LCA Methodology

How to do a LCA for a Monobloc Chair

Description of the System

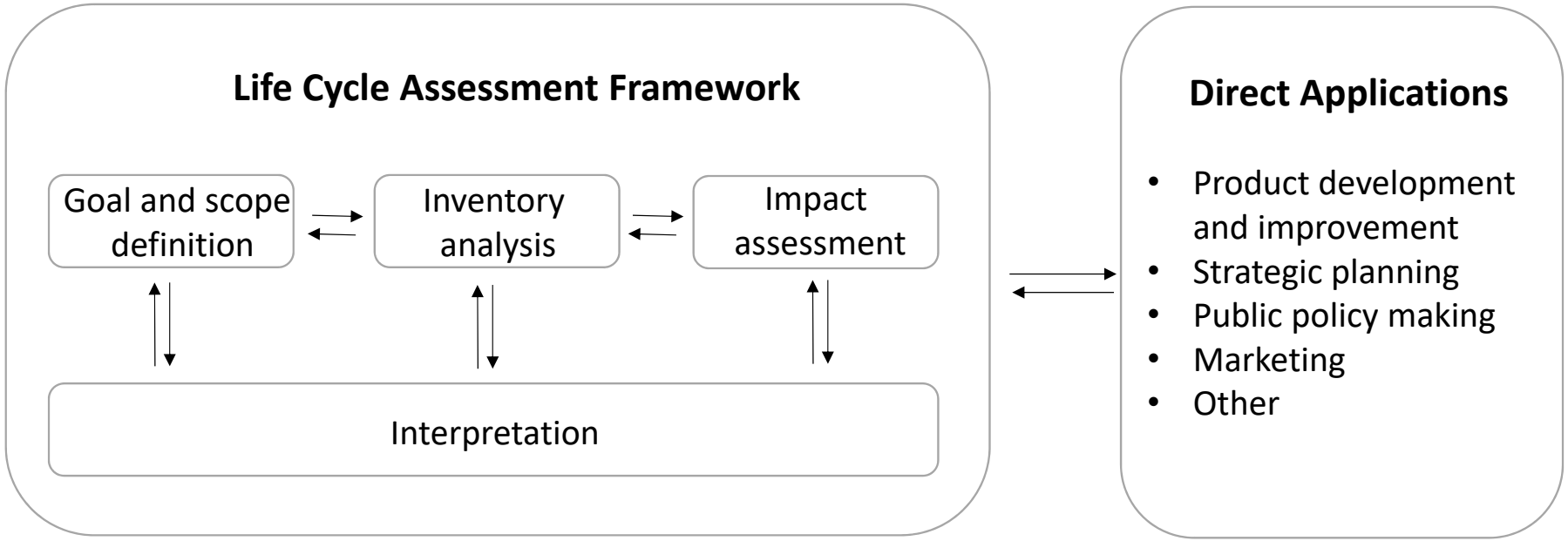
The main function of a Monobloc Chair is to sit on it for a period of time.
It is however unclear how long the life time of a chair can be estimated.
To determine the reference flow the assumption is that one Monobloc chair is used for 5 years.

The functional unit is thus:
The production, use and disposal of one Monobloc chair with a use period of 5 years.
The end-of-life scenarios are: Landfill, incineration and recycling.

Die Hauptfunktion eines Monobloc-Stuhls besteht darin, dass man eine Zeit lang auf ihm sitzt.
Es ist jedoch unklar, wie lange die Lebensdauer eines Stuhls geschätzt werden kann.
Zur Bestimmung des Referenzflusses wird angenommen, dass ein Monobloc-Stuhl 5 Jahre lang benutzt wird.

Die funktionelle Einheit ist somit:
Die Herstellung, Nutzung und Entsorgung eines Monobloc-Stuhls mit einer Nutzungsdauer von 5 Jahren.
Die End-of-Life-Szenarien sind: Deponierung, Verbrennung und Recycling.

How to do a LCA?



Phases and applications of an LCA based on ISO 14040.

[4] ISO 14040: Environmental Management—Life Cycle Assessment— Principles and Framework; International Standard Organisation: Geneva, Switzerland, 1997.
(5) ISO 14041: Environmental Management—Life Cycle Assessment— Goal and Scope Definition and Inventory Analysis; International Standard Organisation: Geneva, Switzerland, 1998.
(6) ISO 14042. Environmental Management—Life Cycle Assessment— Life Cycle Impact Assessment; International Standard Organisation: Geneva, Switzerland, 2000.
(7) ISO 14043: Environmental Management—Life Cycle Assessment— Life Cycle Interpretation; International Standard Organisation: Geneva,Switzerland, 2000.(8) ISO 14040: Environmental Management—Life Cycle Assessment— Principles and Framework; International Standard Organisation: Geneva, Switzerland, 2006.
(9) ISO 14044: Environmental Management - Life Cycle Assessment - Requirements and Guidelines; International Standard Organisation: Geneva, Switzerland, 2006.

LCA methodology - Working step by step

1. Definition of a functional unit
2. Inventory analysis
3. Process chart
4. Classification

   Characterization

   Normalization

   Weighting
5. Interpretation

Data Base: SimaPro5

https://simapro.com/licences/#/education

Method Ecoindicator 99, Demo-Version

1. Definition of a functional unit

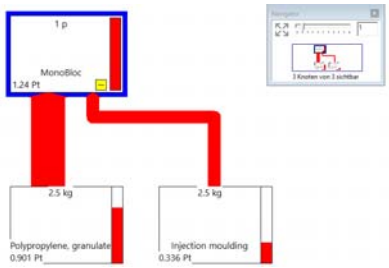
Goal and Scope of this Analysis

A simple Monobloc Chair
Production, Use and End of Life

3. Inventory Analysis

Sort of material:
Polypropylen Granulate
virgin, white
Prize: 1.000 – 1.300 US$ 5 tons

Process:



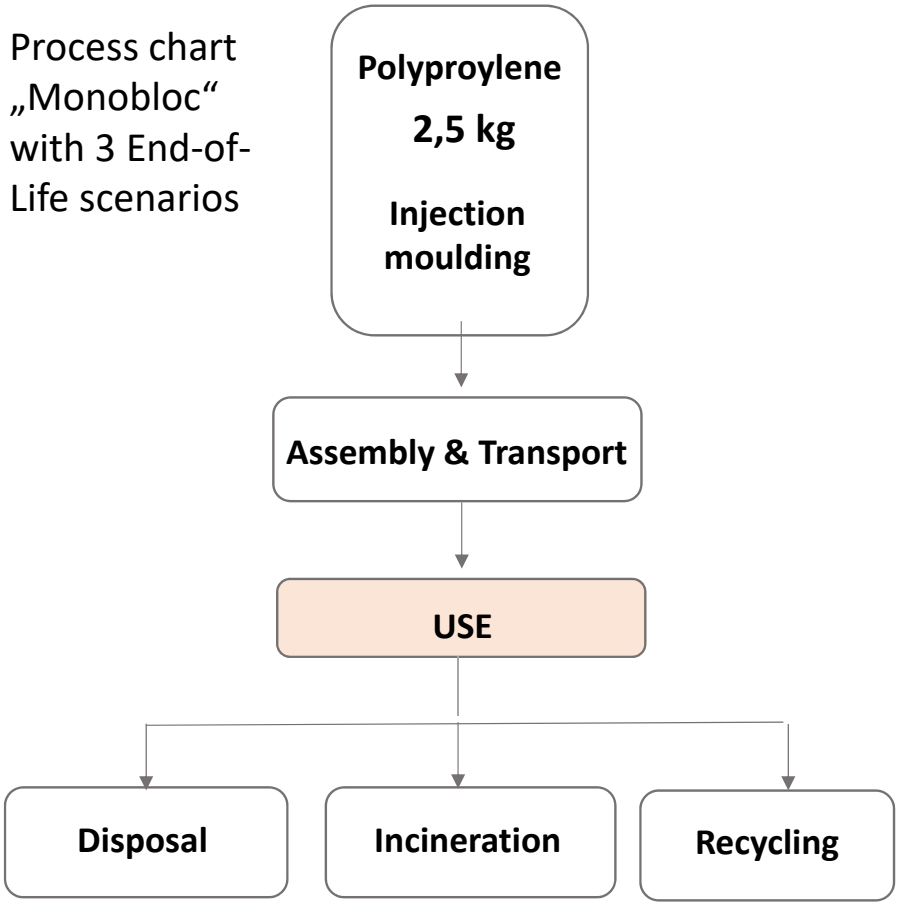
Spritzgussverfahren
Injection moulding 0,336 Pt
56 sec.

Weight of the material: 2,5 kg
0,901 Pt

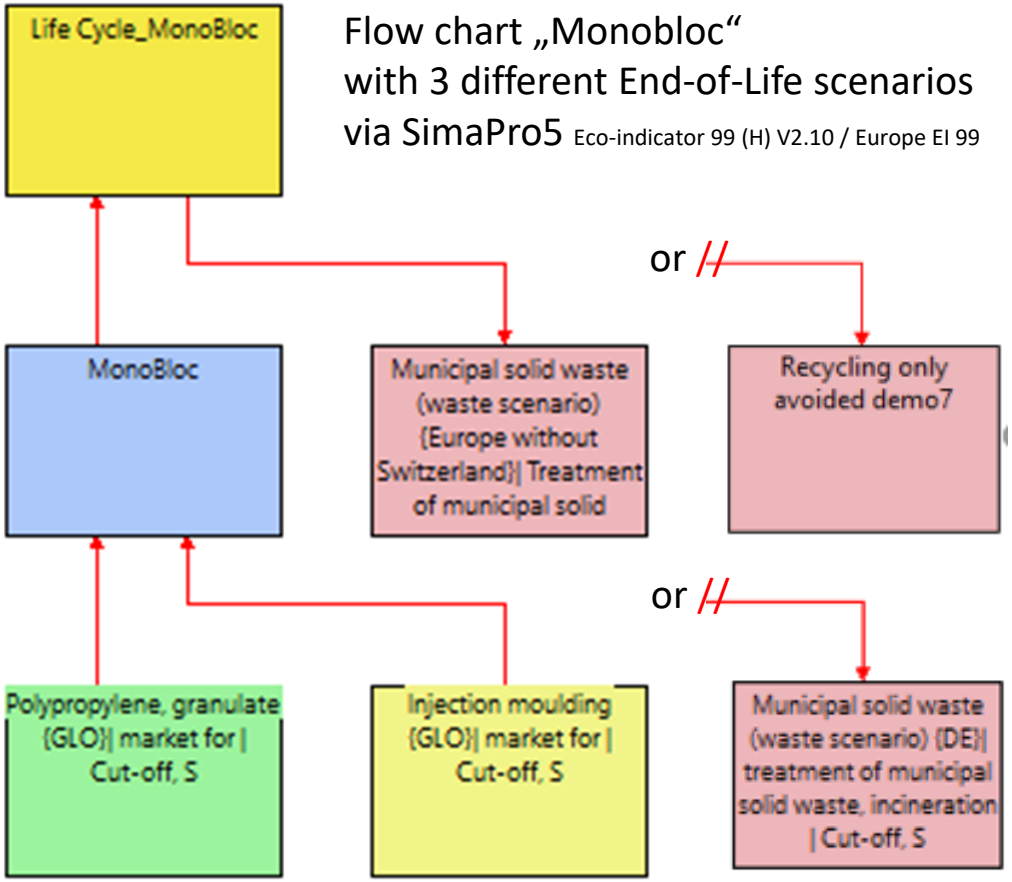
https://www.youtube.com/watch?v=ACf3SqlZ0vQ

4.Process Chart & Flow Chart

Process chart „Monobloc“ with 3 End-of-Life scenarios



Flow chart „Monobloc“ with 3 different End-of-Life scenarios via SimaPro5 Eco-indicator 99 (H) V2.10 / Europe EI 99



4. Classification

Se	Wirkungskategorie	Einheit	Summe	MonoBloc PP Halde	Municipal solid waste (waste
☑	Carcinogens	DALY	7.05E-6	1.7E-6	5.35E-6
☑	Resp. organics	DALY	1.32E-8	1.31E-8	1.3E-10
☑	Resp. inorganics	DALY	6.26E-6	6.22E-6	3.24E-8
☑	Climate change	DALY	1.82E-6	1.78E-6	4.29E-8
☑	Radiation	DALY	1.39E-8	1.38E-8	7.15E-11
☑	Ozone layer	DALY	3.39E-10	3.33E-10	6.44E-12
☑	Ecotoxicity	PAF*m2yr	3.22	2.64	0.584
☑	Acidification/ Eutrophication	PDF*m2yr	0.122	0.121	0.00104
☑	Land use	PDF*m2yr	0.135	0.131	0.00456
☑	Minerals	MJ surplus	0.123	0.123	0.000447
☑	Fossil fuels	MJ surplus	28.5	28.4	0.0747

Landfill/Deponierung

Verbrennung/Incineration

Monobloc End-of-Life

Recycling

Charakterisierung | Schadensabschätzung | Normalisierung | Gewichtung | Einzelergebnis

Kategorien ignorieren: Nie

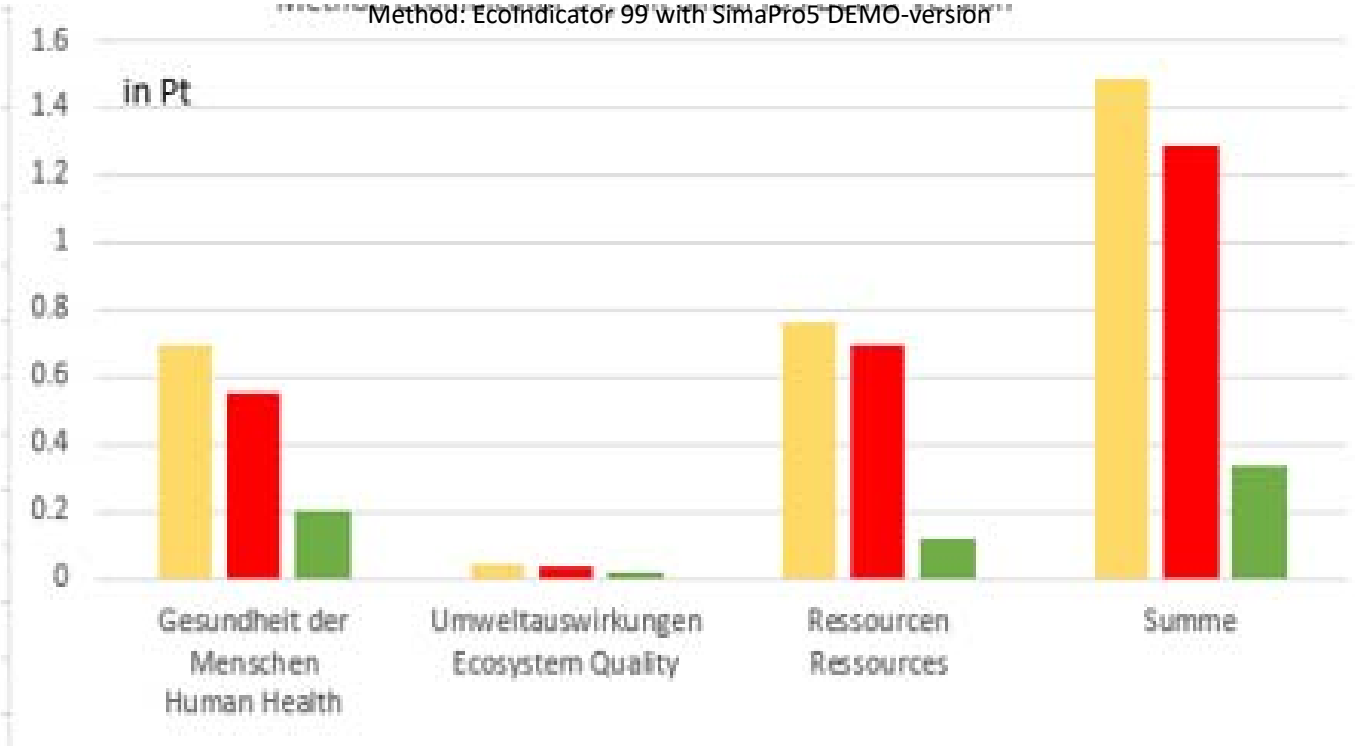
Standard / Gruppe

Se	Wirkungskategorie	Einheit	Summe	Plastic Chair MONOBLOC	Incineration/CH S demo7
☑	Carcinogens	DALY	2.5E-6	2.18E-6	3.22E-7
☑	Resp. organics	DALY	1.11E-8	1.08E-8	2.29E-10
☑	Resp. inorganics	DALY	6.63E-6	6.52E-6	1.1E-7
☑	Climate change	DALY	3E-6	1.67E-6	1.33E-6
☑	Radiation	DALY	1.17E-8	1.16E-8	1.31E-10
☑	Ozone layer	DALY	2.02E-10	1.99E-10	3.83E-12
☑	Ecotoxicity	PAF*m2yr	3.19	3.07	0.125
☑	Acidification/ Eutrophication	PDF*m2yr	0.122	0.116	0.00586
☑	Land use	PDF*m2yr	0.0703	0.0698	0.000508
☑	Minerals	MJ surplus	0.117	0.116	0.00181
☑	Fossil fuels	MJ surplus	26.2	26.2	0.0536

Se	Wirkungskategorie	Einheit	Summe	Monobloc Recycling	Recycling only avoided demo7
☑	Carcinogens	DALY	1.18E-6	1.18E-6	4.94E-9
☑	Resp. organics	DALY	4.27E-9	7.29E-9	-3.02E-9
☑	Resp. inorganics	DALY	2.52E-6	4.42E-6	-1.9E-6
☑	Climate change	DALY	7.4E-7	1.1E-6	-3.55E-7
☑	Radiation	DALY	1.78E-8	1.19E-8	5.94E-9
☑	Ozone layer	DALY	2.84E-10	2.71E-10	1.26E-11
☑	Ecotoxicity	PAF*m2yr	1.62	1.61	0.0141
☑	Acidification/ Eutrophication	PDF*m2yr	0.0117	0.0759	-0.0642
☑	Land use	PDF*m2yr	0.109	0.107	0.00186
☑	Minerals	MJ surplus	0.0665	0.0658	0.000671
☑	Fossil fuels	MJ surplus	4.28	13.7	-9.45

5. Interpretation after Normalization and Weighting

Ecobalance / Ökobilanz MONOBLOC
Use with three End-of-Life-Scenarios
Method: EcoIndicator 99 with SimaPro5 DEMO-version



Impact Categories		Landfill	Incineration	Recycling
Schadenskategorie	**Einheit**	**Deponierung**	**Verbrennung**	**Recycling**
Gesundheit der Menschen Human Health	Pt	0.692	0.555	0.204
Umweltauswirkungen Ecosystem Quality	Pt	0.0405	0.0357	0.0198
Ressourcen Ressources	Pt	0.758	0.698	0.115
Summe	Pt	**1.49**	**1.29**	**0.339**

5. Interpretation

1.24 Pt are generated in the production of the Monobloc alone.
Above all, fossil resources and the composition of the electricity mix used influence the life cycle assessment.

End-of-life scenario...

- Landfilling: 0.25 Pt is added because landfills consume land and the material and energy resources bound in the scrap chair remain unused.
- Incineration: 0.05 Pt are added because the waste heat recovered can be used to generate electricity or fed into district heating pipelines.
- Recycling: 0.336 Pt!!! The negative balance arises from the material and energetic secondary recycling of the PP.

1,24 Pt fallen allein bei der Produktion des Monoblocs an.
Vor allem fossile Ressourcen und die Zusammensetzung des verwendeten Strom-Mixes beeinflussen die Ökobilanz.

End-of-Life-Szenario…

- Deponierung: 0,25 Pt kommen hinzu, weil Deponien Flächen verbrauchen und die im Schrottstuhl gebundenen stofflichen und energetischen Ressourcen ungenutzt bleiben.
- Verbrennung: 0,05 Pt kommen hinzu, weil die gewonnene Abwärme zur Verstromung oder zur Einspeisung in Fernwärmeleitungen genutzt werden kann.
- Recycling: 0,336 Pt!! Die negative Bilanz entsteht durch die stoffliche und energetische sekundäre Verwertung des PPs.