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Co-ordination Action for innovation in Life-Cycle Analysis for Sustainability

Instrument: Co-ordination Action

Thematic Priority: Sustainable Development Global Change and Ecosystem

Critical review of current research needs and limitations related to ISO-LCA practice

Annex 1 - Map of main tools available or under development

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1. INTRODUCTION

The main purpose of the Work Package 5 is to critically review the “standardised LCA”, as based on the principles of the ISO14040 series, covering the scientific foundations, the main R&D activities and the available tools.

The critical review, along with the outcomes of other WPs, will provide information and inputs in order to develop the necessary lines for the improvement of reliability, significance and usability of the applications of standardised LCA, as well as setting up research needs for deepening and broadening the methodology.

While survey activities about the main findings on current practice in EU and non-EU R&D initiatives are focusing in parallel on the methodological aspects of the standardised LCA and its evolution trends, the present analysis deals with operational aspects, by mapping the main tools (softwares and databases) available on the market, in support of LCA practitioners.

Softwares and databases are mapped and classified according to a set of predefined parameters. These parameters consider both the applicability in traditional ISO-based LCA and the possibility to deviate from the standard methodology towards “innovative” and “broader” approaches.

42 softwares and 26 databases have been mapped and classified. Inputs for the analysis derive mainly from information collected by JRC-IES starting from 2005, when a questionnaire was sent out to the tools providers in the worldwide LCA community. The results of that survey, with further updating up to June 2007, are currently available in the LCA Resource Directory on the website of the European Platform on LCA (<http://lca.jrc.ec.europa.eu/lcainfohub/directory.vm>). Further information has been collected in the specific websites of these tools.

Even if a whole coverage is not assured, the most widely used softwares and databases are included in the list.

This report is structured in the following sections:

- Description of the methodology for mapping and classification of softwares and databases;
- Analysis of softwares/databases along the identified parameters;
- Summary of the results and comments.

2. METHODOLOGY

The available information on software and databases as described above has been reorganized in view of the specific purpose of the present analysis.

The softwares have been mapped according to the following parameters:

- being sector specific,
- usability for screening LCA¹,
- suitability to eco-design approach,
- possibility to perform life cycle cost,

¹ Screening LCA can be defined as an initial simplified analysis that aims at identifying whether more in depth assessments are needed and the type and level of these assessments.

- possibility to perform social life cycle analysis,
- applicability for laws/regulatory compliance,
- completeness of life cycle steps (goal and scope definition, inventory, impact assessment, interpretation)
- possibility to perform hybrid LCA².

For the databases, some different parameters have been considered:

- being **sector specific**,
- being **country specific**,
- possibility of **Input/Output data integration**,
- inclusion of **data for Life Cycle Cost**,
- inclusion of data for **Social Life Cycle Analysis**,
- suitability for **consequential**³ LCA.

In case of no available data for the characterization of one or more parameters in the LCA Resource Directory, a further search has been made on the publicly available information on the providers/tools websites. However, neither specific requests nor direct contacts with the providers have been taken during the survey.

The listing of the software, providers, and databases in this analysis does not imply any preference from side of the Commission. The reported information is mainly based on self-declarations sent back in the aforementioned questionnaires by each provider, thereby reflecting his willingness to promote the respective product. All data have been checked over prior to publication, but no liability can be taken for the correctness of the information.

3. ANALYSIS OF SOFTWARES

3.1. AirConLCA

a) **Description:**

The software is developed for air conditioning systems. The user is required to specify a number of parameters (such as refrigerant type, expected lifespan, location and after-use management strategy) to define each system. The results of the assessment are given both in terms of an inventory and in terms of an impact assessment.

The tool is easy to navigate, with a simple 'click button' approach. Results tables are supplemented by graphs that could easily be exported to internal reports.

- b) **Sector specific:** The tool provides the user with valuable information associated with up to four commercial or domestic air-conditioning systems.
- c) **Screening LCA tool:** AirConLCA is not a screening LCA tool.
- d) **Eco-design approach:** No Design for Environment (DfE) included in the tool.

² Hybrid LCA combines process-based LCA with environmental input/output analysis.

³ While attributional LCA aims at describing the environmental properties of a life cycle and its subsystem, consequential LCA aims at describing the effects of changes within the life cycle.

- e) **Application for laws/regulatory compliance:** No
 - f) **Life Cycle Cost:**
The tool provides the information about the costs associated with four commercial or domestic air-conditioning systems.
 - g) **Social Life Cycle Analysis:** No
 - h) **LCA:**
 - **Inventory:** The results of the assessment are given as inventory - actual inputs and outputs, such as electricity, water, materials and money;
 - **Impact Assessment:** The tool provides the information about the potential environmental impacts (indicators of potential environmental impact, such as global warming potential);
 - **Interpretation:** This information is not available.
 - i) **Hybrid LCA:** No
-

3.2. AIST-LCA Ver.4

- a) **Description:**
AIST-LCA Ver.4 is an LCA software developed by the Research Center for Life Cycle Assessment, National Institute of Advanced Industrial Science and Technology (AIST) in Japan. Previous versions of the software, NIRE-LCA, were developed by the National Institute for Resource and Environment (NIRE), before it was transformed into an independent administrative institution. The software can be used for environmental impact assessments by educational and research organizations.
- b) **Sector specific:** No
- c) **Screening LCA tool:** AIST-LCA Ver.4 is not a screening LCA tool.
- d) **Eco-design approach:** No Design for Environment (DfE) included in the tool.
- e) **Application for laws/regulatory compliance:** No
- f) **Life Cycle Cost:** Life Cycle Cost (LCC) is not included in the tool.
- g) **Social Life Cycle Analysis:** No
- h) **LCA:**
 - **Inventory:** In this software, is used to refer to a unit process, which contains the inputs and outputs of a particular activity. In AIST-LCA Ver.4 processes are classified into 5 different types: Production; Processing; Utilities; Transport; and Waste Management. The inputs to a process are the materials and energies required to fulfill the function of the process, while the outputs of a process are the desired product(s) along with any wastes and other by-products.
 - **Impact Assessment:** In AIST-LCA Ver.4 the principal method used is the Japanese method LIME (Life cycle Impact assessment Method based on Endpoint modeling). AIST-LCA Ver.4 also includes other assessment methods used around the world. They are the Eco-indicator 95, Ecopoint and EPS methods. In addition to the predefined methods, AIST-LCA Ver.4 also allows users to define their own assessment methods;
 - **Interpretation:** The interpretation step of LCA, according to the ISO framework, is comprised of: the identification of significant issues based on the results of the LCI and LCIA steps; evaluation of the completeness, sensitivity and consistency of the study; and the

reaching of conclusions and recommendations, and preparation of a report. If the user chose, in the scope of the study, not to carry out an impact assessment then results will not be available for the interpretation step. The software evaluates the data quality, data type, and age of the data used in the study;

i) **Hybrid LCA:** No

3.3. BEES 3.0d

a) **Description:**

BEES (Building for Environmental and Economic Sustainability) is a tool developed by the NIST (National Institute of Standards and Technology) Building and Fire Research Laboratory with support from the U.S. EPA Environmentally Preferable Purchasing Program. The tool is based on consensus standards and designed to be practical, flexible, and transparent.

BEES uses the life-cycle assessment approach specified in the ISO 14040 series of standards. All stages in the life of a product are analyzed: raw material acquisition, manufacture, transportation, installation, use, and recycling and waste management. Environmental and economic performances are combined into an overall performance measure using the ASTM standard for Multi-Attribute Decision Analysis. For the entire BEES analysis, building products are defined and classified according to the ASTM standard classification for building elements known as UNIFORMAT II.

The tool is available in version: BEES 3.0d (free of cost): Downloadable from BEES website.

b) **Sector specific:**

BEES measures the environmental performance of building products. Version 3.0 of the Windows includes actual environmental and economic performance data for nearly 200 building products.

c) **Screening LCA tool:** BEES is not a screening LCA tool.

d) **Eco-design approach:** Version 3.0 of the Windows - based decision support software, aimed at designers, builders, and product manufacturers;

e) **Application for laws/regulatory compliance:**

In support of recent U.S. legislation, BEES has been adapted for application to biobased products. The 2002 Farm Bill authorized the creation of a program awarding Federal purchasing preference to biobased products. To address the questions of environmental and cost performance, candidate biobased products are being evaluated by the BEES tool, and performance results shared with Federal purchasers.

f) **Life Cycle Cost:**

BEES is a LCA/LCC software for selecting cost-effective, environmentally-preferable building products. Economic performance is measured using the ASTM standard life-cycle cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and disposal.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** The Life Cycle Inventory follows the ISO 14040 series of LCA standards

- **Impact Assessment:** TRACI method (the U.S. EPA Tool for the Reduction and Assessment of Chemical and Other Impacts) is used.
- **Interpretation:** Multi-attribute Decision Analysis following ASTM, International Standard E 1765

i) **Hybrid LCA:** No

3.4. DPL 1.0

a) **Description:**

Computer tool DPL measures the sustainable performance of urban districts, for both existing districts and plans. DPL enables you to give sustainable aspects a clear position in urban planning processes. The DPL computer tool measures quantitatively the sustainable performance on the basis of 25 indicators divided over the three elements of sustainability: Planet, People and Prosperity. The indicators for example are related to air pollution, energy, water, social cohesion, employment and the use of space. DPL enables important stakeholders, such as project developers, urban planner, housing organizations and municipalities, to univocally discuss the sustainable ambitions for an urban plan. IVAM and TNO developed the program in close cooperation with the Dutch ministry of environment and five municipalities in The Netherlands.

b) **Sector specific:** No

c) **Screening LCA tool:** DPL 1.0 is not a screening LCA tool.

d) **Eco-design approach:** This information is not available

e) **Application for laws/regulatory compliance:** This information is not available

f) **Life Cycle Cost:** This information is not available

g) **Social Life Cycle Analysis:** This information is not available

h) **LCA:**

- **Inventory:** This information is not available
- **Impact Assessment:** This information is not available
- **Interpretation:** This information is not available

i) **Hybrid LCA:** No

3.5. Eco-Quantum

a) **Description:**

In Eco-Quantum, the diversity of information on the environmental performance of buildings is converted into information that all parties involved in the construction work can use. The supplying industry submits relevant information on environmental matters, tested on the basis of the environmental fact sheet with LCA information about building products, for the computer program. Clients and civil servants can use Eco-Quantum as a policy instrument to determine environmental targets for housing programs.

b) **Sector specific:** Developed by IVAM, the Eco-Quantum system converts the wealth of data about a building's environmental performance into useable information for all those involved in a construction project.

- c) **Screening LCA tool:** Eco-Quantum is not a screening LCA tool.
 - d) **Eco-design approach:** Architects use the program to optimize the environmental terms of their designs. The huge variety of factors involved in designing a building make it difficult to form a picture of what its eventual impact upon the environment will be. But Eco-Quantum system can give architects an idea of their structure's environmental performance from an early stage in the design process.
 - e) **Application for laws/regulatory compliance:** No
 - f) **Life Cycle Cost:** Life Cycle Cost is not included in the tool
 - g) **Social Life Cycle Analysis:** No
 - h) **LCA:**
 - **Inventory:** The input for Eco-Quantum consists of the quantities, specifications and material details of the building components – submitted into the same form as on the specification – as well as its energy consumption for interior heating, cooling, hot water and so on, which is taken from the energy-performance calculation.
 - **Impact Assessment:** The program then calculates the building's environmental impact. As required, this can be presented either as basic statistics (raw materials, emissions, energy, waste) or in the form of a comprehensive environmental profile. As well as seeing the final totals, the user can also “zoom in” on each item to see where the greatest threat to the environment lies.
 - **Interpretation:** This information is not available
 - i) **Hybrid LCA:** No
-

3.6. EIME V2.4

- a) **Description:**

The EIME is a tool that was developed 10 years ago by 6 majors companies of the Electric and Electronic sector. It allows designers (without any environmental competences) to realize environmental assessments of their products.

An Expert interface, dedicated to an environmental expert, allows customizing the tool to the company policy.

EIME is a tool adapted to the companies' environmental needs:

 - Comparison between competing design alternatives in order to improve your products;
 - Internal dissemination to customer requirements, company rules and legal constraints;
 - Active contribution to your environmental management system;
 - Communication of an environmental declaration or an eco-profile to your customers and your shareholders.
- b) **Sector specific:** No
- c) **Screening LCA tool:** EIME V2.4 is not a screening LCA tool.
- d) **Eco-design approach:**

The tool assesses and controls a product environmental risk during the whole design process.
- e) **Application for laws/regulatory compliance:** No
- f) **Life Cycle Cost:** EIME is not a tool to assess Life Cycle Cost

- g) **Social Life Cycle Analysis:** No
- h) **LCA:**
 - **Inventory:** The Designer interface allows to model products inventories.
 - **Impact Assessment:** 11 impact indicators are calculated on the Designer interface, chosen to allow a multi criteria approach to avoid pollution transfers.
 - **Interpretation:** After the assessment, the Designer interface includes some graphical functionalities to allow an easy analysis and interpretation of the results. Possibility to "Track" the main contributors of the product.
- i) **Hybrid LCA:** No

3.7. Environmental Impact Estimator V3.0.2

- a) **Description:**

Capable of modeling 95% of the building stock in North America, the software's results are presented in various ways and levels of detail to meet the needs of different types of users; for example, by specific energy forms or waste substances, by life cycle stage and by assembly type. The software is able to make comparisons between as many as five alternative designs at a time. The operating energy conversion calculator in the Environmental Impact Estimator is an especially valuable feature because it calculates emissions from operating energy, and takes account of the pre-combustion effects of making and moving energy. Other features include an "end of life" module, which simulates demolition energy and final disposition of the materials incorporated in a building. It has been developed by Athena Institute (Canada).
- b) **Sector specific:**

The Athena Institute's Environmental Impact Estimator is a North American LCA tool for assessment at the whole building or assembly level.
- c) **Screening LCA tool:** Environmental Impact Estimator is not a screening LCA tool.
- d) **Eco-design approach:**

The software lets architects, engineers and researchers assess the environmental implications of industrial, institutional, office, multi-unit residential, and single-family residential building design.
- e) **Application for laws/regulatory compliance:** No
- f) **Life Cycle Cost:** Environmental Impact Estimator V3.0.2 is not a tool for assessing Life Cycle Cost
- g) **Social Life Cycle Analysis:** No
- h) **LCA:**
 - **Inventory:** This information is not available
 - **Impact Assessment:** This information is not available
 - **Interpretation:** This information is not available
- i) **Hybrid LCA:** No

3.8. EPD Tools Suit 2007

- a) **Description:**

EPD Tools Suit 2007 is a software tool for EPD certification programs, to facilitate the data and information collection, exchange, treatment, validation and report.

- b) **Sector specific:** No
- c) **Screening LCA tool:** EPD Tools Suit 2007 is not a screening LCA tool.
- d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool
- e) **Application for laws/regulatory compliance:** No
- f) **Life Cycle Cost:** EPD Tools Suit 2007 is not a software for assessing Life Cycle Cost
- g) **Social Life Cycle Analysis:** No
- h) **LCA:**
 - **Inventory:** It composes of two software tools, i.e EPD Inputer and EPD Verifier. EPD Inputer instructs organizations to input inventory data and additional environmental informations according to predetermined parameters and rules as defined in specific PCR document. Then a draft of declaration will be exported to EPD Verifier, where an independent verifier can validate the data and create the declaration.
 - **Impact Assessment:** This information is not available
 - **Interpretation:** This information is not available
- i) **Hybrid LCA:** No

3.9.eVerdEE v.1.0

- a) **Description:**

eVerdEE is a web based tool for screening LCA designed to adapt the ISO 14040 requirements. The tool is supported by a database, which contains pre-elaborated environmental indicators of substances and processes for different impact categories, and a help-on-line. For each step of the inventory procedure users input their data concerning the quantity of the inputs/outputs, choose a corresponding entry from the database and evaluate the quality of the data they have input, selecting between predefined options.

The impacts are quantified on the basis of ten categories (consumption of mineral resources, consumption of biomass, consumption of fresh water, consumption of non-renewable energy, climate change, acidification, eutrophication, photochemical oxidation, ozone layer depletion) and two environmental indicators (total waste and hazardous waste). The study results (characterization and normalization) are automatically calculated by using the inputs and the database values. They are presented in a matrix and interpreted at different levels of detail. A direct comparison of the environmental performances of different life-cycle options is allowed using a target-plot.
- b) **Sector specific:** No
- c) **Screening LCA tool:**

eVerdEE is a web based tool for screening LCA designed to adapt the ISO 14040 requirements and offer easy-to-handle functions with sound scientific bases.
- d) **Eco-design approach:** Design for Environment (DfE) is included in the tool
- e) **Application for laws/regulatory compliance:** No
- f) **Life Cycle Cost:** eVerdEE is not a tool for assessing Life Cycle Cost
- g) **Social Life Cycle Analysis:** No
- h) **LCA:**

- **Inventory:** The inventory procedure covers four phases:
 - Pre-manufacturing including all of the materials, semi-finished products and components that make up the product, their packaging and transport.
 - Manufacturing including energy consumption of the manufacturing plant, auxiliary materials, emissions and waste.
 - Packaging and distribution including packaging and transport related to the distribution of the product to the consumer.
 - Use and end of life including materials and components used for the maintenance and repair of the product, energy consumption, emissions and waste due to the use of the product, waste produced at the end of product's life. Waste treatment processes are not included within the system boundaries of eVerdEE.
- **Impact Assessment:** The impact is quantified on the basis of 10 impact categories: consumption of mineral resources, consumption of biomass, consumption of fresh water, consumption of non-renewable energy, consumption of renewable energy, climate change, acidification, eutrophication, photochemical oxidation, ozone layer depletion. Two environmental indicators (the amount of hazardous waste and total waste) have been added to take into account the production of waste during the life cycle of a product. The characterization factors for the impact categories have been selected on the basis of scientifically accepted methods (CML-IA, april 2004). The results for each impact category have been normalised against aggregate world interventions in a reference year.
- **Interpretation:** The characterization results are viewed in a matrix (environmental indicators/ life cycle phases). Three levels of details can be obtained, so that the contribution of each item of the inventory to a specific indicator can be identified. A data quality evaluation procedure allows evaluating the quality of the most significant inventory data and having a list that prioritizes how to improve their quality. Moreover a table summarises the degree of completeness of the study, as documented by users. The interpretation of the results of the study is assisted by information about the emission of some substances in air and some substances/analytical measures in water, which are not classified and characterised by any of the eVerdEE indicators, but which are documented in the datasets used and in the inventory procedure. The use of a target plot allows a direct comparison of different environmental profiles of a product related to different life cycle options.

i) **Hybrid LCA:** No

3.10. eVerdEE v.2.0

a) **Description:**

The tool is supported by a database, which contains pre-elaborated environmental indicators of substances and processes for different impact categories, and a help-on-line. For each step of the inventory procedure users input their data concerning the quantity of the inputs/outputs, choose a corresponding entry from the database and evaluate the quality of the data they have input, selecting between predefined options.

Two different types of inventory procedures (free and guided) are available, which allows two different types of applications (industrial or agricultural sector). According to the application selected, two different and predefined life cycle models have been developed.

The impacts are quantified on the basis of ten categories (consumption of mineral resources, consumption of biomass, consumption of fresh water, consumption of non-renewable energy, climate change, acidification, eutrophication, photochemical oxidation, ozone layer depletion) and two environmental indicators (total waste and hazardous waste). The study results (characterization and normalization) are automatically calculated by using the inputs and the database values. Predefined subsets of categories can be chosen. The results are presented in a matrix and interpreted at different levels of detail. A direct comparison of the environmental performances of different life-cycle options is allowed using a target-plot.

A new automatic software procedure has been added, linked to eVerdEE v.2.0, for the preparation of Type III labels. The procedure extracts general information from the eVerdEE subscription form and LCA-based data from the eVerdEE studies. Users are asked for inputting into predefined forms additional environmental information. Finally the declaration is printed for third party verification.

b) **Sector specific:** No

c) **Screening LCA tool:**

eVerdEE 2.0 is a web based tool for screening LCA designed to adapt the ISO 14040 requirements and offer easy-to-handle functions with sound scientific bases.

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** eVerdEE is not a tool for assessing Life Cycle Cost

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** The inventory procedure covers four phases but its structure depends on the selected application. Industrial sector:
 - Pre-manufacturing including materials, semi-finished products and components that make up the product, their packaging and transport.
 - Manufacturing including energy consumption of the manufacturing plant, auxiliary materials, emissions and waste.
 - Packaging and distribution including packaging and transport related to the distribution of the product to the consumer.
 - Use and end of life.
 For the Agricultural sector, the procedures differs from the previous in the first two phases:
 - Infrastructure and machinery, including materials and components for construction and maintenance.
 - Cultivation including input and output of the cultivation process. Waste treatment processes are not included within the system boundaries of eVerdEE.
- **Impact Assessment:** The impact is quantified on the basis of 10 impact categories: consumption of mineral resources, consumption of biomass, consumption of fresh water, consumption of non-renewable energy, consumption of renewable energy, climate change, acidification, eutrophication, photochemical oxidation, ozone layer depletion. Two environmental indicators (the amount of hazardous waste and total waste) have been added to take into account the production of waste during the life cycle of a product. The characterization factors for the impact categories have been selected on the basis of scientifically accepted methods (CML-IA, April 2004). The results for each impact category have been normalised against aggregate world interventions in a reference year.
- **Interpretation:** The characterization results are viewed in a matrix (environmental indicators/ life cycle phases). Three levels of details can be obtained, so that the contribution of each item of the inventory to a specific indicator can be identified. A data quality

evaluation procedure allows evaluating the quality of the most significant inventory data and having a list that prioritizes how to improve their quality. Moreover a table summarises the degree of completeness of the study, as documented by users. The interpretation of the results of the study is assisted by information about the emission of some substances in air and some substances/analytical measures in water, which are not classified and characterised by any of the eVerDEE indicators, but which are documented in the datasets used and in the inventory procedure. The use of a target plot allows a direct comparison of different environmental profiles of a product related to different life cycle options.

i) **Hybrid LCA:** No

3.11. GaBi 4.2

a) **Description:**

GaBi 4.2 is a software for Life Cycle Assessment (LCA), Life Cycle Engineering (LCE), Green House Gas Accounting, Benchmarking and Energy Efficiency of products and companies.

GaBi 4.2 is widely used for LCA studies and decision support in industry but also widely used in LCA research institutes.

GaBi 4.2 comes along with one of the globally most comprehensive, consistent and especially high quality database system of the GaBi databases 2006, also including the data from the European Commission's ELCD database. Data updates are done remotely; for in-house data exchange, professional database management features are made available. In addition to the provision of LCI related information the GaBi 4.2 professional database will provide information on social aspects as well (expected to be released mid 2007).

GaBi 4.2 allows creating models based on physical process chains (engineering approach). Next to the basic functions of LCI modelling, data analysis, impact calculation, etc., it has fully integrated parameter functionality to create flexible systems including circularity effects. For a detailed analysis the GaBi analyst offers scenario analysis, parameter variation, sensitivity analysis and a fully user controlled, very performance Monte Carlo analysis.

Web-based data collection: The "GaBi web questionnaire" allows easily to organize data collection e.g. within industrial associations or for global players: Parameterized systems are set-up in GaBi 4.2 and a special functionality allows to automatically create web based questionnaires for easy and effective data collection. The received data can be imported into GaBi 4.2, what is supported by consistency checks, etc.

b) **Sector specific:** No

c) **Screening LCA tool:** GaBi 4.2 is not a screening LCA tool.

d) **Eco-design approach:**

With the extension functions "GaBi i-report" and "GaBi reader", interactive reports can be generated using all objects defined in GaBi 4.2 to created powerful Ecodesign models to be used for e.g. Eco-Design or EPD purposes. With this functionality LCA experts can generate complex parameterised systems, which are then transferred into ready to use applications to support product development or communication or other applications.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:**

GaBi 4 enables consideration of different cost factors connected to the processes or the lifecycle of products. Users are supported by advanced wizards when keying in various cost types. GaBi4 then automatically computes costs related to individual processes, material or energy flows from the user's details.

g) **Social Life Cycle Analysis:** Yes, the tool allows the inclusion of social aspects in LCA

h) **LCA:**

- **Inventory:** GaBi 4.2 allows to easily model realistic process chains, e.g.: - describing a specific production technology or service with the input and output flows and linking them by: - describing the product system by using its structural information and creating parts with material inventories and production processes GaBi's very powerful graphical user interface provides the user with a full overview and insight even of complex product systems and hence supports an efficient work flow. A principle characteristic of GaBi 4.2 is the ability to map real-life activities supported by easy and flexible functionality such as parameters, describing the process' behavior depending on load settings or the specific materials processed etc. This allows case-studies to be set-up efficiently based on the identified physical process chains. Creating flexible models using GaBi 4.2's parameters consequently facilitates: - answering the needs for industrial applications quasi in-time - the communication of GaBi 4.2 with existing IT environments - realise benefits from comprehensive analysis
- **Impact Assessment:** Already implemented methods are: CML 96, CML 2002, Ecoindicator 95, Ecoindicator 99, Ecological scarcity, EDIP 97, EDIP 2003, Impact 2002+, Traci. The user can however define own methods; this possibility is made available in line with the flexibility principle of GaBi.
- **Interpretation:** The GaBi 4.2 balance is the starting point for the extensive analysis and interpretation capabilities. A few examples: The GaBi 4.2 balance view allows to switch between percent shares or absolute numbers, weak points in the modelled system are determined with colors, tracing them back top-down. Normalizations and valuations are easily applicable; own weighing patterns can be added by the users. Users benefit from evident and meaningful results for decisions on materials, processes, usage or disposal scenarios. Available in the GaBi 4.2 Analyst are several different analyzing methods: scenario analysis, parameter variation, sensitivity analysis, and the Monte Carlo analysis.

i) **Hybrid LCA:** No

3.12. GaBi DfX

a) **Description:**

GaBi DfX is the tool for compliance and sustainable product development.

If you, during product design, like to include different regulations such as e.g. the EU directives on End-of-life Vehicles (ELV), on Waste Electrical and Electronic Equipment (WEEE), or on the Restriction of Hazardous Substances (RoHS), then GaBi DfX is your tool. GaBi DfX - in connection with GaBi 4.2, - supports you to:

- react flexible to requirements by legislation and customers;

- ensure cost effective compliance management;
- use ONE transparent and consistent product model for all life-cycle considerations like from EuP to WEEE;
- manage economically product-relevant data and models by a single tool. GaBi DfX provides the following support:

a) Design for Compliance – DfC (support in compliance with legislation on: RoHS - Restriction of Hazardous Substances, ELV - End-of-Life Vehicles (2000/53/EC), Calculation of road vehicles recyclability and recoverability (ISO 22628), WEEE - Waste Electrical and Electronic Equipment (2002/96/EC and Amendment 2003/108/EC))

b) Design for Recycling – DfR (Support of the recycling orientated product design by: Description and classification of materials, such as for VDA 231-106 or ISO 22628, Description of the recoverability processes, Calculation of road vehicles' recyclability and recoverability (ISO 22628), Identification of recycling quotas with regard to material-specific efficiencies, Comparison of end-of-life scenarios)

c) Design for Disassembly – DfD (Analysis of disassembly processes: Modelling of joining techniques, Description of the sequence of disassembly, Definition of disassembly precedence, Calculation of exact disassembly costs and duration, Creation of IDIS reports).

b) **Sector specific:** No

c) **Screening LCA tool:** GaBi DfX is not a screening LCA tool

d) **Eco-design approach:**

GaBi DfX provides support for Design for Environment – DfE (i.e. extensive functions to analyze the products life cycle, modelling and presentation of the product structure, identification of the material composition, calculation of scenarios and alternatives, identification of optimisation potentials, carry out detailed Life Cycle Analysis)

e) **Application for laws/regulatory compliance:** Yes

f) **Life Cycle Cost:** GaBi DfX is a tool for assessing Life Cycle Costs (Cost analysis for End-of-Life scenarios, Breakdown of flow costs, disassembling costs, machine costs and personnel costs, Identification of cost driver in the recycling)

g) **Social Life Cycle Analysis:** Yes, the tool allows the inclusion of social aspects in LCA

h) **LCA:**

- **Inventory:** GaBi DfX allows to either use existing life cycle models created in the GaBi 4.2 tool or enables the user to create a product life cycle model based on parts list information via easy-to-use interfaces. These models are the basis for specific calculations of recycling quotas according to existing EU regulations while also allow to calculate traditional LCA results, if wished so by the user. Further material flow analysis and tracking of used materials within the product structure is easily possible. For the powerful disassembly analysis it is also possible to define and analyze disassembly procedure, time, and associated costs.
- **Impact Assessment:** Already implemented methods are: CML 96, CML 2002, Ecoindicator 95, Ecoindicator 99, Ecological scarcity, EDIP 97, EDIP 2003, Impact 2002+, Traci. The user can however define own methods; this possibility is made available in line with the flexibility principle of GaBi.
- **Interpretation:** Various specific functionalities for analyzing results are included.

i) **Hybrid LCA:** No

3.13. GaBi lite

a) **Description:**

GaBi lite is the simple way of calculating life cycle results. Following defined paths, it is application-oriented, clearly laid out and therefore ideal for beginners or SMEs.

The GaBi lite assistant guides you step by step to your balance results with high clarity but still precise models and data underneath – specialized knowledge of complex LCA modelling is not necessary.

The tool is especially user-friendly and yet very powerful despite the reduced extent of its functions compared to GaBi 4.2. Whether you want to carry out a Life Cycle Assessment on a single process step or for a complex product's complete cycle level, the extensive background database content gives your results a well-founded basis. Numerous evaluation methods and indicators ensure reliable decision support.

How it works: with the GaBi lite assistant it is really that simple: First, the product structure is outlined. Then, the component parts, end of life, materials, use phase and parameters are defined, required readily available data of your product or process. Next, the mode of display for the results is specified.

b) **Sector specific:** No

c) **Screening LCA tool:** GaBi lite is a tool for screening LCA.

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** GaBi lite is not a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** GaBi lite supports the set-up of product life cycles following predefined paths. The user selects from the options - depending on the available information. A wizard will guide the user step by step to the creation of the LCA, descriptions explain the necessary activities. The underlying database provides LCI information on materials, energy, manufacturing processes, and transportation. For the use phase predefined models are available as well as customer specific use phase processes can easily be created.
- **Impact Assessment:** Implemented methods are: CML 96, CML 2002, Ecoindicator 95, Ecoindicator 99, Ecological scarcity, EDIP 97, EDIP 2003, Impact 2002+, Traci.
- **Interpretation:** For the calculation of results as well as for the analysis of the case study outcomes, the user can selected from predefined sets of inventory parameters or impact categories. Also normalization and evaluation is available and can be selected. Based on the choices made, automatically a result report is generated including all the required information. The report includes tables as well as diagrams.

i) **Hybrid LCA:** No

3.14. GEMIS version 4.4

a) **Description:**

GEMIS is a full life-cycle/material flow analysis model with integrated database; the model covers direct and indirect flows, construction/decommissioning, energy flows (fossil, nuclear, renewable), materials (metals, minerals, food, plastics...), and transport services (person and freight), as well as recycling and waste treatment. Environmental indicators are air emissions (SO₂, NO_x, particulates, HCl, HF, H₂S, NH₃, CO, NMVOC), greenhouse gases (CO₂, CH₄, N₂O, other gases), liquid effluents (AOX, BOD, COD, N, P, inorganic salts), solid wastes (ashes, overburden, process residues), land use, and resource use (primary energy and primary material demands).

b) **Sector specific:** No

c) **Screening LCA tool:** GEMIS version 4.4 is not a screening LCA tool

d) **Eco-design approach:** This information is not available

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** The tool calculates and analyzes also the costs (the respective data are implemented for fuels and energy systems).

g) **Social Life Cycle Analysis:** The tool calculates and analyses labor impacts (direct and indirect)

h) **LCA:**

- **Inventory:** This information is not available
- **Impact Assessment:** This information is not available
- **Interpretation:** This information is not available

i) **Hybrid LCA:** Monetary IO tables can be included for hybrid modeling

3.15. Green-E, version 1.0

a) **Description:**

The tool enables companies to quantify their environmental performances and identify economically advantageous improvement opportunities, making transparent decision on development and investments. Four types of information are used to assess the overall activity of a company: (1) purchased goods to characterize the supply chain, (2) on-site direct emissions (if any) to define the in-house company performances, (3) the sales to link the overall company activities with the use phase and (4) the product requirements, to characterize the impacts related to the use phase. Combining this information with existing Life Cycle Inventory databases and related monetary costs and using life cycle assessment methods developed to assess product, one could assess in a consistent way overall company impacts and related costs.

b) **Sector specific:** No

c) **Screening LCA tool:** Green-E is not a tool for screening LCA.

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** Green-E is a tool for assessing Life Cycle Costs.

Green-E combines life cycle oriented environmental and cost assessments for a quantified and integrated eco-efficiency analysis.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** This information is not available
- **Impact Assessment:** Impact 2002+ is used (Impact on human health, ecosystem quality, global warming and resources), primary non-renewable energy is given as well as the CO2 emissions. Other life cycle impact assessment methodology can be included in customized version.
- **Interpretation:** Green-E permits to have the whole picture of a company on a single graphic, including the environmental performances as well as the associated costs.

i) **Hybrid LCA:** No

3.16. KCL-ECO 4.0

a) **Description:**

KCL-ECO Program is developed to carry out module calculations in general. KCL-ECO has a fully graphical user interface. The whole system under study can be chosen to be completely transparent.

With KCL-ECO you can easily handle very large systems. For example, it has been used to build a model for wood fibre flows in paper and board production in Western Europe; a system comprising 660 modules (unit processes), 1900 flows and 7200 linear equations describing the system. Due to KCL-ECO's transparent structure transports can be studied separately. Some of the special features are:

- Closed loop function
- Allocation. Both multi-output and open loop allocations are supported.
- Agglomeration function. Modules can be agglomerated together in a suitable way
- Hiding of modules: User can hide certain modules for example in a case if the flowsheet is sent to a user, who is not wanted to have access to all of the modules.

b) **Sector specific:** Yes. This tool is for forest industry – paper production

c) **Screening LCA tool:** KCL-ECO 4.0 is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** KCL-ECO is not a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** The graphical user interface is very easy to interpret. KCL-ECO can handle very large systems and closed loops. The color coding makes very user-friendly to divide the studied LCA into life cycle stages and there by display results according to the chosen code.
- **Impact Assessment:** EcoIndicator 99 and DAIA 98 (Finnish impact assessment method).
- **Interpretation:** The hot spot function and charts created by using it: toolKCL-ECO

i) **Hybrid LCA:** No

3.17. LCA - Evaluator 2.0

a) **Description:**

The LCA - Evaluator is newly released as 2.0 in 2006. Its aim is to apply the "verbal-argumentative Gesamtbewertung", an LCA grouping and evaluation method developed by the Umweltbundesamt (German EPA), in an automatic manner. Originally, this method is designed to be applied by a panel of experts. It starts from midpoint impact category values, and separates subjective from objective statements as long as possible in the evaluation and often comes to a clear recommendation without applying weighting. While the original method, applied by a panel, tends to be very time-consuming, the application in a software tool gives results not slower than a weighting step. Other evaluation and interpretation methods for LCAs are implemented in the tool as well. In extension of the original methods, uncertain indicator values can also be dealt with via a Monte Carlo simulation.

b) **Sector specific:** No

c) **Screening LCA tool:** LCA-Evaluator is not a screening LCA tool

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** LCA - Evaluator is not a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** This information is not available
- **Impact Assessment:** The LCA-Evaluator starts from midpoint impact category results.
- **Interpretation:** Its aim is to apply the "verbal-argumentative Gesamtbewertung", an LCA grouping and evaluation method developed by the Umweltbundesamt (German EPA), in an automatic manner. Originally, the method is designed to be applied by a panel of experts. It starts from midpoint impact category values, and separates subjective from objective statements as long as possible in the evaluation and often comes to a clear recommendation without applying weighting. While the original method, applied by a panel, tends to be very time-consuming, the application in a software tool gives results not slower than a weighting step. Other evaluation and interpretation methods for LCAs are implemented in the tool as well. In extension of the original methods, uncertain indicator values can also be dealt with via a Monte Carlo simulation. Technically, the tool uses a small Access database, and indicator values and normalization values and other starting values, including uncertainty distributions. The LCA Evaluator generates reports in Excel, where it presents evaluation results and starting parameters.

i) **Hybrid LCA:** No

3.18. LEGEP 1.2

a) **Description:**

LEGEP is a tool for integrated life-cycle analysis. All information is structured along life cycle phases (construction, maintenance, operation (cleaning), refurbishment and demolition. The environmental assessment comprises the material flows (input and waste) as well as an effect-oriented evaluation based on ISO 14040 – 43.

LEGEP is organized along four software tools, each with its own database. The method is based on cost planning by “elements”. The database is hierarchically organized, starting with the LCI-data at the bottom, building material data, work-process description, simple elements for material layers, composed elements like windows, and ends with macro-elements like building objects. The data are fully scaleable and can be used either “bottom-up” or “top-down”. Elements at each level contain all necessary data for cost, energy, and mass-flow and impact evaluation. A building can be described using either preassembled elements or defining elements from scratch. The user can also define a specific composition by exchanging layers or descriptions of the element. The advantage of the top down approach is its completeness: if an element is not explicitly changed or eliminated it will remain in the calculation.

Output of LEGEP at each phase a complete, interrelated set of cost, energy, mass-flow and environmental indicators. The number of indicators, which are displayed, can be chosen from the CML indicators. Additional indicators are under implementation (DALY etc.). It is possible to show separately specific indicators or all indicators, for each life cycle phase (new construction, operation, cleaning, maintenance, refurbishment, demolition) of the building.

b) **Sector specific:** Yes

- Building: The tool supports the planning teams in the design, construction, quantity surveying and evaluation of new or existing buildings or building products.

c) **Screening LCA tool:** LEGEP 1.2 is not a tool for screening LCA

d) **Eco-design approach:**

LEGEP supports the planning teams in the design. It is used at present mainly for the design of new built buildings, taking into account the future life cycle. For existing buildings LEGEP assists in the decisions on refurbishment operations and long term, sustainable management of buildings and building stocks.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:**

The LEGEP database contains the description of all elements of a building (based on DIN 276), their life cycle costs (LCC/WLC) based on DIN 18960 and the final report EU-TG4 LCC in Construction. The tool also establishes the energy needs for heating, warm-water, electricity and their costs (following EnEV 2002 and EN 832). The costs of the elements are established by the SIRADOS database, which is published each year. There are about 8.000 elements “ready for use” for the building fabric, technical equipment and landscape work.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** The LC Inventories are based on the ECOINVENT data and specific values from the Baustoff Ökoinventare (Kohler, N., Lützkendorf, Th. et al., Karlsruhe/Weimar/Zürich 1995). Input in LEGEP: A building can be described alternatively with 15 macro-elements, 40 complex elements, or approx. 150 simple elements. This corresponds to the increase in knowledge during the design and planning process allowing describing the building more and more in detail without losing the overall framework. At each level a complete evaluation can be made and documented automatically.

- **Impact Assessment:** Some thousands ready-made Construction works, construction elements and buildings are assessed by means of the transformation of work descriptions in energy and material flows. This delivers exact LCI's on any level and life cycle phase. These LCI's are the base for the calculation of the LCA. Over 1400 materials (generic and product based) are mapped to more than 200 basic building product LCA's.
- **Interpretation:** The LCA results are shown in the database of the construction elements. The construction elements are put together to model a specific building. With the project specific quantities the user receives a complete LCA of the building, including the new building, operation, refurbishment and demolition. The results can be compared with other construction elements or building. There is a separated tool called comparison of projects, which allows the comparison of several variations of one project or the comparison with a reference project.

i) **Hybrid LCA:** No

3.19. Modular MSWI Model 1.0

a) **Description:**

It consists of several interlinked spreadsheet files, describing the waste input, and several components of the plant. This model was used and partially described for an article on technological and geographical differences for MSWI plants.

The tool is available in version: Modular MSWI Model 1.0 Full model (free of cost): Made available under the GNU General Public Licence.

b) **Sector specific:**

The 'Modular MSWI Model' calculates an input output balance for solid waste incineration plants, based on the elementary composition and on the plant layout.

c) **Screening LCA tool:** Modular MSWI Model 1.0 is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** Modular MSWI Model is a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** Chemical engineering and thermodynamics used for modelling single process steps in the incineration plant, in many cases down to elementary flows
- **Impact Assessment:** This information is not available
- **Interpretation:** This information is not available

i) **Hybrid LCA:** No

3.20. Prototype Demolition Waste Decision Tool 1

a) **Description:**

The tool (Milieu-effecten en aanbestedingsinstrument Duurzaam Slopen Rotterdam) can be used with tenders for demolition works to take into account the level of sustainability in the decision

making phase. Actors involved (commissioners and executioners of demolition works) use the instrument for practical and quick quantitative assessment of the environmental benefits of 'sustainable' demolition compared to traditional demolition.

b) **Sector specific:** Yes

The tool is based on the composition of a building and the LCA-method the environmental consequences of different ways of demolition are shown with the demolition tool.

c) **Screening LCA tool:** Prototype Demolition Waste Decision Tool 1 is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** Prototype Demolition Waste Decision Tool is not a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** This information is not available
- **Impact Assessment:** This information is not available
- **Interpretation:** This information is not available

i) **Hybrid LCA:** No

3.21. REGIS 2.3

a) **Description:**

With REGIS, you can use comprehensive corporate eco-balances in accordance with tried-and-tested standards in a way offering both flexibility and simplicity.

b) **Sector specific:** No

c) **Screening LCA tool:** REGIS is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** REGIS is a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** REGIS has full functionality in modeling inventory
- **Impact Assessment:** all common (Ecoindicator, IPCC, Ecoscarcity, etc.)
- **Interpretation:** several different standard reports and user defined analysis

i) **Hybrid LCA:** No

3.22. Sabento 1.1

a) **Description:**

Sabento is a software tool that allows to quickly and comfortably model biotechnical production processes using assistants. Sabento can support you in early stages of process development.

When developing bio-processes, decisions can have long-lasting consequences. Sabento will help you to analyze such possible consequences at an early stage - giving you an improved basis for decision making. Risks can be minimized and chances of the process in regard to alternatives can be analyzed.

Sabento has been designed in such a way, that a user can start working with the software right away and without a lengthy preparation. To model a process will take approximately 30 to 60 minutes, an economic and ecological assessment can be completed in just 10 to 20 minutes. The social assessment may take 30 to 60 minutes when being done for the first time because of the qualitative character.

Sabento is the result of the BMBF-funded research project 'BioBeN' that ifu Hamburg GmbH, Karl-Winnacker-Institute (KWI)/DECHEMA, Wuppertal Institute and other partners successfully ran from 2002 to 2005.

b) **Sector specific:**

The software is prepared for the assessment of production with microorganisms, cell cultures and enzymes. The basic model contains all process units of a biotechnological process from preparation of media components to down stream processing and formulation of the final product. There is possibility to leave out any process unit if it is not needed.

c) **Screening LCA tool:** Sabento is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** Sabento is a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** Yes, in a qualitative way

h) **LCA:**

- **Inventory:** In Sabento complex process structures can be modelled as simply as networks with only few elements. All modelling steps are carried out using assistants that means following a questionnaire. The model is built up automatically in the background. All biotechnological processes are specified using production coefficients, parameters using mainly the Sabento process library. Assistant guided the user adapts standard processes to his specific situation.
- **Impact Assessment:** Sabento provides more than 500 materials, which are widely used in Biotechnology. All materials are classified according to the following environmental impact categories. E.g. such as land use, toxicity (acute + chronic), Biological Risk, Resources Availability, Complexity of Synthesis, Global Warming Potential, Ozone depletion potential, Ozone creation potential, Acidification potential, Eco-toxicity, Thermal Risk, Eutrophication, Odor. In case of missing materials, an assistant for new material helps the user to add and classify new materials to the database. These are used for an ABC Analysis addressing human health, environment and safety. In addition also economic and social assessments are supported.
- **Interpretation:** The results in Sabento are provided assistant guided as inventories, highlighting specific issues using a traffic light symbol. E.g. a green traffic light is shown if certain economic or environmental issues do not show any critical impact or risk. A yellow traffic light is shown if there is a certain risk, but the user entered a description on how he's going to deal with this risk. A red traffic light is shown, if there is an impact or a risk, which is not handled at all. For the social assessment radar diagrams are used to display to which

extend the social issues of a biotechnological process are dealt with. Social issues are e.g. quality of working conditions, innovation potential, health & safety, knowledge-management. For each dimension of sustainability is provided a specific report document that also includes the description of the methodologies used in the three areas economic, environmental and social.

i) **Hybrid LCA:** No

3.23. SALCA-biodiversity 061

a) **Description:**

The impact category biodiversity comprises 11 indicators (pastureland flora, segetal flora, birds, mammals, amphibians, molluscs, bees, spiders, ground beetles, butterflies and grasshoppers). The biodiversity potential in terms of species diversity and species composition for each indicator is determined in two steps. Firstly, the agricultural activities are scored in terms of their impacts on the organisms. Then, the defined habitat types are weighted according to their significance for the indicators. The final score is the product of the scores from the two weighting steps.

The tool is available in versions:

- SALCA-biodiversity 061 crop level: available: The use of the Tool SALCA-biodiversity is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.
- SALCA-biodiversity 061 farm level: planned: The use of the Tool SALCA-biodiversity is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.

b) **Sector specific:** Yes

c) **Screening LCA tool:** SALCA- biodiversity is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** SALCA- biodiversity is not a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** Calculation of the impacts on biodiversity from management data and site characteristics.
- **Impact Assessment:** The positive and negative impacts on each indicator are evaluated based on literature data and expert knowledge.
- **Interpretation:** Weighting of the impacts performed at two levels (agricultural activity and habitat). Interpretation of the results provided in the documentation.

i) **Hybrid LCA:** No

3.24. SALCA-crop 061

a) **Description:**

This tool allows to calculate LCAs of any arable or fodder crop in principle (for Swiss conditions). By repeating the calculation for each crop in a crop rotation, the whole rotation can

be assessed. The calculation is automatized and can be performed for many crops or variants at the same time. The production data (like machinery use, pesticide application, fertiliser applications, etc.) for each crop are defined by a large set of parameters.

b) **Sector specific:**

SALCA-crop is a generic calculation tool for LCAs of crops.

c) **Screening LCA tool:** SALCA- crop is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** SALCA- crop is not a tool for assessing Life Cycle Costs

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** Based on SALCA-LCI-database
- **Impact Assessment:** A selection of LCIA methods from the literature suitable for the assessment of agricultural systems is included in the tool
- **Interpretation:** EXCEL-sheets, VB-macros combined with a system using the TEAM®-software

i) **Hybrid LCA:** No

3.25. SALCA-erosion 061

a) **Description:**

The tool is available in version: SALCA-erosion 061: The use of the Tool SALCA-erosion is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.

b) **Sector specific:**

The method estimates soil losses through erosion by considering management practices such as selection of crops (e.g. ley, winter wheat) and soil conserving cultivation techniques (e.g. direct seeding). In function of the cultivation, the geographical setting and the site properties three factors for the calculation of the erosion are taken from tables. Apart from the laminar erosion linear processes are taken into account.

c) **Screening LCA tool:** SALCA- erosion is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** SALCA- erosion is not a tool for assessing Life Cycle Costs.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** Calculation of soil erosion from management data and site characteristics
- **Impact Assessment:** No LCIA included in the tool.
- **Interpretation:** No interpretation included in the tool.

i) **Hybrid LCA:** No

3.26. SALCA-farm 1.31

a) **Description:**

The tool is available in version: SALCA-farm 1.31: The use of the Tool SALCA-farm is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.

b) **Sector specific:**

SALCA-farm is a generic calculation tool for LCAs of farms. It allows to calculate LCAs of any farm in principle (for Swiss conditions). The calculation is automatized and can be performed for many farms at the same time. The production data (like machinery use, pesticide application, fertiliser applications, etc.) for each crop are defined by a large set of parameters.

c) **Screening LCA tool:** SALCA- farm is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** SALCA- farm is not a tool for assessing Life Cycle Costs.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** Based on SALCA-LCI-database
- **Impact Assessment:** A selection of LCIA methods from the literature suitable for the assessment of agricultural systems is included in the tool.
- **Interpretation:** This information is not available

i) **Hybrid LCA:** No

3.27. SALCA-heavy metals 061

a) **Description:**

The tool is available in versions:

- SALCA-heavy metals 061 farm level: planned: The use of the Tool SALCA-heavy metals is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.
- SALCA-heavy metals 061crop level: available: The use of the Tool SALCA-heavy metals is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.

b) **Sector specific:**

This method has been developed for recording heavy metal flows (cadmium, copper, zinc, lead, nickel, chromium and mercury). Introduction into farm land and discharge into surface water and groundwater are determined on the basis of heavy metal input from seed, fertilizers, plant protection and growth products and deposition. An allocation factor is used to distinguish between diffuse and agriculture-related introduction. The method refers to generic data for Switzerland

c) **Screening LCA tool:** SALCA- heavy metals is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** SALCA- heavy metals is not a tool for assessing Life Cycle Costs.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** Calculation of the heavy metal balance from management data and site characteristics.
- **Impact Assessment:** No LCIA included in the tool.
- **Interpretation:** No interpretation included in the tool.

i) **Hybrid LCA:** No

3.28. SALCA-nitrate 061

a) **Description:**

The tool is available in versions: SALCA-nitrate 061: The use of the Tool SALCA-nitrate is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.

b) **Sector specific:**

Nitrate leaching is defined as the surplus between introduction (mineralization and fertilizing) and uptake by the plants. The model calculates the risk of nitrate leaching by taking into account of the management practices (crop rotation, tillage and N-fertilisation) as well as the microbial nitrogen mineralisation in the soil, the uptake by plants and soil characteristics. The model is valid for crops and grazing systems. It is especially adapted for the calculation of crop rotations. The method is applicable to the central lowlands of Switzerland and adjacent regions.

c) **Screening LCA tool:** SALCA- nitrate is not a tool for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** SALCA- nitrate is not a tool for assessing Life Cycle Costs.

g) **Social Life Cycle Analysis:**

h) **LCA:**

- **Inventory:** Calculation of nitrate emissions from management data and site characteristics.
- **Impact Assessment:** No LCIA included in the tool.
- **Interpretation:** No interpretation included in the tool.

i) **Hybrid LCA:** No

3.29. SALCA-soil quality 061

a) **Description:**

The tool is available in versions: SALCA-soil quality 061: The use of the Tool SALCA-soil quality is to be negotiated case by case with the developers. Normally, the use of SALCA is arranged in the frame of a common project.

b) **Sector specific:** The model has been designed to record long-term changes in soil quality. Within the impact category soil quality nine direct indicators are used to express the impact of crop rotation on the soil (soil depth, macropore volume, aggregate stability, humus content, heavy metal content, organic pollutants, microbial activity, earthworm and microbial biomass). These direct indicators are determined with the aid of indirect indicators derived from current management practices.

- c) **Screening LCA tool:** SALCA-soil quality is not a tool for screening LCA
 - d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool.
 - e) **Application for laws/regulatory compliance:** No
 - f) **Life Cycle Cost:** SALCA-soil quality is not a tool for assessing Life Cycle Costs.
 - g) **Social Life Cycle Analysis:** No
 - h) **LCA:**
 - **Inventory:** Calculation of the impacts on soil quality from management data and site characteristics.
 - **Impact Assessment:** Positive and negative impacts on the 9 indicators are weighted and added.
 - **Interpretation:** Interpretation performed relative to target values in five classes: very unfavorable, unfavorable, neutral, favorable, very favorable.
 - i) **Hybrid LCA:** No
-

3.30. SankeyEditor 3.0

- a) **Description:**

Sankey Editor is best for drawing Sankey Diagrams for materials and energy flows. A Sankey Diagram is a flowchart, in which the flows are represented by arrows with a width that is mass (or energy) flow proportional. They are used to indicate waste, emissions, efficiency of systems on the individual company level or for the life cycle of a product. With Sankey Editor it is very easy to build static or dynamic Sankey Diagrams.
 - b) **Sector specific:** No
 - c) **Screening LCA tool:** No
 - d) **Eco-design approach:** This information is not available
 - e) **Application for laws/regulatory compliance:** No
 - f) **Life Cycle Cost:** This information is not available
 - g) **Social Life Cycle Analysis:** No
 - h) **LCA:**
 - **Inventory:** This information is not available
 - **Impact Assessment:** This information is not available
 - **Interpretation:** This information is not available
 - i) **Hybrid LCA:** No
-

3.31. SimaPro 7

- a) **Description:**

SimaPro 7.1 is an LCA software that offers ultimate flexibility, parameterized modelling, interactive results analysis and a large included database. SimaPro LCA has many advanced features, yet is still very easy to use. SimaPro has flexibility in handling different impact assessment methods. You can always click through a result screen and find out what is behind the results; what are the most important emissions or processes etc. For beginners an LCA

wizard is available to help you define the lifecycle, and add the most important data. Later you can refine your work. For advanced users we have features like Monte Carlo, and the use of parameters. It is even possible to make links to outside data sources. SimaPro comes with a huge database included.

- b) **Sector specific:** No.
- c) **Screening LCA tool:** It is not a tool for screening LCA
- d) **Eco-design approach:** Design for Environment (DfE) is included in the tool.
- e) **Application for laws/regulatory compliance:** No
- f) **Life Cycle Cost:** SimaPro is a tool for assessing Life Cycle Costs.
- g) **Social Life Cycle Analysis:** No
- h) **LCA:**
 - **Inventory:** SimaPro, can handle very advanced inventory techniques, but is at the same time very easy to use and understand; novice users can really make things simple. There is even a dedicated LCA wizard that lets you define your data model, by answering a series of questions. SimaPro comes with very large and up to date datasets. SimaPro process records can be used for systems and unit processes, as well as input output data. Each process record, can have multiple outputs; each with an allocation percentage; it is also possible to combine this way of allocation with avoided products (system boundary expansion). Inputs can come from nature or technosphere. These links can both be expressed in physical units and financial terms, allowing to make hybrid data models that combine input output and traditional processes. In this respect it is important to notice that loops may be modelled, as the calculation routines use matrix inversions. In each process record, emissions can be specified into air, water, soil, but it is also possible to specify solid waste, and waste streams (gas, liquid and solids) can be linked to a waste treatment. Emissions can be defined using the sub compartments used by Eco-invent (i.e. emission in high and low population density can be separated). All inputs and outputs can contain uncertainty data, specified as lognormal, normal triangular and even distributions. These uncertainties can be evaluated in a Monte Carlo analysis. All amount fields can also be defined as parameters. Parameters can be defined directly by the user, or the result of an expression; a wide range of linear and non-linear, or conditional expressions can be defined. In some versions, it is possible to link an amount field directly to an external data source, like excel or an SQL dataset. This makes it possible to store data outside SimaPro but use it without typing over. Many documentation fields are available.
 - **Impact Assessment:** Impact assessment methods are defined in SimaPro as a series of tables for impact categories, normalization and weighting. More than ten different impact assessment methods are included. These methods can be copied to your project, so they can easily be edited, extended etc. It is also easy to define completely new methods. If an impact assessment method is selected, all impact categories can be displayed as a profile in the same graph.
 - **Interpretation:** Inventory results can be presented as a table, that can be presented in many ways. For instance it is possible to show only the inventory results that contribute to a certain impact category, and it is also possible to show the uncertainties of every inventory result in a table. The impact assessment results can be displayed as a graph or table, and it is very easy to shift from characterization to damage assessment, normalization or weighting

(if the method allows). The user can double click on the graph to get a specification of substances or processes that contribute to the impact category that was clicked on. A separate contribution analysis is available that also displays pie-charts. With every impact result a completeness check is available that displays substances that were in the inventory, but not in the impact assessment result. SimaPro can compare two or more versions of a product system, each with different parameter settings. Similar graphs are also available to show the result of the Monte Carlo analysis if a single system is analyzed. If a comparison is evaluated, SimaPro will show the DIFFERENCE between two product systems, which gives the user the chance to see if the difference between product systems are indeed relevant, and for which impact category. In this procedure the correlations between identical processes in both LCI's are taken into account. SimaPro can generate a process network, in which each process has a small bar chart showing the contribution of this process to the total environmental load. The bar chart can display a single score, an impact category indicator or an individual inventory parameters. It is also possible to show product or financial flows.

- i) **Hybrid LCA:** In SimaPro, you can simply combine Input Output data with the normal process data in SimaPro, to create hybrid LCA's.

3.32. TEAM™ 4.5

- a) **Description:**

TEAM™ allows the user to build and use a large database, to model any system representing the operations associated with products, processes and activities and to calculate the associated life cycle inventories and potential environmental impacts in compliance with the ISO 14040 series of standards. TEAM allows to run simulations and scenarios comparison by defining variables.

- b) **Sector specific:** No

- c) **Screening LCA tool:** TEAM™ 4.5 is not a software for screening LCA

- d) **Eco-design approach:** Design for Environment (DfE) is included in the tool.

- e) **Application for laws/regulatory compliance:** No

- f) **Life Cycle Cost:** TEAM™ 4.5 is a tool for assessing Life Cycle Costs.

- g) **Social Life Cycle Analysis:** No

- h) **LCA:**

- **Inventory:** Computes the related LCI at any level of the system and for as many scenarios as wished. Modulifying of systems. Subsystems are used. All implemented data can be parameterized and controlled through a simple interface for LCA calculations.
- **Impact Assessment:** Different methods are used, such as IPCC, energy consumption, resource depletion, ozone depletion, tropospheric ozone creation, air acidification, eutrophication, emissions to soils, human and ecotoxicity. The user might implement and use its own impact assessment methodologies.
- **Interpretation:** TEAM allows to provide tables and graphics. The user might choose the level of detail which is of relevance for his goal. TEAM provides also sensitivity analyses possibilities. **DOMINANCE:** Results are detailed per LCA stage so that a dominance analysis can be performed. **SENSITIVITY:** Parameterised simulations can be run to observe

the influence of different alternatives on the input and output of an inventory.
UNCERTAINTY: Min-Max and Montecarlo.

i) **Hybrid LCA:** No

3.33. TEAM™ Web Simulator

a) **Description:**

"TEAM™ Web Simulator", through a standard Web browser, allows non-LCA practitioners to run LCA simulations through user friendly control panels. TEAM™ Web Simulator uses TEAM™ on a remote web server.

b) **Sector specific:** No

c) **Screening LCA tool:** No. TEAM™ Web Simulator is not a software for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** TEAM™ Web Simulator is a tool for assessing Life Cycle Costs.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** The modeling is predefined in TEAM™ with parameters.
- **Impact Assessment:** All TEAM™ methodologies are available. Different methods are used, such as IPCC, energy consumption, resource depletion, ozone depletion, tropospheric ozone creation, air acidification, eutrophication, emissions to soils, human and ecotoxicity. The user might implement and use its own impact assessment methodologies.
- **Interpretation:** TEAM™ Web simulator displays results in graphical and tabular views.

i) **Hybrid LCA:** No

3.34. TESPI

a) **Description:**

The tool is structured in two parts: quality analysis and environmental check. With the quality analysis, the user identifies the customers' needs and requirements, assess their relevance, compares their own product with the competitors' one. With the environmental check they assess the environmental performance of their product answering a checklist of environmental aspects (ex: Use of recycled materials, Use of harmful materials, Energy Consumption, Emissions etc.). The results are given in 4 graphs and identify the following points: which needs are the most relevant and how the product is good at satisfying each need, in comparison with the reference competitor; which eco-design strategies are the most relevant for the product; which part presents the most critical aspects concerning quality (customers needs analysis) and the environment; which needs and environmental aspects require improvement efforts for each part.

b) **Sector specific:** No

c) **Screening LCA tool:** TESPI is not a software for screening LCA

d) **Eco-design approach:** TESPI is aimed at supporting the environmentally conscious design, taking into account the product life cycle, the customers' needs and the competitors' products. It

can support the process of redesigning an existing product. The product should be a modular manufactured article, so that it can be disassembled and analyzed in each component. Each page has a “Help” to explain how to input data and to complete the check list.

- e) **Application for laws/regulatory compliance:** No
 - f) **Life Cycle Cost:** No
 - g) **Social Life Cycle Analysis:** No
 - h) **LCA:**
 - **Inventory:** This information is not available
 - **Impact Assessment:** This information is not available
 - **Interpretation:** This information is not available
 - i) **Hybrid LCA:** No
-

3.35. The Boustead Model 5.0.12

a) **Description:**

The Boustead Model one of the most detailed, yet relevant and easy-to-use LCA tools currently available.

Besides determining inventory datasets, the Boustead Model also offers automatic global warming (GWP) calculation. The global/regional environmental effects module features a tool with the ability to aggregate air emissions, water emissions and solid waste emissions on a national, regional or a global basis and the airborne acidification analysis now has historical precipitation data for 2300+ locations worldwide.

The Boustead Model database and software are aimed primarily at educational users (both in teaching and research), large companies or companies who manufacture a large number of different products, technical trade associations, government agencies and consultancy firms requiring an LCA capability.

- b) **Sector specific:** No. The Boustead Model is a self-contained database and software application, which enables the user to construct full life-cycle inventories for virtually any process situated anywhere in the world. The database that accompanies the application is a large, open and fully-editable inventory database.
- c) **Screening LCA tool:** The Boustead Model 5.0.12 is not a screening LCA tool
- d) **Eco-design approach:** No
- e) **Application for laws/regulatory compliance:** No
- f) **Life Cycle Cost:** No LCC included in the tool
- g) **Social Life Cycle Analysis:** No
- h) **LCA:**
 - **Inventory:** The Boustead Model enables full life-cycle inventory modelling
 - **Impact Assessment:** The Boustead Model enables calculation of various environmental effects, including Global Warming potentials, Airborne Acidification and National/regional emissions (solid, liquid and gaseous)
 - **Interpretation:** Sensitivity analysis is easily conducted, with various tools available to compare two or more operations.
- i) **Hybrid LCA:** No

3.36. trainEE

a) **Description:**

This is a software package for calculating Life Cycle Costs and environmental indicators or impact categories from life cycle assessment as well as other indicators.

The basics were developed at the Technical University of Berlin in a three years research project funded by the German ministry of research and technology, with participants from the railway industry. In the following, the software was made more user friendly and thoroughly tested for several months. trainEE models the „life of a long living good “ over time, calculating results for time units (like years) and also aggregated results. Users can modify the level of detail.

b) **Sector specific:**

Originally designed for railway vehicles and for components of railway vehicles, but it has been extended to the calculation of other long living goods.

c) **Screening LCA tool:** trainEE is not a software for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is included in the tool.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** trainEE is a tool for assessing Life Cycle Costs. trainEE calculates environmental and economic indicators on a consistent methodological basis and thus provides a necessary condition for a comparison of environmental and economic results.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** In trainEE stochastic processes and scheduled processes may be modelled as well
- **Impact Assessment:** Currently only midpoint impact categories
- **Interpretation:** Different scenarios can be compared (subtracted, set in relation). Otherwise currently no specific interpretation method, though trainEE can be coupled with the LCA - Evaluator tool (see separate description)

i) **Hybrid LCA:** No

3.37. Umberto 5.5

a) **Description:**

Umberto is a flexible and powerful software tool for modelling, calculation, visualization, and evaluation of material and energy flows. Industries with material- and cost-intensive production, such as the chemical, semiconductor, waste management, and printing industries, use Umberto extensively. A proven tool with a known success record and intuitive user-interface, Umberto is also embraced by consulting businesses and research facilities in the completion of many successful projects.

The strength of Umberto lies in its versatility. The software can be used regardless of the size of a company or the industry you operate in, and it can be adapted to meet your specific needs. Umberto keeps track of inventory and simulates your processes and systems. The results give significant support for critical decisions.

The main task of Umberto is to model and optimize production processes. Umberto is flexible enough to display even the most complex process with the level of detail needed for each decision. The user can look at the highest level, say the whole company, and then zoom into a specific product line, or even a specific process. The modelling process itself can also start on a high level, with extensive detail added later as it is needed. These models consider all relevant causal relationships and transparently show the consequences of changing parameters. This allows you to reliably determine the effectiveness and results of optimization measures, even before you invest time and capital into their implementation.

Umberto also supports life cycle assessments. To facilitate this assessment, Umberto provides a module library that contains extensive data sets on numerous generic upstream and downstream processes (including ecoinvent data). These data consider all relevant flows and enable Umberto to provide visualization of the entire process – from raw material extraction to waste disposal. This way it is easy to analyze various scenarios until the optimal and most ecologically sensible production process is identified.

Regardless of the industry, Umberto can be adapted and customized to special needs, objectives, and operational contexts. Umberto's open concept allows connecting it to standard business software like SAP, avoiding redundant data entry. The user can export all Umberto data through a variety of interfaces, and you can also import company data from other systems. You can build up your own process library and easily reuse processes or partial models in ever-changing new contexts. Umberto optimally adapts to your requirements.

b) **Sector specific:** No

c) **Screening LCA tool:** Umberto 5.5 is not a software for screening LCA

d) **Eco-design approach:** Design for Environment (DfE) is not included in the tool

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:**

Umberto allows connecting process viewpoint and business viewpoint on the one hand, to life cycle assessment and life cycle costing (LCC) on the other hand. This unique perspective provides powerful insight into process and operation optimization.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** In Umberto complex process structures can be modelled as simply as networks with only few elements. The degree of detail can be varied according to the quantity and quality of data and the goal of the study. A process can be specified using the coefficients between input and output flows. The input and output flows in the production process are linearly dependent. Process specification may also contain non-linear functions or parameters. Also dynamic and time-dependent process specifications are possible. For each value the data quality can be stated to provide information on the origin of data. The calculation is done sequentially and locally, independent of the calculation direction; i.e. the calculation direction does not depend on the direction of the material flow but only from the information already known and the information, which is lacking and thus has to be calculated. Using the process specification, Umberto will determine all material and energy flows of the system.
- **Impact Assessment:** Umberto includes the following impact assessment methodologies: Ecoindicator 99, CML 2001, Swiss Ecopoints, German EPA method, Cumulated Energy

Demand. For ecoinvent additionally we provide Impact 2002 respectively all impact assessment systems provides with the current ecoinvent version.

- **Interpretation:** Inventories for the systems under study often contain enormous amounts of data, which may be of variable relevance as to the goal of the study and questions set forth. Umberto therefore allows to flexibly aggregate inventory results and to calculate condensed indicator values. There are various ways to analyze balances: according to materials, to contributions of individual processes, e.g. to the energy consumption of the entire system, or according to the pollutant entries in environmental media, etc. In complex systems individual network elements or subnets can be selected for which a balance is to be drawn up. A model can be analyzed from a product, a process or a site perspective. For the corporate perspective also period-oriented assessments are relevant, so result can be created for monthly, quarterly or yearly reports. Umberto also allows the comparison of two or more balances. The entire balance sheet or parts of it can be displayed in different diagram types

i) **Hybrid LCA:** No

3.38. USES-LCA

a) **Description:**

The multi-media fate, exposure and effects model USES-LCA was developed based on the Uniform System for the Evaluation of Substances 2.0 (USES 2.0). Toxic Equivalency Factors (TEF) include in calculations environment fate, human exposure and toxic effect. The new fate and exposure module of USES-LCA was applied to calculate human population intake fractions and fate factors of the freshwater, marine and terrestrial environment for 3393 substances, including neutral organics, dissociating organics and inorganics, emitted to 7 different emission compartments. Apart from the fate and exposure update, a new method to derive cancer and non-cancer human damage and effect factors of toxic pollutants was developed. Human damage factors are expressed as Disability Adjusted Life Years (DALY). Human effect factors contain a disease-specific and a substance-specific component.

The tool is available in version: USES-LCA 2.0 (free of cost): USES-LCA 2.0 + database are available free of charge from the website.

b) **Sector specific:**

Toxic Equivalency Factors (TEF) are standard values used in Life Cycle Assessment (LCA) and Comparative Risk Assessment (CRA) to enable a comparison of toxic impacts between substances. The new method has been applied to calculate combined human damage and effect factors for 1,192 substances.

c) **Screening LCA tool:** USES-LCA is not a tool for screening LCA

d) **Eco-design approach:** No Design for Environment (DfE) included in the tool - USES-LCA

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** USES-LCA software allows to assess Life Cycle Cost

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** This information is not available
- **Impact Assessment:** Life Cycle Impact Assessment for toxic chemicals (human toxicity and ecotoxicity) is on the midpoint and endpoint level.

- **Interpretation:** This information is not available

i) **Hybrid LCA:** No

3.39. Verdee

a) **Description:**

The approach of Graedel's Streamlined LCA method was followed for its development, but also innovative characteristics have been added. The tool is implemented on a CD-ROM. It includes two main parts: 1) the self assessment procedure (goal and scope definition, inventory, checklist, assessment matrixes, target plot) and a help-on-line system (procedure description, valuation rules, database and case study); 2) the informative part, which includes the background information about environmental and methodological issues.

The tool is available in version: VerdEE (free of cost): The CD ROM can be requested free of cost.

b) **Sector specific:** No

c) **Screening LCA tool:** Verdee is a screening LCA tool (streamlined LCA).

d) **Eco-design approach:** VerdEE is a tool for the adoption of the life cycle thinking approach in SMEs. Target users are environmentally non-expert designers and engineers of SMEs.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** Verdee software allows to assess Life Cycle Cost

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** The life cycle was divided in 5 steps: pre-manufacturing, manufacturing, distribution and use, waste management, life cycle of packages. Demand for data collection was limited in order to minimise time requirements. Pre-defined forms, which can be completed in a semi-quantitative way, help non-expert users understand the life cycle concept.
- **Impact Assessment:** The main environmental concerns taken into account were the following: material choice, use of energy and water, solid waste emissions, liquid emissions, airborne emissions. Checklists and scoring rules for quantitative and qualitative aspects allow identifying the critical points in the eco-efficiency matrix (5x5, life cycle phases vs. environmental concerns) and target plot.
- **Interpretation:** A checklist aimed at analysing improvement opportunities and scoring rules for improvement analysis are available. Supporting tools for this self-assessment are also provided. The results can be shown in a 5x5 improvement matrix and in a target plot.

i) **Hybrid LCA:** No

3.40. WAMPS, betaversion

a) **Description:**

WAMPS is based on many years of research and applied studies on direct and indirect impacts of waste management strategies.

The tool is available in version: beta version: contact IVL for information

- b) **Sector specific:**
 - Waste: WAMPS is a software to assist the decision maker to evaluate waste management strategies.
 - c) **Screening LCA tool**: WAMPS is an LCA based screening tool for assessing environmental and economic aspects of different waste management strategies.
 - d) **Eco-design approach**: No Design for Environment (DfE) included in the tool.
 - e) **Application for laws/regulatory compliance**: No
 - f) **Life Cycle Cost**: This information is not available
 - g) **Social Life Cycle Analysis**: No
 - h) **LCA**:
 - **Inventory**: This information is not available
 - **Impact Assessment**: This information is not available
 - **Interpretation**: This information is not available
 - i) **Hybrid LCA**: No
-

3.41. WISARD 4.0

- a) **Description**:
 Ecobilan's Waste Management Life Cycle Assessment software tool (WISARD) is used by Environmental Agencies, Local Authorities and by Industry to evaluate the relative environmental performance of alternative waste management options.
 WISARD allows to model easily alternative waste management including landfilling, incineration, sorting - recycling, composting and anaerobic digestion. Users can access scroll-down menus and select parameters by clicking on boxes. All scenarios are automatically checked for consistency providing guidance if problems occur.
- b) **Sector specific**:
 - Waste: WISARD is a unique program to assist the decision maker to evaluate alternative waste management scenarios.
- c) **Screening LCA tool**: WISARD 4.0 is not a screening LCA tool.
- d) **Eco-design approach**: No Design for Environment (DfE) included in the tool.
- e) **Application for laws/regulatory compliance**: No
- f) **Life Cycle Cost**: WISARD 4.0 software allows to assess Life Cycle Cost
- g) **Social Life Cycle Analysis**: No
- h) **LCA**:
 - **Inventory**: Ecobilan/Ecobalance has one of the largest Life Cycle Assessment database with rigorous systems in place to ensure Data Quality. WISARD is provided with a core set - 'Starter Kit' - of data. Additional data sets may be purchased by the user as appropriate and the tool is customisable according to specific needs (region, processes specifications...) In addition, users can collect and create their own data sets either directly or by adapting from the data sets provided.
 - **Impact Assessment**: WISARD incorporates all major impact assessment methodologies. This enables the user to calculate impact potentials using a variety of different published methods. Respecting that impact assessment methodology is the subject of much debate,

WISARD provides the user with extensive help files and cautionary notes to assist with the interpretation of impact assessment results.

- **Interpretation:** This information is not available

i) **Hybrid LCA:** No

3.42. WRATE

a) **Description:**

WRATE (Waste and Resources Assessment Tool for the Environment) is waste management Life Cycle Assessment (LCA) software developed by the Environment Agency of England and Wales.

WRATE uses a life cycle approach to predict the environmental consequences of integrated waste management systems for municipal solid waste. It can achieve this for all life cycle stages including: home composting, waste collection, transport, transfer, pre-treatment, treatment, recovery and disposal. WRATE balances the process environmental burdens caused by managing wastes against any avoided burdens due to materials recycling and energy recovery. As such WRATE can direct attention to the point where change in a system will be most effective, ensuring that impact reduction at one point in a system does not lead to an increase in impacts elsewhere.

WRATE is a decision-support tool that can be used in a range of applications: in waste plans, strategic policy decisions, sustainability appraisals, strategic environmental assessment, impact assessment, waste management services tender procurement and process engineering applications.

WRATE's user interface is multilingual and separate databases are employed to reflect national conditions, including energy production (50 national energy mixes are already available in the tool), waste technologies etc.

b) **Sector specific:**

- Waste: WRATE is Life Cycle Assessment (LCA) software designed specifically to improve the management of waste in integrated municipal solid waste management systems.

c) **Screening LCA tool:** WRATE is not a screening LCA tool.

d) **Eco-design approach:** No Design for Environment (DfE) included in the tool.

e) **Application for laws/regulatory compliance:** No

f) **Life Cycle Cost:** WRATE includes the processes environmental costs and benefits of resources used, transport and the operational impacts of materials, and energy treated downstream from WTDC processes. It includes the ecoinvent v1.2 database that is used to estimate the life cycle costs for the materials and energy that are used or recovered by processes.

g) **Social Life Cycle Analysis:** No

h) **LCA:**

- **Inventory:** The expert version of WRATE provides detailed results functionality which permits full transparency to the inventory. The inventory can be aggregated/disaggregated into every phase of the life cycle and can be ordered according to contribution. In the expert version, individual processes can be disaggregated into each type of burden e.g. operational inputs, capital burdens, avoided burdens etc. The standard version permits

aggregation/disaggregation of the inventory to the point where the background database is masked.

- **Impact Assessment:** Six default Life Cycle Impact assessments are provided in the standard version of WRATE that have been selected as most relevant to the waste management sector. The expert version of WRATE provide 50+ impact assessment methods. In each version impact assessment methods can be disaggregated to every phase of the life cycle and ordered.
- **Interpretation:** Guidance is provided in the tool regarding the analysis and interpretation of results. In addition, the software forces users to complete a full audit trail for undertaking studies and for specific data development. Results for impact assessment indices can be normalized to European inhabitant equivalents for comparative purposes. All results are provided in realtime, or quicktime so iterations to system parameters and the effect of sensitivity analyses can be appreciated rapidly.

i) **Hybrid LCA:** No

4. ANALYSIS OF DATABASES

4.1. DEAM™

a) **Description:**

The TEAM™ software comes with a Starter Kit database of over 300 modules to use in the construction of almost any system.

The modules provided in the Starter Kit are only a subset of the those available in the Ecobilan Group's general catalogue of data (referred to as DEAM™- Data for Environmental Analysis and Management).

b) **Sector specific:** Yes

These modules cover the range from fuel production to transportation and from chemical production to plastic molding.

c) **Country specific:** No

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.2. DEAM™ Impact

a) **Description:**

Greenhouse effect, energy consumption, resource depletion, ozone depletion, tropospheric ozone creation, air acidification, eutrophication, emissions to soils, human and ecotoxicity methods from different sources (IPCC, CML, Ecobilan, USES, FRED....) and weighting methods (Eco-indicators, Ecopoints...). Over 120 impact and weighting methods available. Ecobilan considers adding some normalization methods in the future.

b) **Sector specific:** No

c) **Country specific:** No

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** Yes

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.3. DIM 1.0

a) **Description:**

Each DB item is described in terms of elementary flows (a simplified set of 65 flows) and processes already included in the DB. Each dataset is documented by metadata including a technical description, a set of data quality scores, information about data collection, origin and generation method. A utility is available to calculate the LCIA results and export them as XML file. This makes it possible to populate the database of the impact indicators in eVerdEE and to update it with the new processes. The direct access to DIM is private.

b) **Sector specific:** No

The DIM database includes both general and specialized datasets of Life Cycle Inventories (LCI) covering different background systems (energy, materials, transport, packaging) and product chains (lighting and lamps, printed circuit boards, kitchen furniture, office desks, textile finishing processes).

c) **Country specific:** No

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.4. Ecoinvent Data v1.3

a) **Description:**

Data are based on the production and supply situation in the year 2000 with a global/european/swiss coverage. Capital goods (roads, transport means, power plants, electricity network, chemical plants) are consistently included. More than 2'700 datasets (supplied in EcoSpold format) are available on the levels of unit processes as well as product systems. About 1'000 elementary flows are reported for each dataset, including emissions to air, water and soil, mineral and fossil resources and land use.

The ecoinvent data v1.3 is the solution for data needs in Integrated Product Policy (IPP), Environmental Product Declaration (EPD), Life Cycle Assessment (LCA), Life Cycle Management (LCM), Design for Environment (DfE).

A reference work for consistent life cycle inventory data including the following areas:

- Electricity mixes: electricity mixes of 25 European countries, incl. trade, transport and distribution on high, medium and low voltage
- Power plants: Power plants based on hard coal, lignite, peat, fuel oil, natural gas, industrial gas, nuclear energy, hydro (run-of river, storage and pumping storage), wind, solar, and biomass. Country - specific data with regard to emission factors and efficiencies.
- Fuel and heat supply: Supply of hard coal, lignite, light and heavy fuel oil, petrol, diesel, kerosene, LPG, natural gas (high and low pressure network), wood (logs, chips and pellets). Heat and steam supply based on the aforementioned fuels.
- Construction materials: mineral materials such as bentonite, bricks, cement, clay, concrete, fibre cement, gravel, gypsum, insulation materials, limestone, sand, tiles.
- Basic Chemicals: main bulk organic and inorganic chemicals such as ammonia, carbon dioxide, caustic soda, hydrogen, silicones, sulphuric acid, and acetylene, carbon black, formaldehyde, methanol, phenol, toluene, and xylenes.
- Metals: aluminium, brass, bronze, cast iron, chromium, cobalt, copper, lead, magnesium, manganese, mercury, molybdenum, nickel, steel (un-alloyed, low alloyed and stainless), tin, zinc; metal processing such as drawing, rolling, welding; precious metals: palladium, platinum, and rhodium. Where appropriate and available: primary production, secondary production and supply mix.

- Transport services: goods transports by airplane (Europe and intercontinental), ship (oversea and inland), train, van and truck (different sizes). Passenger transports by private car, bus, tramway, regional, intercity and high-speed train, airplane (Europe and intercontinental).
- Waste management services: incineration, inert, residual and sanitary landfilling, hazardous waste incineration, hazardous and nuclear waste underground deposits, land farming, building demolition, waste water treatment. Data are waste-specific.
- Wood materials: forestry, sawmill and supply of construction wood, feedstock for paper production, fuel.
- Agriculture: seed growing, cultivation, harvesting of basic agricultural commodities. Differentiation between organic, integrated, extensive and intensive production.

b) **Sector specific:** No.

The ecoinvent data v1.3 contains international industrial life cycle inventory data on energy supply, resource extraction, material supply, chemicals, metals, agriculture, waste management services, and transport services.

c) **Country specific:** No.

The ecoinvent data v1.3 is used by more than 1000 members in more than 40 countries worldwide and is included in the leading LCA software tools as well as in eco-design tools for building and construction, waste management and product design.

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.5. EIME V8.0

a) **Description:**

The database contains Life Cycle Inventories from cradle to gate of materials process and electric and electronic components manufacturing, developed according to the ISO 1404x standards in partnership with electrical and electronic component manufacturers.

b) **Sector specific:** Yes

- Energy: This database is dedicated to the description of electrical, mechanical and electronic products.

c) **Country specific:** No

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.6. Esu-services database v1

a) **Description:**

Most of them are documented according to the ecoinvent methodology and nomenclature. The offer includes a transparent description of the life cycle inventory including all entries to the

inventory, a short life cycle impact assessment (LCIA) and a discussion of the results. The reports are written in English (if not stated otherwise). The data can be transferred to the formats used by different software products (e.g. SimaPro, Umberto, GaBi).

Databases include the following areas:

- Bentonite, Base Oil, Lubricants, Bleaching Earth: Data delivered in the format of Life cycle inventories of energy systems
- Cotton T-Shirt, wool: Data delivered in EcoSpold and in the format of Life cycle inventories of energy systems. Documentation in German.
- Drinks: Apple juice, Beer, Orange juice, Mineral water, Wine, Milk: Data delivered in EcoSpold and in the format of Life cycle inventories of energy systems. Documentation in German.
- Food consumption: vegetables, meat, packages, transports, consumption: Data delivered in EcoSpold format. Datasets in English, documentation in German.
- Fruits: Apples, Strawberries, Cherries, Grapes, Oranges, Vine: Data delivered in the format of Life cycle inventories of energy systems. Documentation in German.
- Gold and Silver: Data delivered in EcoSpold format. Datasets and documentation in English.
- Household appliances: cooking stoves, refrigerator, washing machine: Data delivered in EcoSpold format and in the format of Life cycle inventories of energy systems.
- Leather, shoes: Data delivered in the format of Life cycle inventories of energy systems. Documentation in German.
- Lithium, Lithium Carbonate, Lithium Chloride: Data delivered in the format of Life cycle inventories of energy systems. Documentation in English
- Packages: bottles, vegetables and meat packages: Data delivered in EcoSpold format.
- Processed food: Cheese, butter, coffee, etc.: Data delivered in EcoSpold format.
- Tap water: infrastructure, processing: Data delivered in EcoSpold format.
- Vanadium Pentoxide (V₂O₅) produced from power plant granulate or furnace slag: Data delivered in the format of Life cycle inventories of energy systems. Documentation in English

b) **Sector specific:** No.

Esu-services database is a compilation of various transparently reported and fully documented life cycle inventories.

c) **Country specific:** No

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.7. Eurofer data sets

a) **Description:**

Data collection exercises are being undertaken for both carbon and stainless steel. The data set includes the burden and credit associated with the recycling of steel scrap during steel

production, manufacturing and End-of-Life. For this, the current global average recycling rate is estimated to be 80 %.

For specific steel data set requests contact the European Confederation of Iron and Steel Industries, Eurofer (European data): www.eurofer.org; the International Iron and Steel Institute, IISI (Global data): www.worldsteel.org; the International Stainless Steel Forum, ISSF (Global Stainless Steel data) www.worldstainless.org; and APEAL (Steel packaging data): www.apeal.org.

b) **Sector specific:** Yes

- Iron and Steel Industry: data are provided, electronically, for a number of carbon and stainless steel products.

c) **Country specific:**

The data sets are based on average site-specific data (gate-to-gate) of European and Global steel producers, over the period of one year. Electricity grid mix is country-specific (European average for stainless steel). Other upstream data (e.g. iron ore production) are based on global averages.

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.8. GaBi databases 2006

a) **Description:**

The GaBi software family provides you with 100% compatible databases, which form the highly esteemed basis for professional LCA work in decision-support in companies and in leading research institutions. All GaBi databases are developed, maintained, and regularly updated since 1990 by PE International jointly with LBP (formerly "IKP"), University of Stuttgart resulting in an fully consistent and very extensive data basis. In addition, the ELCD, the ecoinvent, APME, and EDIP data sets are provided as additional data basis.

The contained data sets are based on the experience of cooperation with the industry, patent and technical literature and make GaBi to one of the most extensive databases worldwide.

b) **Sector specific:** No

The wide range of the data sets cover many industrial branches like metals (steel, aluminium and non ferrous metals), organic and inorganic intermediate products, plastics, mineral materials, energy supply (steam, thermal energy, power grid mixes), end-of life, coatings, manufacturing and electronics, construction materials, renewable materials, and textile processing.

The GaBi databases 2006 with fully consistent GaBi extension databases offer presently access to more than 2300 inventory data sets of high to highest quality for all types of materials, energy carriers, services, and processing technologies.

c) **Country specific:** No

The GaBi database system includes data sets for e.g. electricity-mix data sets of more than 70 countries and regions, inorganic and organic intermediates, many plastics for different countries and thermal energy and steam for many different European countries

- d) **I/O data integration:** This information is not available
 - e) **Data for Life Cycle Cost:** Yes
 - f) **Data for Social Life Cycle Analysis:** Yes, in the upcoming version
 - g) **Consequential:** This information is not available
-

4.9. GEMIS 4.4

a) **Description:**

The GEMIS database covers processes for energy (fossil, nuclear, renewable), materials (metals, minerals, food, plastics...), and transport (person and freight), as well as recycling and waste treatment processes. Material conversion processes are based on EU data, with regional differentiation for extraction (AU, CA, RU, ZA), and processing (e.g. for aluminium, steel). Transport processes are based on EU and US data, with special processes for developing countries. Currently, about 10,000 data entries exist in the process database, and some 1,000 products (especially energy carriers with ultimate analysis, and costs).

Sector specific: No

The GEMIS database offers information on:

- fossil fuels (hard coal, lignite, natural gas, oil), renewables, nuclear, biomass (residuals, and wood from short-rotation forestry, miscanthus, rape oil etc) and hydrogen (including fuel composition, and upstream data)
- processes for electricity and heat (various powerplants, cogenerators, fuel cells, etc.)
- materials: raw and base materials, and especially those for construction, and auxiliaries (including upstream processes)
- transports: airplanes, bicycles, buses, cars, pipelines, ships, trains, trucks (for diesel, gasoline, electricity, and biofuels).

b) **Country specific:** No

The database covers all EU-27 countries for energy plus AU, CA, NO, RU, US, and various developing countries (BR, CN, IN, MA, MX, ZA).

- c) **I/O data integration:** In GEMIS 4.4 also, monetary IO tables can be included for hybrid modeling.
 - d) **Data for Life Cycle Cost:** GEMIS can also provide information about costs - the respective data are implemented for fuels and energy systems.
 - e) **Data for Social Life Cycle Analysis:** This information is not available
 - f) **Consequential:** This information is not available
-

4.10. IO-database for Denmark 1999

a) **Description:**

Database based on the Danish National Economic and Environmental Accounting Statistics for 1999. A number of modifications/improvements have been made to these basic data in order to make them more relevant for LCA purposes.

These modifications include:

All substances that contribute significantly (more than 1.5%) to the normalization reference for Denmark provided by the Danish LCA methodology EDIP have been added.

Data on land use has been included.

Several industries were disaggregated based on data in the underlying supply-use tables and other statistical sources.

Investments (capital goods) of each industry has been linked to the industries supplying the investment goods, based on the investment matrices of Statistics Denmark.

Similarly, expenditures for financial intermediation services indirectly measured (FISIM), i.e. bankers' net interest, have been linked to the financial industries supplying the loans.

Imported products were modelled by a version of the US data supplied by Suh (CEDA 3.0. Comprehensive Environmental Data Archive of the US. Leiden: CML, Leiden University 2003) modified to better reflect European conditions.

Constrained supplies are transferred to the alternative non-constrained industry. An attributional version of the database, where this modification has not been made is available separately.

Service (labour) outputs of commodity producing industries ('Lønarbejde' in the commodity statistics) have been eliminated (as labour does not carry any environmental impact) and are instead recorded as direct wages of the service-receiving industries.

The main omissions of toxic substances are believed to be the omission of PAH emissions to water and hydrogen cyanide to air and for imported products that metals to soil and vinyl chloride and chlorine to air are not included.

The data (and the Danish normalization reference) do not cover the following impacts, which are believed to be important: Species dispersal, Poverty-related health issues and other socio-economic impacts, Accidents, Occupational health, and Noise.

- b) **Sector specific:** No
- c) **Country specific:** Input-output database on the Danish economy
- d) **I/O data integration:** Input-output database
- e) **Data for Life Cycle Cost:** Yes
- f) **Data for Social Life Cycle Analysis:** Yes
- g) **Consequential db:** This information is not available

4.11. IVAM LCA Data 4.04

a) **Description:**

The IVAM LCA database is a compilation of several well-known databases such as APME (plastics, chemicals), Buwal and ETH96 and additional LCA data originating from own LCA-studies. It consists of well over 1.300 unit processes. The nomenclature of the database is adapted to the Standard SimaPro database and the Ecoinvent database for SimaPro to achieve maximum compatibility. For the purpose of consistency all processes contain data quality information. Specific features are the addition of land use data methods in all processes (including land use assessment method) and the use of 'switch' processes for energy and transport enable easy change to other processes, i.e. for the purpose of sensitivity analysis.

b) **Sector specific:**

The database is especially comprehensive on the subjects of building and construction sector, food production and waste management.

- c) **Country specific:** No
- d) **I/O data integration:** This information is not available
- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** This information is not available
- g) **Consequential:** This information is not available

4.12. KCL EcoData

a) **Description:**

KCL-ECO software has been developed for performing LCA calculations and module calculations in general. KCL-ECO makes it easy to handle very large systems. Thanks to KCL-ECO's transparent structure, transports can be studied separately, and carbon flows can be easily followed throughout the value chain.

Altogether the database includes nearly 300 data modules covering the following sectors:

- energy production back-pressure and condensation power plants using different fuels (BAT, average or low technology)
- chemicals manufacturing (pulp and paper chemicals)
- wood growth and harvesting operations for spruce, pine and birch
- pulp, paper and board mills (typical product specific processes based on Finnish/Nordic production technology)
- deinking processes for different printing papers and tissue papers
- printing
- waste management operations (paper incineration, landfill)
- transport data for trucks, trains and ships, covering the transport of both raw materials and product
- plastics

b) **Sector specific:** Yes

- Forest Industry: KCL EcoData is a continuously updated LCI database is primarily intended for life-cycle inventory calculations related to forest products. EcoData contains unique and detailed process descriptions of various pulp, paper and board grades.

- c) **Country specific:** No
- d) **I/O data integration:** This information is not available
- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** This information is not available
- g) **Consequential:** This information is not available

4.13. LCA Database for the Forest Wood Sector

- a) **Description:** This information is not available
- b) **Sector specific:**
 - LCA Database for the Forest Wood Sector
- c) **Country specific:** This information is not available
- d) **I/O data integration:** This information is not available

- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** This information is not available
- g) **Consequential:** This information is not available

4.14. LCA_sostenipra_v.1.0

a) **Description:**

The database is found online in the PRIVATE AREA. The data compiled is national and current data used to characterize the different processes of the main topics mentioned above. This database does not contain inventories of the different process included in the analyzed system. However this database supposes a reliable data of several productive processes which can be used by leading research institutions or private enterprises. The data is organized by topic, the project title and the team. The main projects included below are:

EnergyCrops_Agrosost;
ForestBiomass_Policy;
WoodUseGasification_Policy;
WoodUsePallets_Policy;
WoodUseSpools_Policy;
Ecodesign_Urbanelements.

b) **Sector specific:** No

The database contains several information in different research topics, such us: biomass production (energy crops and forest biomass), wood use and recycling (energy and products), ecodesign, sustainable architecture, service systems and green chemistry.

c) **Country specific:** No

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.15. MFA_sostenipra_v.1.0

a) **Description:**

The database is found online in the PRIVATE AREA and contains the MFA data of Catalonia.

b) **Sector specific:** No

c) **Country specific:** Yes

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** This information is not available

f) **Data for Social Life Cycle Analysis:** This information is not available

g) **Consequential:** This information is not available

4.16. Option data pack

a) **Description:**

- b) **Sector specific:**
 - The option data pack includes a total of 967 inventory data from chemical production, iron & steel and waste management process data. The chemical substance database considered the in house generation using statistical data.
- c) **Country specific: Yes. Japan**
- d) **I/O data integration: This information is not available**
- e) **Data for Life Cycle Cost: This information is not available**
- f) **Data for Social Life Cycle Analysis: This information is not available**
- g) **Consequential: This information is not available**

4.17. PlasticsEurope Eco-profiles

- h) **Description:**

To properly understand the meaning of these data, it is highly recommended to read attentively the accompanying methodology document. These data are intended for calculations needed for the Life Cycle Assessment of products or services. Comparison between products or services shall be made according to ISO standards, on the basis of functional units delivering the same useful service, not e.g. on the basis of the same weight of material.
- i) **Sector specific:** Gives, for the main polymers and their intermediates, as produced in Europe, average cradle to factory gate environmental data (LC inventory).
- j) **Country specific:** Polymers and their intermediates which are produced in Europe.
- k) **I/O data integration:** This information is not available
- l) **Data for Life Cycle Cost:** This information is not available
- m) **Data for Social Life Cycle Analysis:** This information is not available
- n) **Consequential:** This information is not available

4.18. ProBas

- a) **Description:**

ProBas is a database containing more than 7,000 unit process datasets useful for a diversity of life cycle management applications. ProBas data are freely available over the internet. The ProBas website provides extended search and data filtering options as well as fast access to the data records. Downloading data is possible in Excel and PDF formats, and a Help system is offered.

ProBas is not a data source itself, but rather a compilation, a “library”, of data from very different sources. Since the access to ProBas is free of charge, the data stock is restricted to free available data, such as the GEMIS database (Global Emission Model for Integrated Systems) from Oeko-Institut, ZSE emission database from Umweltbundesamt, various data from Plastics Europe etc.

It is intended to enlarge the ProBas data stock continuously. Potential data sources can be public sponsored research or development projects. Also publications by enterprises or industry associations may contain appropriate process data. Any advice to publicly available data sources is highly appreciated.

- b) **Sector specific:** No
- c) **Country specific:** no
- d) **I/O data integration:** This information is not available
- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** This information is not available
- g) **Consequential:** This information is not available

4.19. Sabento library 1.1

- a) **Description:**
- b) **Sector specific:**
Large library with modules for enzymatic processes, cell cultures, and microbiological systems of production.
- c) **Country specific:** No
- d) **I/O data integration:** This information is not available
- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** This information is not available
- g) **Consequential:** This information is not available

4.20. SALCA 061

- a) **Description:**
SALCA (Swiss Agricultural Life Cycle Assessment) is a life cycle assessment method and database developed by Agroscope Reckenholz-Tänikon Research Station ART.
The SALCA database (Swiss Agricultural Life Cycle Assessment database) contains over 700 modules relating to agriculture with agricultural and non-agricultural inputs, outputs and processes. The data stored are based on in house calculations, the ecoinvent database and on data imported from other LCA study inventories.
SALCA comprises the following elements:
 - A database with agricultural life cycle inventories.
 - Models for determining direct field and farm emissions, such as nitrate, nitrous oxide, methane, ammonia, phosphorus and heavy metals.
 - A selection of methods for assessing the impact of environmental issues that are particularly relevant to agricultural systems: demand for non-renewable energy resources, land occupation, global warming potential, eutrophication, acidification, ozone formation, human toxicity and ecotoxicity (water and soil).
 - Methods developed by ART for assessing the impact of the biodiversity and soil quality categories, which have mostly been disregarded in LCAs until now.
 - Calculation tools for frequently studied agricultural systems (crops at field level and farms).
The required life cycle inventories from the SALCA database and the models for calculating direct field and farmyard emissions have been combined into a complete system with the aid of the TEAM LCA software marketed by PricewaterhouseCoopers-Ecobilan.

- Results are displayed in bar chart form, based on the selected reference variable (e.g. area, yield in kg or nutritional value). This allows to analyse the contributions of the different inputs to the impact categories on the basis of reference values for farms of the same type.
- b) **Sector specific:**
- Agriculture: It is used for the purposes of analysing and optimising the environmental impacts of agricultural production. The method is currently used in agricultural life cycle research.
- c) **Country specific:** No
- d) **I/O data integration:** This information is not available
- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** This information is not available
- g) **Consequential:** This information is not available

4.21. SimaPro database

a) **Description:**

SimaPro comes with a set of third party, public databases published by industries and well-known data providers.

The following inventory or LCA databases are included or available for SimaPro 7:

- Ecoinvent v1 and Ecoinvent v2 (v2 available November 2007) - General purpose database with over 2700 industrial processes. Data are included as unit processes and calculated results (systems). The unit processes contain uncertainty data, to allow Monte Carlo Analysis.
- US Input Output database - Input-output database on 481 sectors of the US economy
- Danish Input Output database - Input-output database on the Danish economy
- Dutch Input Output database - Economic Input Output database
- Industry data - Inventory data provided by industry associations. Mostly cradle to gate data.
- LCA food database - The present LCAfood database provides environmental data on processes in food products' product chains and on food products at different stages of their product chains in Denmark.
- ETH-ESU 96 - Energy. Electricity generation and related processes like transport, processing, waste treatment. Includes 1200 unit processes and 1200 system (results) processes. Extensive documentation provided.
- BUWAL 250 - Packaging materials (plastic, carton, paper, glass, tin plated steel, aluminium), energy, transport, waste treatments
- IDEMAT 2001 - Engineering materials (metals, alloys, plastics, wood), energy, transport.
- Franklin US LCI database - North American inventory data for energy, transport, steel, plastics, processing.
- Data archive - Materials, energy, transport, processing, waste treatment.
- IVAM database - Materials, transport, energy and waste treatments. Mostly focused on Dutch data

b) **Sector specific:** No

c) **Country specific:** No

- d) **I/O data integration:** Yes
 - e) **Data for Life Cycle Cost:** Yes
 - f) **Data for Social Life Cycle Analysis:** This information is not available
 - g) **Consequential:** This information is not available
-

4.22. sirAdos 1.2.

- a) **Description:**

LEGEP uses this large set of data to combine them with physics, life cycle costs and LCI and LCA data. By means of these ready made data the user is able to model new construction elements if necessary.
 - b) **Sector specific:**
 - Building: These data can be used then to model buildings of any kind and use.
 - c) **Country specific:** No
 - d) **I/O data integration:** This information is not available
 - e) **Data for Life Cycle Cost:**

The sirAdos database includes over 20.000 specifications and constructions elements with information about costs. The cost-information are prices of the market.
 - f) **Data for Social Life Cycle Analysis:** This information is not available
 - g) **Consequential:** This information is not available
-

4.23. The Boustead Model 5.0.12

- a) **Description:**

The database is split into two parts. The first of these, called the Core, contains data for 33300 unit operations, which include fuel production and processing operations for almost every country (27000 operations in total), as well as over 6000 materials processing operations. All of the materials processing data is industry derived — in fact much of it has been determined using the Boustead Model! The second part of the database, called the Top, has space for a further 6000 unit operations and is available to construct user operations. This can be further extended if required (subject to hard disc space). This elegant yet tested structure enables complex structures like networks and open- and closed-loop recycling operations to be easily modelled. A list of included operations can be downloaded from the website.
 - b) **Sector specific:** No
 - c) **Country specific:** No
 - d) **I/O data integration:** This information is not available
 - e) **Data for Life Cycle Cost:** This information is not available
 - f) **Data for Social Life Cycle Analysis:** This information is not available
 - g) **Consequential:** This information is not available
-

4.24. Umberto library 5.5

- a) **Description:**

In the Umberto all data is documented transparently including the data sources and technological constraints.

Process data collected on site can be easily incorporated in the library. Besides the standard import/export possibilities, Umberto also features an EcoSpold interface to conveniently use other LCI data sources, e.g. from the US NREL database.

In the Umberto process library the user has access to several hundred modules from various fields of application: auxiliary processes occurring in companies, e.g. energy supply (e.g. electricity-mix data sets of different countries and regions), waste disposal (e.g. different sewage plants), transport (different lorries, trains, ships, planes as parameterised models), provision of raw materials and basic materials such as plastics, metals (various steel, aluminium, several non-ferrous and precious metals), building material, fibres, renewable materials (wood, paper, cardboard, etc.) etc

- b) **Sector specific:** No
- c) **Country specific:** No. In Umberto data are for different countries and regions
- d) **I/O data integration:** This information is not available
- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** This information is not available
- g) **Consequential:** This information is not available

4.25. US Life Cycle Inventory Database

a) **Description:**

The US Life Cycle Inventory Database collects information on the environmental impact of commonly used materials, products, and processes. The LCI Database provides a central source for critically reviewed LCI data that is developed in accordance with a common research protocol, is consistent with international standards, and is maintained by the National Renewable Energy Laboratory. The US LCI Database is freely available through the project website at. One of the major objectives of this project is to keep the process and data transparent. Users can access project documentation via the website. The LCI data is available in different formats to fit different user needs. There is a streamlined spreadsheet, EcoSpold format spreadsheet, EcoSpold XML file, and a detailed spreadsheet with all the calculation details. The data can be imported into major LCA tools.

- b) **Sector specific:** No
- c) **Country specific:** The US Life Cycle Inventory Database regards United States and Canada
- d) **I/O data integration:** This information is not available
- e) **Data for Life Cycle Cost:** This information is not available
- f) **Data for Social Life Cycle Analysis:** No
- g) **Consequential:** This information is not available

4.26. Waste Technologies Data Centre

a) **Description:**

The Waste Technology Data Centre gives the facts on how waste treatment technologies work, as well as how much they cost to build and maintain. On its web pages, you can find out what types of waste the technologies accept and recycle, and what effect they have on the local community. There are case studies from equipment suppliers and users of the technology explaining how specific instances of the technologies have been implemented.

Part of the information provided on the website is a simple Life Cycle Assessment (LCA) profile for each waste technology type.

b) **Sector specific:**

- Waste: Some 40 waste treatment technologies are covered.

c) **Country specific:** No

d) **I/O data integration:** This information is not available

e) **Data for Life Cycle Cost:** The Waste Technology Data Centre provides the information how much waste treatment technologies cost to build and maintain.

f) **Data for Social Life Cycle Analysis:** No

g) **Consequential:** This information is not available

5. SUMMARY OF RESULTS

The table 1 below summarizes the results of the mapping and classification of the 42 softwares, according to the predefined parameters.

SOFTWARES										
Result	Sector specific	Screening LCA tool	Eco-design approach	Application for laws/regulatory compliance	Life Cycle Cost	Social Life Cycle Analysis	LCA			Hybrid LCA
							LCI	LCIA	LC Int.	
Yes	21	5	21	2	20	4	34	32	27	3
No	21	37	19	40	21	38	0	3	3	39
N/A	0	0	2	0	1	0	8	7	12	0

Table 1: Summary of results for softwares

The following main considerations can be derived.

All software enable the users to perform LCA studies based on a “traditional” approach; the missing information are more likely due to inaccuracy in filling in the questionnaires, rather than to a lack of functionality in the tool.

A significant number of software are addressed to a specific sector; the most represented are building/construction processes, waste/end of life scenarios and crops/agricultural products.

A considerable number of tools can support simplified approaches like eco design, but very few of them look suitable for screening LCA and regulatory compliance.

With reference to the parameters more related to the innovative and broader LCA approaches, about half of the available tools may support Life Cycle Cost modeling, but a few of them is suitable for hybrid approaches as well as to allow the integration of social aspects into the analysis.

The table 2 below provides the results of the analysis carried out on the 26 databases.

Result	Sector specific	Country specific	I/O data integration	Data for LCC	Data for SLCA	Consequential
Yes	12	6	3	7	2	0
No	14	20	0	0	0	0
N/A	0	0	23	19	24	26

Table 2: Summary of results for databases

The comments are similar to those made on the software, but there is a far larger amount of unavailable and uncertain data.

A considerable number of databases are sector specific, addressing building materials, waste management, electric and electronic products, iron and steel, food production chain, forest/agricultural products, polymers and other chemicals.

Most of the databases include a full geographic coverage, while some of them are country specific, mainly about Japan and the United States.

With reference to innovative and broader LCA approaches, the available data do not allow for a proper classification. Some databases include explicitly economic data for Life Cycle Cost modeling, few other include input/output table for data integration and data for social LCA. In most cases, no information can be derived about the presence of data on social aspects, but since most of the software do not include the Social LCA, it can be assumed that databases do not contain such data. Even the information on the applicability to consequential LCA is not obtainable from the current available information.