

MONOBLOC

A Life Cycle Assessment for interested parties

Developed within the framework of the
project



www.lca-meets-efs.net



Dear pupils, trainees, students, colleagues and interested people,

With this handout we would like to introduce you to the LCA learning offer on the topic "POTATOES - regional or from the desert".

With the 2030 Agenda, sustainable development is increasingly being brought into focus and expanded to include new concepts and strategies. Processes in everyday life, technology and industry are to be transformed towards sustainable practice. However, evaluating this is not an easy task. In recent decades, however, techniques have been developed for this purpose which, when they include all relevant impacts of a process or product in the consideration, are referred to as Life Cycle Assessment (LCA). Central to the transformation of our world today in terms of sustainable development is chemistry and the sciences and economic sectors associated with and based on it. Chemistry also needs to become more sustainable; this is done through the concept of Green Chemistry (also Sustainable Chemistry). Since Agenda 21 has already outlined the importance of education for the sustainable development of our society, a change in thinking is also taking place in chemistry and a new area in chemistry-related education is increasingly being implemented in many countries: Green Chemistry Education (GCE).

GCE includes knowledge of a changed view of chemistry, for example in the field of chemical synthesis and production in research and industry. Closely related to this are also competencies in the environmentally sound, legally compliant and safety-related treatment of chemicals and chemical production processes. So far, however, assessment strategies in the context of sustainable chemistry, such as LCA, have hardly been the subject of GCE. The aim of the project is to develop and implement a digital learning environment on assessment strategies and methods for the handling of chemicals and chemical-related processes. This concerns both the LCA and integrated methods, such as the CO₂ or water footprint.

A website www.lca-meets-efs.net introduces the topic at different levels. It introduces central concepts and methods and explains these with examples.

In the following, we will *briefly* explain the student laboratory "*Life Cycle Assessment meets Education for Sustainability*" (*LCA-meets-EfS for short*), the design of the student laboratory offer and safety-relevant aspects of behaviour in the laboratory for the practical part. We would be very pleased if you would visit the student laboratory,

the project team of the student laboratory "FreiEx" at the University of *Bremen*

I. The student laboratory "FreiEx" in the chemistry didactics of the University of Bremen

A student lab is a non-school learning environment that includes a pre-structured learning offer. The special feature of a student laboratory is the supplementation of school and non-school learning and the adjustment to the specific learning requirements of the students. This implies a didactic design of the learning offer.

The student laboratory offer is designed in such a way that it can be flexibly adapted to different learning groups and also has a high degree of internal differentiation. The digital teaching and information elements, experiment instructions and supplementary materials are intended to challenge pupils to learn about topics in the sustainability debate and to be able to orient themselves in corresponding subject areas. The target groups for these student lab offerings are school and out-of-school learning groups, trainees, and students of scientific and technical disciplines.

II. The LCA material for faculty and users

Based on current issues in the climate and sustainability debate, this handout on the LCA learning tool "MONOBLOC" is intended to provide an introduction to the complex topic of life cycle assessment using the **LCA tool SimaPro5 for Life Cycle Assessment**. The material is suitable for learners in the upper grades of general and vocational schools and in higher education.

For teachers/trainers/lecturers/course leaders the learning offer contains the following documents and materials:

- Teacher information LCA learning offer "MONOBLOC"
- Course plan for the learning unit with suggestions for getting started, for implementation and for securing knowledge with solutions and time details
- Materials: Worksheets (fact check, endpoints condensed, argumentation sheet)
Print templates (world map, value chain (inventory of LCA))
DATA-SETS for calculatory processing via Excel or Numbers
- Argumentation aids and background information on the relevant end points
- +++ Basic knowledge FAKTEN-Tool LCA with SimaPro5 and FACT-Tool Interpretation of results
- List of data sources, media offers, further literature, order addresses

The LCA software tool SimaPro5 can be downloaded as DEMO in the version "CLASSROOM" <https://simapro.com/licences/#/education>. The tool is then available for 30 days and offers reduced access to the databases. Up to 16 LCA inventories can be stored. This LCA offer "MONOBLOC" is adapted to the DEMO version. SimaPro5 is Windows-based. iOS users can work with a virtual box.

Sustainability is important - but rarely simple. With the "MONOBLOC" module offer, the endpoints relevant for a life cycle assessment "human health, effects on or in the environment as well as resource consumption" can be developed in detail for the production and ultimately the disposal of this classic seat. The inventory (concerning material and processes, see value/supply chain) is simple, only the tree disposal scenarios "landfilling", recycling, and "incineration" are dealt with. The material flow is deliberately kept simple, as the emission considerations in this module are complex.

The worksheets SECTION 1-3 with the two print templates are meant to guide and support the learners in shooting the facts about the product MONOBLOC. Of course, the pupils / students are

free to design their analogue or digital MindMaps. Each member of the group can thus contribute his or her individual strengths - be it analytical, organisational, creative, linguistic - to the group work. Internal differentiation is possible in the school context.

Course Plan "**MONOBLOC**"

| PHASE | SUB TOPIC | MATERIAL | DURATION |
|-------------------|---|-------------------------|---------------|
| Access | It's ugly and wobbly, but it's all over the place → Name places and occasions where MONOBLOC has been used. | Survey | 10 min |
| | https://www1.wdr.de/mediathek/audio/wdr3/wdr3-mosaik/audio-film-ueber-plastikstuhl-monobloc-100.html | Video clip | 6 min |
| | Features and a podcast series all about the Monobloc at https://www.ndr.de/nachrichten/info/podcasts/Monobloc_monobloc104.html . | Video clip | arbitrary |
| | | | |
| Group work | Division into working groups with 2-3 participants | | |
| | | | |
| FACT CHECK | MONOBLOC - a chair conquers the world: How and with what is it produced. Why is it the best-selling piece of furniture in the world? | SECTION 1 | 30 min |
| Info | Plastic - curse and blessing: Name advantages & disadvantages | Survey 2 | 10 min |
| SimaPro5 | Starting the LCA tool | | 10 min |
| FACTS TOOL | STEP by STEP INSTRUCTION LCA with SimaPro5 | SECTION 2 | 30 min |
| | | | |
| PRODUCTION | Using the DATA SET and Supply Chain | Research | 10 min |
| RESULTS | Fill in number tables, enter valuations in the overview | SECTION 3 + DATA SET | 30 min |
| | | | |
| | | | |
| CONCLUSION | Group discussion / expert round / group puzzle | | 30 min |

In addition, an explanation of the damage categories considered in this simple life cycle assessment, the connection to analytically measurable pollutants, emissions and requirements can be consulted as an aid to interpretation. It is available under BASIC FACTS.

To start with, the learning group should/could approach the topic "MONOBLOC" by means of surveys, impulse film, planting instructions etc. Suggestions for suitable research questions are noted on the progress plan. Practical activities in the (school) garden or tastings arouse curiosity and are fun. With the division into groups and the handing out of the materials or delivery of links on the website, each group gets access to the work folders deposited there. **(Time requirement 1 double hour)**

Group work In the web folder are the worksheets (SECTION 1-3) of this module offer "MONOBLOC" for the life cycle assessment of the plastic chair and three end-of-life scenarios with the compressed DATA SET. The subtopics in designed in such a way that both the group processing of a subtopic can be done by itself or - if it is too difficult – within only one disposal per group can be considered within a sub-topic. The following scenarios are available: landfill, incineration and recycling. How many scenarios are worked on depends on the individual size and interest of the learning group.

SECTION 1 is a FACT CHECK. A headline with research question(s) leads to the text. This contains the most important information about the product/endpoint under consideration and about ingredients, growing areas and conditions in a condensed form. The learners can/should prepare the **results of their research** for the final group discussion.

The **print template "value/supply chain"** (also as .pptx) contains prepared buttons with starting material, possible work steps up to the customer. The end-of-life view of the packaging can be expanded/optionally added.

SECTION 2 and 3 are DATA SHEETS. There are three „End-of-Life“ scenarios to choose from: landfilling (yellow background), incineration (red) and PP recycling (green). The latter is a method that has only recently been recovery process for polypropylene that has only recently become economically feasible. The information required to carry out a life cycle assessment is presented in tabular and graphic form and graphical presentation.

A summary worksheet **SECTION 3** for the three production countries to be considered in this set is part of the documents. **SECTION 3** forms the basis for the final presentation and group discussion. On it, facts about the evaluation criteria "Ecological & economic, health reasons" are recorded in tabular form. This should be an aid for the comparative evaluation and classification of the relevant production data.

The DATA-SETs created for this purpose focus on the three end-of-life scenarios considered. The collected data were created with the software tool "SimaPro5" www.simapro5.com in the DEMO version and are prepared in such a way that the data can be processed by the learners without using the software tool.

However, in order to familiarize the learning group with the software tool SimaPro5, a step-by-step guide was developed. that enables an ecological assessment of the MONOBLOC with the End-of-Life scenarios. The learning groups should prepare, harmonize and graphically display the results obtained from their life cycle assessment.

With the final **presentation of the results** (via keynote, powerpoint, padlet or as poster) and **discussion** (as group puzzle / panel discussion / expert round), the results from the individual group work can be communicated to the entire learning group to discuss the pros & cons of the respective End-of-Life scenarios for the Monobloc chair in an expert round. (**Time requirement 2 double lessons**).

III. Notes and literature on the technical background

- Software-Tool SimaPro5 <https://simapro.com/> DEMO Version – Education-Classroom
- [https://en.wikipedia.org/wiki/Monobloc_\(chair\)](https://en.wikipedia.org/wiki/Monobloc_(chair))
- VIDEO https://www.youtube.com/watch?v=8NNM-UWib_4
- Wendler, H.: Podcast-Serie des NDR in 6 Teilen
<https://www.ndr.de/nachrichten/info/podcasts/podcast5316.html>