



# Databázové nástroje LCA

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**Seminář Posuzování životního cyklu LCA**

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## Sotwarové nástroje pro LCA

- Boustead Model (Boustead Consulting, Velká Británie)
- CMLCA (Leiden University, Nizozemsko)
- GaBi (PE International, Německo)
- SimaPro (Pré Consultants, Nizozemsko)
- Umberto (ifu Hamburg, Německo)

## Specializované LCA softwarové nástroje pro oblast odpadového hospodářství

- model ORWARE – Švédsko
  - model LCA-LAND – Dánsko
  - model WISARD – Velká Británie, Francie
  - model WRATE – Velká Británie
  - model IWM2 – Velká Británie
  - model IWM - Kanada
  - model DST – USA
- 
- model WAMPS – Švédsko
  - model EASEWASTE - Dánsko

## GaBi 4

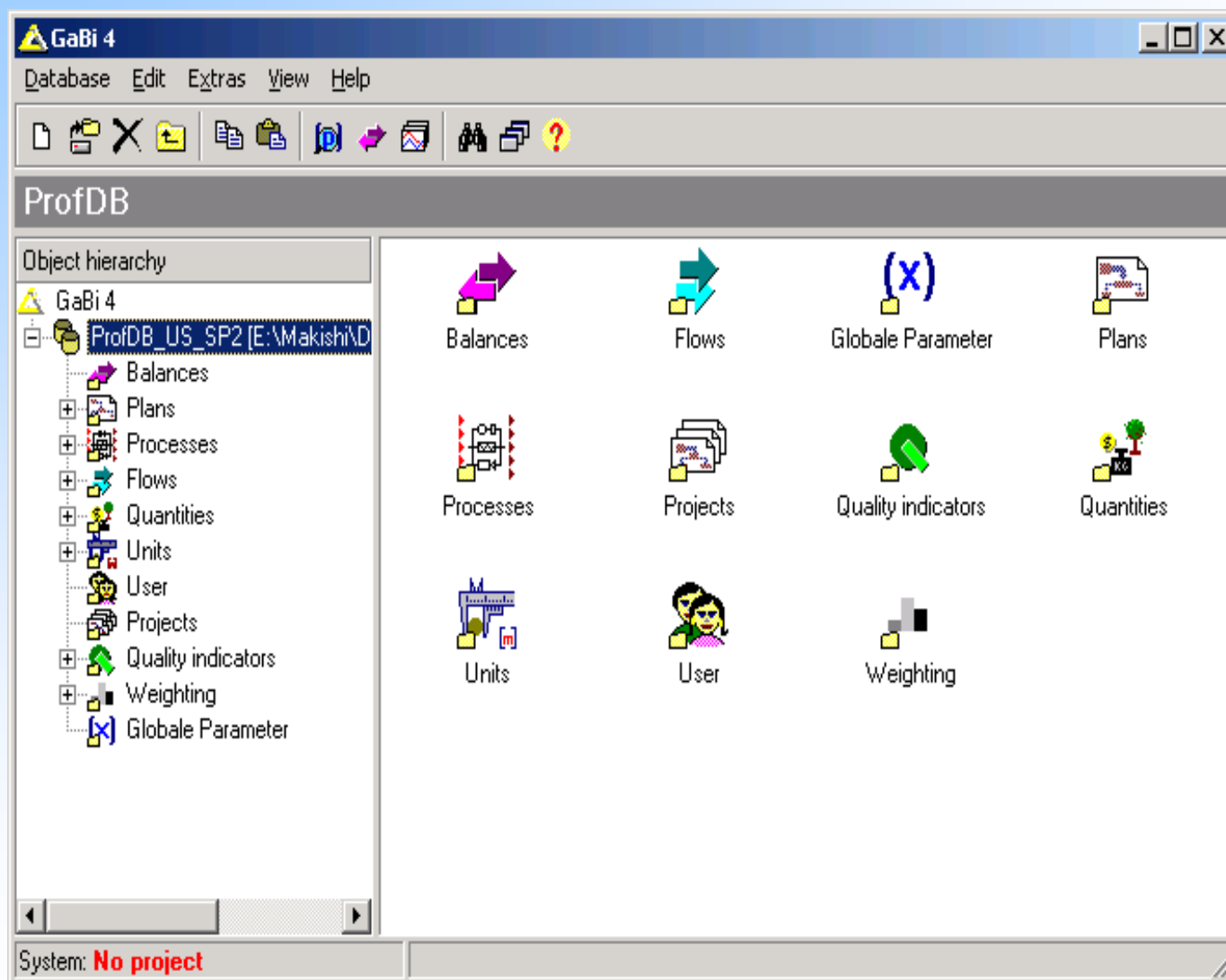
- PE International GmbH, Německo
- LBP University of Stuttgart, Německo

### GaBi 4:

- komplexní environmentální posouzení nebo součást všech modelových a analytických metod
- standardizováno dle norem ISO 14040
- modulární systém
- software a databáze jsou na sobě nezávislé
- možnost inovací a změn
- transparentní struktura



## DB Manager



Následující objekty jsou základem každé GaBi databáze a jsou základními elementy Posuzování životního cyklu:

- Bilance
- Plány
- Procesy
- Toky



K výpočtu bilancí jsou potřebné i tři následující objekty :

- Veličiny
- Jednotky
- Vážení



Následující objekty jsou doplňkovými komponenty Posuzování životního cyklu a používají se k/ke:

- Správě uživatelů (→ Uživatel)
- Organizaci databáze (→ Projekty)
- Dokumentaci kvality dát (→ Indikátory kvality)
- Zvýšení flexibility modelování (→ Globalní parametry)



# Projekt

Project Example GaBi 4 [Projects]

Object Edit View Help

Project administration

Name: Project Example GaBi 4 Deaktiviere projekt ... active ...

**ISO documentation** | Object list

Goal of project  
Show the functionality and practical use of GaBi 4

Function und functional unit  
.....

System boundaries  
.....

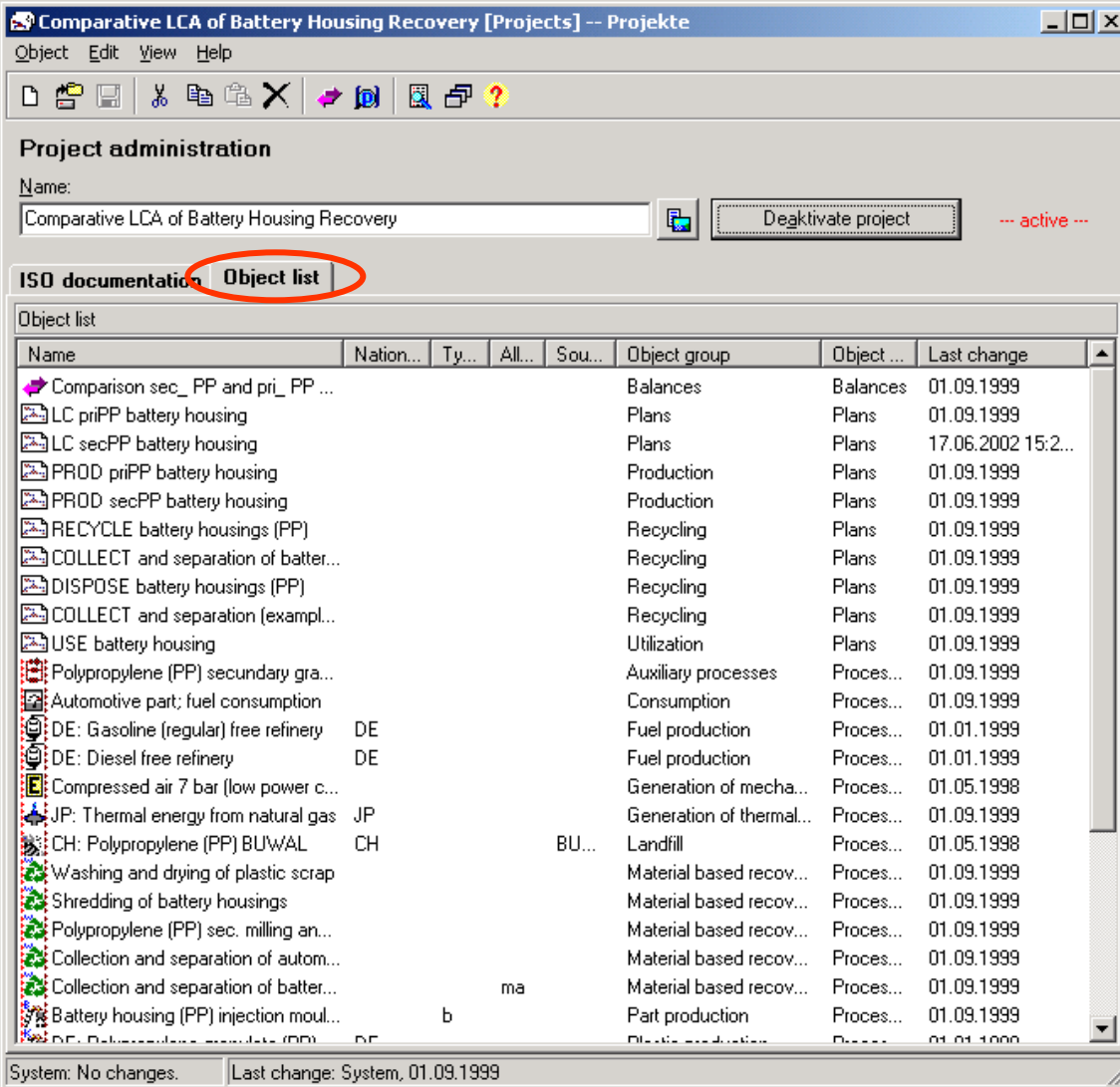
Data quality requirements  
.....

Comparisons between systems  
.....

Critical review considerations  
.....

System: Changed. Last change: System, 24.09.2002 17:26:36

## Projekt



System: No changes. Last change: System, 01.09.1999

Name	Nation...	Ty...	All...	Sou...	Object group	Object ...	Last change
Comparison sec_PP and pri_PP ...					Balances	Balances	01.09.1999
LC priPP battery housing					Plans	Plans	01.09.1999
LC secPP battery housing					Plans	Plans	17.06.2002 15:2...
PROD priPP battery housing					Production	Plans	01.09.1999
PROD secPP battery housing					Production	Plans	01.09.1999
RECYCLE battery housings (PP)					Recycling	Plans	01.09.1999
COLLECT and separation of batter...					Recycling	Plans	01.09.1999
DISPOSE battery housings (PP)					Recycling	Plans	01.09.1999
COLLECT and separation (exempl...					Recycling	Plans	01.09.1999
USE battery housing					Utilization	Plans	01.09.1999
Polypropylene (PP) secondary gra...					Auxiliary processes	Proces...	01.09.1999
Automotive part; fuel consumption					Consumption	Proces...	01.09.1999
DE: Gasoline (regular) free refinery	DE				Fuel production	Proces...	01.01.1999
DE: Diesel free refinery	DE				Fuel production	Proces...	01.01.1999
Compressed air 7 bar (low power c...					Generation of mecha...	Proces...	01.05.1998
JP: Thermal energy from natural gas	JP				Generation of thermal...	Proces...	01.09.1999
CH: Polypropylene (PP) BUWAL	CH			BU...	Landfill	Proces...	01.05.1998
Washing and drying of plastic scrap					Material based recov...	Proces...	01.09.1999
Shredding of battery housings					Material based recov...	Proces...	01.09.1999
Polypropylene (PP) sec. milling an...					Material based recov...	Proces...	01.09.1999
Collection and separation of autom...					Material based recov...	Proces...	01.09.1999
Collection and separation of batter...				ma	Material based recov...	Proces...	01.09.1999
Battery housing (PP) injection mou...				b	Part production	Proces...	01.09.1999
DE: Polypropylene (PP) injection mou...	DE				Part production	Proces...	01.01.1999

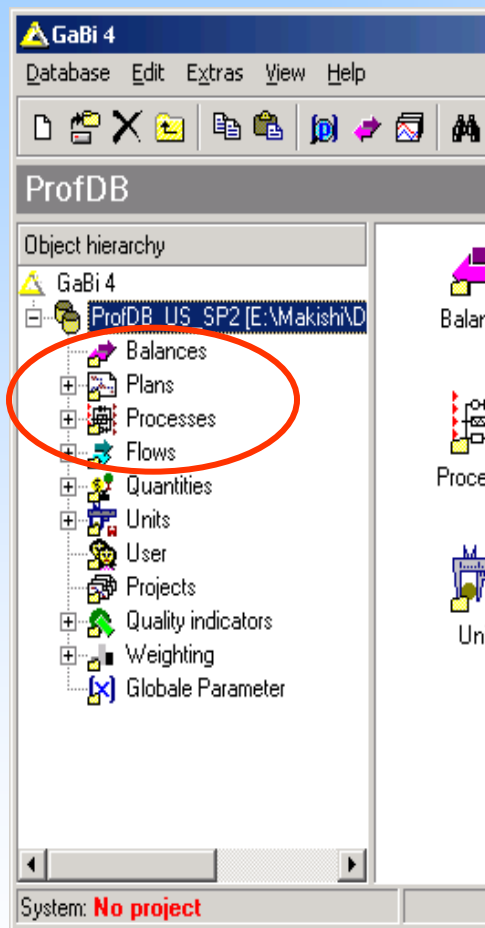
- Všechny objekty vytvořené nebo změněné jsou zaznamenány do seznamu objektů k projektu, který je právě aktivovaný



## Bilance, plány, procesy a toky

**Při zpracování případové studie musí být uvažovány následující kroky :**

1. Procesy, nezbytné k výrobě produktu, musí být určeny zahrnutím všech Toků.
2. V Plánech jsou jednotlivé Procesy propojeny za účelem kompletního zmapování produktu.
3. Z Bilance vyplývají různé seznamy vstupních a výstupních Toků všech zahrnutých Procesů.



# Tok

**Ethene (ethylene) [Organic intermediate products] -- DB Flow**

Object Edit View Help

Name: Ethene

LCA LCC

Addition: ethylene CAS Code: 74-85-1

Chemical formula: CH<sub>2</sub>=CH<sub>2</sub> Basis:

Reference quantity: Mass

Comment/Synonyms: Synonyms: Ethene

Quantity	1 kg = *	Unit	Standard deviation	1 [Quantity]
Energy (gross calorific value)	50,336	MJ	0 %	0,019866
Energy (net calorific value)	47,151	MJ	0 %	0,021209
Market price US97	0,11383	€	0 %	8,7849
Standard volume	0,79302	Nm3	0 %	1,261

System: No changes. PE Last change: System, 1.1.2004

**thane [Organic emissions to air (group VOC)] -- DB Flow**

Edit View Help

Methane

LCA LCC

Addition:

Chemical formula: CH<sub>4</sub> CAS Code: 74-82-8

Reference quantity: Mass

Comment/Synonyms:

Quantity	1 kg = *	Unit	Standard deviation	1 [Quantity]
L2001, Global Warming Potential (GWP 100 year)	23	kg CO <sub>2</sub> -Equiv.	0 %	0,043478
L2001, Photochem. Ozone Creation Potential	0,006	kg Ethene-Equiv.	0 %	166,67
L96, Global warming potential (GWP 100 year)	21	kg CO <sub>2</sub> -Equiv.	0 %	0,047619
L96, Global warming potential (GWP 20 year)	56	kg CO <sub>2</sub> -Equiv.	0 %	0,017857
L96, Global warming potential (GWP 500 year)	6,5	kg CO <sub>2</sub> -Equiv.	0 %	0,15385
L96, Photochemical oxidant potential (POCP)	0,007	kg Ethene-Equiv.	0 %	142,86
P 1997, Global warming potential (GWP 100 year)	25	kg CO <sub>2</sub> -Equiv.	0 %	0,04
P 1997, Photochemical oxidant potential (high)	0,007	kg Ethene-Equiv.	0 %	142,86
P 1997, Photochemical oxidant potential (low)	0,007	kg Ethene-Equiv.	0 %	142,86
P 2003, Global warming	25	kg CO <sub>2</sub> -Equiv.	0 %	0,04
P 2003, Photochemical ozone formation - im	2,9E-005	pers*ppm*hours	217 %	34483
P 2003, Photochemical ozone formation - im	360	m2 UES*ppm*hours	167 %	0,002777
EI99, EA, Human health, Climate Change	4,4E-006	DALY	0 %	2,2727E01
EI00, EA, Human health, Respiratory (organic)	1,28E-00	DALY	0 %	7,8125E01

System: No changes. PE Last change: System, 1.1.2006

# Proces

DE: Steam from light fuel oil (0.2%S) 89% [Steam producer] -- DB Process

Object Edit View Help

Name: DE Steam from light fuel oil (0.2%S) 89%

Parameter

LCA LCC: 0 € LCWT

Year: 1997 Region: Meridian: Latitude: Allocated: No image

Completeness: All relevant flows recorded Comment:

Synonyms:

**Inputs**

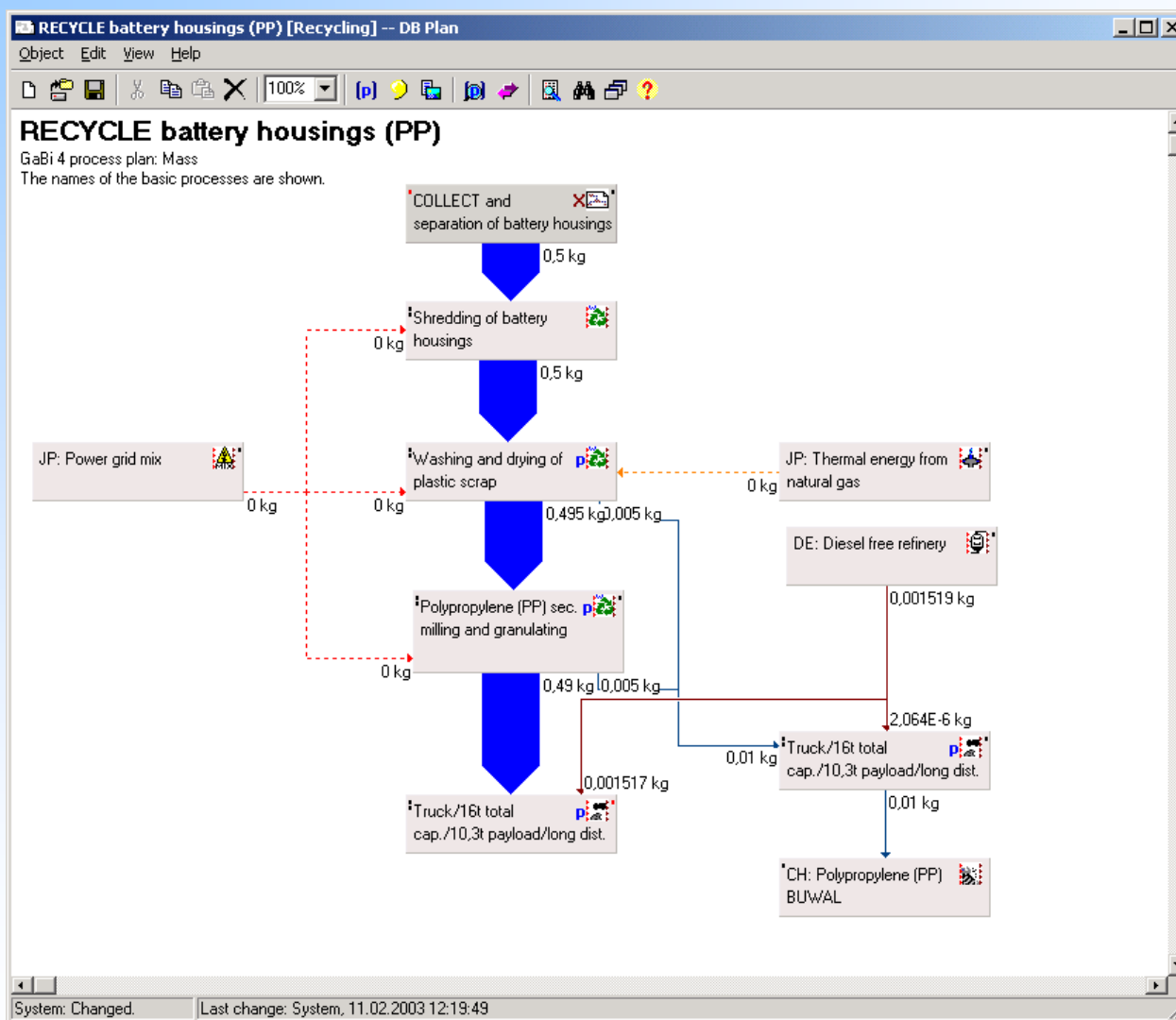
Flow	Quantity	Amount	Unit	Tracked	Standard	Origin
Air [Renewable resources]	Mass	0.4651	kg		0 %	Calculated
Bentonite [Non renewable resources]	Mass	1.507E-5	kg		0 %	Literature
Crude oil [Crude oil (resource)]	Mass	0.0006734	kg		0 %	Calculated
Crude oil Algeria [Crude oil (resource)]	Mass	0.001396	kg		0 %	Literature
Crude oil Angola [Crude oil (resource)]	Mass	0.0005644	kg		0 %	Estimated

**Outputs**

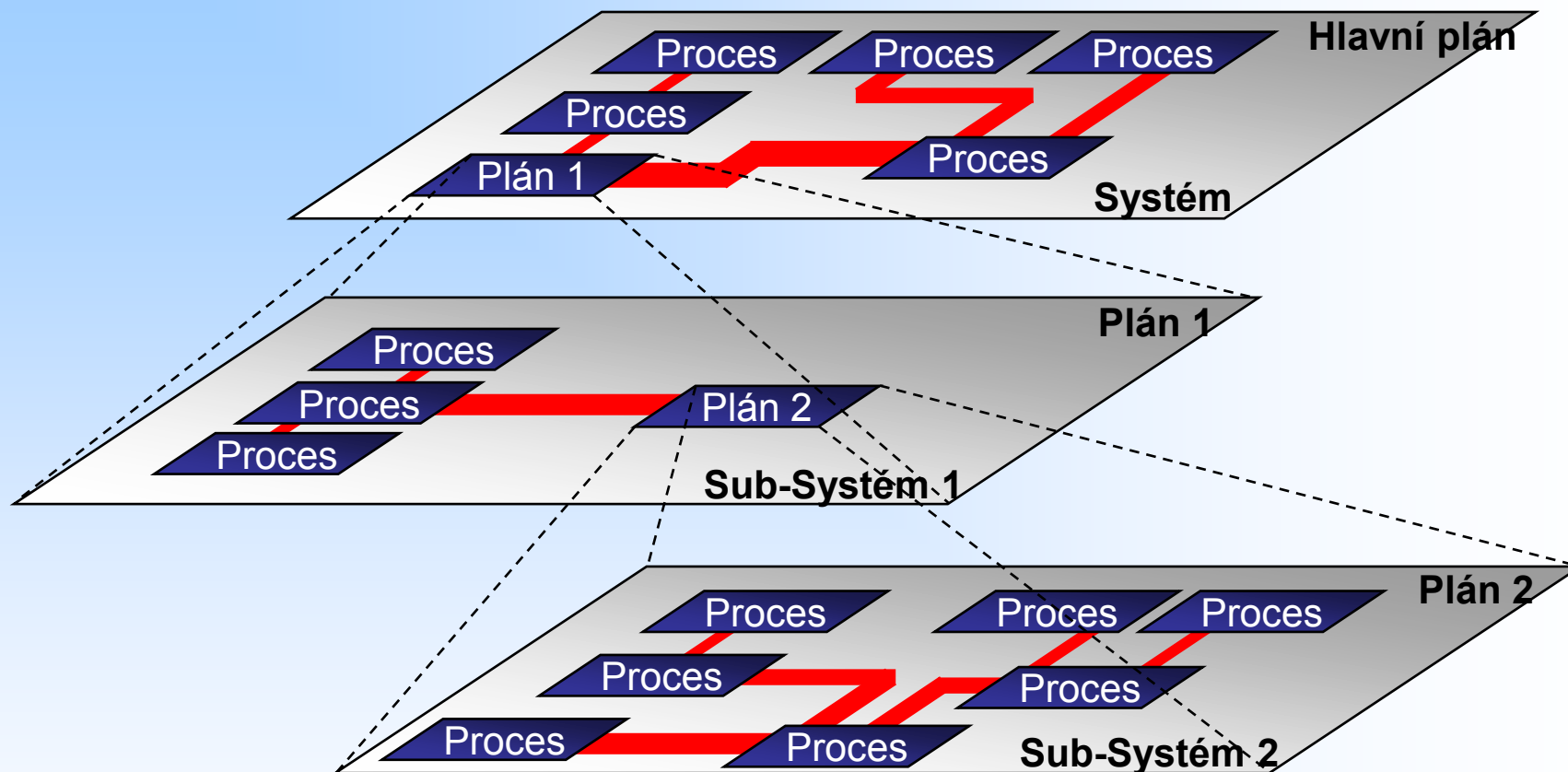
Flow	Quantity	Amount	Unit	Tracked	Standard	Origin
Acetic acid [Group NMVOC to air]	Mass	4.42E-9	kg		0 %	Literature
Acetone (dimethylcetone) [Group NMVOC to air]	Mass	9.893E-10	kg		0 %	Literature
Acid (calculated as H+) [Inorganic emissions to water]	Mass	9.585E-13	kg		0 %	Calculated
Adsorbable organic halogen compounds (AOX) [Analytical measures]	Mass	2.629E-10	kg		0 %	Measured
Alkane (unspecified) [Group NMVOC to air]	Mass	9.438E-7	kg		0 %	Calculated
Aluminum [Inorganic emissions to water]	Mass	2.802E-8	kg		0 %	Literature
Ammonia [Inorganic emissions to air]	Mass	1.126E-9	kg		0 %	Calculated
Ammonium / ammonia [Inorganic emissions to water]	Mass	4.393E-7	kg		0 %	Measured
Antimony [Heavy metals to air]	Mass	2.864E-13	kg		0 %	Calculated
Arsenic [Heavy metals to water]	Mass	2.656E-10	kg		0 %	Calculated
Arsenic [Heavy metals to air]	Mass	8.897E-11	kg		0 %	Calculated
Ash [Stockpile goods]	Mass	8.204E-6	kg	*	0 %	Calculated
Barium [Inorganic emissions to water]	Mass	2.802E-9	kg		0 %	Literature
Barium [Inorganic emissions to air]	Mass	1.442E-7	kg		0 %	(Calculated)

System: No changes. Last change: System, 01.01.1999

# Plán



## Hierarchie plánů



- Již namodelovaný plán může být použit v jiném plánu jako proces. (Hierarchické řazení plánů).

# Bilance

RECYCLE battery housings\_PP\_ [Balances] -- Balance

Object Edit View Tools Help

Name: RECYCLE battery housings\_PP\_ Rows: 1 Columns: 1

Quantity Evaluation  Quantity view Unit Normalization  In/out aggregation Absolute values

Mass kg not filtered

LCA LCC LCWT

	RECYCLE bat	COLLECT and	CH: Polypropy	DE: Diesel fre	JP: Power gric	JP: Thermal ex	Polypropylene
<b>Flows</b>	13,78	0,532	0,01005	0,006583	8,123	0,3145	0,495
Deposited goods	1,275E-8		0,01		1,279E-8		
Production residues in life cycle	0,5	0,5					0,495
Resources	8,476	0,03204	4,586E-5	0,006583	8,123	0,3145	
Valuable substances	4,8		9E-9				

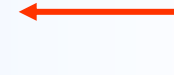
	RECYCLE bat	COLLECT and	CH: Polypropy	DE: Diesel fre	JP: Power gric	JP: Thermal ex	Polypropylene
<b>Flows</b>	13,84	0,5412	0,008097	0,006884	8,168	0,3201	0,495
Deposited goods	0,09767	0,001381		0,0005124	0,09524	0,0005359	0,005
Emissions to air	1,522	0,01605	0,001226	0,0007673	1,182	0,3165	
Emissions to soil	1,464E-6		1,464E-6				
Emissions to water	11,73	0,02371	0,00687	0,004084	6,888	0,003031	
Production residues in life cycle	0,002784	0,5		1,617E-6	0,002773	9,793E-9	
Valuable substances	0,49			0,001519			0,49

System: Changed. Last change: System, 11.02.2003 13:46:31

Vstupy



Výstupy



# Bilance

Recycling PP\_battery housing [Balances] -- Balance

Object Edit View Tools Help

Name: Recycling PP\_battery housing

Quantity Evaluation  Quantity view

Unit: kg Normalization: not filtered

In/out aggregation Absolute values

Rows: 1 Columns: 1

Diagram -

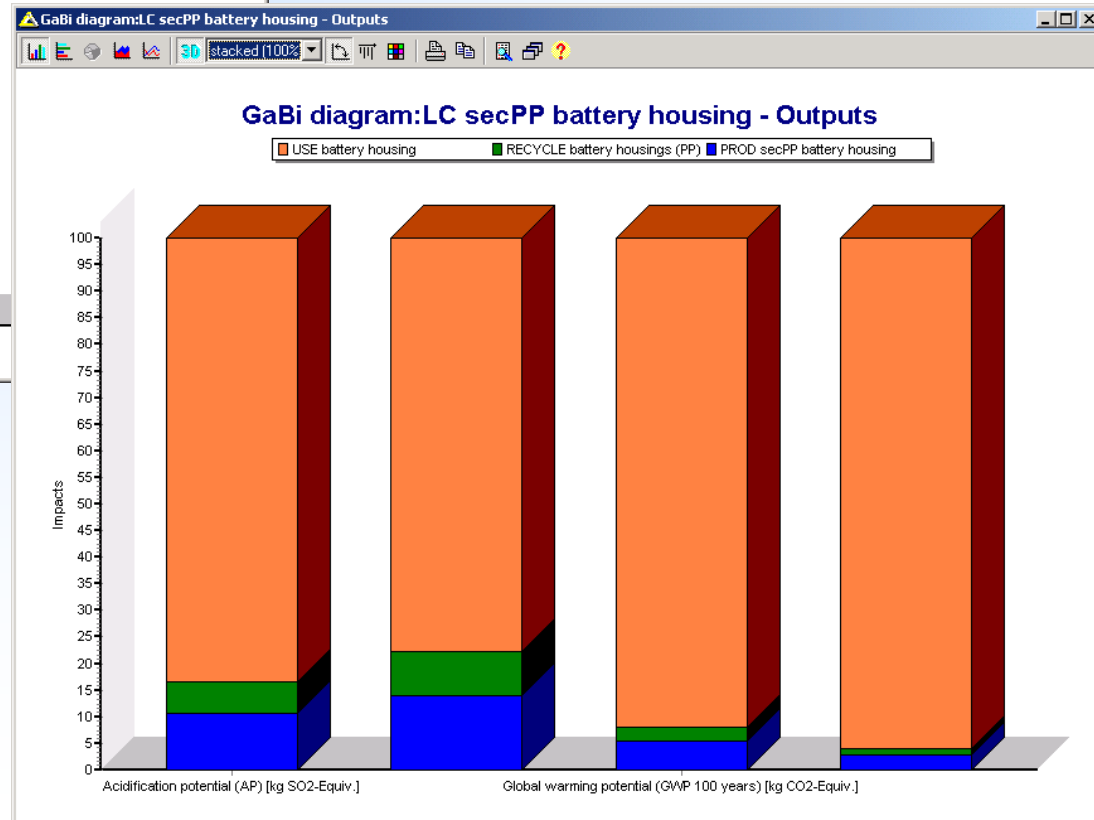
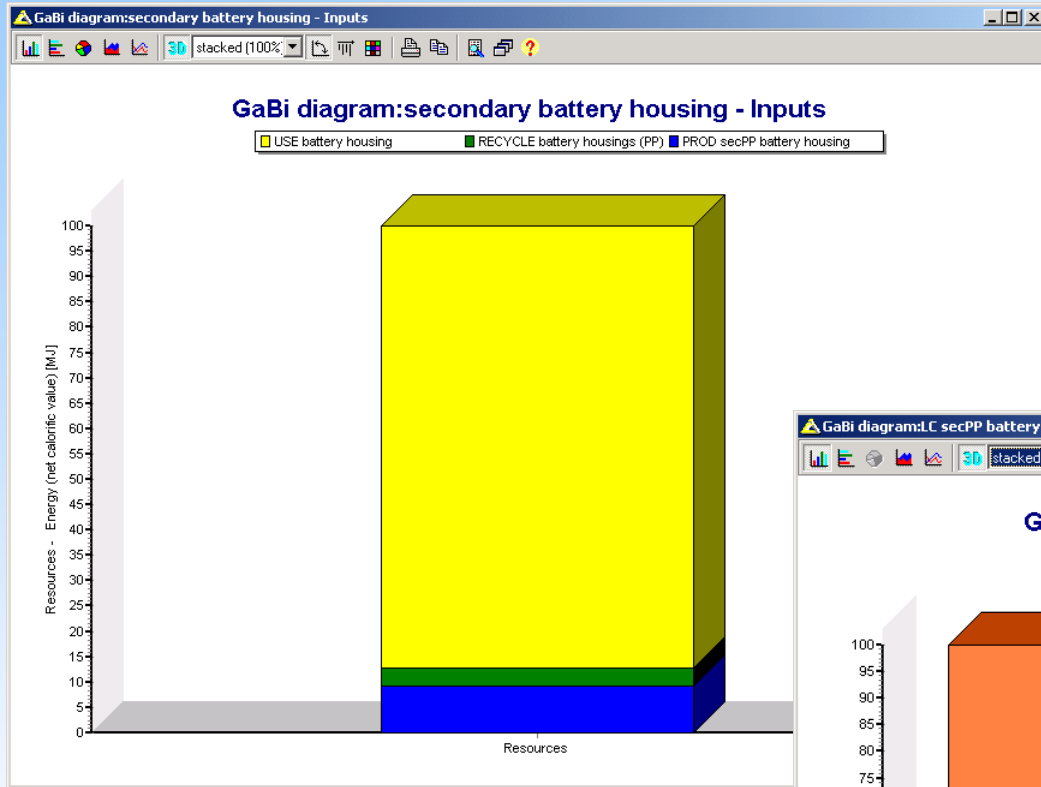
res	DE: Power grid	DE: Thermal e	CH: Polypropy	Polypropylene	Shredding of P	Truck/16t tota	Tru
13,252	0,31589	0,010045	0,495	0,5	2,0635E-006	0,0	

Diagram -

res	DE: Power grid	DE: Thermal e	CH: Polypropy	Polypropylene	Shredding of P	Truck/16t tota	Tru
13,264	0,31677	0,0080964	0,495	0,5	6,9587E-006	0,0	

System: Changed. Last change: System, 25.1.2008 14:48:42

# Možnosti vizualizace bilancí





# Vážení a normalizace

GaBi 4

Database Edit Extras View Help

Evaluation

Object hierarchy

- GaBi 4
  - Prof DB
    - Balances
    - Plans
    - Processes
    - Flows
    - Quantities
    - Units
    - User
    - Projects
    - Quality indicators
    - Weighting
      - Evaluation
      - Normalization
      - Global parameter
    - Koncepty\_kusebni1 [H:\Program Files\GaBi 4\Da

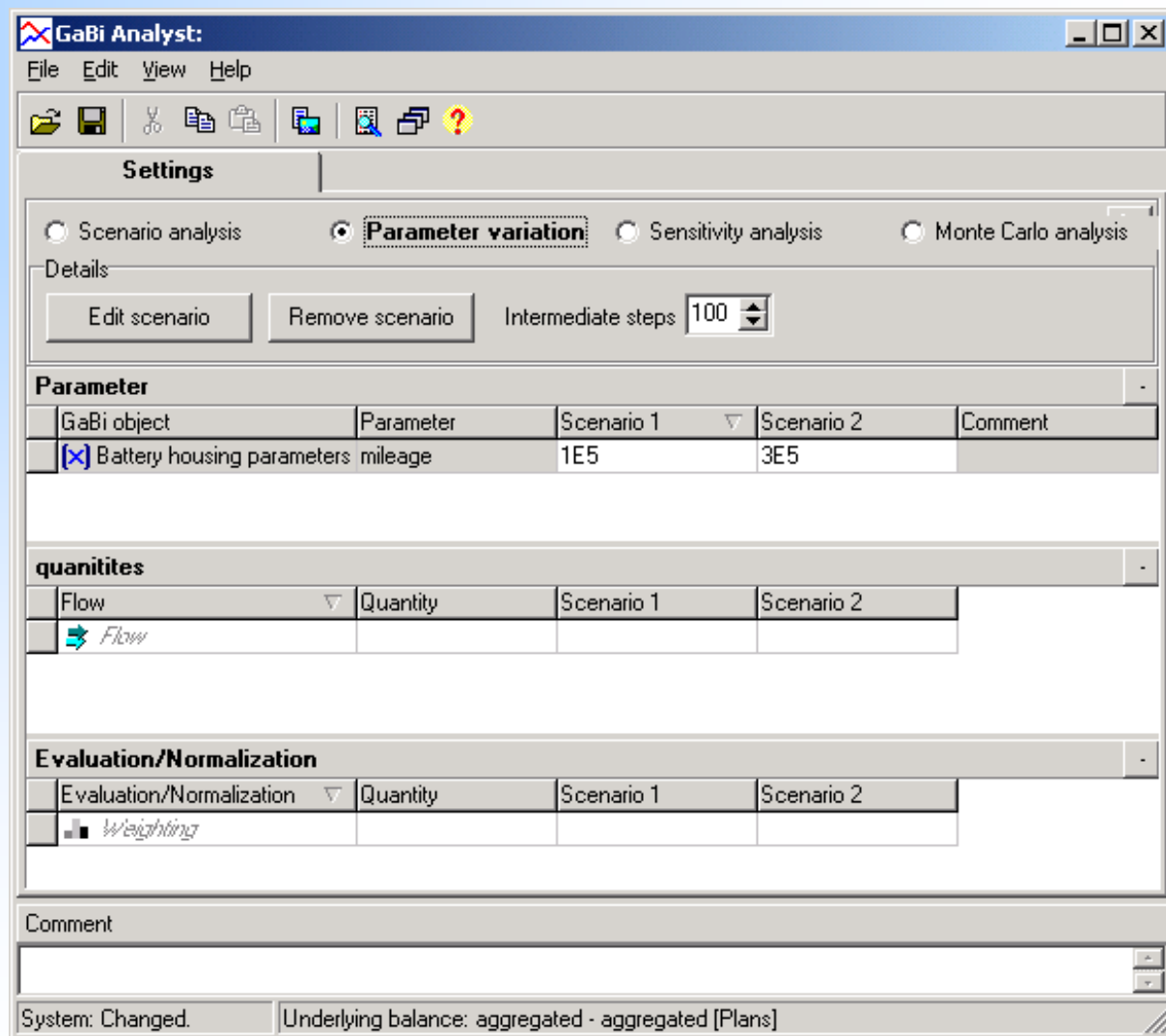
Name	Data ...	Last change
■ CML2001, Experts IKP (Central Europe)	PE	1.1.2004
■ CML2001, Experts IKP (Northern Europe)	PE	1.1.2004
■ CML2001, Experts IKP (Southern Europe)	PE	1.1.2004
■ CML96, Expert judgement, IKP	PE	1.10.2004
■ CML96, Experts, IKP	PE	1.10.2004
■ CML96, Policy long term, IKP	PE	1.10.2004
■ CML96, Policy short term, IKP	PE	1.10.2004
■ CML96, Policy, IKP	PE	1.10.2004
■ CML96, Population, IKP	PE	1.10.2004
■ CML96, Survey Europe, IKP	PE	1.10.2004
■ CML96, Survey Germany, IKP	PE	1.10.2004
■ CML96, Sustainable development, IKP	PE	1.10.2004
■ EDIP 1997, Env. imp. eval. (PET W, EU 2004)	PE	1.8.2005
■ EDIP 1997, Res. eval. (PR W 2004)	PE	1.1.2006
■ EDIP 1997, Toxicity eval. (PET EU 2004)	PE	1.8.2005
■ EDIP 1997, Waste eval. (PET DK 2000)	PE	1.8.2005
■ EDIP 2003, Env. imp. eval. (PET W, EU 2004)	PE	1.1.2006
■ EI95	PE	1.10.2004
■ EI95 (incl. ionizing radiation, RF)	PE	1.10.2004
■ EI99, EE (Egalitarian approach)	PE	1.10.2004
■ EI99, HA (Hierarchist approach)	PE	1.10.2004
■ EI99, II (Individualist approach)	PE	1.10.2004
■ Energy total (gross calorific value)	PE	1.1.1999
■ Energy total (net calorific value)	PE	1.10.2004
■ UBP, Ecological scarcity method	PE	1.10.2004

View Help

Name	Data ...	Last change
■ CML2001, Australia	PE	1.1.2004
■ CML2001, Canada	PE	1.1.2004
■ CML2001, Europe	PE	1.1.2004
■ CML2001, Germany	PE	1.1.2004
■ CML2001, Japan	PE	1.1.2004
■ CML2001, Netherlands	PE	1.1.2004
■ CML2001, Northern America	PE	1.1.2004
■ CML2001, OECD	PE	1.1.2004
■ CML2001, South Korea	PE	1.1.2004
■ CML2001, USA	PE	1.1.2004
■ CML2001, Western Europe (EU)	PE	1.1.2004
■ CML2001, World	PE	1.1.2004
■ CML96, Europe	PE	1.10.2004
■ CML96, European Community	PE	1.10.2004
■ CML96, Germany	PE	1.10.2004
■ CML96, OECD	PE	1.10.2004
■ CML96, World	PE	1.10.2004
■ EDIP 1997, Env. imp. norm. (PE W, EU 1994)	PE	1.8.2005
■ EDIP 1997, Res. norm. (PR W 2004)	PE	1.1.2006
■ EDIP 1997, Toxicity norm. (PE EU 1994)	PE	1.8.2005
■ EDIP 1997, Waste norm. (PE DK 1990)	PE	1.8.2005
■ EDIP 2003, Env. imp. norm. (PE W, EU 1994)	PE	1.1.2006
■ EI95	PE	1.10.2004
■ EI95 (incl. ionizing radiation RF)	PE	1.10.2004
■ EI95 (incl. ionizing radiation, RF) adapted	PE	1.10.2004
■ EI99, EE (Egalitarian approach)	PE	1.10.2004
■ EI99, HA (Hierarchist approach)	PE	1.10.2004
■ EI99, II (Individualist approach)	PE	1.10.2004
■ I02+ Damage	PE	1.1.2006
■ I02+ Normalisation at midpoint	PE	1.1.2006
■ I02+ Normalized damage	PE	1.1.2006
■ UBP, Ecological scarcity method	PE	1.10.2004

## Funkce GaBi 4

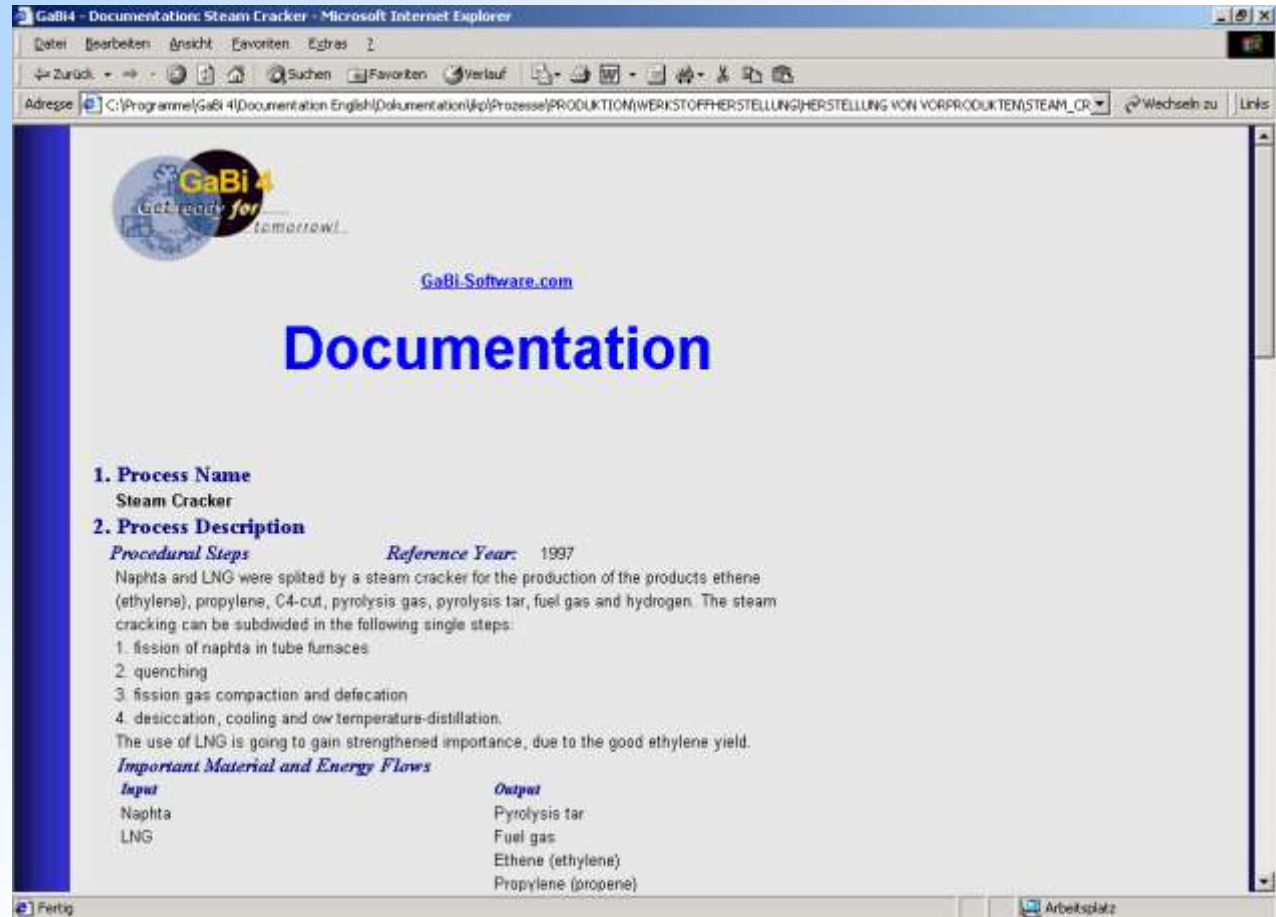
- analýza scénáře
- změna parametrů
- citlivostní analýza
- analýza Monte Carlo
  
- náklady životního cyklu (LCC)
- pracovní čas životního cyklu (LCWT)



# Dokumentace všech složek databází

-všechna data jsou zdokumentována prostřednictvím souborů html

-dokumentace splňuje požadavky ISO 14040



The screenshot shows a Microsoft Internet Explorer window displaying the GaBi 4 documentation page for the Steam Cracker process. The page title is "GaBi 4 - Documentation: Steam Cracker". The address bar shows the file path: C:\Programme\GaBi 4\Documentation English\Documentation\p\Prozesse\PRODUKTION\WERKSTOFFHERSTELLUNG\HERSTELLUNG VON VORPRODUKTEN\STEAM\_CR... The page content includes the GaBi 4 logo, the website URL GaBi-Software.com, and the main heading "Documentation". The document structure is as follows:

- 1. Process Name**  
Steam Cracker
- 2. Process Description**
  - Procedural Steps*
  - Reference Year:* 1997
  - Naphta and LNG were split by a steam cracker for the production of the products ethene (ethylene), propylene, C4-cut, pyrolysis gas, pyrolysis tar, fuel gas and hydrogen. The steam cracking can be subdivided in the following single steps:
    - fission of naphta in tube furnaces
    - quenching
    - fission gas compaction and defecation
    - desiccation, cooling and ow temperature-distillation.
  - The use of LNG is going to gain strengthened importance, due to the good ethylene yield.
  - Important Material and Energy Flows*

<i>Input</i>	<i>Output</i>
Naphta	Pyrolysis tar
LNG	Fuel gas
	Ethene (ethylene)
	Propylene (propene)

# Děkuji za pozornost.

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