An emerging open source software for LCAs

Andreas Ciroth, Michael Srocka

29 August 2007

Outline

1. The openLCA project
2. A format converter as a first plugin
3. The overall LCA framework and application
4. Conclusions

GreenDeLTa TC

1. The openLCA project

Two Key ideas:

1 Create

open source,
freely available,
flexible,
high performance

software for sustainability assessment
(environment; cost; social aspects)

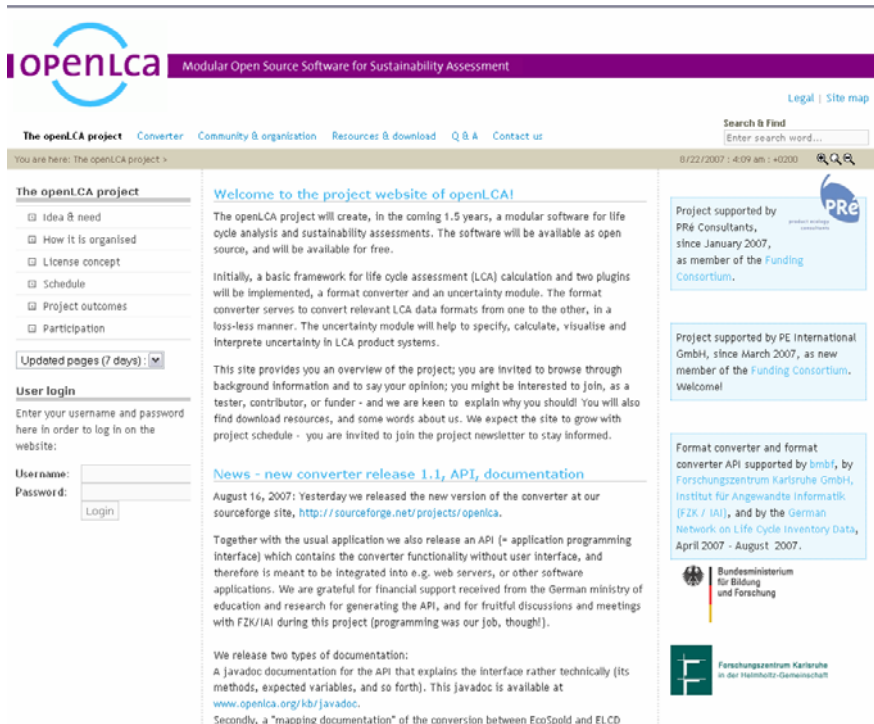
2 Build a community of users and contributors

Selected techniques

- IT: Eclipse/Java
  (→ Rich Client Application, highly modular and flexible),
  MySQL database

- Collaboration website, server,
repository:
www.openlca.org

- Additional Sourceforge site for file releases



Project schedule

Start: Autumn 2006,
foreseen end: spring 2008

Format converter: summer 2007, revision autumn 2007
LCA application and assessment framework: autumn 2007 (!)
Uncertainty module: Winter 2007

Organisation - today

Core project team: GreenDeltaTC

Funding Consortium:

PRé Consultants, PE International (thanks!!)

External advisors (US, D)

External support:

Format converter: UNEP

FZK/Netzwerk

Lebenszyklusdaten, (thanks, as well!!)

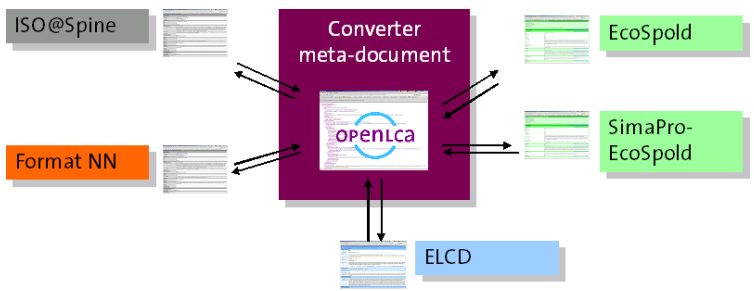
GreenDeLTa TC

(bootstrapping: chance, and necessity)

2. The format converter

The converter - today

- Converts between LCI data formats EcoSpold, ELCD, ISOTS14048/IMI
- from one format into the other
- works also in batch mode (multiple files)
- Stores all information from the source format file in a metadocument, which can optionally by considered when re-converting the generated data set → "loss-less conversion"



The converter - today

- Version 1.1 released August 15, 2007
- Together with a stand-alone application, we released also an API (→ ready to be integrated in software tools and web servers)

File Releases

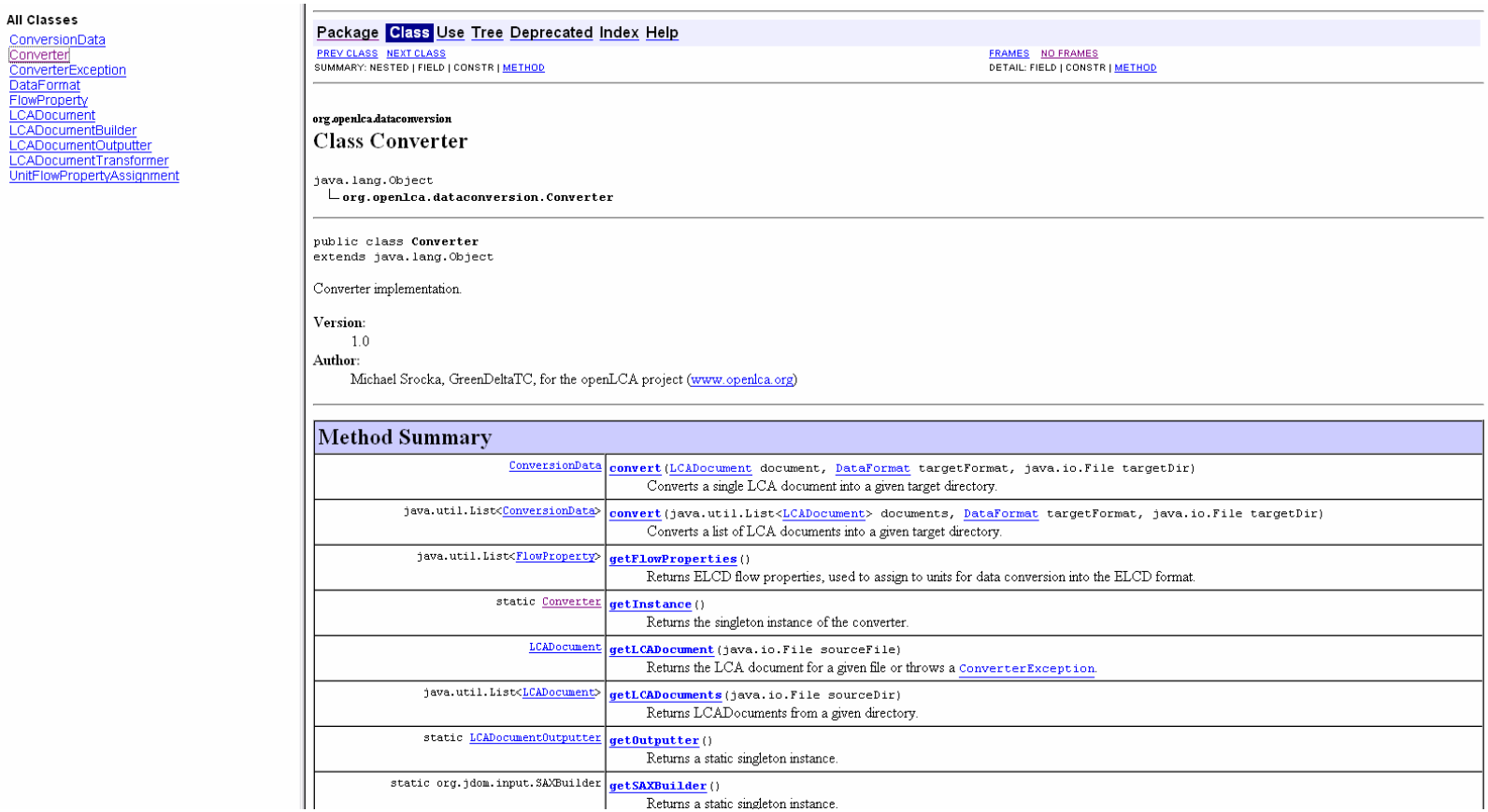
Below is a list of all files released by this project. Before downloading, you may want to read Release Notes. The current release for each package is shown.

Package	Release (date)	Filename	Size (b
openlca_converter			
Latest	openlca_converter_1.1 (2007-08-15 08:01)		
		converter15aug07.txt	1610
		GPL_API_openLCAFormatConverter_1.1.zip	867309
		openLCAFormatConverter__1.1.zip	186123
		openLCAFormatConverter_Source__1.1.zip	117765
	converter1.0 (2007-05-04 06:49)		
Totals:	2	7	412275

(http://sourceforge.net/projects/openlca)

The converter - today

- Converter Javadoc made available at www.openlca.org/kb/javadoc/



All Classes

ConversionData
Converter
ConverterException
DataFormat
FlowProperty
LCADocument
LCADocumentBuilder
LCADocumentOutputter
LCADocumentTransformer
UnitFlowPropertyAssignment

Package Class Use Tree Deprecated Index Help

PREV CLASS NEXT CLASS FRAMES NO FRAMES
SUMMARY: NESTED | FIELD | CONSTR | METHOD DETAIL: FIELD | CONSTR | METHOD

org.openlca.dataconversion

Class Converter

java.lang.Object
└ org.openlca.dataconversion.Converter

public class Converter
extends java.lang.Object

Converter implementation.

Version:
1.0

Author:
Michael Srocka, GreenDeltaTC, for the openLCA project (www.openlca.org)

Method Summary

ConversionData	convert(LCADocument document, DataFormat targetFormat, java.io.File targetDir) Converts a single LCA document into a given target directory.
java.util.List<ConversionData>	convert(java.util.List<LCADocument> documents, DataFormat targetFormat, java.io.File targetDir) Converts a list of LCA documents into a given target directory.
java.util.List<FlowProperty>	getFlowProperties() Returns ELCD flow properties, used to assign to units for data conversion into the ELCD format.
static Converter	getInstance() Returns the singleton instance of the converter.
LCADocument	getLCADocument(java.io.File sourceFile) Returns the LCA document for a given file or throws a ConverterException.
java.util.List<LCADocument>	getLCADocuments(java.io.File sourceDir) Returns LCADocuments from a given directory.
static LCADocumentOutputter	getOutputter() Returns a static singleton instance.
static org.jdom.input.SAXBuilder	getSAXBuilder() Returns a static singleton instance.

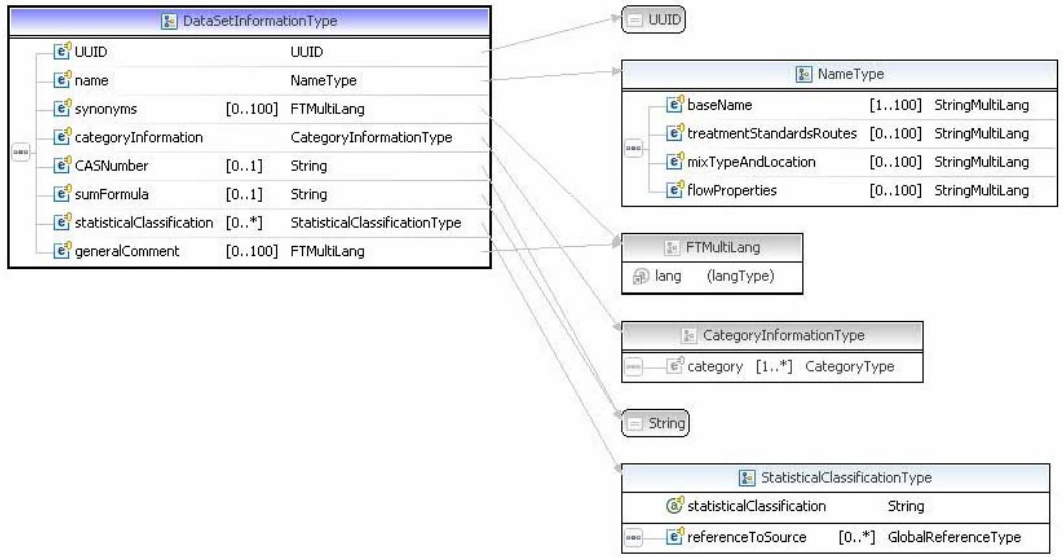
GreenDeLTa TC

The converter - today

Converter mapping documentation made available at

www.openlca.org/kb/mappingdoc/EcoSpold_to_ELCD.xml and
www.openlca.org/kb/mappingdoc/ELCD_to_EcoSpold.xml,

including an evaluation of the conversion



Fields

Field summary	
Name	CASNumber
Key	ELCD-Flow-DataSetInformationType-CASNumber
Requirement	optional
Occurrence	[0..1]
Enumeration or pattern	false
Data type	string
Field length	500
	Reference to code

Mapping summary	
Requirement	✓
Occurrence	✓
Nomenclature/Pattern	✓
Data type	✓

Source fields

Name	CASNumber
Key	EcoSpold-FlowData-TExchange-CASNumber
Requirement	optional
Occurrence	[0..1]
Enumeration or pattern	true
Data type	string

GreenDeLTa TC

→Conversion problems

(screenshot from the mapping doc)

Requirement	
✓	Both target and source required or target optional
⚠	Target required and source optional
✗	Target format default value needs to be set
Occurrence	
✓	1:1 relationship (source field : target field)
⚠	0:1 or n:1 relationship (source field : target field), no or several related fields in the source format
Nomenclature / pattern	
✓	Target field has no nomenclature or is not a pattern
⚠	Target field has nomenclature or is a pattern
Data type	
✓	Target and source of same data type
⚠	Target and source of same data type but of different length (esp. strings)
✗	At least one source field is of a different data type than the target field

Nomenclature and semantics

Example: Uncertainty Distribution Types

ELCD	EcoSpold
undefined	0=undefined
log-normal	1=lognormal (default)
normal	2=normal
triangular	3=triang
uniform	4=uniform

GreenDeLTa TC

Semantic mapping: The next level

Basic idea: In different formats, similar objects exist, which should better be assigned on the object level than on the level of single attributes.

Semantic mapping and beyond: The next level

Basic idea: In different formats, similar objects exist, which should better be assigned on the object level than on the level of single attributes.

Example:

Exchange "Carbon dioxide, in air" in the ecoinvent database corresponds to

Carbon_dioxide_Emissions_to_air_8864ce84-9967-11da-a72b-0800200c9a66_01.00.001.xml

in the ELCD database

GreenDeLTa TC

Semantic mapping.. The next level

→Names will be preserved
(e.g. names for flows!)

→ structure can be prepared
and better preserved

→ Needs: Object mapping lists
(flow ab in format x corresponds to
flow cd in format y)

GreenDeLTa TC

Semantic mapping.. The next level

Semantic mapping: The next level

→Planned for EcoSpold and ELCD format, for

flows

contacts

sources

→We seek partners for managing lists (more details available).

3. The overall LCA framework and application

GreenDeLTa TC

(in a nutshell)

Some Features of the LCA Application

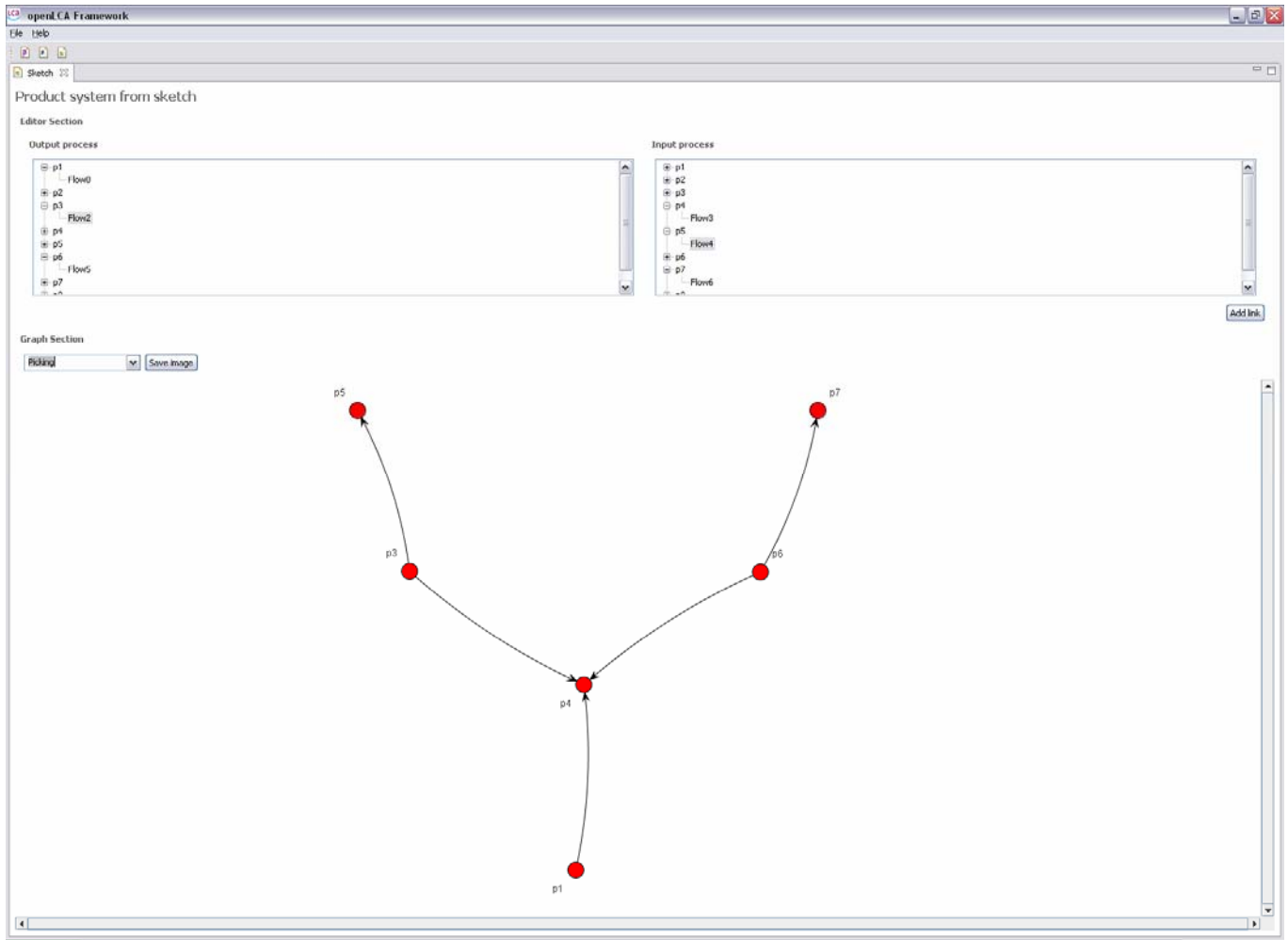
- database (MySQL),
  import & export of ecoinvent, ELCD database
- forms for editing data in the database and
  in calculation projects

- hierarchical process systems (process in process)
- parameterised processes possible
- hierarchical flows (substances in flows)
- product system may contain loops

- LCI calculation (sequential, no matrix inversion)
- impact assessment methods
- reports, graphics
- graphical modelling of the product system

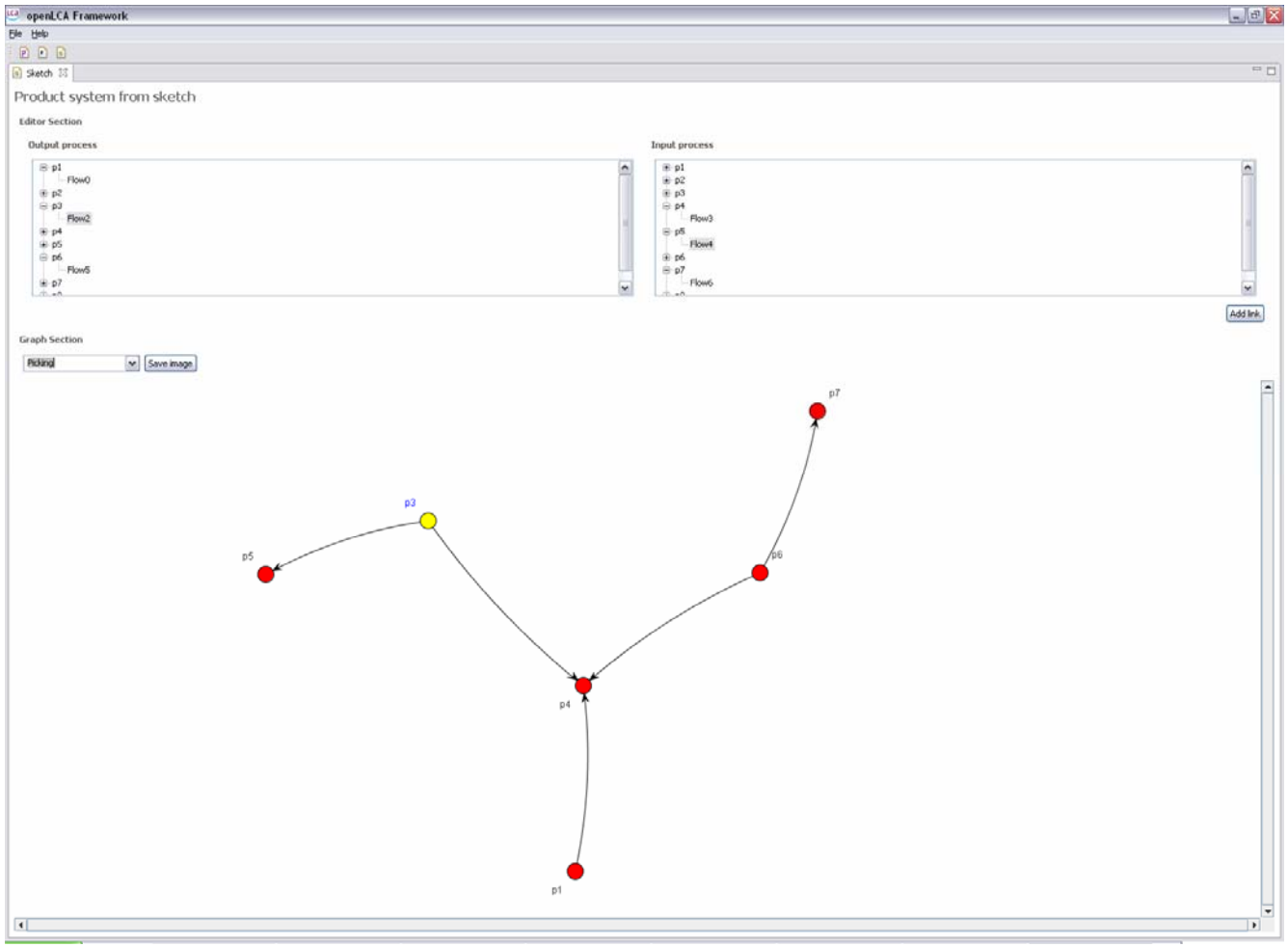
GreenDeLTa TC

Graphical modelling of the product system

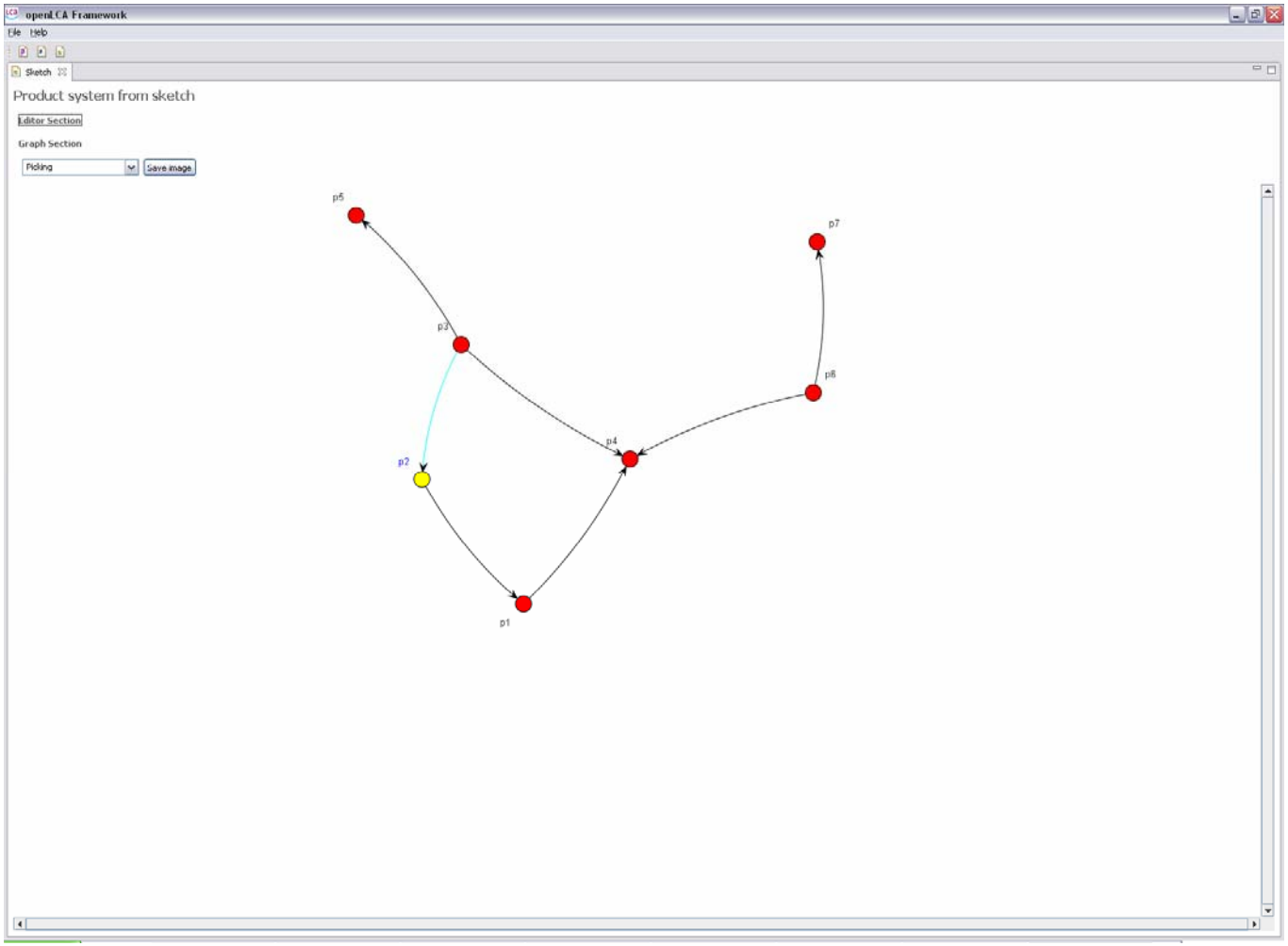


GreenDeLTa TC

Graphical modelling of the product system



Graphical modelling of the product system



LCA Application: possible uses

- General LCA application
- Extensions (matrix calculation, assessment methods, LCC…)
- Specifc models for e.g. industrial branches, distributed without licence costs
- Critical review (predefined assessment checks; LCA model distributed without licence costs)

4. Conclusions

Conclusions

- An open source, modular, extensible application is currently created in the openLCA project; it will allow calculation of an LCA, a first version is planned in autumn 07
- A format converter is available in v. 1.1. since August 2007, for converting EcoSpold, ELCD, ISO14048TS/IMI, together with documentation, and also as an API

Conclusions, 2

- Semantic mapping lists will enable a next step in the format conversion; we seek institutions & experts for managing these
- The application is designed to be extended for further methods, or for creating special process systems
- We are an open project, please contact us with further questions and ideas.

Merci!

Dr. Andreas Ciroth

GreenDeltaTC GmbH, Berlin, Germany

ciroth@greendeltatc.com