

ライフサイクルアセスメント

生命週期評估

전 과정 평가

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ارزیابی چرخه عمر

Evaluarea Ciclului de Viață

Posuzování Životního Cyklu

Bizi zikloaren analisi

Olelusringi hindamine

Lífssferilsgreining

Levenscyclusanalyse

Livscyklusvurdering

# Lessons learned from assessing life cycle impacts for an environmental product declaration (EPD): Examples for run-of-river power plant

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Dr Niels Jungbluth

Over 20 years of experience in life cycle assessment

Founded 1998 as an ETHZ spin-off

## Who are we?



Christoph Meili

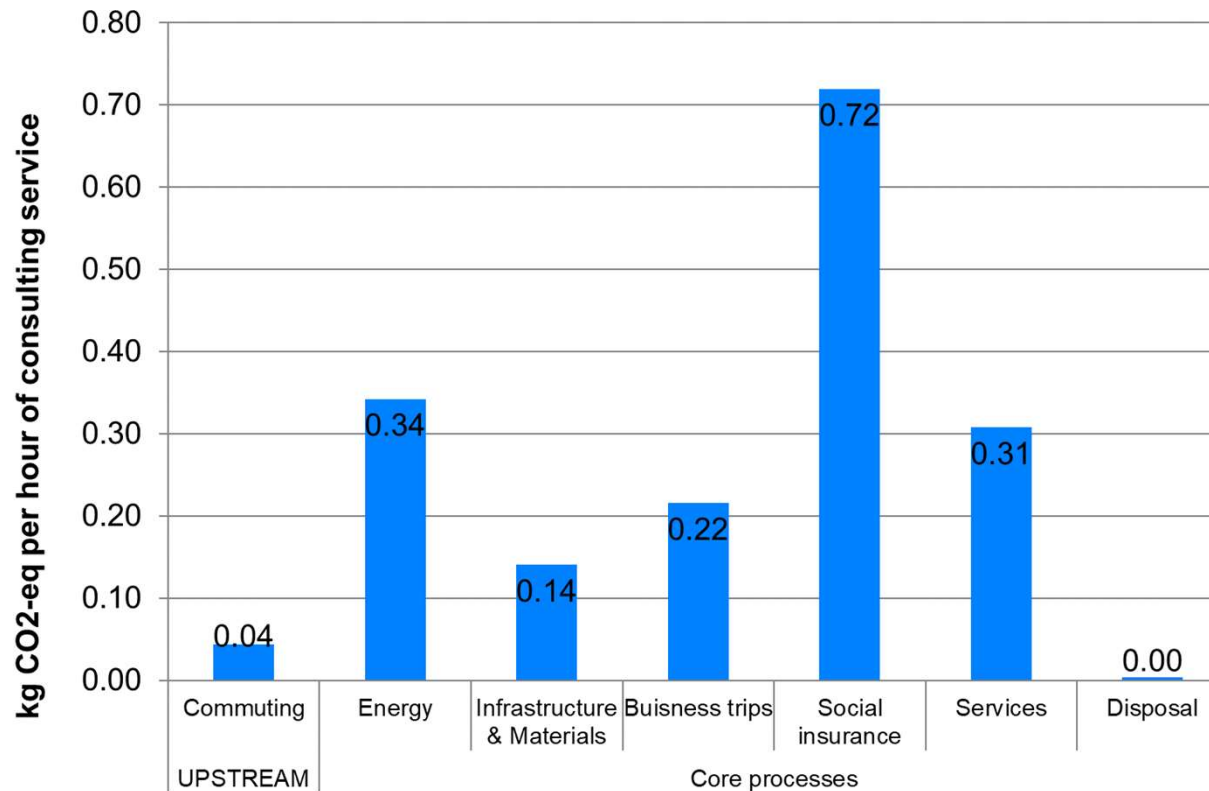
Clients from industry, NGOs, administration, universities

Own LCA database with more than 6'000 datasets

## EPD-related projects in 2018

- **EPD of our own consulting services**
- EPD on run-of-river power plants
- Revision of a PCR for electricity
- Review of an EPD on concrete products

## EPD of our own consulting services 2018



<http://esu-services.ch/news/reporting>

- ~1.5kg CO<sub>2</sub>eq per hour is low. This value would already have doubled if one person would have taken a business class trip by plane to e.g. New York and back!

## EPD-related projects in 2018

- EPD of our own consulting services
- **EPD on run-of-river power plants**
- Revision of a PCR for electricity
- Review of an EPD on concrete products

- What were the main challenges faced?
- How could EPD and PCR be improved to simplify consulting and interpretation by customers?

## Example: Run-of-river power plant

### Goals:

- Show improvement options to operator
- Give rough estimate for comparison with other electricity sources in the portfolio of the operator



# Parameter model

**Anlagenanalyse: Energie aus Laufwasserkraftwerken**

**Anleitung**

**Eingaben**

Alle weissen Felder im Blatt „Eingabe“ müssen ausgefüllt werden. In der unteren Hälfte der blau hinterlegten Felder mit Werten je Baukomponente ausgefüllt werden. Für die weitere Berechnung grössere Wert, also entweder die Summe der Detailangaben, in den blauen Feldern, oder das Feld, verwendet. Grün, grau oder rot gefärbte Zellen dürfen nicht verändert werden.

**Systemgrenzen**

Für die Eingaben sind die Systemgrenzen gemäss Hintergrundbericht zu beachten. Grundsätzlich sind die Angaben nach dem Stand der Technik zu machen. Das Modell ist nur für Laufwasserkraftwerke (ohne Pumpspeicherung) gültig, welche durch ein Staudamm, angetrieben werden. Dieses Modell wurde für die Schweiz entwickelt und ist in anderen Ländern anzuwenden.

Alle Angaben müssen für den jeweils angegebenen Zeitraum (beispielsweise ein Jahr, ein Nutzungsmonat) eingegeben werden.

**Ergebnisse**

Sind alle Eingaben getätigt, können die Ergebnisse der Berechnung im entsprechenden Tabellensymbol als Kurzbericht ausgedruckt werden.

**XXXX AG -Anlagenanalyse: Energie aus Laufwasserkraftwerken**

1	Anlage-Standort	Test-Gelände				
2	Referenzjahr	2018				
3	BearbeiterIn	Hans Muster				

7	Allgemeine Angaben zum Betrieb der Anlage pro Jahr					
8	Einheit	Eingabe	Total über Lebensdauer	pro kWh	Beispiel	
8	Turbinierte Wassermenge (Zufluss Jahresmittel)	m³/s	-	-	0.00E+00	
9	Technische Effizienz von Generator und Transformator zusammen	%	95%	95%	95%	95%
10	Mittlerer Jahresertrag (Brutto)	MWh	38'451	3'076'074	1.00E-03	38'
11	Eigenstromverbrauch	MWh	0.0	-	0.00E+00	
12	Jahresertrag (Netto)	MWh	38'451	3'076'074	1.00E-03	38'
13	Benzin- & Dieselbedarf für Unterhalt	L	0.0	-	0.00E+00	
14	Schmiermittel	kg	5	375	1.22E-07	
15	Korrosionsschutz	kg	0	-	0.00E+00	

17	Allgemeine Angaben zur Anlage					
18	Einheit	Eingabe	Total über Lebensdauer	pro kWh	Beispiel	
18	Landbedarf inkl. Aufstauzone inkl. Uferbefestigung (exkl. Umgehungsgerinne und Renaturierung)	m²	173'983	173'983	5.66E-05	173'
19	Landbedarf, Anteil Infrastruktur	%	0.99%	0.99%	0.99%	0.

23	Optionale Angaben zum Verteilnetz (nachgelagerte Infrastruktur und Prozesse)					
24	Einheit	Eingabe	Transportierte Strommenge (kWh/a)	pro kWh	Beispiel	
24	Verlustrate Übertragung und Transformation Werkstrom - Hochspannung	%	3.30%		3.30%	3.

**Auswertungen für die Umwelterklärung (Environmental Product Declaration - EPD)**

Wirkungsindikatoren gemäss EPD 2013 für das Laufwasserkraftwerk 'Test-Gelände'

Der Farbcodes zeigt die Verknüpfung zu relevanten kumulierten Sachbilanzdaten in der nächsten Tabelle auf Seite 32

33	Umweltauswirkung	Einheit	1kWh Strom (Netto) ab Kraftwerk Test-Gelände	1kWh Strom Niederspannung beim Kunden der XXXX AG
34	Klimaerwärmung (GWP 100a)	g CO <sub>2</sub> eq	15	24
35	Versauerung (ohne Langzeiteffekte)	mg SO <sub>2</sub> eq	54	133
36	Smogbildung (bodennahes Ozon)	mg C <sub>2</sub> H <sub>4</sub> eq	2.83	6.51
37	Überdüngung (Eutrophierung)	mg PO <sub>4</sub> <sup>3-</sup> eq	35	122
38	Ozonabbauende Gase (ODP)	ng CFC-11 eq	5.42	6.09
39	Abbau fossiler Ressourcen	MJ	162	222
40	Abbau mineralischer Ressourcen	mg Sb eq	46	335

**Dominanzanalyse EDP 2013, pro kWh Strom, Niederspannung, beim Endkunden**

➤ Allows managers to gain their own insights

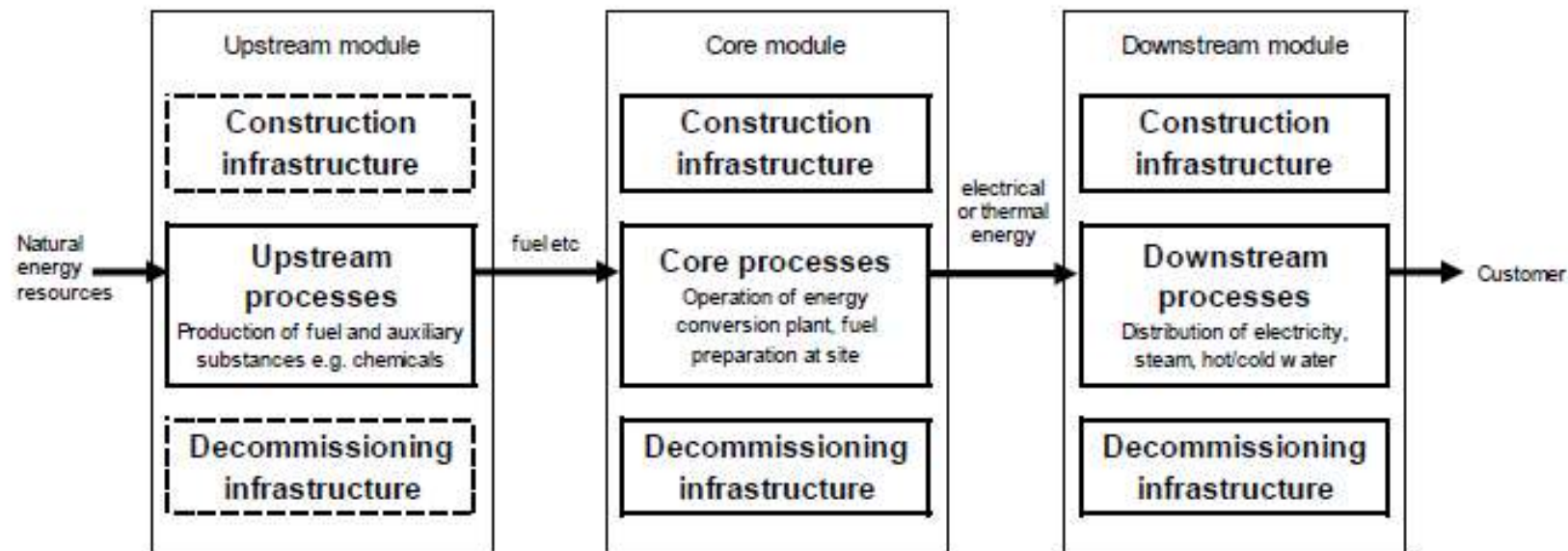


## Selected challenges

- Which standard (ISO, EN) and Product Category Rules (PCR) to apply?
  - How to draw system boundaries accordingly?
  - Which life cycle impact assessment methods match the standard?
  - How to obtain requested information from LCI data which are not included in LCIA-methods?
- How to build an appropriate model in the LCA-software of choice?
- How to set findings in perspective and foster encouragement/improvement?

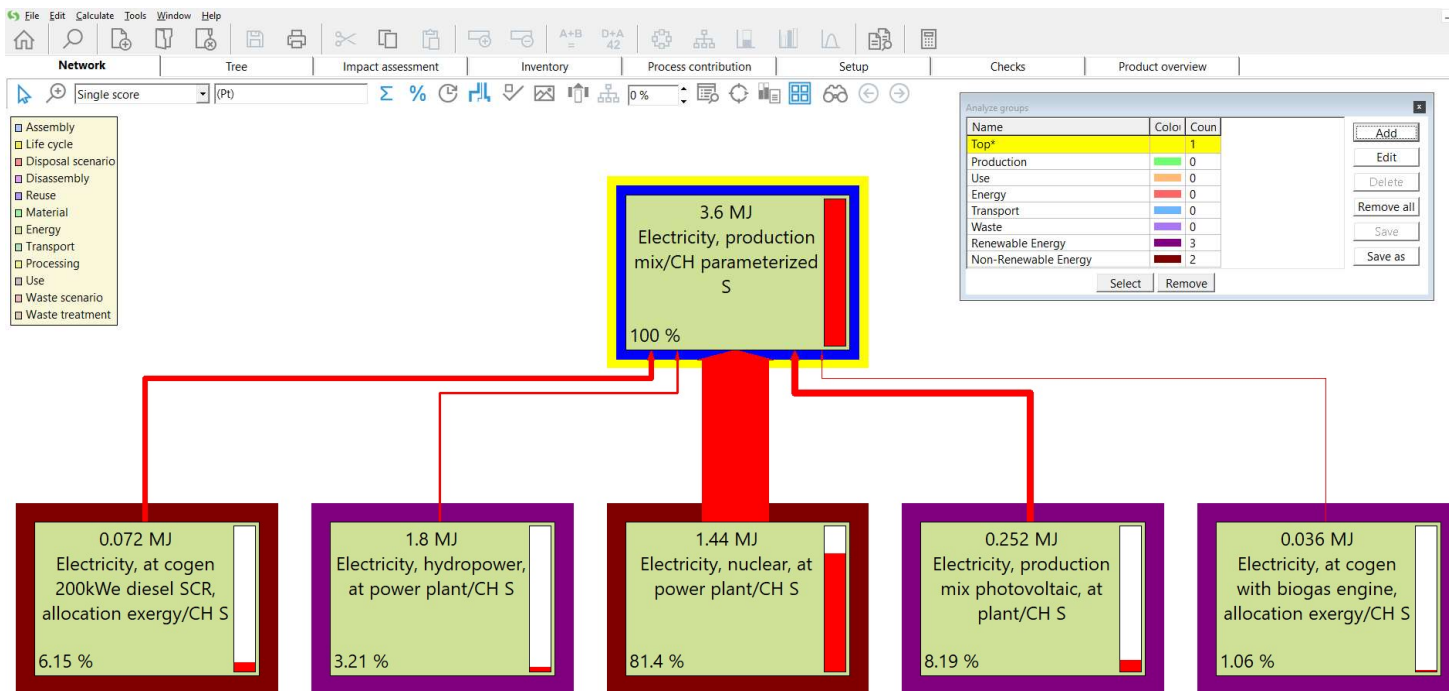
## Issue: LCI system boundaries

System boundaries have to be drawn following a predefined pattern, depending on the product under investigation:



## Solution: LCI system boundaries

System boundaries can be distinguished in SimaPro using the analysis-group function in network-view:



## Issue: environmental impact categories

- EPD (2018) in SimaPro 9.0
- 8 LCIA indicators
- Based on environdec

[www.environdec.com/Creating-EPDs/Steps-to-create-an-EPD/Perform-LCA-study/Characterisation-factors-for-default-impact-assessment-categories/](http://www.environdec.com/Creating-EPDs/Steps-to-create-an-EPD/Perform-LCA-study/Characterisation-factors-for-default-impact-assessment-categories/)

Environmental impacts			UNIT	SimaPro
PARAMETER				Use EPD (2018) method
Global warming potential	Fossil		kg CO2 eq.	/Inventory/GWP/fossil or own LCIA method
	Biogenic		kg CO2 eq.	/Inventory/GWP/biogenic or own LCIA method
	Land use and land transformation		kg CO2 eq.	/Inventory/GWP/land transformation or own LCIA method
	TOTAL	GWP	kg CO2 eq.	EPD (2018)
Acidification potential		AP	kg SO2 eq.	EPD (2018)
Eutrophication potential		EP	kg PO43-eq.	EPD (2018)
Formation potential of tropospheric ozone		POCP	kg C2H4 eq.	EPD (2018)
Abiotic depletion potential – Elements		ADP	kg Sb eq.	EPD (2018)
Abiotic depletion potential – Fossil fuels		ADP	MJ, net calorific value	EPD (2018)
Water scarcity potential		WSP	m³ eq.	EPD (2018)

## Additional indicators

- Use of resources (PERE, PERMSM, NRSF, ....)
- Waste production (HWD, NHWD, RWD)
- Output flows for further use (CRU, MFR, MER, EEE, EET)
- Important are further instructions in the general description

[www.environdec.com/contentassets/95ee9211a9614f1faa7461ff32cecc91/general-programme-instructions-v3.0.pdf](http://www.environdec.com/contentassets/95ee9211a9614f1faa7461ff32cecc91/general-programme-instructions-v3.0.pdf)

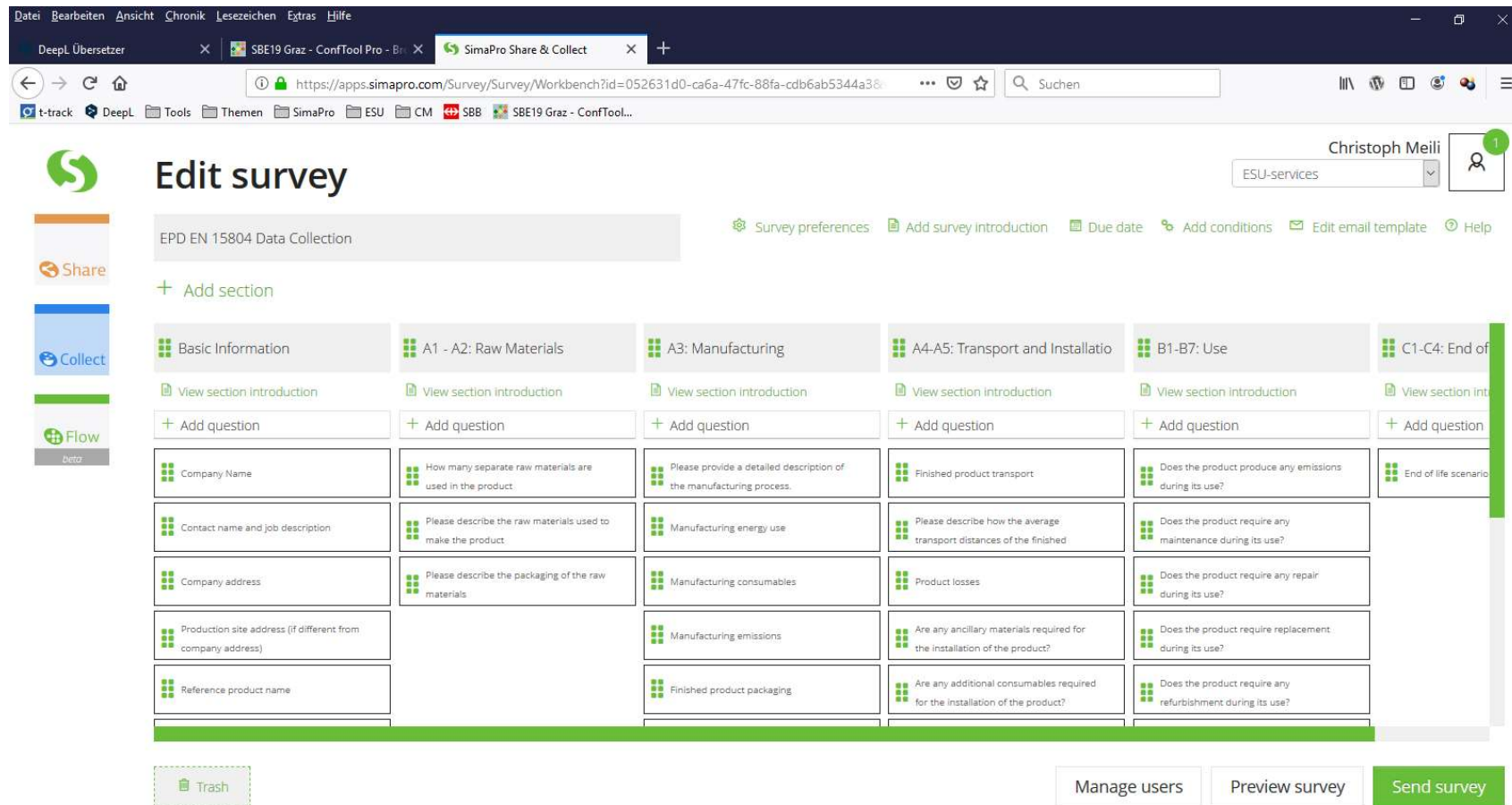
## Recommendations for PCR

- Concentrate on main LCIA indicators
- Skip non-LCA indicators (internal waste flows, material/energy differentiation of resources), or
- Give clear guidance how to measure and report these flows
- Report less, but more comparable information
- Request unit process raw data as an annexe

## Recently available supporting tools for EPDs in common LCA software-packages:

- Include an LCIA methodology with which one can easily access the available indicator information requested by the EPD-framework.
- Include an EPD-related questionnaire which might be directly linked to the LCA-project-model

# Survey: Might be done with SimaPro Collect



Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe  
 DeepL Übersetzer x SBE19 Graz - ConfTool Pro - B... x SimaPro Share & Collect x +

https://apps.simapro.com/Survey/Survey/Workbench?id=052631d0-ca6a-47fc-88fa-cdb6ab5344a36

Christoph Meili  
 ESU-services

## Edit survey

EPD EN 15804 Data Collection

[Survey preferences](#) [Add survey introduction](#) [Due date](#) [Add conditions](#) [Edit email template](#) [Help](#)

+ Add section

Basic Information	A1 - A2: Raw Materials	A3: Manufacturing	A4-A5: Transport and Installatio	B1-B7: Use	C1-C4: End of
View section introduction	View section introduction	View section introduction	View section introduction	View section introduction	View section int
+ Add question	+ Add question	+ Add question	+ Add question	+ Add question	+ Add question
Company Name	How many separate raw materials are used in the product	Please provide a detailed description of the manufacturing process.	Finished product transport	Does the product produce any emissions during its use?	End of life scenario
Contact name and job description	Please describe the raw materials used to make the product	Manufacturing energy use	Please describe how the average transport distances of the finished	Does the product require any maintenance during its use?	
Company address	Please describe the packaging of the raw materials	Manufacturing consumables	Product losses	Does the product require any repair during its use?	
Production site address (if different from company address)		Manufacturing emissions	Are any ancillary materials required for the installation of the product?	Does the product require replacement during its use?	
Reference product name		Finished product packaging	Are any additional consumables required for the installation of the product?	Does the product require any refurbishment during its use?	

[Trash](#) [Manage users](#) [Preview survey](#) [Send survey](#)



## Automate data collection and analysis with tools like SimaPro Share&Collect

 **Collect** allows to link a model prepared with  **Flow**

The connection between the collection form and the model is:

- Tailored: User can only pick from datasets with simple names as listed by the Expert
- Dynamic: Data entered are visible in the model in real-time
- Collaborative: Support feature is available in-app
- Traceable: Data entered by the user are saved even if modified by the expert afterwards

→ <http://esu-services.ch/simapro/sharecollect/>

## Use a Report Maker Tool

The screenshot shows a Microsoft Word document titled "Parquet EPD.docx" with a ribbon menu including FILE, HOME, INSERT, DESIGN, PAGE LAYOUT, REFERENCES, MAILINGS, REVIEW, VIEW, Acrobat, and SimaPro. The document content is an "ENVIRONMENTAL PRODUCT DECLARATION" for a parquet floor. It includes fields for the owner (Institut Bauen und Umwelt e.V.), the author of the project ("My New Fancy Parket"), and the declared product ("My New Fancy Parket"). A large image of the product is shown, with a red arrow pointing to its settings. The status bar at the bottom indicates "PAGE 1 OF 3", "352 WORDS", and "ENGLISH (UNITED STATES)".

- Link Word or Excel to parameterized model from LCA-software
- Automatize reporting for several similar products
- Update the whole report with one click

## Conclusions

- There are many tools available for assistance
- Still, there is a need for clearer, harmonized guidance
- Reports, PCR, EPD and practitioner should have a clearer focus and should keep the goal for improvement in mind.

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