Decision support system (DSS)

Andreas Ciroth
GreenDelta
GCSM conference
Berlin, 25 September 2013
Agenda

- ProSuite: Goals, introduction
- A new sustainability assessment framework
- Decision support tool
- Towards standardisation?
Project PROSUITE

Goals, introduction
Project PROSUITE

Development and application of a standardized methodology for the PROspective SUstainability assessment of TEchnologies
In a nutshell...

• Tools that are applicable in a generic way to assess all aspects of sustainability of future technologies
• A new integrative framework addressing five major impact categories:
  – Human health
  – Social well-being
  – Prosperity
  – Natural Environment
  – Exhaustible resources
• Integration through normalisation and use of MCA-tools
• The PROSUITE open source decision support system
In a nutshell...

• Economic deliverables
  – Hybrid LCA model for modelling full scale adoption of a technology
  – Standardized Cost Estimation for New Technologies (SCENT)

• Environmental deliverables
  – PROSUITE methodology (midpoint and endpoint)
  – Improvement of selected characterisation models (metals, nanoparticle exposure) and assessment of uncertainties in existing models

• Social deliverables
  Participatory approaches for selecting impacts and categorize them into
  • Safety, security and tranquility;
  • Autonomy;
  • Participation and influence
  • Equal opportunities
PROSUITE case studies

Four case studies for testing and demonstrating the methodology on emergent technologies
• Biorefineries and organic waste
• Nano technologies
• Carbon capture and Storage
• Multifunctional mobile devices
<table>
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<th>Consortium</th>
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About us

GreenDelta is an independent capital company founded 2004 in Berlin by Andreas Ciroth; our work focusses on sustainability research, consulting, and software development for sustainability.

- Life Cycle Assessment
- Life Cycle Costing
- Social Life Cycle Assessment
  - Case studies
  - Method development (social LCA; uncertainties; aligning different LCA approaches)
- Training
- Reviews
- ...
About us

GreenDelta is an independent capital company founded 2004 in Berlin by Andreas Ciroth; our work focusses on sustainability research, consulting, and software development for sustainability.

- Web-based software & desktop software
- Enterprise solutions, SME, open source solutions
  - openLCA
  - E-DEA
  - BEST
  - Nexus
  - ...
News

Latest news on the project:

25 April 2013: Paper on 5 impact categories

15 May 2013: PROSUITE mini workshop at SETAC Eurose Glasgow

18 April 2013: Tracking mobile phone recycling

16 April 2013: Nanosilver in textiles – friend or foe?

8 Feb 2013: Experience curves for novel technologies (D1.3)

19 Dec 2012: Read our updated project summary

28-29 Nov 2012: Project team meeting in Copenhagen

5 Nov 2012: New deliverables:
- D3.2: Decision rule and statistical uncertainties in environmental impact methods
- D2.1: Economic indicators for SAT and model & methodology for scenarios

PROSUITE - PROSpective SUstainability Assessment of TEnchnologies - is now entering its final phase and in a few months from now, we will be delivering our project’s final outcome, i.e., a new methodology, framework and software tool for you to conduct sustainable assessment of technologies within a life cycle approach.

While we are currently fine tuning our conceptual findings which has progressed to offer a new integrative sustainability assessment that goes beyond the traditional 3 pillars to identify 5 major impact categories, we are also preparing and scheduling our final dissemination activities in order to reach the widest possible range of interested parties and end-users. Learn where you can participate in workshops and case study demonstrations within the four emergent technologies chosen for our PROSUITE model development.

Find our methodological reports and indicator derivations in the PROSUITE Library:

Learn about the PROSUITE Sustainability Assessment Framework

Meet us!
Find out where to participate in workshops and case study demonstrations.

Read about our four project case studies and findings.
PROSUITE Final conference

Brussels,
30 October 2013

- Sign up to receive an invitation
A new sustainability assessment framework
Problem definition

• Conventional methodologies for sustainability assessment:
  – Often too specific for certain products
  – Not applicable to wide range of technologies
  – No clear aggregation of various impacts

• There is a need for sustainability assessment method that:
  – Covers all dimensions of sustainability in a comprehensive way
  – Is applicable to a wide range of technologies
  – Pursues a rigorous assessment along the cause-effect chain to ultimate scores
Impact assessment in environmental LCA

European Commission, 2010
Initial approach in Prosuite

- Employment
- Systems integrity
- Occup. hazard
- Justice
- Perceived risks
- Quality of life
- Social Assessment
- CO2 emission
- Climate change
- Human health
- Summer smog
- Ecosystem health
- Ecotoxicity
- Res. depletion
- Environmental assessment
- Labour prod.
- GDP impact
- Capital prod.
- Novelty
- New markets
- Resource prod.

“Inventory”
“Midpoints”
“Endpoints”
Problems with initial approach

• There are overlaps:
  – Social impacts (quality of life) could include health (env) and income (econ)
  – If an external cost approach were applied, all impacts are economic

• Health impacts from environmental interventions considered part of environmental pillar, but occupational health part of social pillar
New approach within Prosuite

• 5 Endpoints:
  – Impact on human health
  – Impact on social well-being
  – Impact on prosperity
  – Impact on natural environment
  – Impact on exhaustible resources

Mostly present generation

Mostly future generations
Impact on human health

inventory data

Toxic exposures

# Non-fatal accidents at work
# Fatal accidents at work
# Occupational diseases
# Accidents ending with death/inability to work

Midpoints

Impact on consumption related human health
Impact on occupational human health

Endpoint

Impact on human health (DALYs)

Climate change
Ozone depletion
Human toxicity
Respiratory organics
Ionising radiation
Photochemical ozone formation

Elementary environmental flows
Impact on social well-being

Indicators from Delphis

- Impacts on participation and influence
- Impact on equal opportunities
- Impact on safety, security & tranquility
- Impact on autonomy

inventory data → midpoints → endpoint

impact on social health (Likert)
Social indicators

- **Safety, security and tranquility**
  - Knowledge-intensive jobs
  - Total employment
  - Risk perception
  - Possibility of misuse

- **Autonomy**
  - Child labour
  - Forced labour

- **Participation and influence**
  - Trust in risk information
  - Stakeholder involvement
  - Long-term control functions

- **Equal opportunities**
  - Regional income inequalities
  - Global income inequalities
Impact on prosperity

inventory data  midpoints  endpoint

CAPEX

Impact on labour productivity

Impact on capital productivity

Impact on resource productivity

Impact on new market development

Impact on prosperity (ΔGDP)
Impact on natural environment

inventory data  midpoints  endpoint

Elementary flows

- Climate change
- Ozone depletion
- Photochemical ozone formation
- Eutrophication
- Acidification
- Ecotoxicity
- Land use
- Water use

Impact on ecosystem health

Impact on natural environment (PDF)

GreenDelta
Impact on exhaustible resources

- Inventory data
- Midpoints
- Endpoint

Impact on fossil resource depletion
Impact on mineral resource depletion

Impact on exhaustible resources (€)
Overall sustainability assessment

• Assessment across all impact categories is needed.
• Various approaches available:
  – No aggregation, leave as it is
  – Multicriteria analysis, results shown as hierarchy
  – Aggregate into one single score
Conclusions

• A framework is proposed that covers all dimensions of sustainability
• For all impact categories, an assessment is possible on a life-cycle basis and across the full cause-effect chain
• The impact categories follow the McKinsey ‘MECE’ principle: Mutually Exclusive, Collectively Exhaustive (Friga, 2008)
Main challenges for LCSA (1)

- Development of indicators for the social assessment
- Define a quantitative metric for these indicators
- Determine how to aggregate them into one value for the end-point indicator ‘social well-being’
Main challenges for LCSA (2)

• How to integrate/interpret the endpoint indicators across the environmental, economic and social domain?
  – Aggregation into one value (yes/no)?
  – Multi-criteria analysis
  – Other…?
Decision Support Tool
Decision Support System

- Modular software consisting of a framework and set of tools for scenario analyses and technology assessment

- Implementation of PROSUITE methods in openLCA
  - Specific plugins
  - Improvement of the overall architecture of openLCA

- Freely available, as open source software
openLCA as a basis: a professional, open source LCA software
– Process creation
– Data import/export
– Product systems
– System view
– LCI calculation
Results analysis
A plugin-architecture and “framework” has been implemented in the DSS.
Results of the macroeconomic module

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Sustainability assessment

• Input: results from the other modules
• Output → Multi-Criteria tool:
  – Graphical display of alternatives performance for endpoint indicators
Multi-criteria tool

- Ranking of alternatives applying Condorcet decision rule
  - following a strong sustainability idea, the integration module will not compute a single score but keep the sustainability dimensions separate

- Sensitivity analysis results
Project PROSUITE
Towards standardisation?
Towards standardisation

- Candidates:
  - Sustainability framework...
  - ..or parts of it
  - Indicator sets
  - Approaches for data collection (in the context of life cycle sustainability assessment)
  - Approaches for data quality assurance (in the context of life cycle sustainability assessment)
Comments and feedback welcome!

Thank you for your attention

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