

Training workshop for Anglophone African countries: Deep dive into tracking NDC mitigation commitments under the Paris Agreement

LEAP as a supporting tool to
estimate ex ante mitigation
actions

Dominic Sheldon

Senior Consultant – Climate Action
Planning and Transparency

Ricardo Energy and Environment

Registration details

When you open the software, answer **NO** to the question of do you want to register



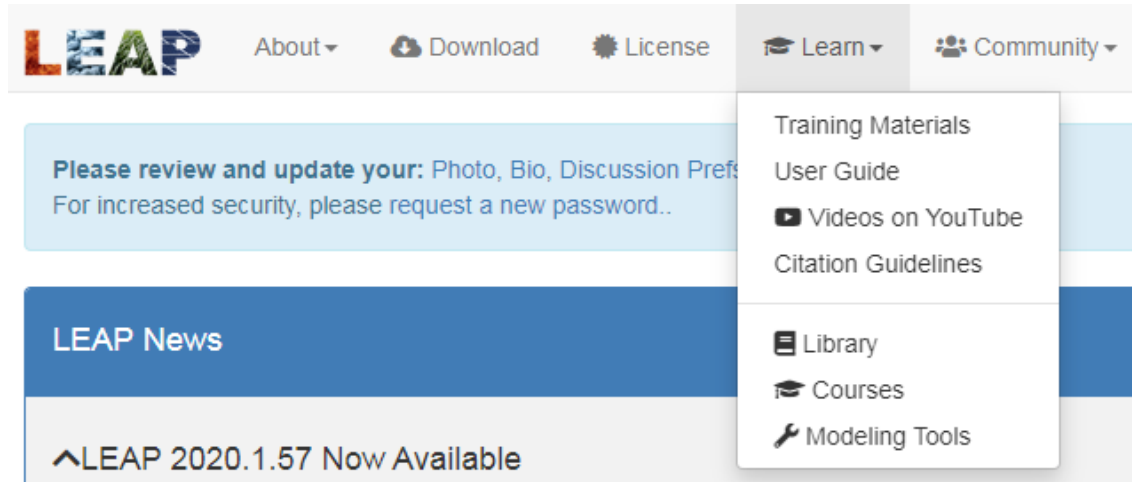
Navigate to:

- Help
- Register

Input the details below

| | | |
|--------------------------|----------------------------|---|
| User name | CAPT May 2023 | (not case sensitive) |
| Registration code | 987-743-643-996-170 | (you can omit the dashes if you prefer) |

LEAP resources available



The screenshot shows the top navigation bar of the LEAP website. The navigation items are: LEAP logo, About, Download, License, Learn, and Community. The 'Learn' dropdown menu is open, showing the following options: Training Materials, User Guide, Videos on YouTube, Citation Guidelines, Library, Courses, and Modeling Tools. Below the navigation bar, there is a light blue notification box with the text: 'Please review and update your: Photo, Bio, Discussion Pref... For increased security, please request a new password..'. Below that is a dark blue 'LEAP News' section, and at the bottom, a grey box with the text: '^LEAP 2020.1.57 Now Available'.

LEAP About Download License Learn Community

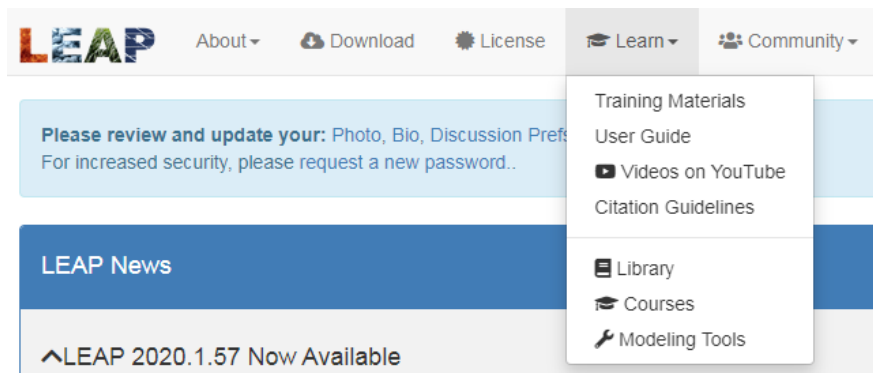
Please review and update your: Photo, Bio, Discussion Pref...
For increased security, please request a new password..

LEAP News

^LEAP 2020.1.57 Now Available

- Training Materials
- User Guide
- Videos on YouTube
- Citation Guidelines
- Library
- Courses
- Modeling Tools

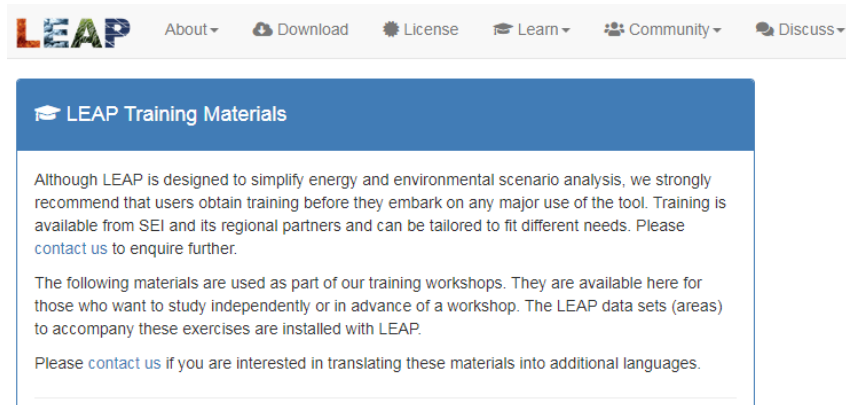
LEAP resources available: Training materials



The screenshot shows the top navigation bar of the LEAP website. The 'Learn' menu is open, displaying the following options: Training Materials, User Guide, Videos on YouTube, Citation Guidelines, Library, Courses, and Modeling Tools. Below the navigation bar, there is a light blue banner with the text: 'Please review and update your: Photo, Bio, Discussion Pref... For increased security, please request a new password..'. Below that is a dark blue banner with the text: 'LEAP News'. At the bottom of the screenshot, there is a light grey banner with the text: 'LEAP 2020.1.57 Now Available'.

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.



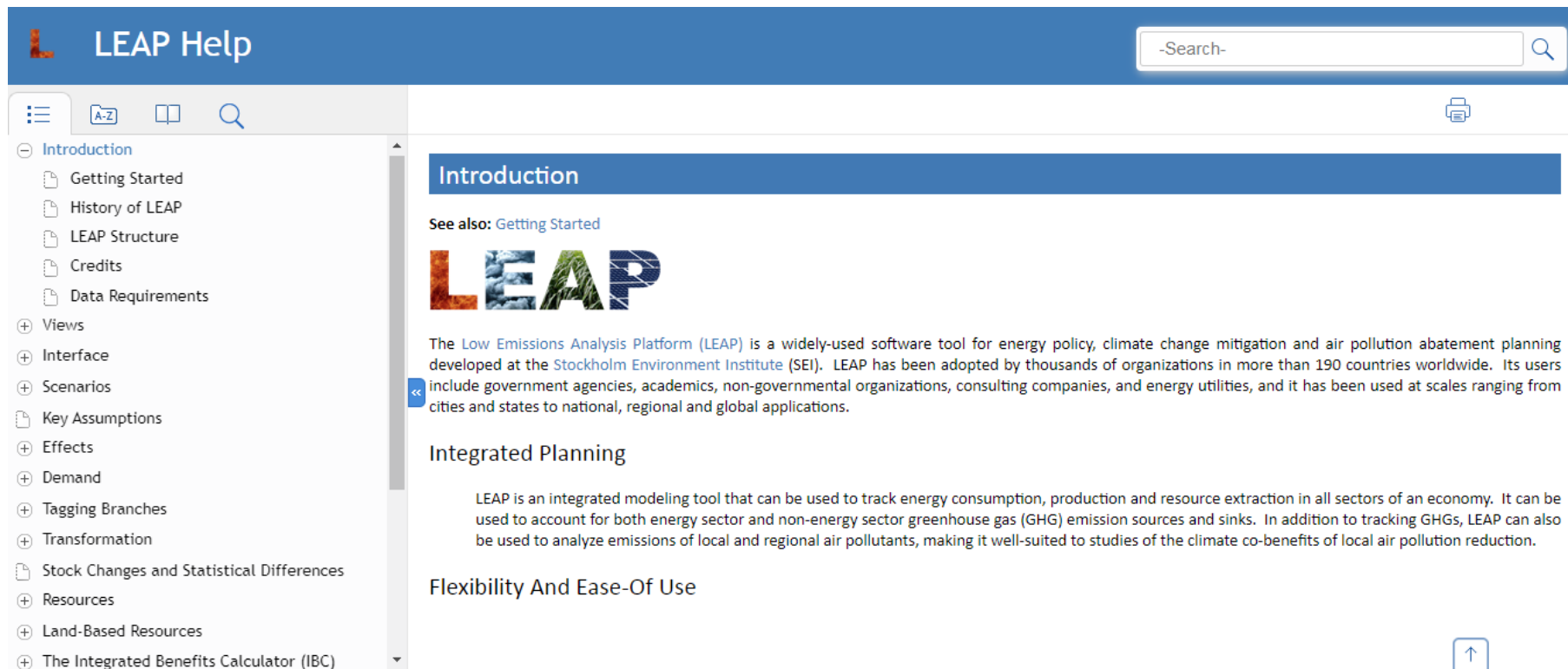
The screenshot shows the 'LEAP Training Materials' page. The page has a blue header with the text 'LEAP Training Materials'. Below the header, there is a paragraph of text: 'Although LEAP is designed to simplify energy and environmental scenario analysis, we strongly recommend that users obtain training before they embark on any major use of the tool. Training is available from SEI and its regional partners and can be tailored to fit different needs. Please contact us to enquire further.' Below this paragraph, there is another paragraph: 'The following materials are used as part of our training workshops. They are available here for those who want to study independently or in advance of a workshop. The LEAP data sets (areas) to accompany these exercises are installed with LEAP.' Below this paragraph, there is a final paragraph: 'Please contact us if you are interested in translating these materials into additional languages.'

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: User guide




The screenshot shows the LEAP Help user guide interface. At the top, there is a blue header with the LEAP logo and the text "LEAP Help". To the right of the header is a search bar with the placeholder text "-Search-". Below the header is a navigation sidebar on the left, containing a list of topics with expand/collapse icons. The main content area on the right is titled "Introduction" and features a blue header bar. Below the title, there is a "See also" link for "Getting Started" and a large, stylized "LEAP" logo. The main text describes the LEAP software tool, its development at the Stockholm Environment Institute (SEI), and its widespread adoption. Below the main text, there are sections for "Integrated Planning" and "Flexibility And Ease-Of Use". A print icon is visible in the top right corner of the main content area, and an up arrow icon is in the bottom right corner.

LEAP Help

- Introduction
 - Getting Started
 - History of LEAP
 - LEAP Structure
 - Credits
 - Data Requirements
- Views
- Interface
- Scenarios
- Key Assumptions
- Effects
- Demand
- Tagging Branches
- Transformation
- Stock Changes and Statistical Differences
- Resources
- Land-Based Resources
- The Integrated Benefits Calculator (IBC)

Introduction

See also: [Getting Started](#)



The [Low Emissions Analysis Platform \(LEAP\)](#) is a widely-used software tool for energy policy, climate change mitigation and air pollution abatement planning developed at the [Stockholm Environment Institute \(SEI\)](#). LEAP has been adopted by thousands of organizations in more than 190 countries worldwide. Its users include government agencies, academics, non-governmental organizations, consulting companies, and energy utilities, and it has been used at scales ranging from cities and states to national, regional and global applications.

Integrated Planning

LEAP is an integrated modeling tool that can be used to track energy consumption, production and resource extraction in all sectors of an economy. It can be used to account for both energy sector and non-energy sector greenhouse gas (GHG) emission sources and sinks. In addition to tracking GHGs, LEAP can also be used to analyze emissions of local and regional air pollutants, making it well-suited to studies of the climate co-benefits of local air pollution reduction.

Flexibility And Ease-Of Use

LEAP resources available: YouTube training videos



The Low Emissions Analysis Platform

LEAP Platform
1.35K subscribers

HOME VIDEOS PLAYLISTS COMMUNITY CHANNELS ABOUT

Follow-Along Training Videos ▶ PLAY ALL

Companion videos for LEAP's standard training exercises, available here:
<https://leap.sei.org/training>

| Training Exercise #1 An Introduction to LEAP <small>(Follow-along Video)</small> | Training Exercise #2 Industry, Transport & Commercial <small>(Follow-along Video)</small> | Training Exercise #3 Transformation <small>(Follow-along Video)</small> | Training Exercise #4 Cost-Benefit Analysis <small>(Follow-along Video)</small> | Training Exercise #5 Non-Energy Sector <small>(Follow-along Video)</small> |
|--|---|---|---|---|
| | | | | |
| 1:23:09 | 58:09 | 24:35 | 52:46 | 30:24 |
| Training Exercise #1: Introduction to LEAP LEAP Platform 21K views • 1 year ago | Training Exercise #2 on Industry, Transport and the... LEAP Platform 6.5K views • 1 year ago | Training Exercise #3: Transformation LEAP Platform 3.2K views • 1 year ago | Training Exercise #4: Cost- Benefit Analysis LEAP Platform 3.1K views • 1 year ago | Training Exercise #5: Non- Energy Sector Emissions LEAP Platform 2K views • 1 year ago |

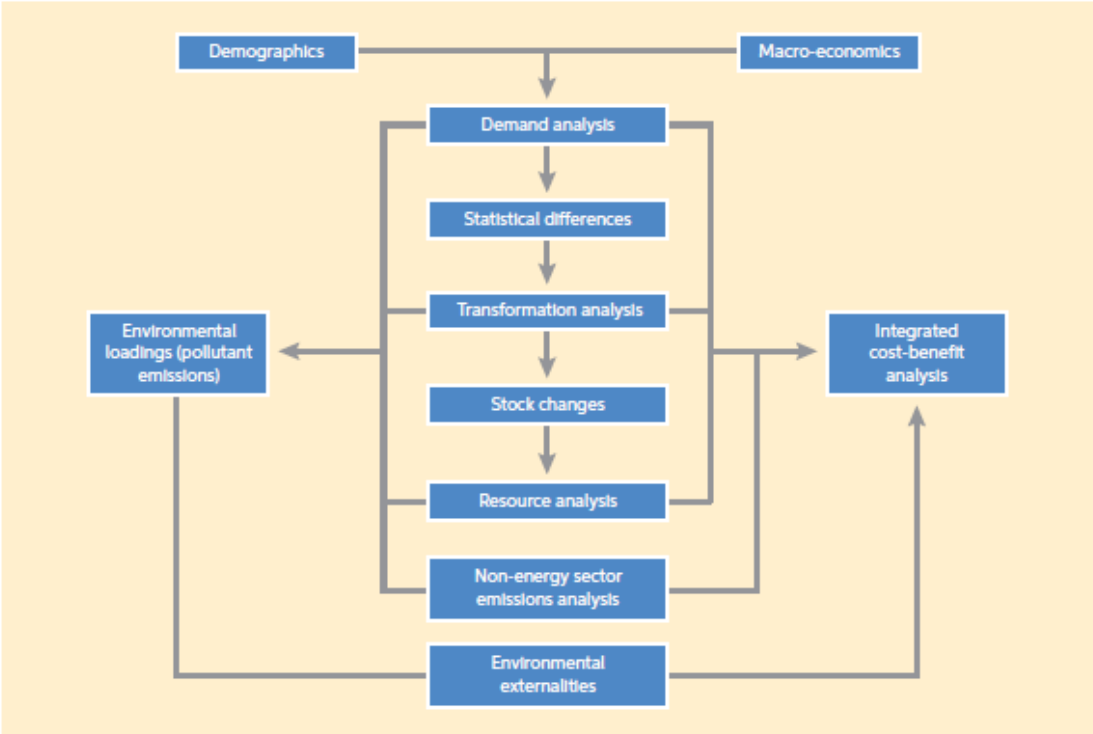


Introduction to LEAP

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:

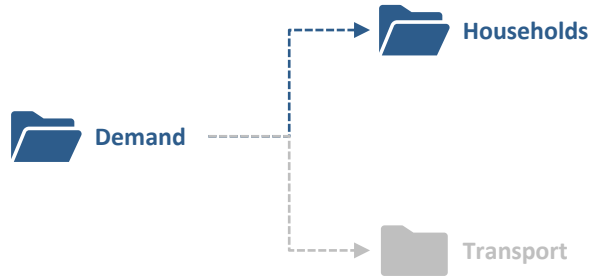
- It is a model that is **familiar to key stakeholders around the world** and has been used for previous modelling exercises, so will allow for greater comparability with previous GHG scenarios.
- The **LEAP model has been used for NDCs and LTSs**
- The model **is relatively simple to use**.
- The **model is free for developing countries to use**
- Its **low initial data requirements** are well suited to a country like Uganda where accessing robust data has been, and will continue to be, a challenge.
- It presents outputs in a **transparent and intuitive** way.

LEAP can be intimidating

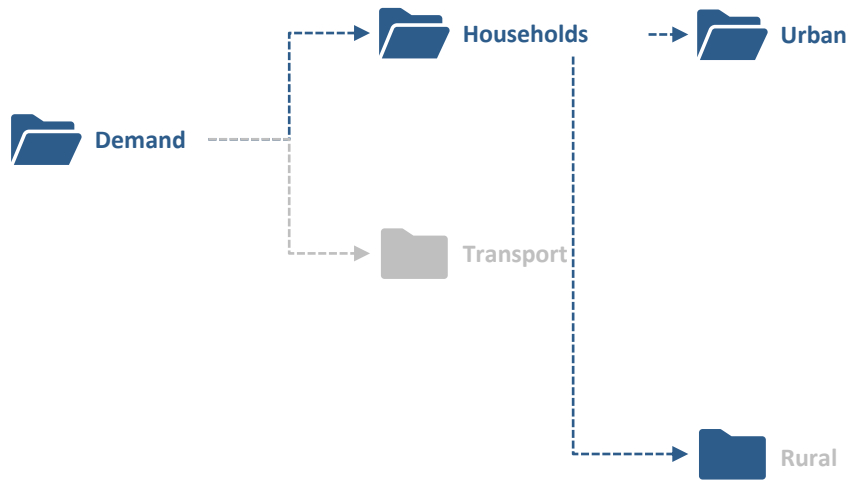


Source: <https://leap.sei.org/default.asp?action=Introduction>;

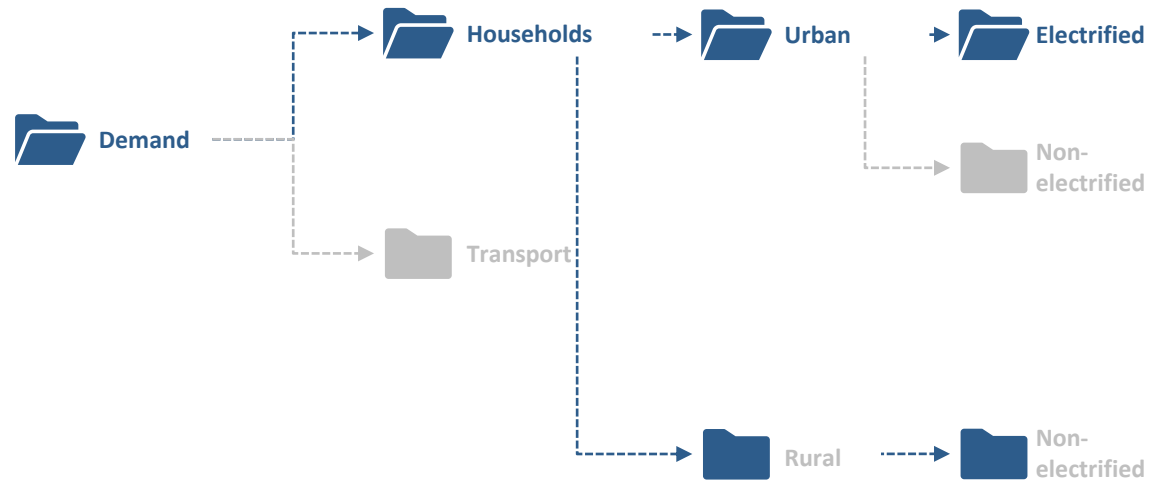
Basic structure of LEAP model: The Tree and its branches



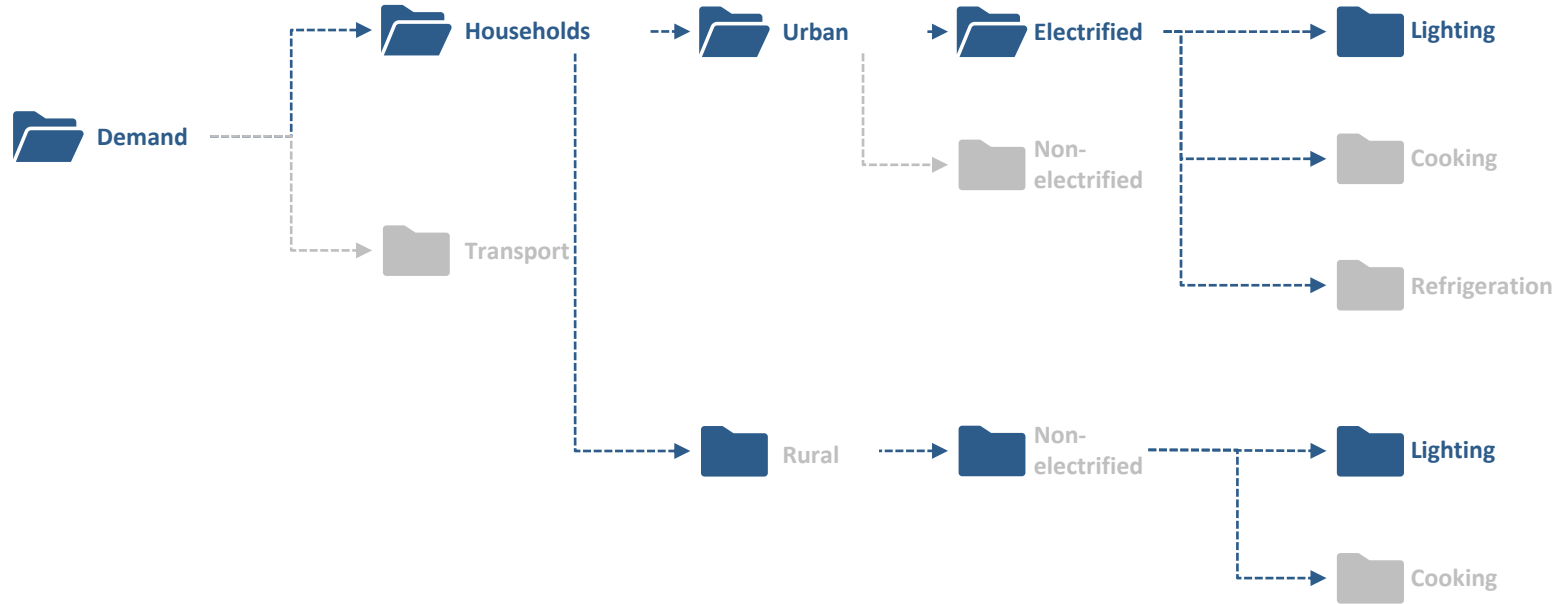
Basic structure of LEAP model: The Tree and its branches



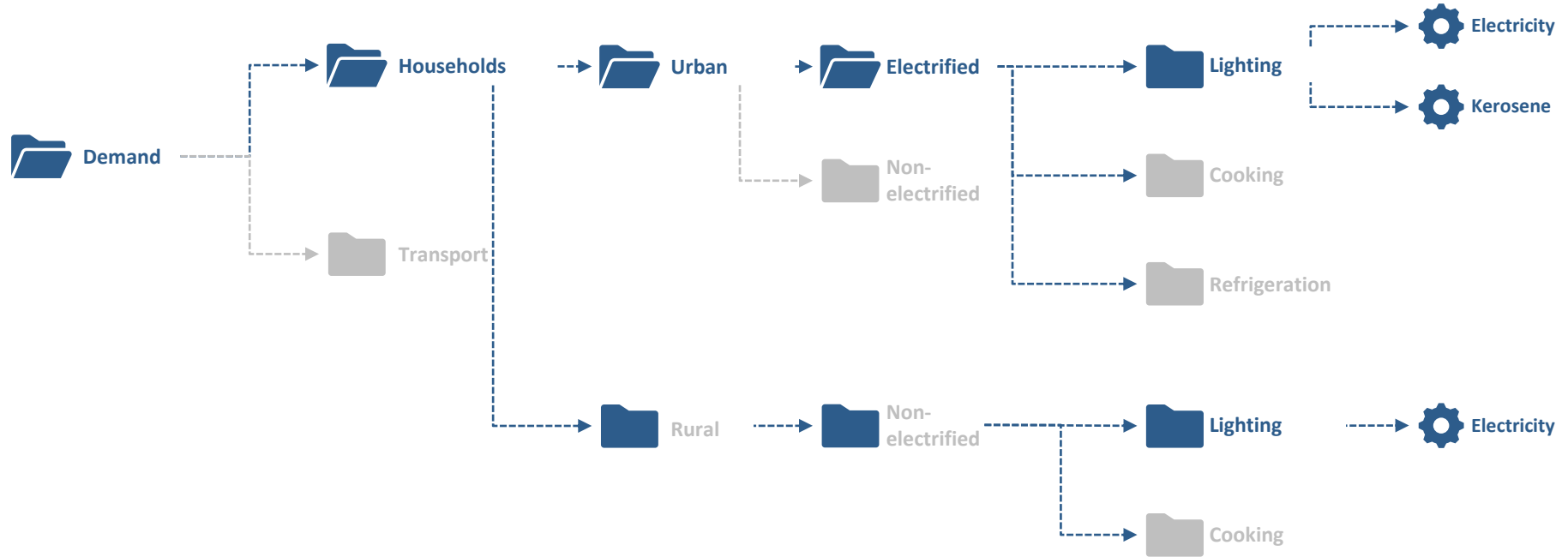
Basic structure of LEAP model: The Tree and its branches



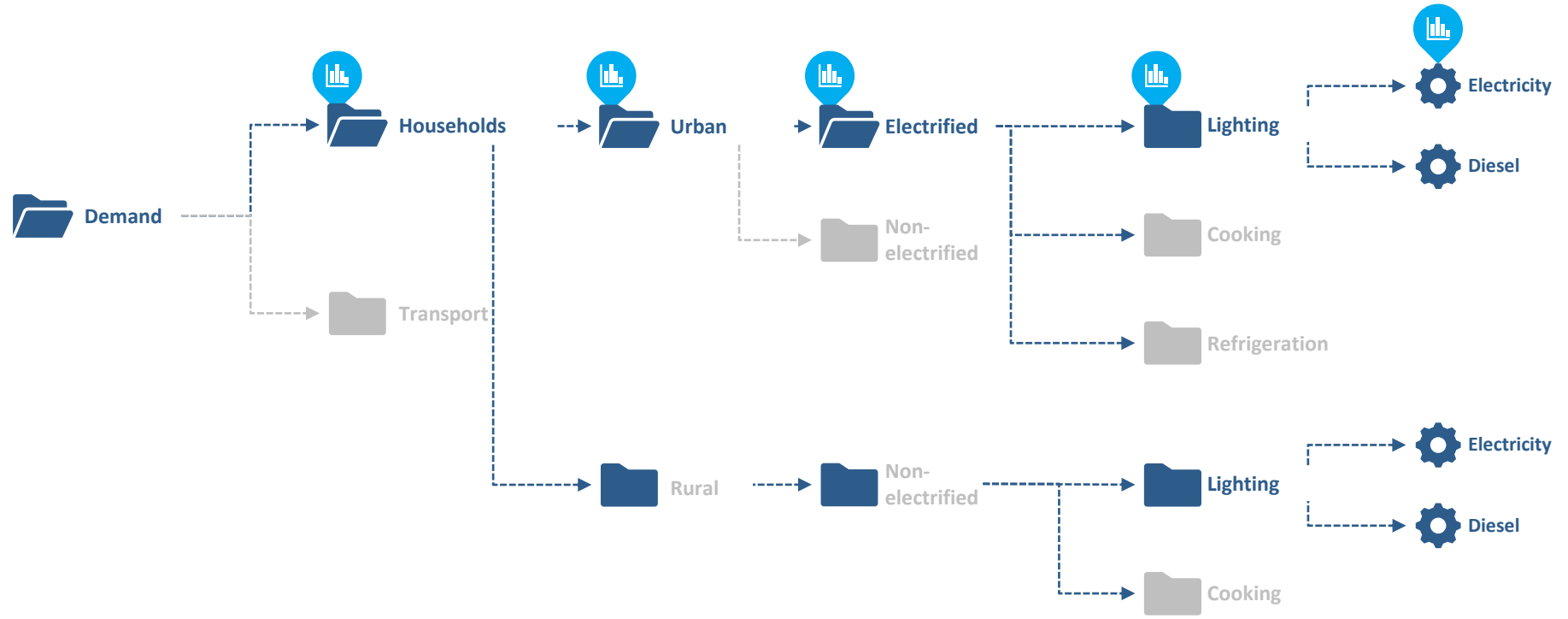
Basic structure of LEAP model: The Tree and its branches



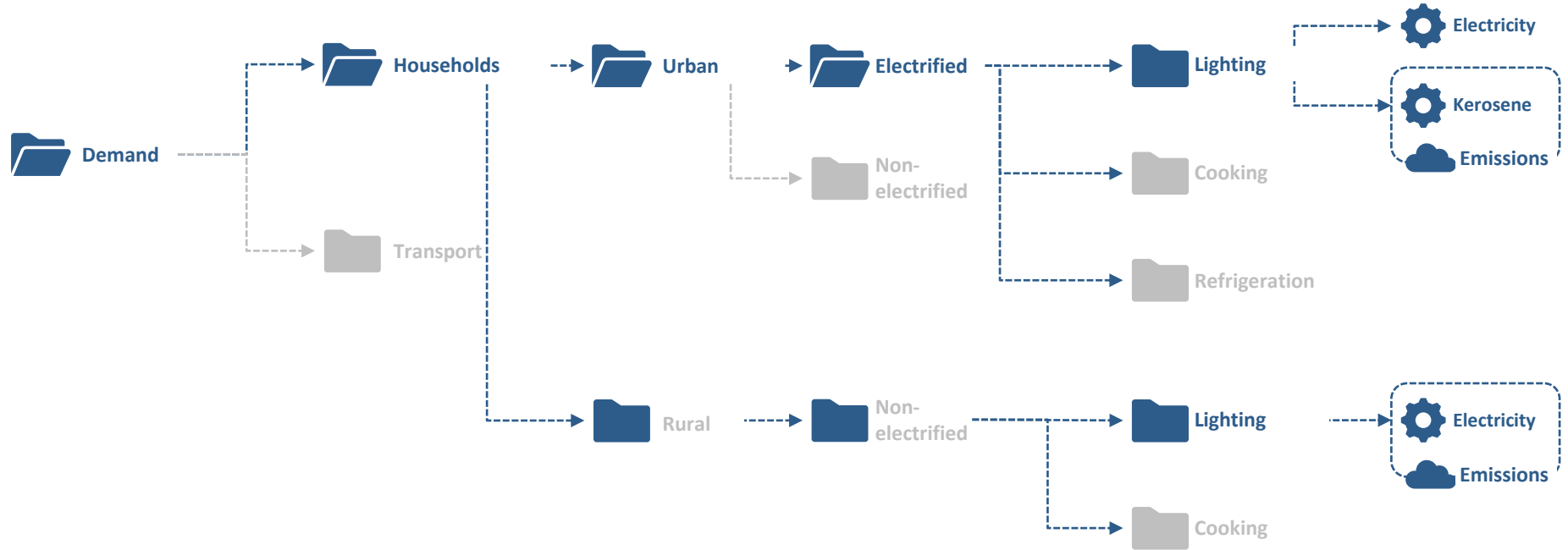
Basic structure of LEAP model: The Tree and its branches



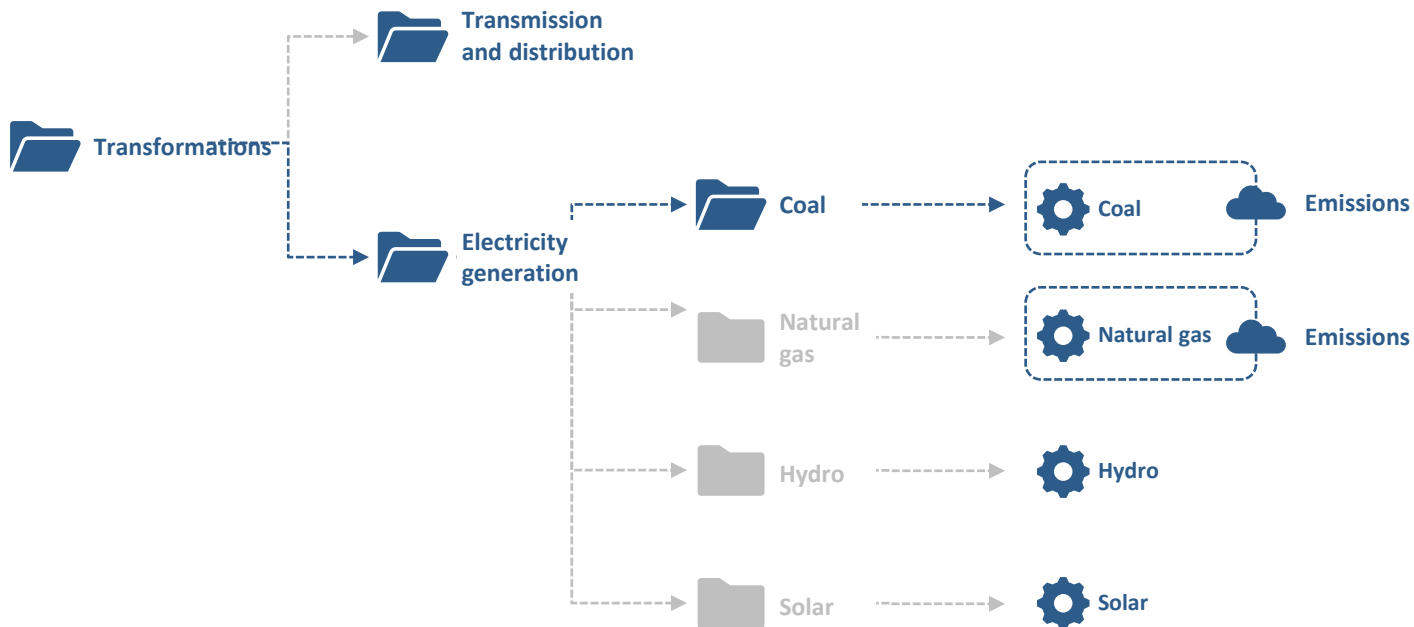
Basic structure of LEAP model: The Tree and its branches



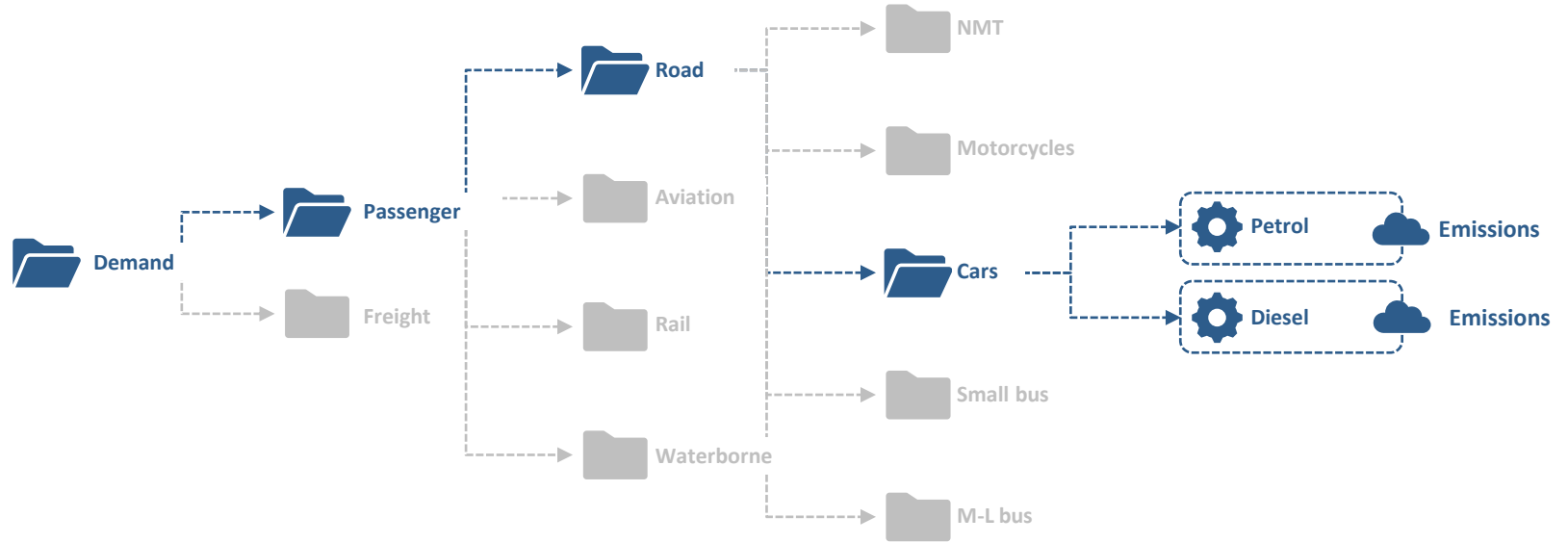
Basic structure of LEAP model: The Tree and its branches



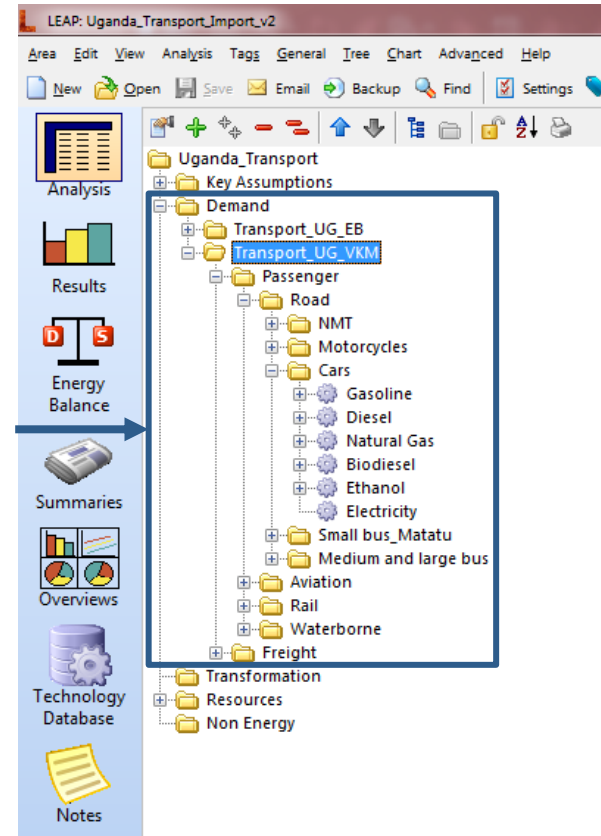
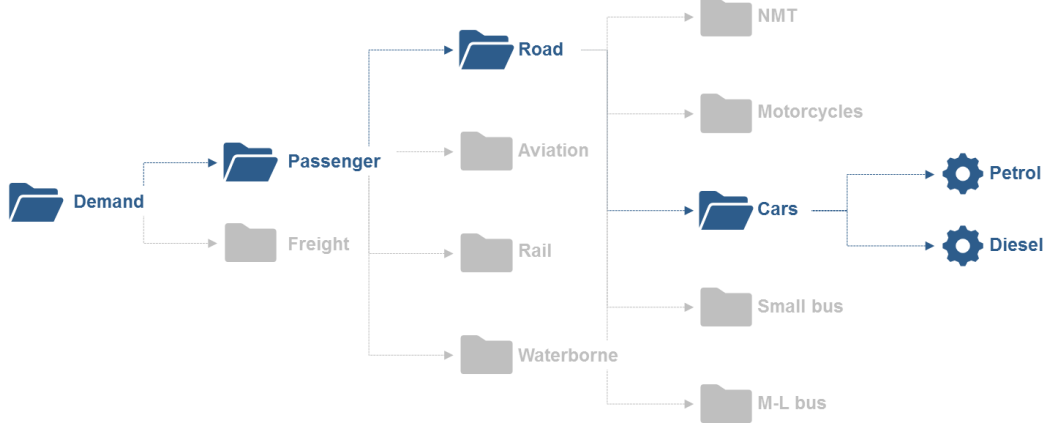
Basic structure of LEAP model: The Tree and its branches



Basic structure of LEAP model: The Tree and its branches



Basic structure of LEAP model: The Tree and its branches





Using LEAP

LEAP: Settings input

The screenshot shows the 'Settings' dialog box with the 'Years' tab selected. The dialog has a title bar with a close button and a 'Settings' label. Below the title bar are several tabs: 'Scope & Scale', 'Years', 'Costs', 'Calculations', 'Optimization', 'Internet', 'Folders', and 'Scripts'. The 'Years' tab contains the following settings:

- Base Year: 2010 (First calculated year)
- First Scenario Year: 2011 (First year in which scenario expressions used)
- End Year: 2040 (Last calculated year)
- Results Every: 1 years
- Monetary Year: 2010 (Year to which all costs are discounted)
- First Depletion Year: 2010 (First year in which reserves are depleted)
- Count Costs to End Year
 - Last Year to Count Costs: 2030 (costs after this year will be ignored)

At the bottom right of the dialog are two buttons: 'Close' (with a green checkmark icon) and 'Help' (with a question mark icon).



LEAP: Settings input

Settings input

Settings

Scope & Scale | **Years** | Costs | Calculations | Optimization | Internet | Folders | Scripts

Base Year: 2003 (First calculated year)

First Scenario Year: 2020 (First year in which scenario expressions used)

End Year: 2050 (Last calculated year)

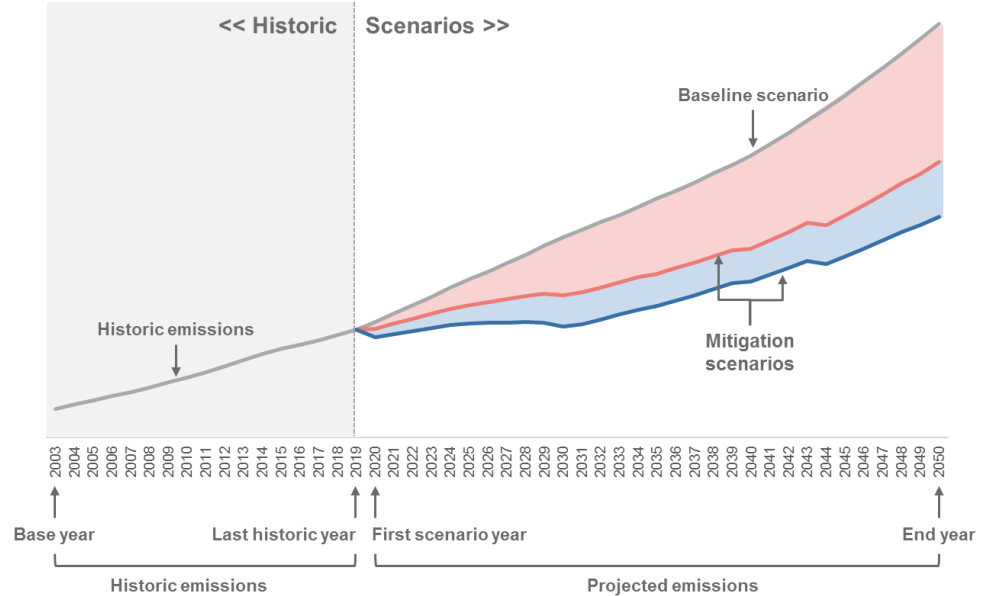
Results Every: 1 years

Monetary Year: 2010 (Year to which all costs are discounted)

First Depletion Year: 2010 (First year in which reserves are depleted)

Count Costs to End Year

Last Year to Count Costs: 2030 (costs after this year will be ignored)



Interface: Overview

The screenshot displays the LEAP software interface for a model named 'Uganda_Test'. The interface is divided into several main sections:

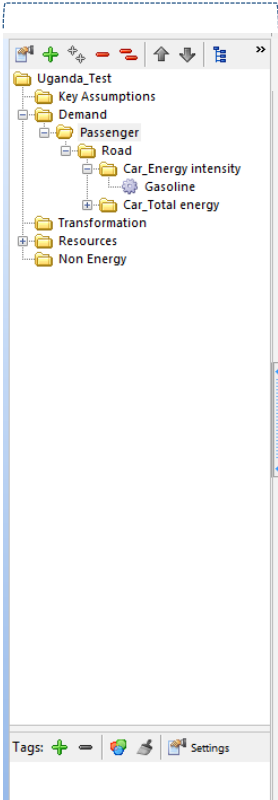
- Left Panel:** A vertical navigation menu with icons for Analysis, Results, Energy Balance, Summaries, Overviews, Technology Database, and Notes.
- Tree View:** A hierarchical tree structure showing the model's components: Uganda_Test, Key Assumptions, Demand, Passenger, Road, Car_Energy Intensity, Gasoline, Car_Total energy, Transformation, Resources, and Non Energy.
- Table:** A table titled 'Activity Level' showing the expression for different branches. The table has columns for Branch, Expression, Scale, and Units.
- Chart:** A bar chart titled 'Road: Activity Level (% Share)' showing the percentage share of activity level for the Road branch. The y-axis is labeled '% Share' and ranges from 0 to 100. The x-axis is labeled 'Road'. A single red bar represents the value for the year 2010.

| Branch | Expression | Scale | Units |
|-----------|------------|---------|-------|
| Passenger | 0 | Percent | Share |
| Road | 100 | Percent | Share |

2020.1.0.59 (64-Bit) Area: Uganda_Test Analysis Registered to: "nadja.taeger@giz.de" until September 30, 2022

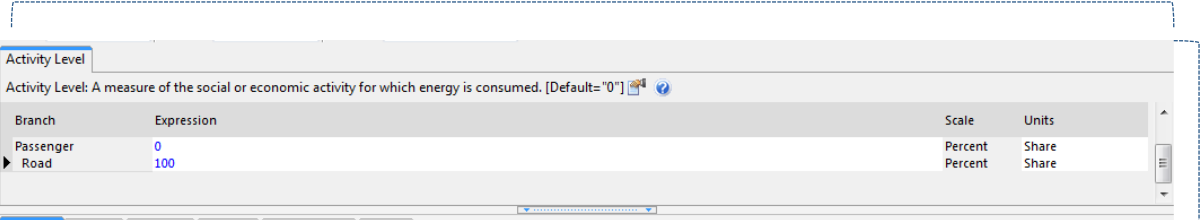
Interface: Analysis

Branches



A hierarchical tree view of the model structure. The root is 'Uganda_Test', which contains 'Key Assumptions', 'Demand', 'Transformation', 'Resources', and 'Non Energy'. 'Demand' is expanded to show 'Passenger' and 'Road'. 'Road' is further expanded to show 'Car_Energy intensity', 'Gasoline', and 'Car_Total energy'.

Variables



Activity Level

Activity Level: A measure of the social or economic activity for which energy is consumed. [Default="0"]

| Branch | Expression | Scale | Units |
|-----------|------------|---------|-------|
| Passenger | 0 | Percent | Share |
| Road | 100 | Percent | Share |

Expressions



Chart showing Road: Activity Level (% Share) for the year 2010. The Y-axis is labeled '% Share' and ranges from 0 to 100. The X-axis is labeled 'Road'. A single red bar represents the value 100%.

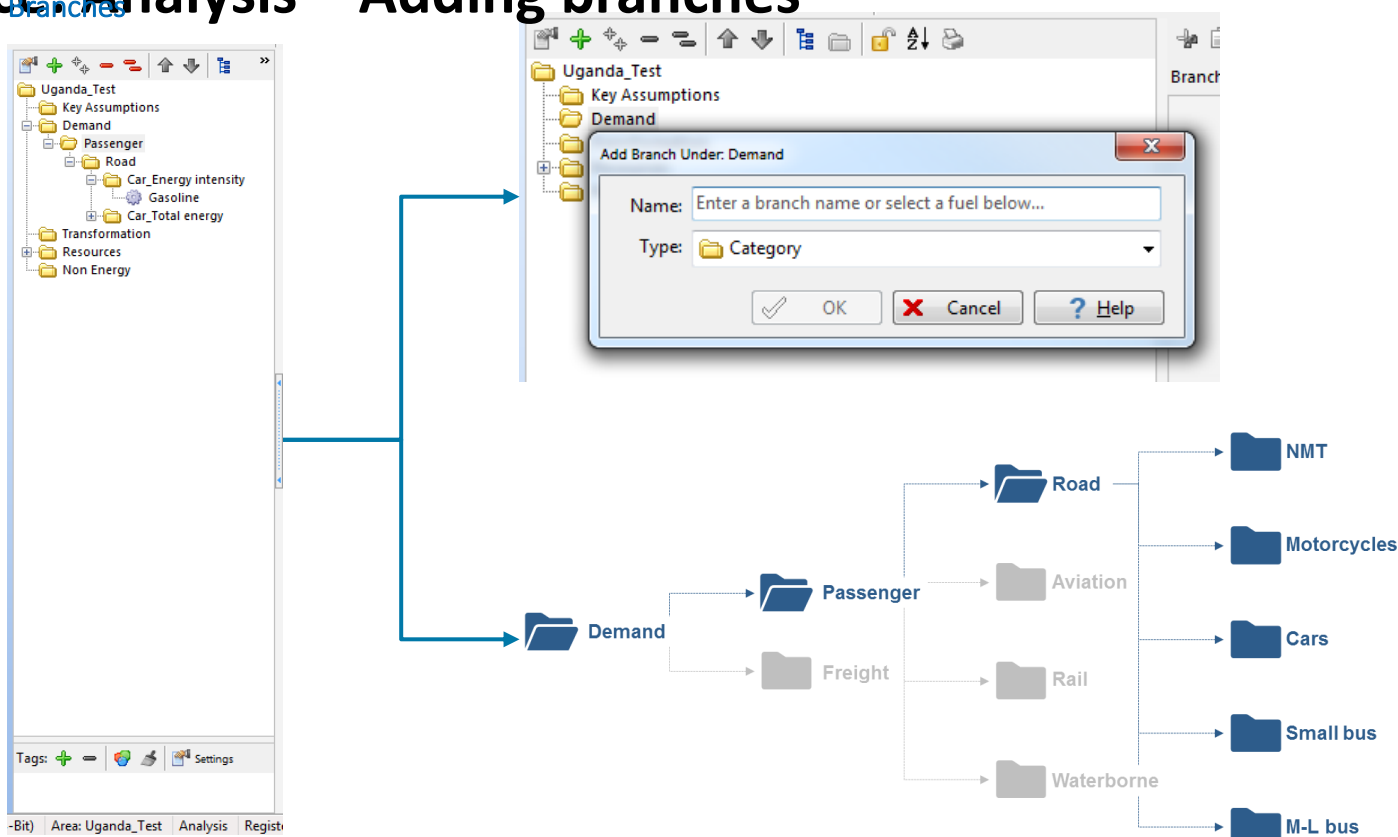
| Year | Road: Activity Level (% Share) |
|------|--------------------------------|
| 2010 | 100 |

Information

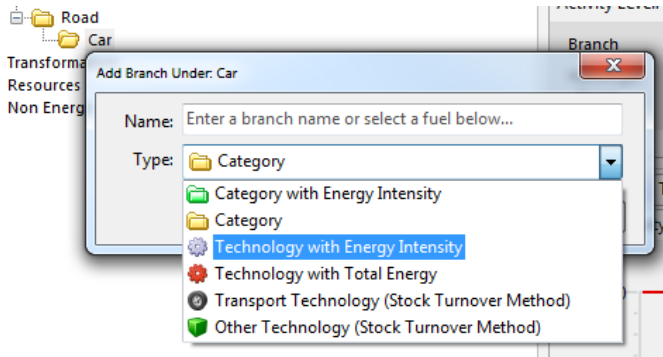
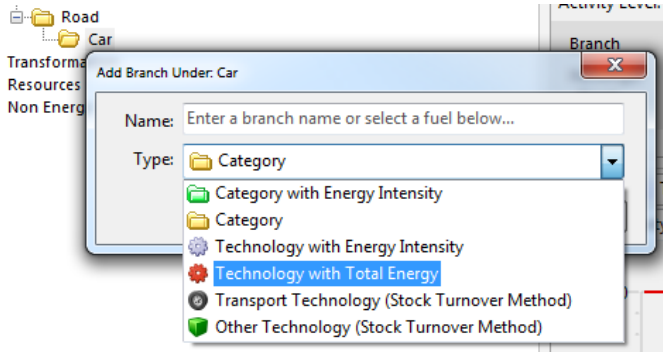


Interface: Branches

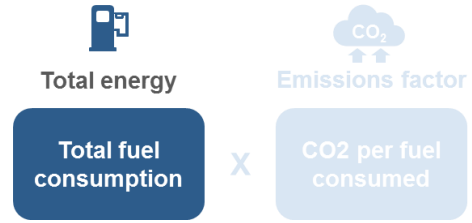
Interface: Analysis – Adding branches



Interface: Analysis – Variables

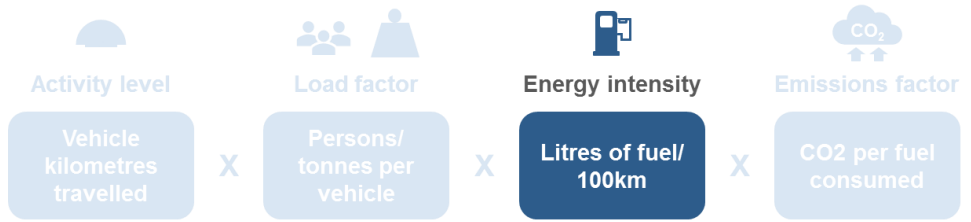


Top-down methodology



 **Technology with Total Energy**

Bottom-up methodology



 **Technology with Energy Intensity**

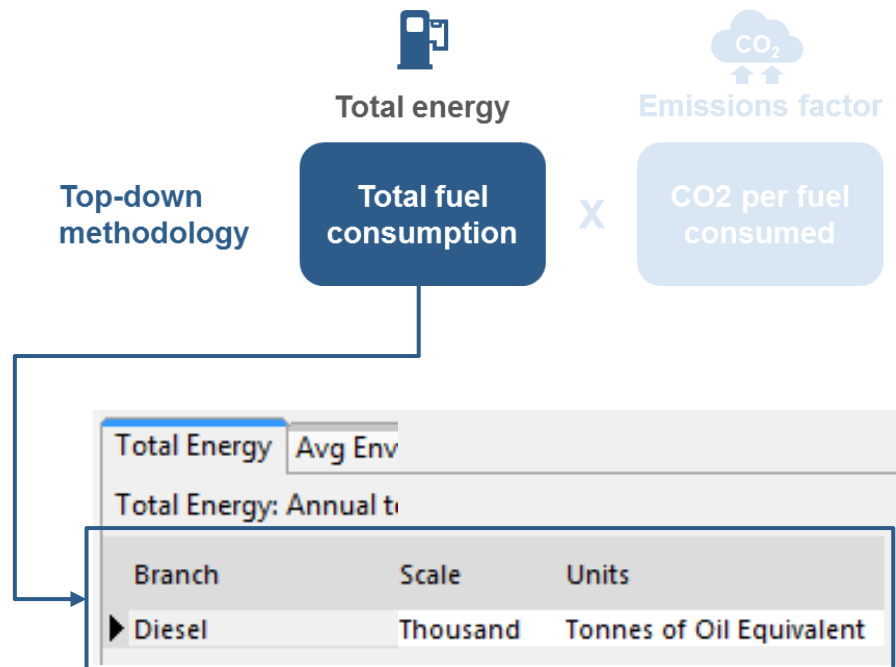


Interface: Expressions

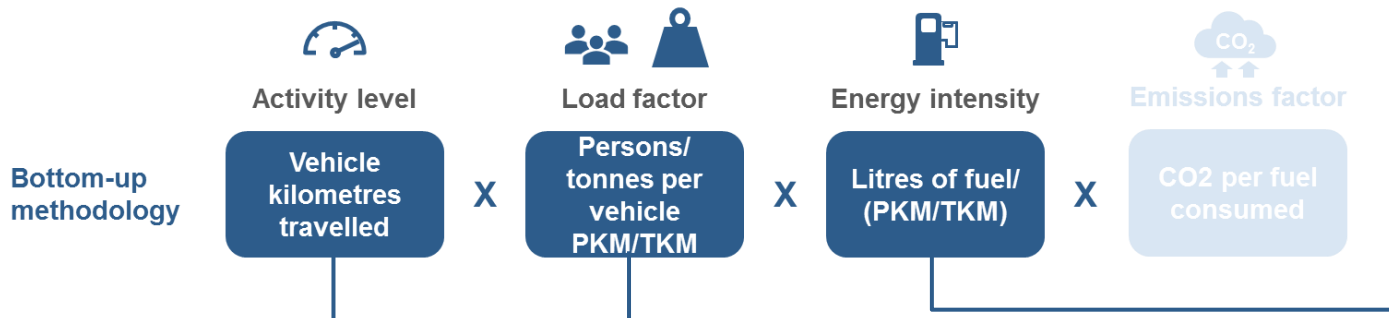
Top-down methodology: Variables

Technology with Total Energy

| Activity Level | Total Energy |
|--|--------------|
| Total Energy: Annual total final consu | |
| Branch | 2019 Value |
| ▶ Jet Kerosene | 111.81 |



Bottom-up methodology: Variables



Technology with Total Energy

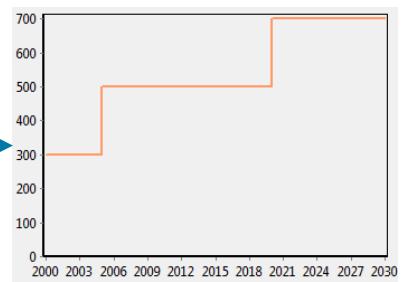
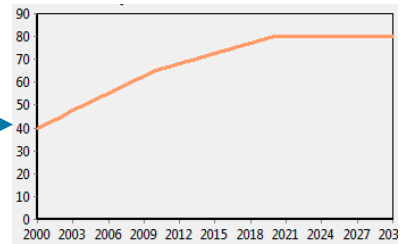
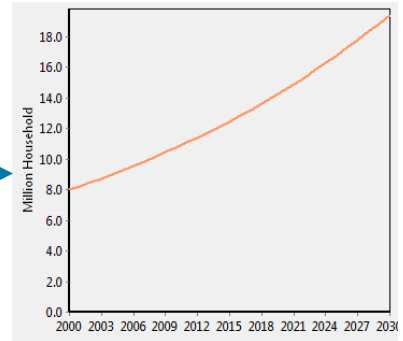
| Activity Level | | Final Energy Intensity | |
|---|------------|------------------------|--|
| Activity Level: A measure of the social or economic | | | |
| Branch | 2019 Value | Expression | |
| Transport_UG_VKM | | | |
| Passenger | | | |
| Road | | | |

| Activity Level | | Final Ener | |
|---------------------------|---------|--------------|-----------------|
| Activity Level: A measure | | | |
| Branch | Scale | Units | Per |
| Transport_UG_VKM | | No data | |
| Passenger | | No data | |
| Road | | No data | |
| Cars | Million | Passenger-km | |
| Gasoline | Percent | Share | of Passenger-km |
| Diesel | Percent | Share | of Passenger-km |

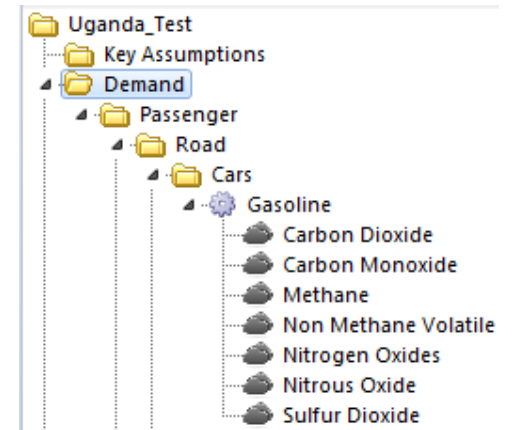
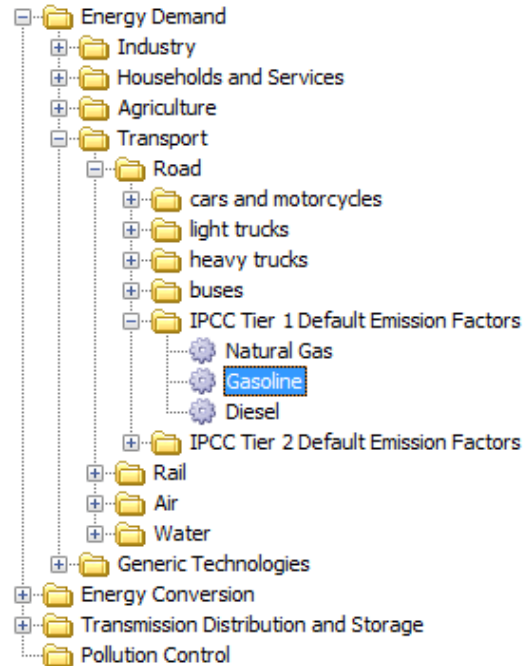
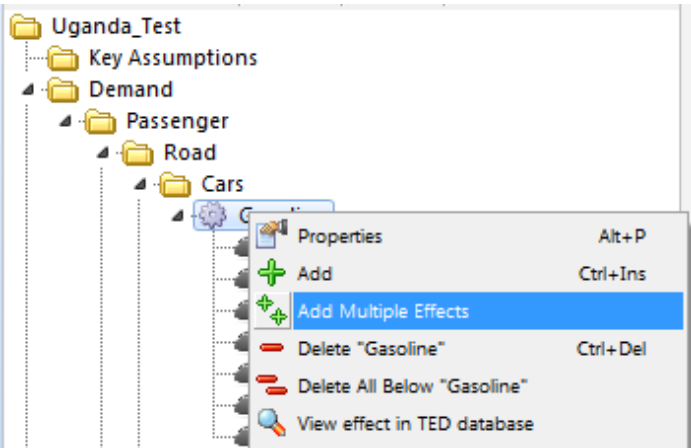
| Activity Level | | Final Energy Intensity | |
|---|----------|------------------------|------------------|
| Final Energy Intensity: Annual final co | | | |
| Branch | Fuel | Units | Per |
| Gasoline | Gasoline | Liter | per Passenger-km |
| Diesel | Diesel | Liter | per Passenger-km |

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) | Variable A: 70 Variable B: Remainder(100) (=30) |
| Branch and Variable References | Branch (operator) Value | Passenger: Activity Level + 10% |
| GrowthAs | GrowthAs(Branch,elasticity) | GrowthAs(Key\Income,1.1) |



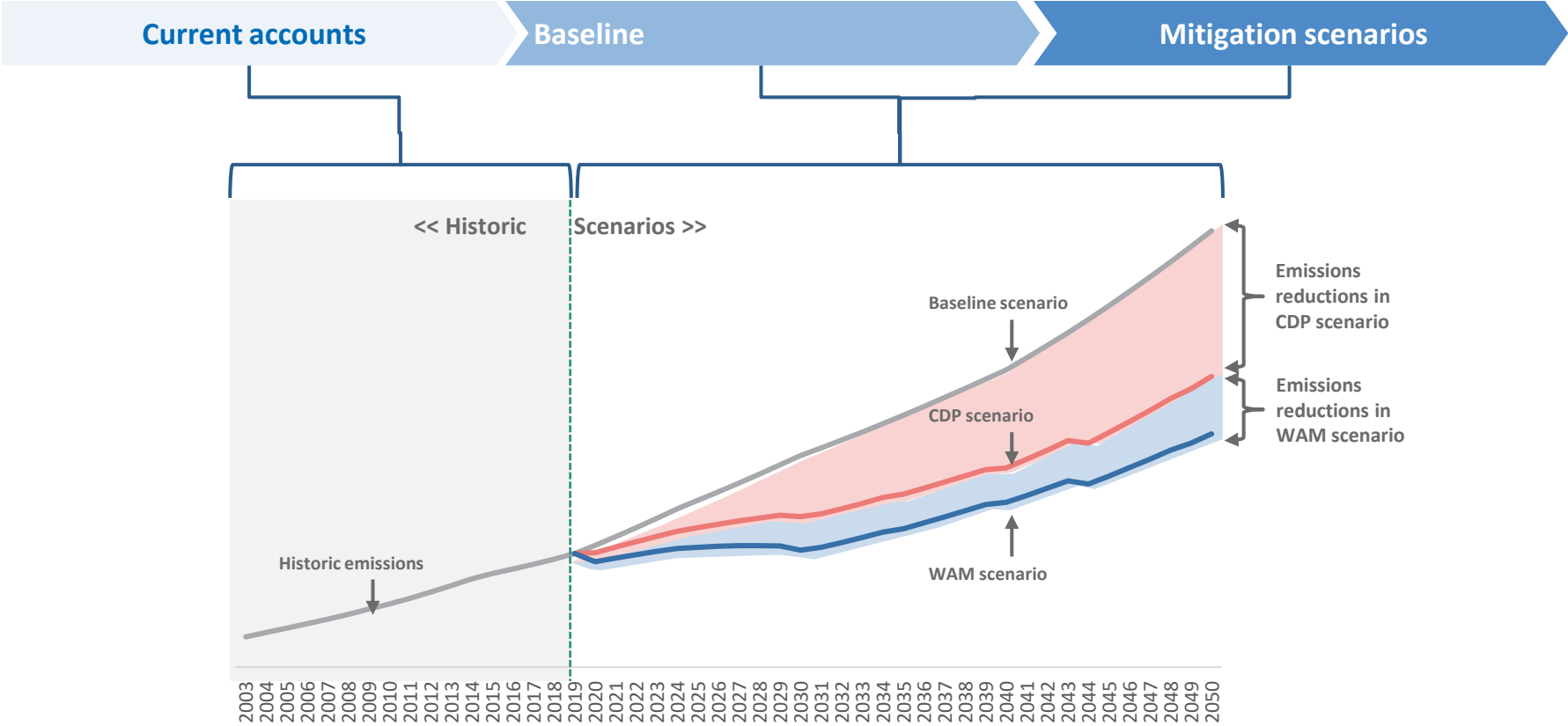
Interface: Variables – Multiple effects





Interface: Scenarios

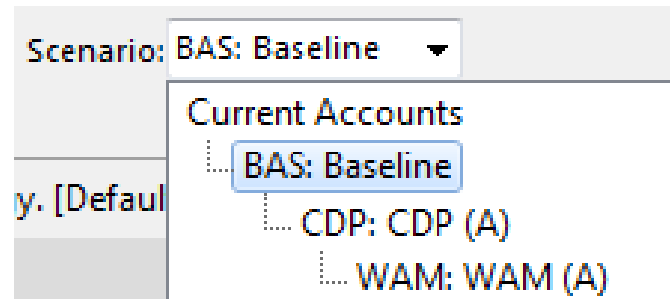
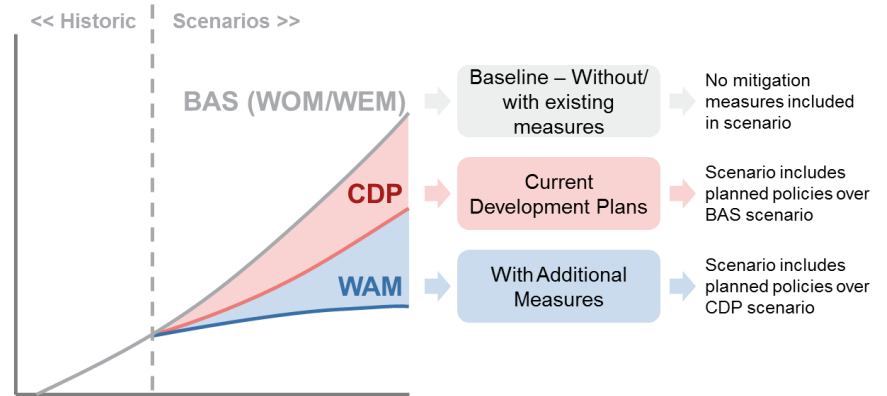
Interface: Scenarios



Scenario inheritance

Within LEAP, each scenario “inherits” the conditions of the previous scenario.

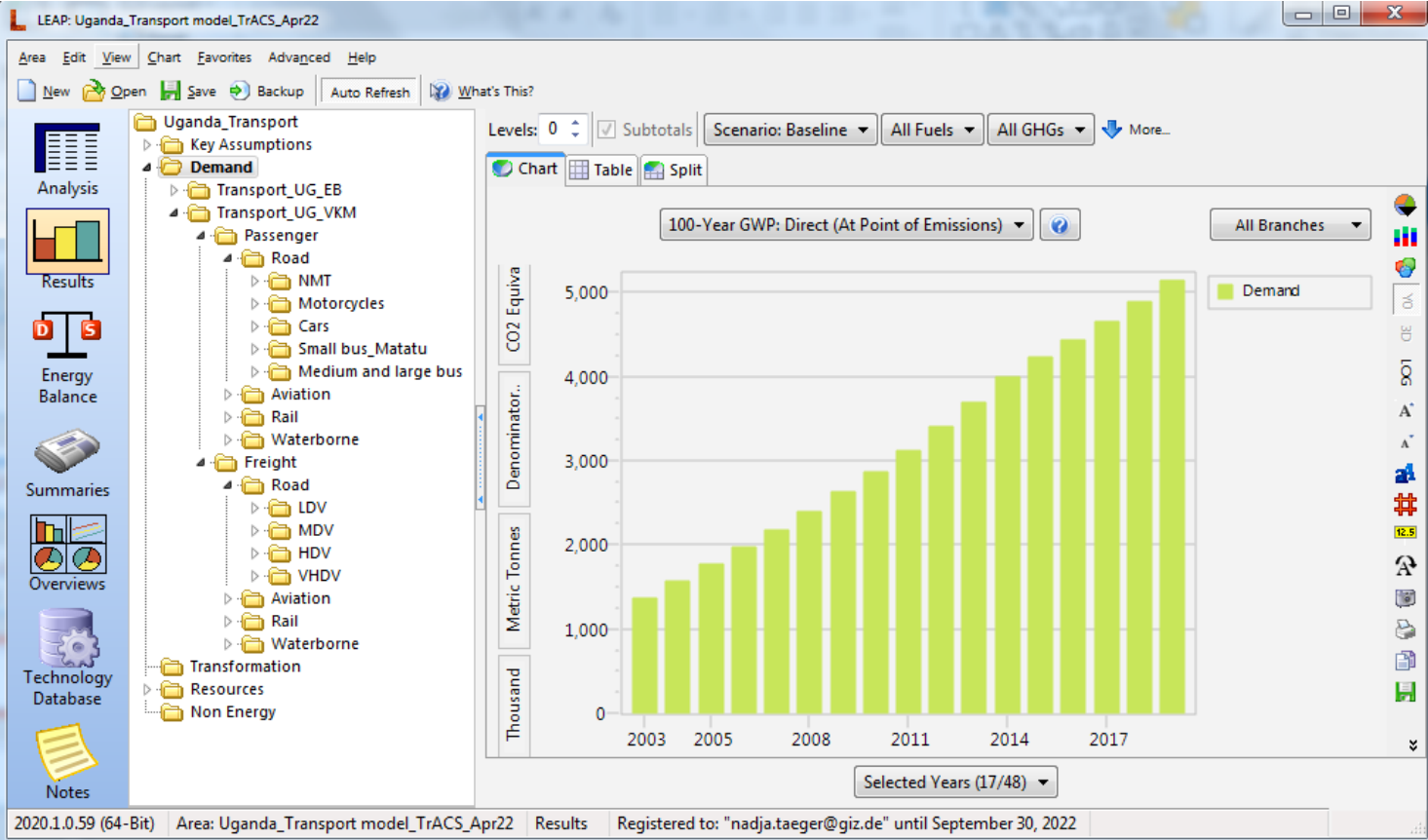
- **Baseline scenario: BAS:** The baseline scenario forms the foundation of the model. In this case the BAS is identical to both a without measures and a with existing measures scenario as it is considered that no mitigation measures are currently implemented.
 - **Current development plans: CDP = BAS (WEM) + CDP measures:** The CDP takes the conditions modeled in the BAS+WEM and adds the effects of currently planned measures
 - **With additional measures: WAM = BAS (WEM) + CDP + WAM measures:** The WAM adds the effects of the final layer of measures





Interface: Results tab

Interface: Results



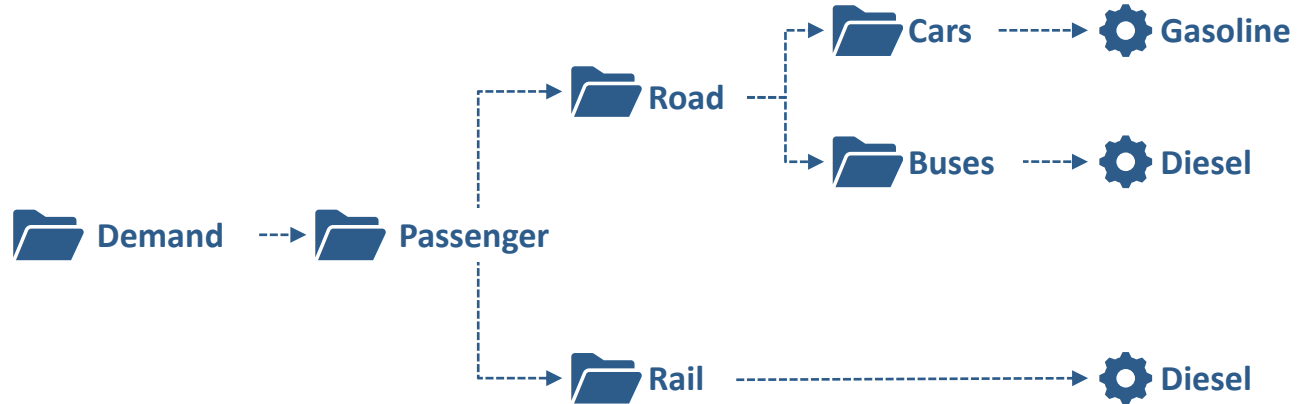


Building a basic energy demand model

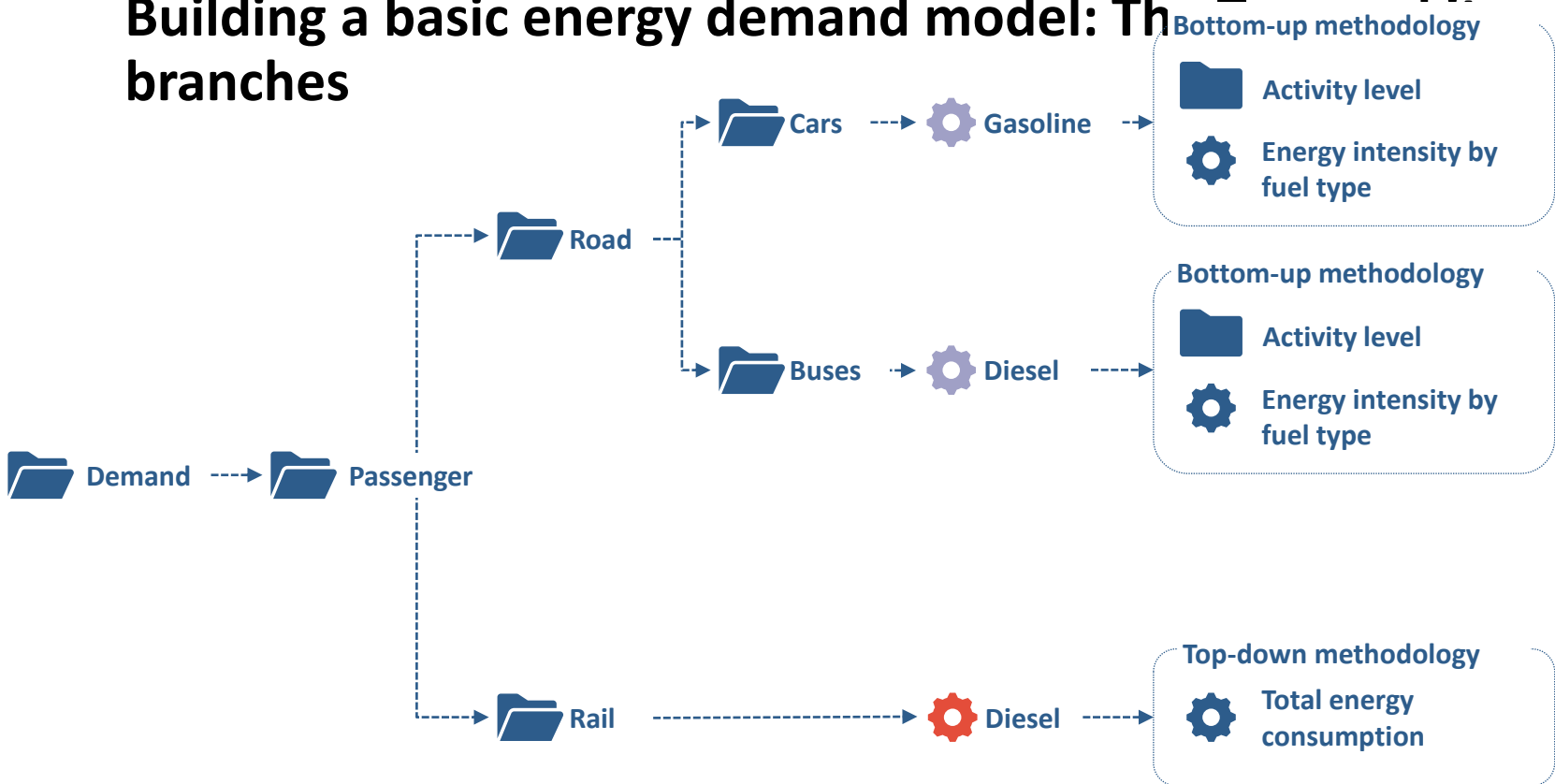
Building a basic energy demand model: The Tree and its branches

Characteristics of the system

- One branch of demand
 - Passenger
- Two sub-sectors:
 - Road
 - Rail
- Two road modes:
 - Cars
 - Buses
- Two fuels:
 - Gasoline
 - Diesel



Building a basic energy demand model: The branches



Top-down methodology



Total energy consumption

a basic energy demand model: input data

Bottom-up methodology



Activity level



Energy intensity by fuel type

Proportion of diesel consumption

| Mode | Unit | Proportion |
|------|------|------------|
| Road | % | 50 |
| Rail | % | 50 |

Energy demand

| Fuel | Unit | 2015 | 2016 | 2017 | 2018 |
|--------------|------|------|------|------|------|
| Total diesel | ktoe | 6000 | 7000 | 8000 | 9000 |
| Road | ktoe | 3000 | 3500 | 4000 | 4500 |
| Rail | ktoe | 3000 | 3500 | 4000 | 4500 |

Energy intensity/fuel economy

| Mode | Unit | Fuel economy |
|-------|-------|--------------|
| Cars | L/PKM | 0.04 |
| Buses | L/PKM | 0.01 |

Passenger kilometres travelled

| Data | Unit | 2015 | 2016 | 2017 | 2018 |
|-------|----------|--------|--------|--------|--------|
| Total | Mil. PKM | 25,000 | 27,000 | 29,000 | 31,000 |
| Cars | % | 60 | | | |
| Buses | % | 40 | | | |



Building a basic energy demand model: Results



Making our energy demand model an emissions model



Making our energy demand model an emissions model: Results



Creating a baseline scenario



Creating a baseline scenario: Results



Creating individual mitigation scenarios



Aggregating mitigation scenarios



Aggregating mitigation scenarios: Results