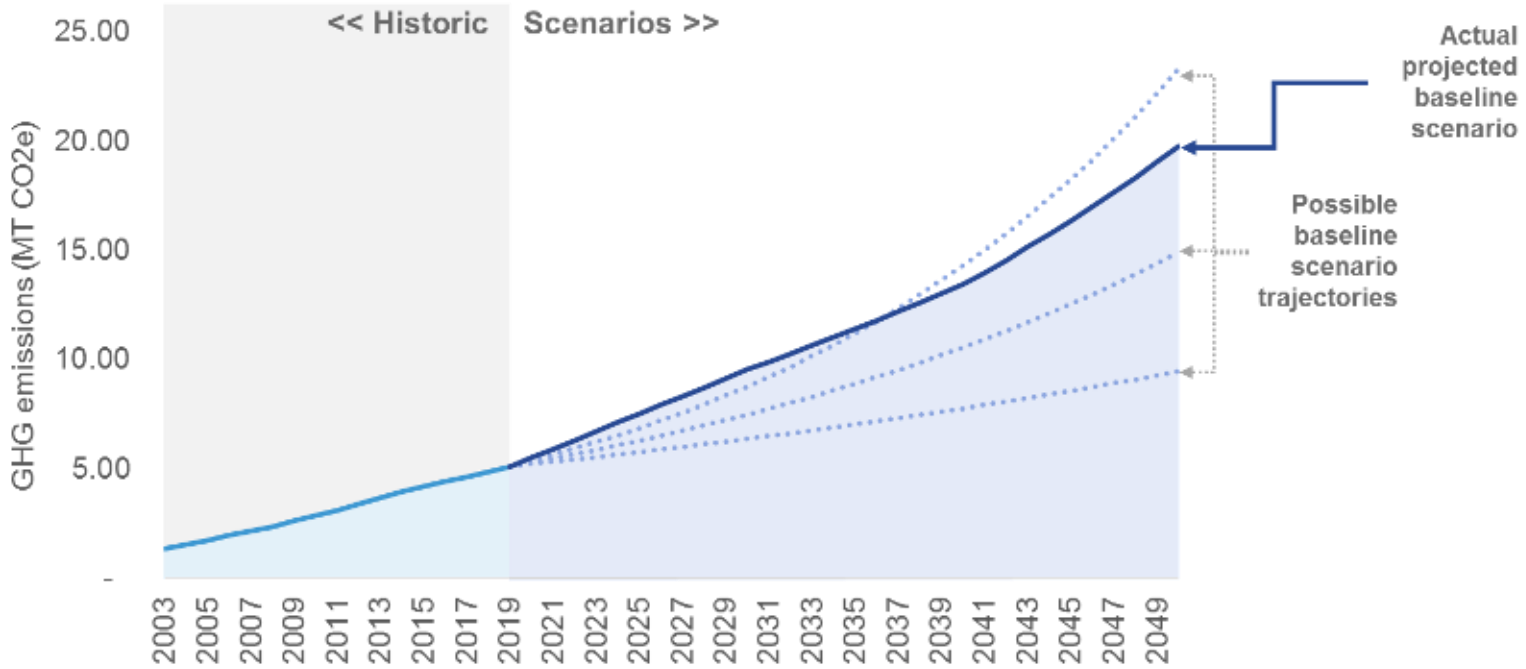
In order to model projected future GHG emissions, it is key to first develop a model of existing activities and their associated GHG emissions. The model of historic emissions is an essential reference against which to compare projected future emissions to assess whether they seem realistic.



How do you model future emissions?

2. Model baseline scenario

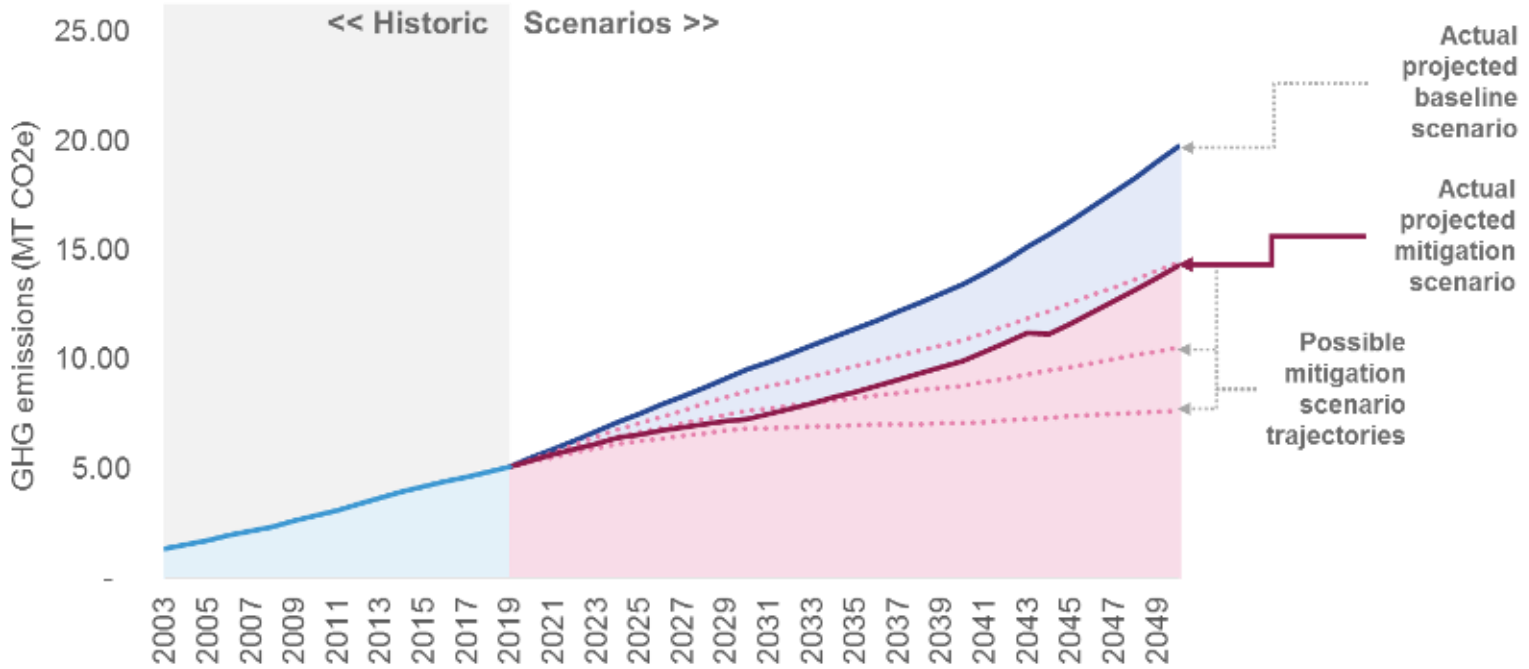
Once a model of historic activity and the associated emissions has been developed, it is then possible to project into the future what might happen to this activity and the associated emissions. The main assumptions underpinning this are what the expected future trends are in the activity, for example, do you expect the activity to increase or decrease, by how much and over what period.



How do you model future emissions?

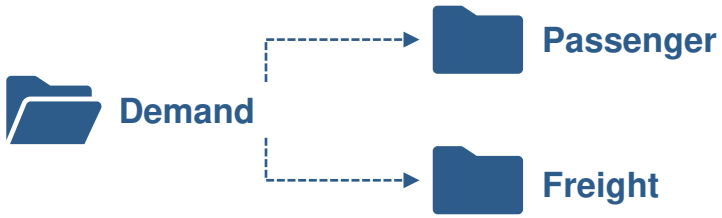
3. Model mitigation scenarios

Once a model of the baseline activity and associated emissions in the sector has been developed, it is then possible to develop a model of what might happen to this activity and the associated emissions if certain measures were implemented. In other words, it is then possible to assess what mitigation (emission reduction) potential there is relative to the baseline.

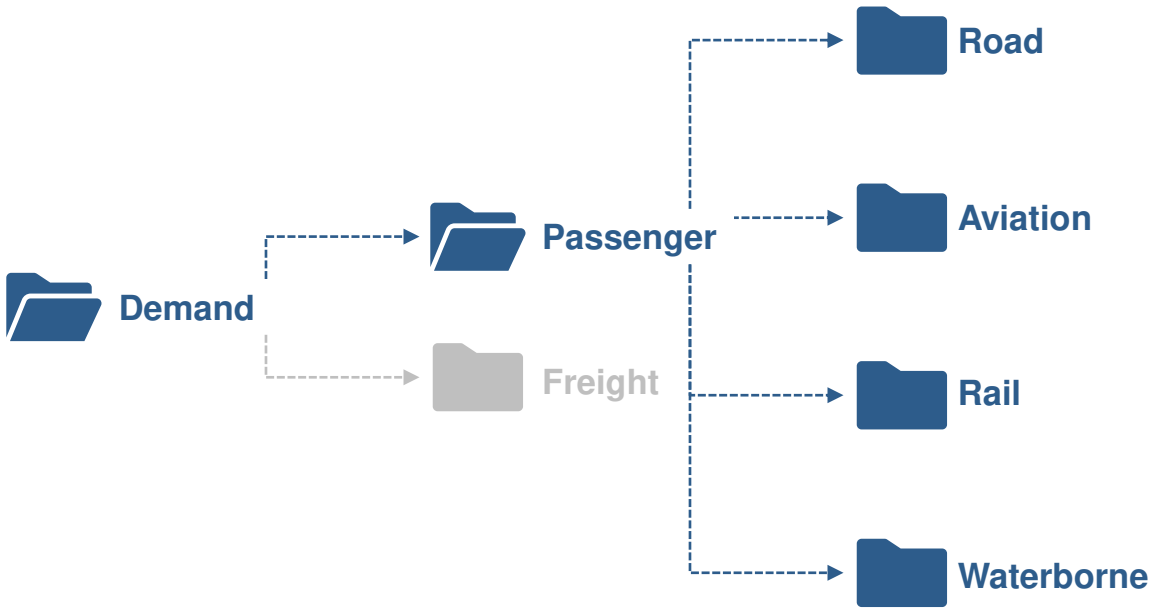


Introduction to the way LEAP works

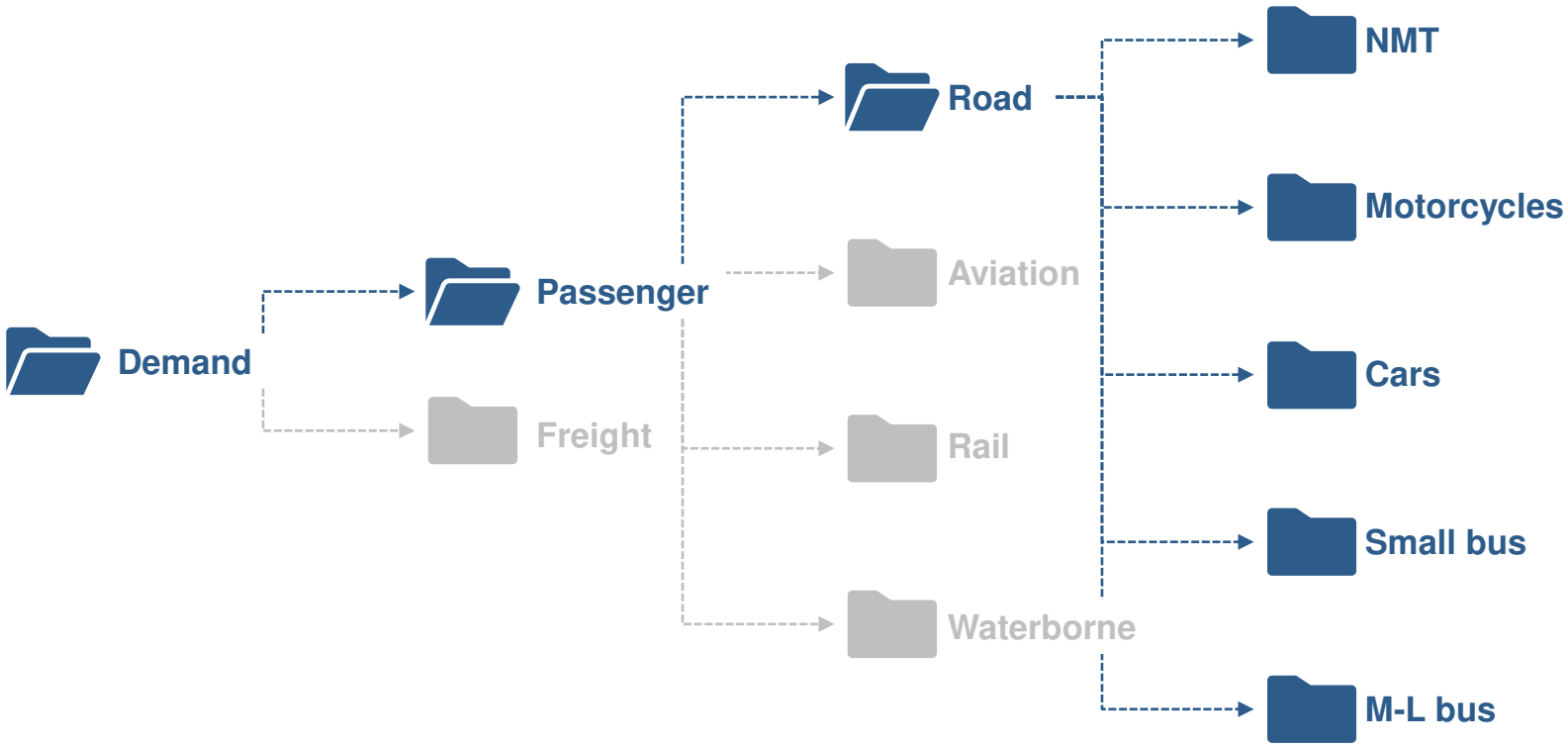
Basic structure of LEAP model: The Tree and its branches



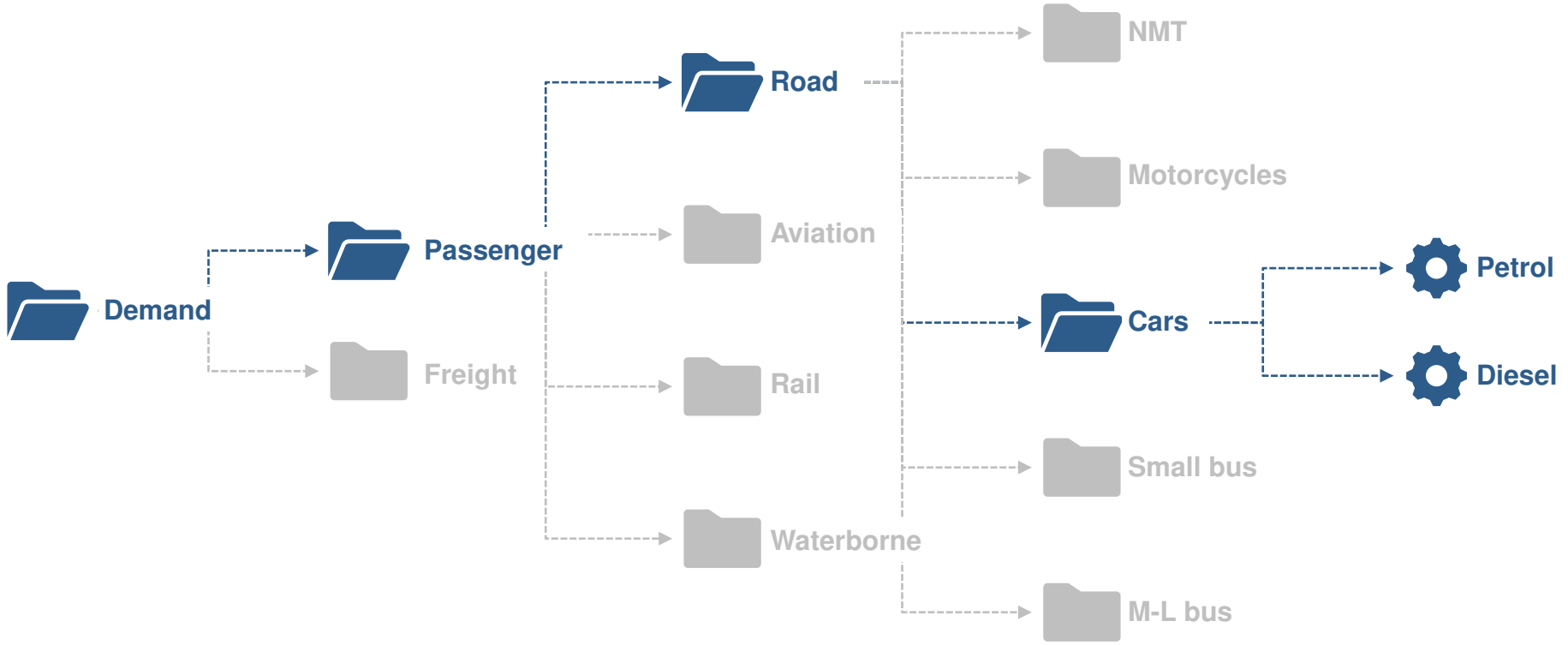
Basic structure of LEAP model: The Tree and its branches



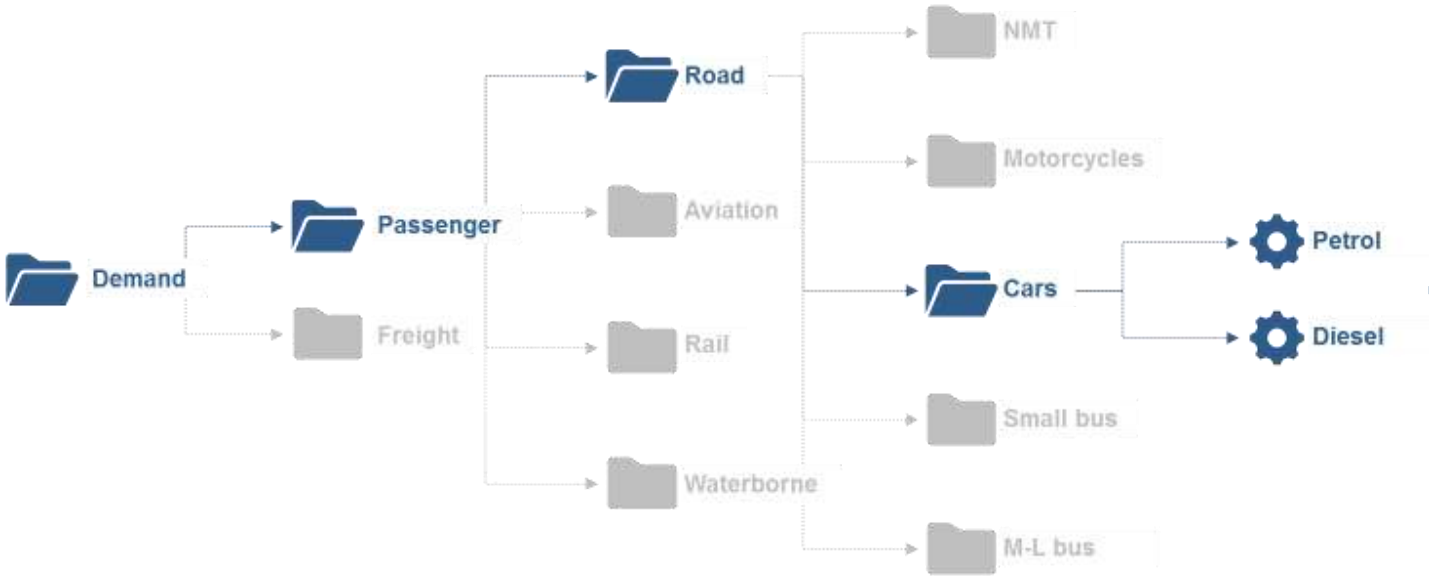
Basic structure of LEAP model: The Tree and its branches

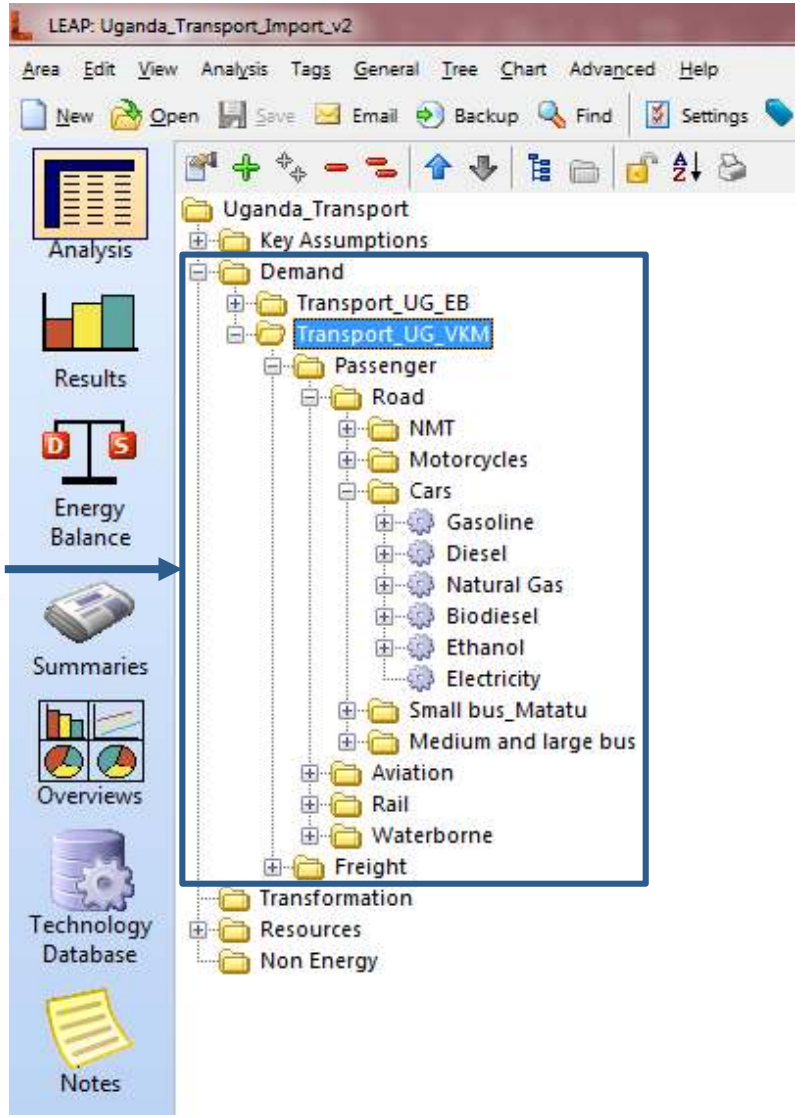


Basic structure of LEAP model: The Tree and its branches



Basic structure of LEAP model: The Tree and its branches





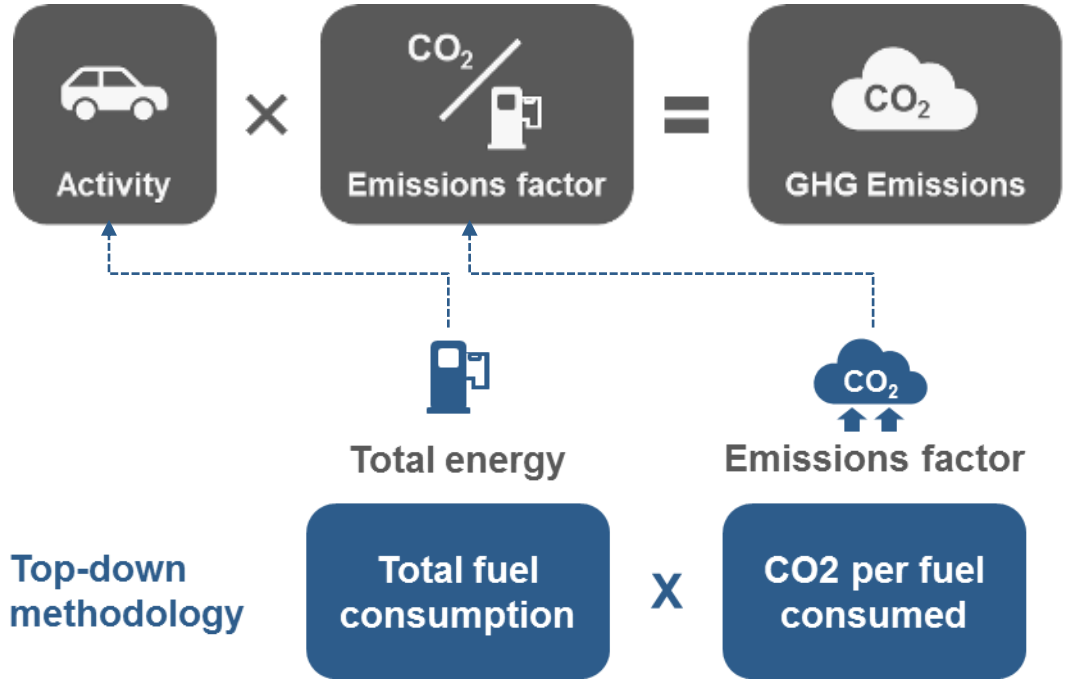
Methodology of analysis

Top-down or bottom-up methodology

Top-down methodology

A top-down methodology takes an aggregated input value (such as total energy consumption) and multiplies this by an emissions factor in order to compute emissions.

- **Calculation:** Fuel consumption * emissions factor = GHG emissions
- **Pros:** Simple, fast, often low uncertainty in source data
- **Cons:** Difficult to model mitigation effect

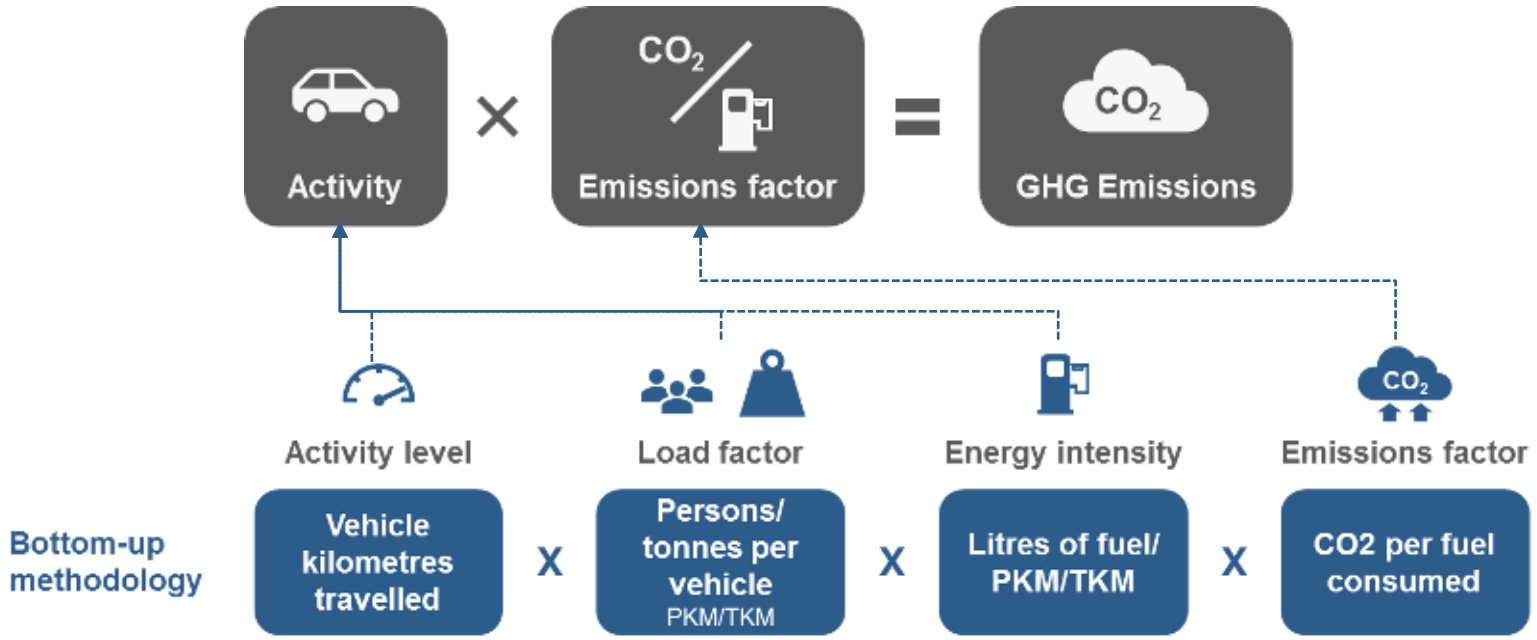


Top-down or bottom-up methodology

Bottom-up methodology

A bottom-up methodology takes the opposite approach to top-down, attempting to compile the total energy consumption of a mode of transport by modelling the transport activity itself. The total energy consumption computed is then multiplied by an emissions factor for that specific mode and that specific activity.

- **Calculation:** Transport activity by mode of transport (VKM * load factor) * fuel economy value * emissions factor = GHG emissions.
- **Pros:** Disaggregated by activity, therefore allows clear modelling of mitigation effect of measures
- **Cons:** High data requirements



Mitigation measures

Measure structure in ASIF framework

Measure category	Measure description	Effect of measure		Modelled effect
A – Avoid	Avoiding journeys where possible		Reduction in total vehicle kilometres travelled (VKM)	Change to VKM
S – Shift	Modal shift to lower-carbon transport systems		Shift of VKM from higher to lower emission modes	
I – Improve	Improving the energy intensity of travel per passenger kilometre or tonne kilometre		Increase in the fuel economy (distance travelled per litre of fuel)	Change to energy intensity
F - Fuel	Reducing carbon intensity of fuel consumed		Reducing carbon intensity of fuels	Change to fuel type consumed

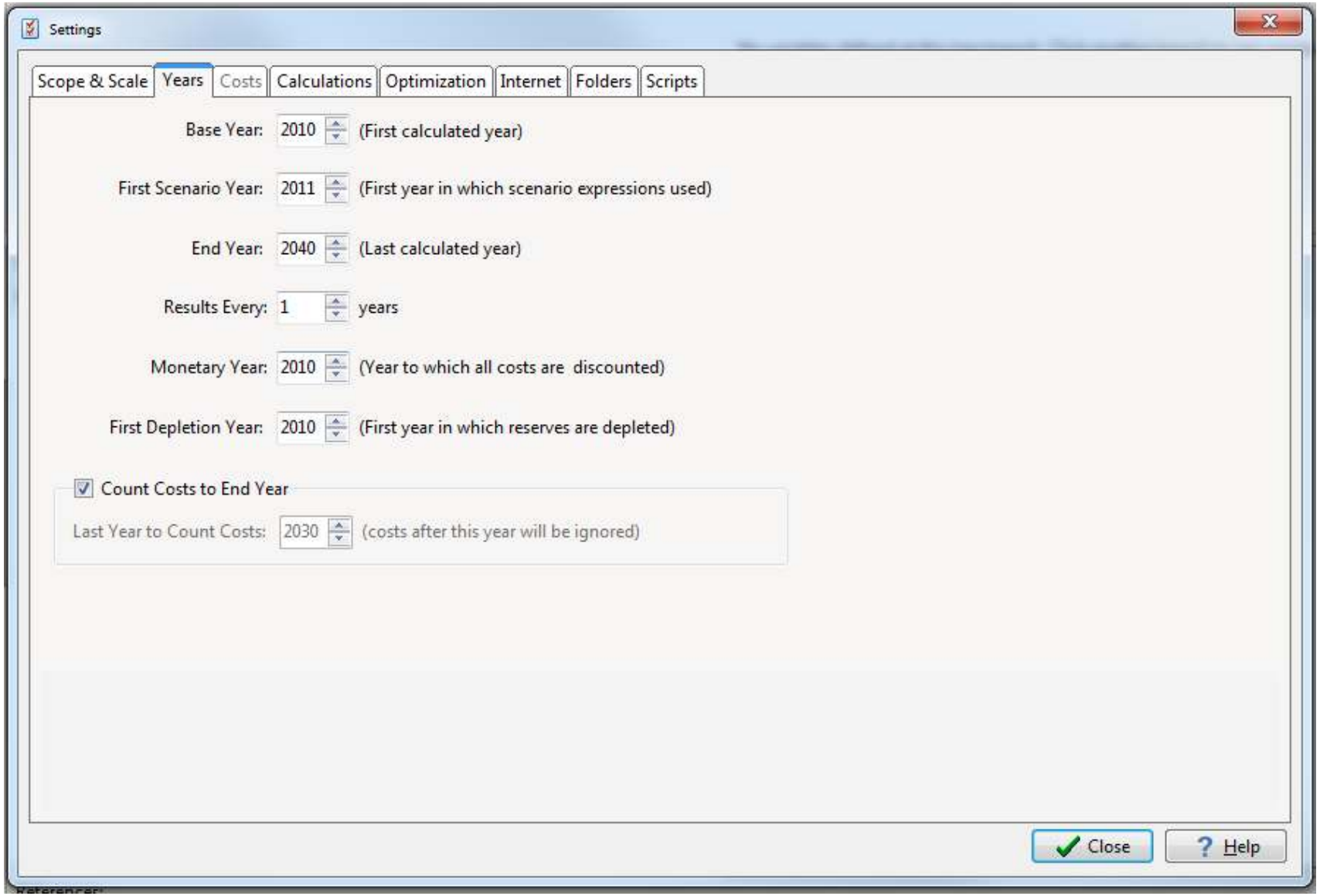
Mitigation measures

Overview of measure categories within the ASIF framework and modelled effects of measures

Measure category	ASIF	Modelled effect		Measures included
Fuel efficiency	Improve		Change to energy intensity	Passenger road transport fuel efficiency
Freight modal shift	Shift		Change to VKM	Freight modal shift from road to rail

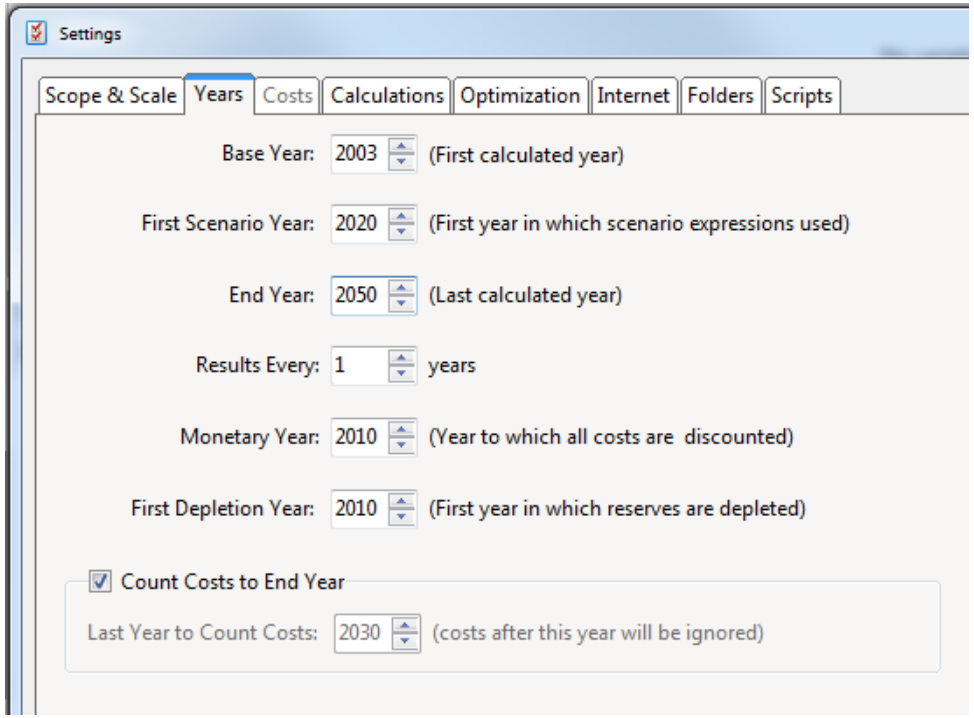
Using LEAP

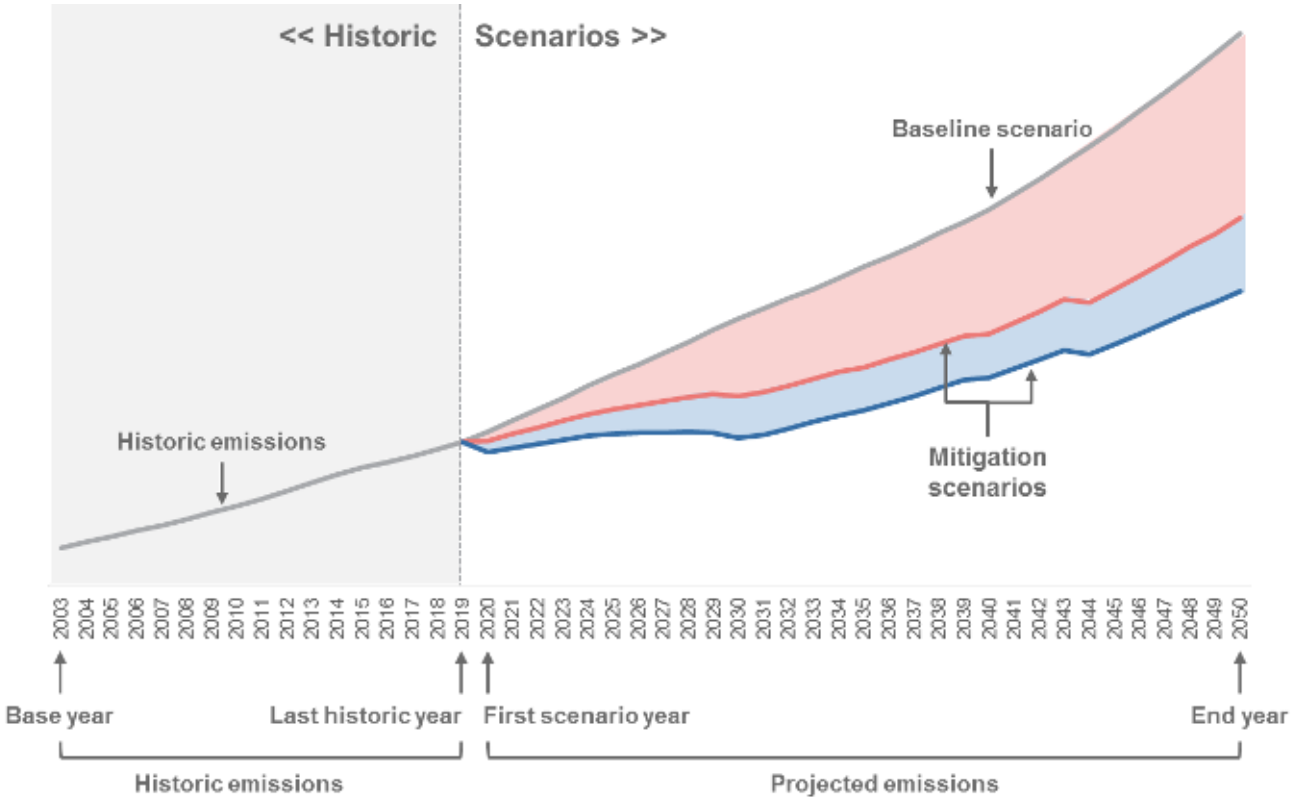
LEAP: Settings input



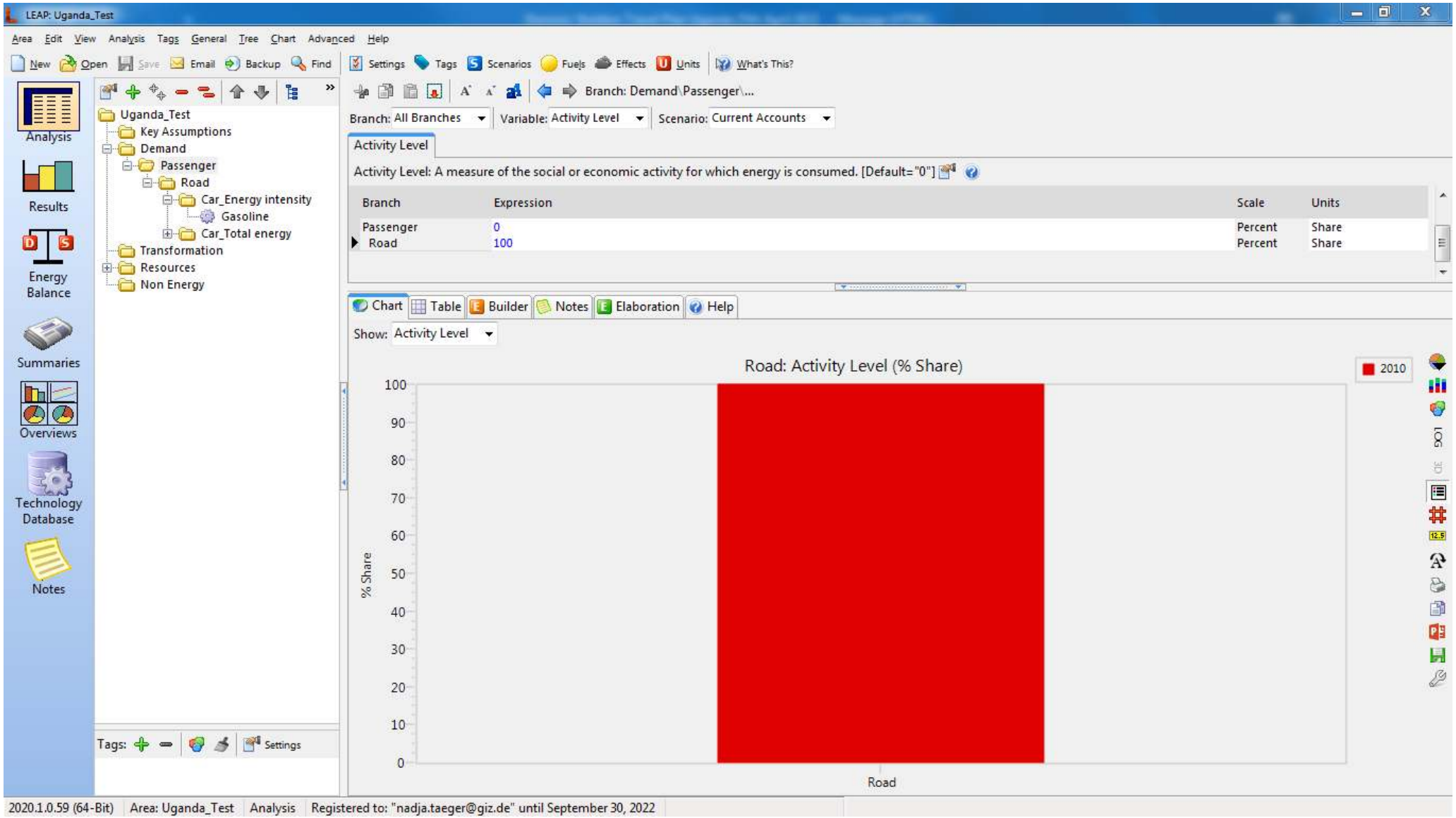
LEAP: Settings input

Settings input

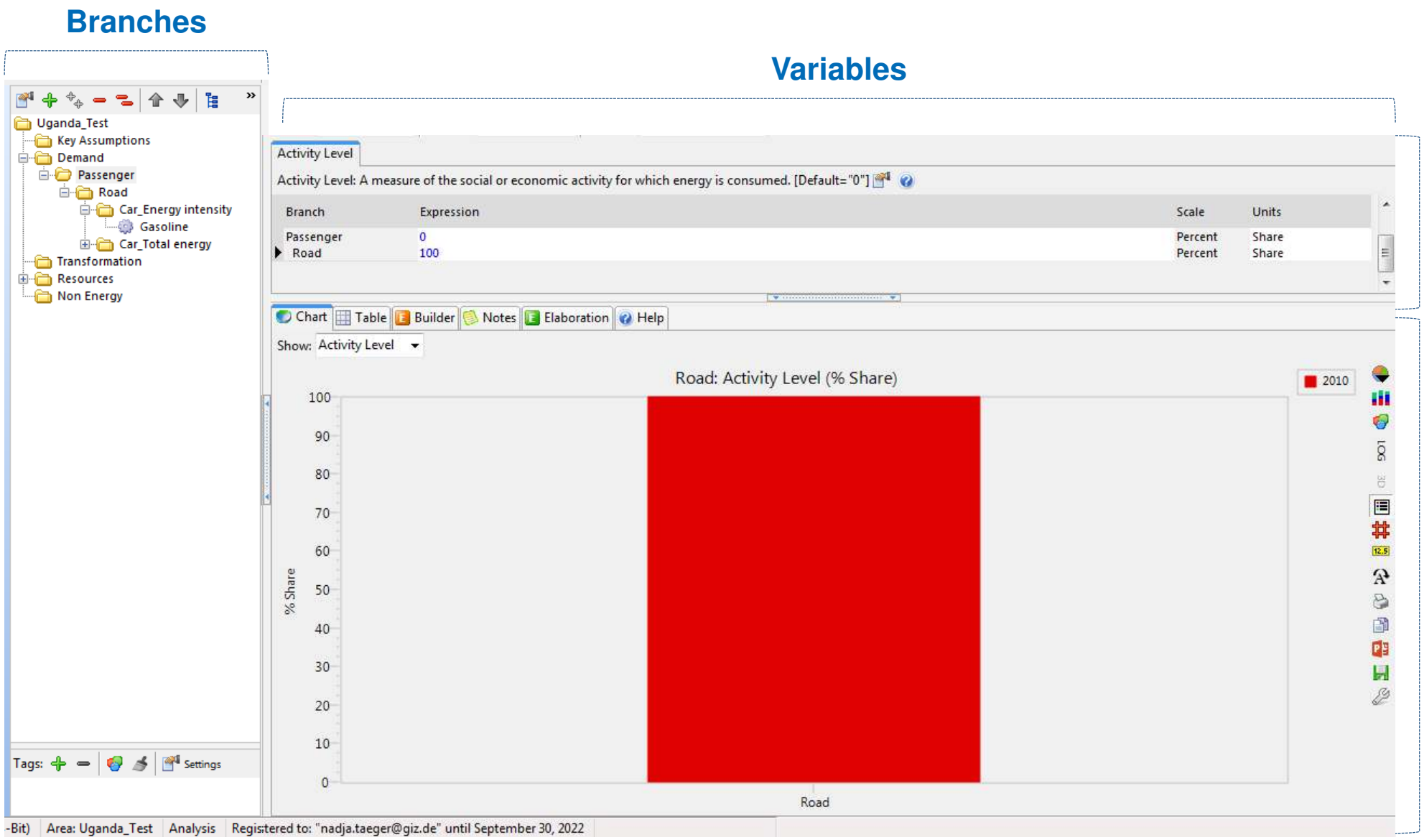




Interface: Overview



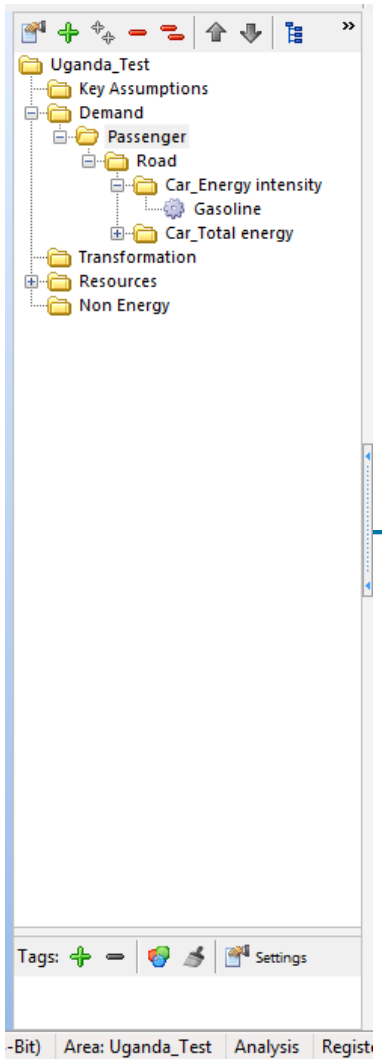
Interface: Analysis

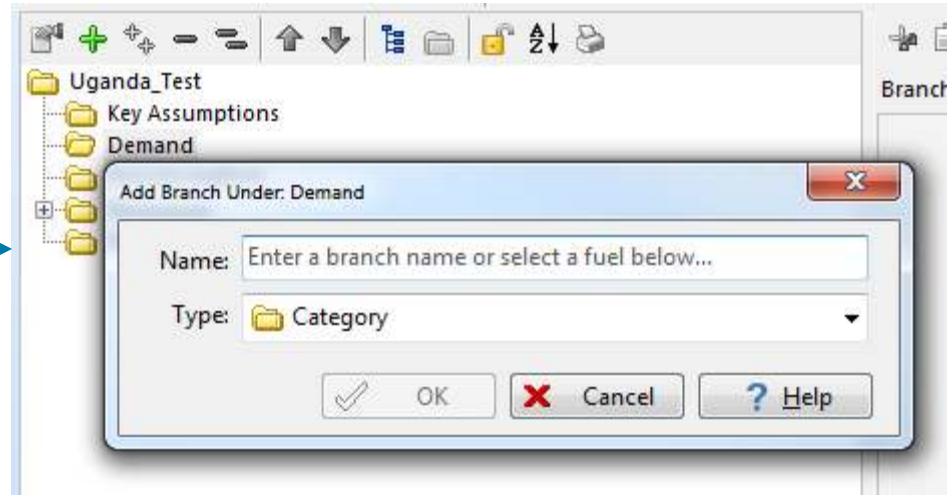


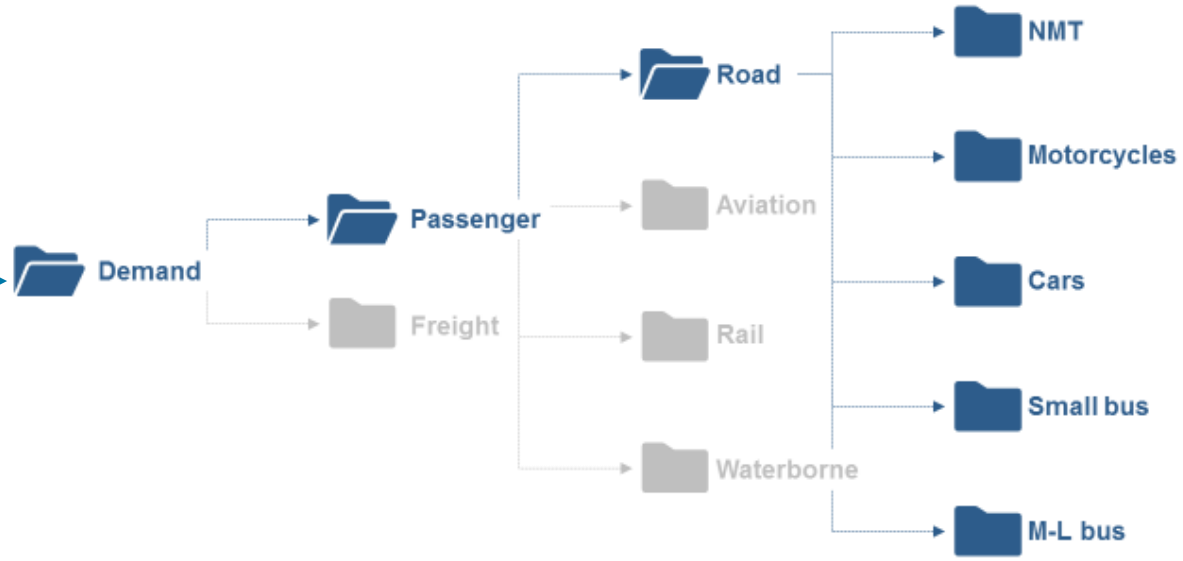
Interface: Branches

Interface: Analysis – Adding branches

Branches

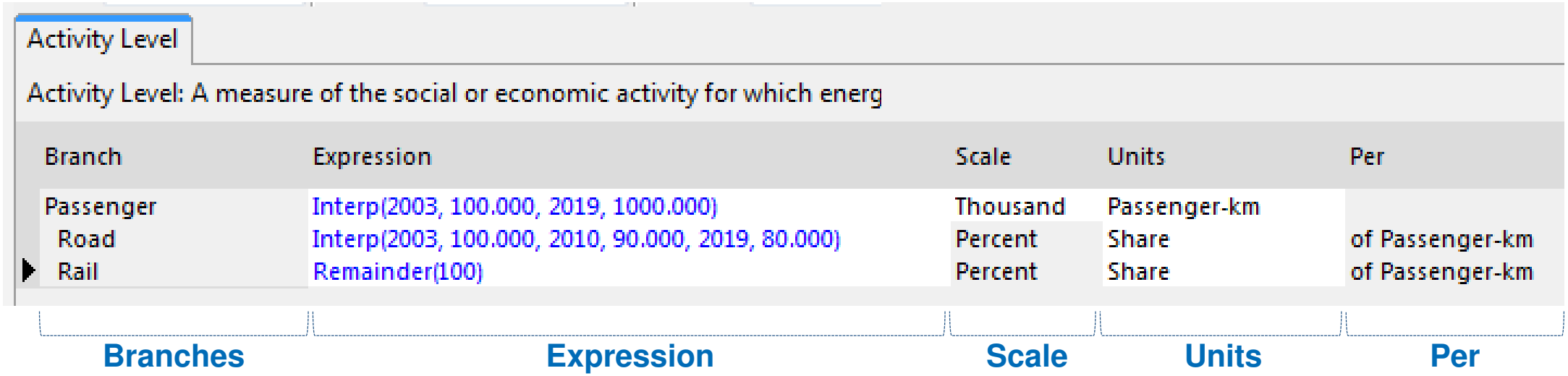






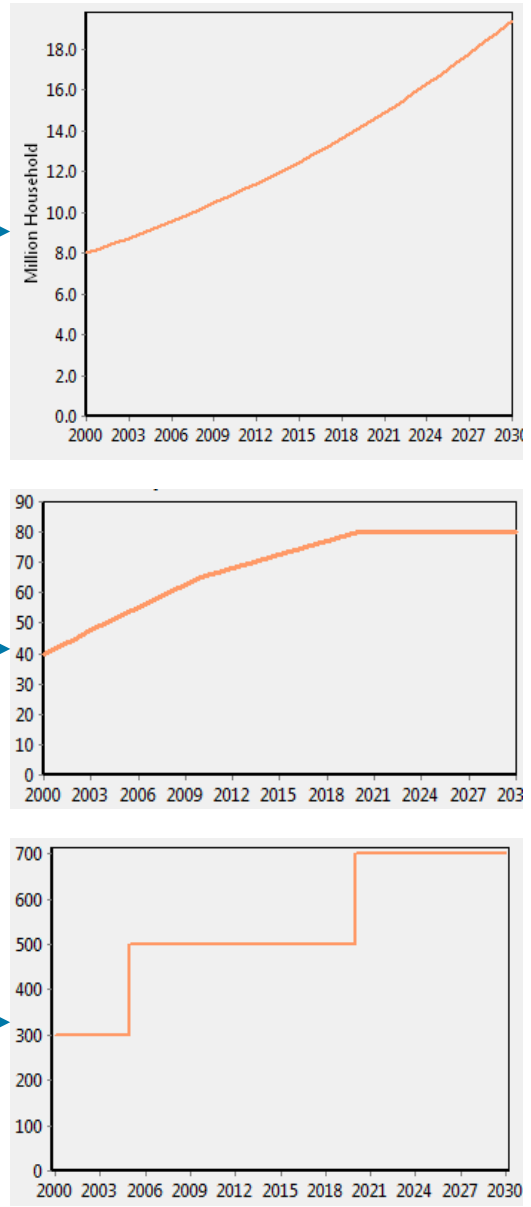
Interface: Expressions

Interface: Variables - Expressions

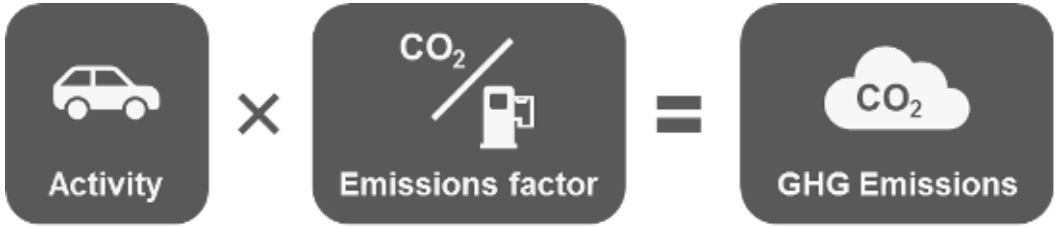


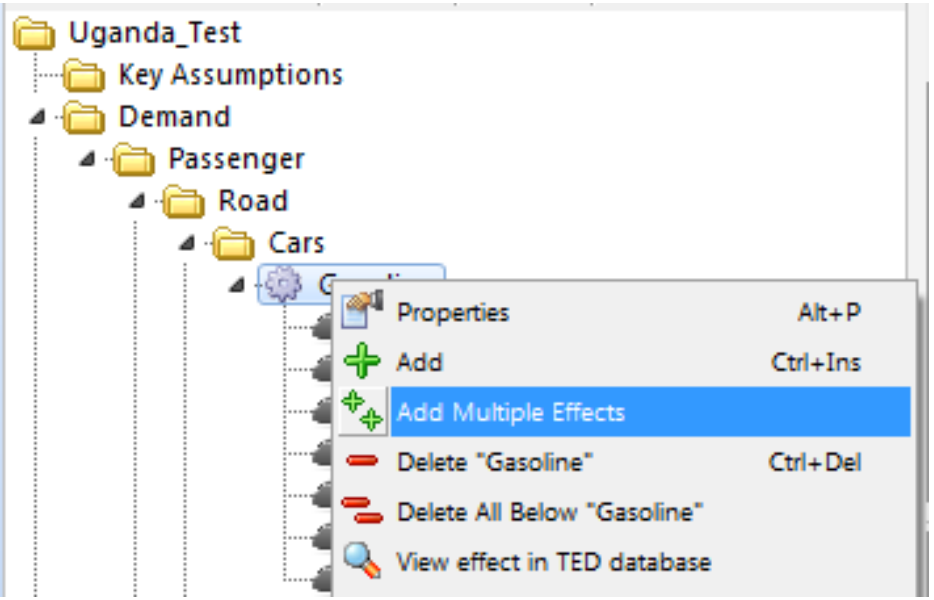
Interface: Expressions

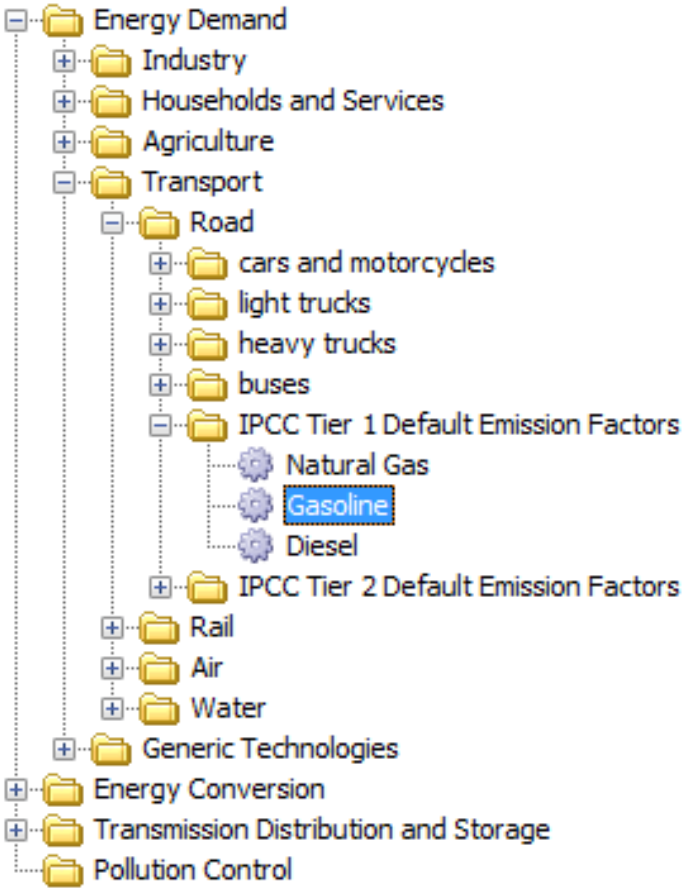
Type	Syntax	Example Syntax and Graph
Simple Number	Value	3.1415
Simple Formula	Value (operator (+ - / *)) value	0.1 * 5970
Growth Rate	Growth(annual % growth)	Growth(3.2%)
Interpolation	Interp(Year, value, year, value)	Interp(2000, 40, 2010, 65, 2020, 80)
Step	Step(Year, value, year, value)	Step(2000, 300, 2005, 500, 2020, 700)
Remainder	Remainder(Value)	70 Remainder(100) (=30)
Branch and Variable References	Branch (operator) Value	Passenger: Activity Level + 10%
GrowthAs	GrowthAs(Branch,elasticity)	GrowthAs(Key\Income,1.1)

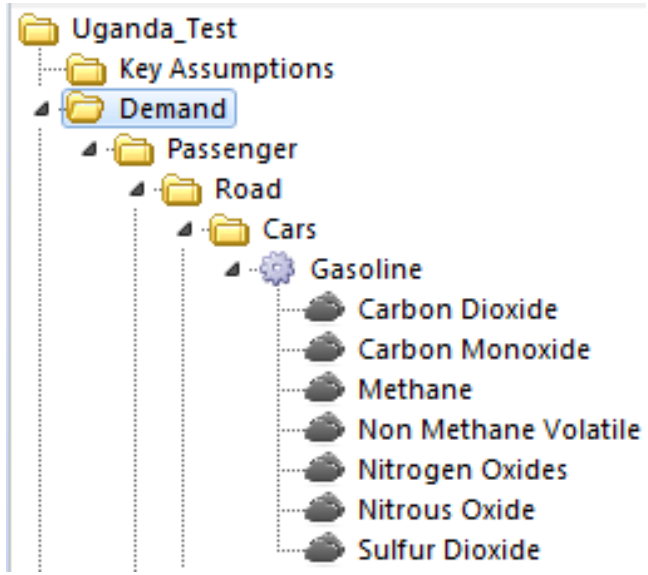


Interface: Variables – Multiple effects









Now we're ready to build our model!

Any questions?

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