

Cost-benefit analysis

in LEAP

Anna Flessa, Dipl. Ing., MSc.
Research associate, KEPA



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Basics

Cost-benefit analysis calculates the costs of each part of the energy system

- the costs of purchasing and using the technologies in the Demand and Transformation,
- the costs of extracting primary resources and importing fuels,
- the benefits from exporting fuels,
- environmental externalities, by assigning costs to the emission of pollutants
- any other direct social and environmental impacts.

Prerequisites:

- Create at least two scenarios with similar economic assumptions
- Enter costing data



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Choose the Basic Parameters (1/2)

Basic Parameters

Scope & Scale | Years | Default Units | **Costing** | 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 COMMENT

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 COMMENT to edit your user profile](#)

Close Help



Choose the Basic Parameters (2/2)

Basic Parameters

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

Cost-benefit calculation boundary: Complete Energy System

Capital and O&M costs in modules belong to:

- ☐ Environmental externality costs
- ☐ Foreign exchange fraction of costs

Capital cost annualization method: Capital Recovery Factor (Default)

Discount rate: 5

Inflation rate: 0

Close Help

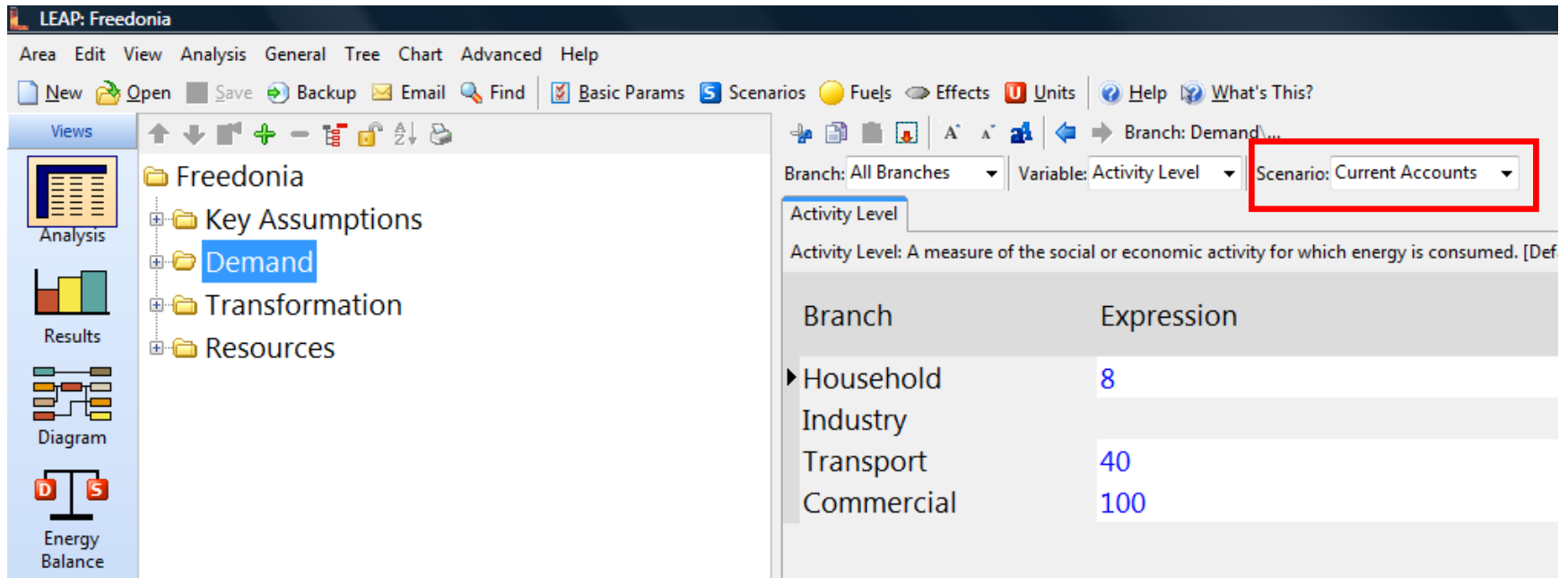


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Switch to Current Accounts



The screenshot shows the LEAP: Freedonia software interface. The 'Scenario' dropdown menu is highlighted with a red box, indicating the selection of 'Current Accounts'. The 'Activity Level' variable is also selected. The 'Branch' dropdown is set to 'All Branches'. The 'Activity Level' section is expanded, showing a table of activity levels for different branches.

Branch	Expression
Household	8
Industry	
Transport	40
Commercial	100



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Enter costing data

- Demand
 - Costs of saved energy
 - Device costs
 - Other non-fuel costs
- Transformation
 - Capital costs
 - Operational and maintenance costs
- Resources
 - Indigenous resource or imported fuel costs
 - Exported fuel benefits
- Environmental externality costs
- User-defined costs



Enter costing data/Demand (1/2)

- Non-fuel costs of Demand
 - costs for each demand technology
 - costs at higher levels of aggregation (e.g. the costs of sectoral demand side management programs)

Tree view structure:

- Freedonia
 - Key Assumptions
 - Effects
 - Demand
 - Household
 - Urban
 - Electrified
 - Refrigeration
 - Lighting
 - Other Uses
 - Cooking
 - Electric Stoves
 - Natural Gas Stoves

Branch: All Branches Variable: Demand Cost Scenario: Current Accounts

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

Demand Cost: Costs of energy-consuming devices or costs of saving energy. [Default="0"]

Branch	Expression	Scale	Units	Per	Cost Method
▶ Electric Stoves	0	E	U.S. Dollar	per Household	Activity Cost
Natural Gas Stoves	0		U.S. Dollar	per Household	Activity Cost



Enter costing data/Demand (2/2)

Methods for specifying demand costs

- **Costs Per Activity** (default): $(\text{cost/unit of activity}) \times (\text{activity level})$
- **Cost of Saved Energy**: incremental cost of saving energy in a device relative to the energy used in baseline scenario
- **Total Cost**: total annual costs at demand branches
- **Costs Per Device Sold**: applicable in case of Stock or Transport Analysis



Enter costing data/Transformation (1/2)

Transformation Module Properties

Name:

☐ Simple non-dispatched module: one output fuel per process.

Types of data to include:

- ☒ Costs
- ☒ Capacities
- ☒ System Load Curve (required if dispatching by cost or merit order)
- ☒ Planning Reserve Margin (if unchecked will be calculated endogenously)
- ☐ Co-product fuel:
- ☐ Output shares (otherwise outputs in proportion to requirements).

Enter efficiency data as:

☒ Efficiencies ☐ Losses ☐ Heat rates



Enter costing data/Transformation (2/2)

- Module costs
- Process costs
 - **Capital** : total capital costs/unit of capacity
 - **Operation and maintenance**
 - Fixed: costs per unit of capacity
 - Variable: costs per unit of energy produced
 - **Salvage**: net value of a process at the end of its lifetime
 - *Stranded*: any remaining costs to be paid on pre-existing processes (typically debt payments on old capital)
 - *Fuel*: cost of feedstock fuels and auxiliary fuels
- *Output Price*: the price at which the outputs of a module are sold

**The costs in red are not included in cost-benefit analysis calculations*



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Enter costing data/Resources

- **Indigenous Production Cost:** delivered cost of the fuels produced by the extraction industries
- **Import and Export Cost:** generally identified directly with market prices
- **Cost of Unmet Requirements:** cost of not supplying energy (a measure of the economic damage done by blackouts, etc.)



Results: Summaries View

Cost-benefit summary report

- tabular report showing the incremental total cumulative costs (discounted to base year) of each calculated scenario summed across all years
- comparative overview of costs and benefits of each scenario compared to a chosen baseline scenario.



Summary: Cost-Benefit Summary

Manage Summaries

Compared to: Reference

☐ Show Compared Scenario

Units: Million

U.S. Dollar

Discount Rate: 5 %

Table

Cumulative Costs and Benefits: 2010-2040. Relative to Scenario: Reference.

Discounted at 5,0% to year 2010. Units: Million 2010 U.S. Dollar

	Mitigation	Efficient Lighting	Efficient Refrigerators	CNG Buses	Natural Gas + Renewables	Industrial Efficiency
Demand	4.995,49	179,59	548,76	2.564,48	-	1.702,66
Household	728,35	179,59	548,76	-	-	-
Industry	1.702,66	-	-	-	-	1.702,66
Transport	2.564,48	-	-	2.564,48	-	-
Commercial	-	-	-	-	-	-
Transformation	-3.003,08	-233,93	-163,38	-	-2.241,84	-526,54
Transmission and Distribution	-	-	-	-	-	-
Electricity Generation	-3.003,08	-233,93	-163,38	-	-2.241,84	-526,54
Charcoal Production	-	-	-	-	-	-
Oil Refining	-	-	-	-	-	-
Coal Mining	-	-	-	-	-	-
Resources	-376,96	-430,74	-421,56	-236,23	1.532,94	-1.042,08
Production	-2.480,94	-88,83	-64,02	-	-2.480,65	-185,31
Imports	2.103,97	-341,91	-357,53	-236,23	4.013,59	-856,76
Exports	-	-	-	-	-	-
Unmet Requirements	-	-	-	-	-	-
Environmental Externalities	-	-	-	-	-	-
Net Present Value	1.615,45	-485,09	-36,18	2.328,25	-708,90	134,05
GHG Savings (Mill Tonnes CO2e)	474,88	29,72	23,88	3,27	420,51	65,41
Cost of Avoiding GHGs (U.S. Dollar/Tonne CO2e)	3,40	-16,32	-1,52	713,00	-1,69	2,05



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Let's practice!

Anna Flessa

Energy Policy and Development Centre (KEPA)
National and Kapodistrian University of Athens

Tel.: +30 210 7275732

E-mail: aflessa@kepa.uoa.gr



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