Implementation of ProSuite modules
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Version 1.8
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1 Introduction

This document explains the installation and usage of the ProSuite Decision Support System (DSS) as an openLCA Plugin.

The plugin was developed in the course of the ProSuite project, www.prosuite.org. It provides a prospective sustainability assessment of technologies, consisting of “individual” assessments for microeconomic costs, macroeconomic, environmental, and social impacts. These assessment results can then be integrated into a comprehensive sustainability assessment result.

2 Installation

To install ProSuite you need to download openLCA from the openLCA Website. After downloading follow the steps in the install wizard. For further help on installing openLCA and a first steps tutorial please visit the openLCA Wiki.

After your first start you need to install the ProSuite Plugin. Therefore select Settings/Plugin Manager in the main menu. In the Dialog click on ‘Install’ right next to the ProSuite Plugin. After installing please restart openLCA.

On the download page you will also find a default database containing the ProSuite Midpoint and Endpoint impact assessment method, including normalization factors. To Import this database follow the steps here.
3 Cost assessment module

Cost assessments can be done for processes modelled in openLCA. To run a cost assessment pick a process in the navigation tree and select ProSuite/SCENT tool in the main menu.

![Run SCENT Tool](image1.png)

*Figure 1 – Run SCENT Tool*

The SCENT tool wizard opens. The first pages of the wizard enable you to change general inputs for the calculation. On the later pages you can specify utility usage, waste treatment figures and the type of equipment used in the modelled technology.

![SCENT Tool Wizard](image2.png)

*Figure 2 – SCENT Tool Wizard*

After completing the wizard the input will be written into the SCENT Excel tool. Also several resources will be mapped to the raw material spreadsheet and will be taken into account in the calculation (for a full list of mapped resources see **Appendix A**).
The results then are read back into openLCA. For each cost a process cost entry will be created (for a full list of cost categories see Appendix B). The costs will be separated into fixed and variable costs.

<table>
<thead>
<tr>
<th>Cost category</th>
<th>Amount</th>
<th>Economic property</th>
<th>Currency</th>
<th>Fixed costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal Expenses</td>
<td>61348265448546698</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Engineering and Supervision</td>
<td>1589550699106567</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Buildings and services</td>
<td>154989628078205817</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Delivery Charges</td>
<td>27258252385</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Instrumentation and Control</td>
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<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Installed Equipment Cost</td>
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<td>Yes</td>
</tr>
<tr>
<td>Purchased Equipment Cost</td>
<td>374687659857</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Contractor's fee</td>
<td>61348265448546698</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Contingency</td>
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<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Additional Contingency</td>
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<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Start-up expenses</td>
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<td>USD</td>
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<td>USD</td>
<td>Yes</td>
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<tr>
<td>Yard Improvements</td>
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<td>USD</td>
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</tr>
<tr>
<td>Land</td>
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<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Raw materials cost</td>
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<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Operating Labor cost</td>
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<td>Market value US 2000</td>
<td>USD</td>
<td>No</td>
</tr>
<tr>
<td>Supervision and clerical labor</td>
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<td>Market value US 2000</td>
<td>USD</td>
<td>No</td>
</tr>
<tr>
<td>Utilities</td>
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<td>USD</td>
<td>No</td>
</tr>
<tr>
<td>Maintenance and repairs</td>
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<td>Market value US 2000</td>
<td>USD</td>
<td>No</td>
</tr>
<tr>
<td>Laboratory Changes</td>
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<td>USD</td>
<td>No</td>
</tr>
<tr>
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<td>USD</td>
<td>No</td>
</tr>
<tr>
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<td>USD</td>
<td>No</td>
</tr>
<tr>
<td>Environmental expenses</td>
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<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Capital recovery</td>
<td>32447.7656533522</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>General plant overhead</td>
<td>52.1761427992412</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Administrative costs</td>
<td>1.601337684846522</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
<tr>
<td>Distribution and marketing</td>
<td>15.34430736623991</td>
<td>Market value US 2000</td>
<td>USD</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Figure 3 – SCENT Tool Results**
4 Macroeconomic & Social Impact Assessment Preferences

The macroeconomic & social impact assessment modules allow the user to compare the macroeconomic & social impacts of a technology (modelled as a product system in openLCA) by comparing it to a prospective technology.

4.1 Assignment of product codes

Before using the modules, flows that have to be considered for the calculation have to be mapped to product codes. To assign one or more product codes to a flow first select it in the openLCA navigation and then either press CTRL+SHIFT+P or select ProSuite/Assign Product Codes in the openLCA main menu.

To see an overview of all assigned codes of a specific database go to Settings/Preferences. Under ProSuite/Product Codes you can check the current assignments.
4.2 Assignment of region codes

Before using the modules, locations – assigned to flows and processes – that have to be considered for the calculation have to be mapped to region codes. To do so go to Settings/Preferences. Under ProSuite/Region Codes you can map all existing locations of a specific database to region codes. After selecting a database you can assign a region code to a specific location by clicking into the Code or Value field in a location’s row. A dropdown will open up listing all available region codes.

![Region Codes preference page](image)

*Figure 6 – Macroeconomic & Social Impact Assessment – Region codes preference page*

4.3 Assignment of product costs

There are two ways to specify costs for the ProSuite DSS. One way is to specify costs for specific LCC categories. This is done on process level. To add a cost for a specific process, open it in the process editor and select the Costs tab (see Figure 3 – SCENT Tool Results).

Also I/O costs can be specified for each exchange of a process. To specify the costs for a specific input or output select the I/O Costs tab.

![I/O Costs](image)

*Figure 7 – Assigning I/O costs*
5 Sustainability Assessment

5.1 Scoping module

In order to apply the module the reference and prospective technology has to be modelled as product systems in openLCA. To start the assessment select ProSuite/Sustainability Assessment in the openLCA main menu.

A dialog to select a database will open.

After selecting a database to work on, the sustainability assessment wizard opens. In the top right corner of each page there is a Load from file and Save to file button. The save button is only available when all necessary information is entered. Also the load button loads (and overrides) all fields and not just the information present on a specific page. This will overwrite respective information that has already been entered.

On the first page you have to select the reference technology and the prospective technology you want to compare the reference technology to and specify the region and time information of each technology. Each assessment module can be unchecked. Though the integration module can only be run if a full assessment is performed. Depending on the selection of modules additional wizard pages will follow.
If *Environmental Assessment* is selected the next step is to select an impact method. You can also check the ‘Apply regionalized impact factors’ option to apply regionalization to the impact assessment (Only visible if regionalized impact factors are available in the selected impact method).

Figure 10 – Sustainability Assessment Wizard – Specify Assessment

Figure 11 – Sustainability Assessment Wizard – Environmental Assessment page
If Economic Assessment or Social Assessment is selected the next step is to specify the economic parameters of the reference system.

**Note:** The production volumes must be relative to the target amount specified in the respective product system. Otherwise the economic assessment will calculate against a different functional unit as the environmental assessment.

![Image 1](image1.png)

*Figure 12 – Sustainability Assessment Wizard – Economic Assessment page for reference technology*

After that the same parameter have to be defined for the prospective technology. Additionally the willingness to pay can be specified here.

![Image 2](image2.png)

*Figure 13 – Sustainability Assessment Wizard – Economic Assessment page for prospective technology*
If *Social Assessment* is selected the next step is to specify the qualitative social indicators for each system.

![Figure 14 – Sustainability Assessment Wizard – Qualitative social indicators page for reference technology](image)

If *Integration* is selected three additional pages will be included to specify your integration parameters, such as normalization factors, weighting factors and a mapping of impact categories to the three environmental integration categories. Only the impacts of the selected categories will apply to the integration score.
Figure 15 – Sustainability Assessment Wizard – Normalization page – Default values will be initially selected

Figure 16 – Sustainability Assessment Wizard – Impact Category Mapping Page
5.2 Evaluating the results

After the calculation a new window will open and display the results of the sustainability assessment. Depending on which assessments you have selected only a subset of the results that will be described in the following part will be available. Each result tab carries the type of assessment it belongs to in its name (e.g. Economic – Industry results is a result of the economic assessment module). For a full overview of the results tab see Appendix C.

The window opens with then Overview tab as initial selection.

On the top you can switch the tabs to see detailed results for each assessment type.
The *Environmental – Inventories* tab display the inputs and outputs of each system. The values are directly compared. Both, the input and output table, have a column reference value and prospective value in which the result for the specific flow are displayed. On the left corner of the pane the results can be filtered.

![Figure 19 – Results – Environmental Inventories with filter](image)

On the *Environmental – Impacts* tab the results of the impact assessment are shown. The previous described filter is available on the impacts tab as well.

The next two tabs show the economic results, in one case the aggregated results and in the other case the detailed industry & region results. The latter pane will load asynchronous, so the user can view the first results while the rest is loaded. After all data is loaded the values can be switched between *Economy wide* and *Functional Unit*.

![Figure 20 – Results – Switch between Economy wide values and values per functional unit](image)

By hovering over a value (this applies to all tables) a tooltip with the exact value is shown.

![Figure 21 – Results – Tooltip](image)
The next four tabs show the social results. The first two are likewise the economic tabs, displaying the aggregated results and industry and region results. On the Social - Industry & Region results tab additional switches are present. The values can on the one hand be switched between Economy wide and Functional unit and on the other hand between Compensation, Hours and Wages. On the third and fourth tab DALY and bad labour values are shown.

Figure 22 – Results – Switches on Social – Industry & Region results tab
6 Appendix

A List of mapped resources

The following flows from openLCA / ecoinvent are mapped to the raw materials tab of the SCENT tool (if the units are consistent). The format of the list is: FLOW (LOCATION)

- acetic acid from acetaldehyde, at plant (RER)
- acetic acid from butane, at plant (RER)
- acetone, liquid, at plant (RER)
- butyl acrylate, at plant (RER)
- methyl acrylate, at plant (GLO)
- acrylic acid, at plant (RER)
- acrylonitrile from Sohio process, at plant (RER)
- ammonia, liquid, at regional storehouse (RER)
- acetaldehyde, at plant (RER)
- acetic anhydride, at plant (RER)
- acetonitrile, at plant (RER)
- adipic acid, at plant (RER)
- aluminium oxide, at plant (RER)
- aluminium sulphate, powder, at plant (RER)
- ammonium nitrate, as N, at regional storehouse (RER)
- diammonium phosphate, at regional storehouse (RER)
- monoammonium phosphate, at regional storehouse (RER)
- ammonium sulphate, as N, at regional storehouse (RER)
- aniline, at plant (RER)
- benzene, at plant (RER)
- palm methyl ester, production MY, at service station (CH)
- butadiene, at plant (RER)
- butyl acetate, at plant (RER)
- Bisphenol A, powder, at plant (RER)
- Borax, anhydrous, powder, at plant (RER)
- boric acid, anhydrous, powder, at plant (RER)
- butene, mixed, at plant (RER)
- sodium hydroxide, 50% in H2O, production mix, at plant (RER)
- chlorine, gaseous, diaphragm cell, at plant (RER)
- trichloromethane, at plant (RER)
- cumene, at plant (RER)
- rape seed IP, at farm (CH)
- crude coconut oil, at plant (PH)
- cotton seed, at farm (US)
- calcium carbide, technical grade, at plant (RER)
- calcium chloride, CaCl2, at plant (RER)
- carbon black, at plant (GLO)
- copper oxide, at plant (RER)
- cyclohexane, at plant (RER)
- diethylene glycol, at plant (RER)
- epoxy resin, liquid, at plant (RER)
- ethyl acetate, at plant (RER)
- ethanol, 95% in H2O, from rye, at distillery (RER)
- ethyl benzene, at plant (RER)
- ethylene, average, at plant (RER)
- ethylene dichloride, at plant (RER)
- ethylene oxide, at plant (RER)
- polystyrene, expandable, at plant (RER)
- epichlorohydrin, from hypochlorination of allyl chloride, at plant (RER)
- ethylene glycol, at plant (RER)
- ethylene glycol, at plant (RER)
- ethylene glycol, at plant (RER)
- ethylene glycol, at plant (RER)
ethylenediamine, at plant (RER)
EDTA, ethylenediaminetetraacetic acid, at plant (RER)
fatty alcohol, from coconut oil, at plant (RER)
fatty alcohol, from palm kernel oil, at plant (RER)
fatty alcohol, from palm oil, at plant (RER)
iron (III) chloride, 40% in H2O, at plant (CH)
formaldehyde, production mix, at plant (RER)
glycerine, from epichlorohydrin, at plant (RER)
hydrochloric acid from benzene chlorination, at plant (RER)
hydrochloric acid, 30% in H2O, at plant (RER)
heptane, at plant (RER)
hexane, at plant (RER)
hydrogen peroxide, 50% in H2O, at plant (RER)
isopropanol, at plant (RER)
magnetite, at plant (GLO)
isobutanol, at plant (RER)
butene, mixed, at plant (RER)
kaolin, at plant (RER)
quicklime, in pieces, loose, at plant (CH)
quicklime, milled, loose, at plant (CH)
lime, hydrated, loose, at plant (CH)
alkylbenzene, linear, at plant (RER)
melamine, at plant (RER)
methanol, at plant (GLO)
4-methyl-2-pentanone, at plant (RER)
methyl methacrylate, at plant (RER)
dichloromethane, at plant (RER)
methyl tert-butyl ether, at plant (RER)
magnesium oxide, at plant (RER)
magnesium sulphate, at plant (RER)
magnesium sulphate, at plant (RER)
maleic anhydride, at plant (RER)
melamine formaldehyde resin, at plant (RER)
methyl acrylate, at plant (GLO)
methylenediphenyl diisocyanate, at plant (RER)
methyl ethyl ketone, at plant (RER)
monochlorobenzene, at plant (RER)
xylene, at plant (RER)
1-butanol, propylene hydroformylation, at plant (RER)
butyl acetate, at plant (RER)
butyl acrylate, at plant (RER)
1-butanol, propylene hydroformylation, at plant (RER)
nitric acid, 50% in H2O, at plant (RER)
nitrobenzene, at plant (RER)
N-methyl-2-pyrrolidone, at plant (RER)
1-propanol, at plant (RER)
xylene, at plant (RER)
xylene, at plant (RER)
paraffin, at plant (RER)
tetrachloroethylene, at plant (WEU)
phenol, at plant (RER)
phthalic anhydride, at plant (RER)
polycarbonate, at plant (RER)
polyethylene, HDPE, granulate, at plant (RER)
polyethylene, LDPE, granulate, at plant (RER)
polyethylene, LLDPE, granulate, at plant (RER)
polyethylene, HDPE, granulate, at plant (RER)
polyethylene, LDPE, granulate, at plant (RER)
polyethylene, LLDPE, granulate, at plant (RER)
polypropylene, granulate, at plant (RER)
polystyrene, general purpose, GPPS, at plant (RER)
polystyrene, high impact, HIPS, at plant (RER)
polyvinylchloride, at regional storage (RER)
polyvinylchloride, bulk polymerised, at plant (RER)
polyvinylchloride, emulsion polymerised, at plant (RER)
propylene, at plant (RER)
propylene oxide, liquid, at plant (RER)
xylene, at plant (RER)
palm kernel oil, at oil mill (MY)
palm oil, in esterification plant (MY)
phosgene, liquid, at plant (RER)
phosphoric acid, industrial grade, 85% in H2O, at plant (RER)
phosphoric acid plant, fertiliser grade (US)
phosphorus, white, liquid, at plant (RER)
phosphoryl chloride, at plant (RER)
phosphorous chloride, at plant (RER)
polyester resin, unsaturated, at plant (RER)
potassium carbonate, at plant (GLO)
potassium chloride, as K2O, at regional storehouse (RER)
potassium sulphate, as K2O, at regional storehouse (RER)
propanal, at plant (RER)
soda production, solvay process, at plant (RER)
styrene, at plant (RER)
secondary sulphur, at refinery (RER)
soybean oil, at oil mill (US)
soybean meal, at oil mill (US)
2-butanol, at plant (RER)
sodium chlorate, powder, at plant (RER)
sodium cyanide, at plant (RER)
sodium dithionite, anhydrous, at plant (RER)
sodium phosphate, at plant (RER)
sodium silicate, furnace liquor, 37% in H2O, at plant (RER)
sodium silicate, furnace process, pieces, at plant (RER)
sodium silicate, hydrothermal liquor, 48% in H2O, at plant (RER)
sodium sulphate production, Mannheim process, at plant (RER)
latic, at plant (RER)
sulphur dioxide, liquid, at plant (RER)
sulphuric acid, liquid, at plant (RER)
toluene, liquid, at plant (RER)
trichloroethylene, at plant (WEU)
tallow, at plant (CH)
purified terephthalic acid, at plant (RER)
tetrahydrofuran, at plant (RER)
titanium dioxide at plant, sulphate process, at plant (RER)
titanium dioxide, chloride process, at plant (RER)
toluene diisocyanate, at plant (RER)
triethylene glycol, at plant (RER)
urea, as N, at regional storehouse (RER)
vinyl acetate, at plant (RER)
xylene, at plant (RER)
zinc monosulphate, ZnSO4.H2O, at plant (RER)
B List of cost categories (used in SCENT tool and in the macroeconomic impact assessment module)

Capital costs
- Purchased Equipment Cost
- Installed Equipment Cost
- Instrumentation and Controls
- Delivery Charges
- Buildings incl. services
- Engineering and Supervision
- Construction Expenses
- Legal Expenses
- Contractor’s fee
- Contingency
- Additional Contingency
- Start-up expenses
- Service Facilities
- Yard Improvements
- Land
- Working Capital

Operational costs
- Raw materials cost
- Operating Labor cost
- Supervision and clerical labor
- Utilities
- Maintenance and repairs
- Operating Supplies
- Laboratory Charges
- Local taxes
- Insurance
- Environmental expenses
- Capital recovery
- General plant overhead
- Administrative costs
- Distribution and marketing
C Overview of result views

Overview

Environmental – Inventories
Environmental – Impacts

Economic – Aggregated results
### Economic – Industry & Region results

![Economic Industry & Region results](image)

### Social – Aggregated results

![Social Aggregated results](image)
### Social – Industry & Region results

<table>
<thead>
<tr>
<th>Product &amp; Region</th>
<th>DALY</th>
<th>DALY</th>
<th>DALY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>2.65%</td>
<td>3.73%</td>
<td>4.43%</td>
</tr>
<tr>
<td>Sugar cane, sugar beet</td>
<td>3.49%</td>
<td>3.63%</td>
<td>3.83%</td>
</tr>
<tr>
<td>Cereals, incl. rice, wheat</td>
<td>7.24%</td>
<td>7.55%</td>
<td>8.11%</td>
</tr>
<tr>
<td>Soybeans</td>
<td>3.26%</td>
<td>3.73%</td>
<td>4.23%</td>
</tr>
<tr>
<td>Vegetables, incl. nuts</td>
<td>8.17%</td>
<td>8.75%</td>
<td>9.46%</td>
</tr>
<tr>
<td>Canola</td>
<td>4.72%</td>
<td>5.37%</td>
<td>6.16%</td>
</tr>
<tr>
<td>Tobacco</td>
<td>1.00%</td>
<td>1.28%</td>
<td>1.67%</td>
</tr>
</tbody>
</table>

### Social – DALY

<table>
<thead>
<tr>
<th>Product &amp; Region</th>
<th>DALY</th>
<th>DALY</th>
<th>DALY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy rice</td>
<td>2.04%</td>
<td>2.98%</td>
<td>3.46%</td>
</tr>
<tr>
<td>Wheat</td>
<td>2.64%</td>
<td>3.71%</td>
<td>4.30%</td>
</tr>
<tr>
<td>Sugar cane, sugar beet</td>
<td>3.49%</td>
<td>3.63%</td>
<td>3.83%</td>
</tr>
<tr>
<td>Cereals, incl. rice, wheat</td>
<td>7.24%</td>
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<tr>
<td>Canola</td>
<td>4.72%</td>
<td>5.37%</td>
<td>6.16%</td>
</tr>
<tr>
<td>Tobacco</td>
<td>1.00%</td>
<td>1.28%</td>
<td>1.67%</td>
</tr>
</tbody>
</table>
Social – Bad labour

Social – Qualitative indicators
Integration results