WS 1 FACT CHECK

The **Monobloc** is a stackable plastic seating furniture manufactured since the early 1970s. Together with designer Pierre Paulin, French engineer Henry Massonnet developed the plastic chair, which is now the most sold seating furniture in the world.

Despite the fact that the monobloc is reviled as mostly white, ugly monstrosity, you can find it in almost every garden, pub, beach, park and large events around the world. It has many practical qualities: it is stackable, very light, quite weather-resistant, washable with soapy water and, above all, cheap. Particularly detrimental to its image are its instability and the stain-attracting effect of its surface, which quickly make it look gray and unsightly. Broken Monobloc chairs litter the landscape and contribute significantly to global plastic litter.

The production of one piece (monobloc) in a single operation gave the chair its name, because the injection molding process can produce a chair from 2.5 kg of polypropylene granules PP worth 2.50 euros in just 56 seconds. Up to 1,500 chairs are produced within 24 hours!

Advances in the chemical-technical processing of petroleum into plastics with weather-resistant and load-bearing properties, as well as efficient polymerization processes, are the foundations for monobloc production in such high volumes at a low price.

But in the future, not only the practical things in life will be connected with the plastic chair. Since the beginning of 2022, the Monobloc is even a movie star! Hauke Wendler from Hamburg is a documentary filmmaker, journalist and producer and has researched the history, distribution, use and disposal of the Monobloc in such detail that reports, podcasts and a cinema film have been produced. The film "Ein Plastikstuhl erobert die Welt" ("A plastic chair conquers the world") is presented in the Kulturjournal of the NDR. Broadcast: Kulturjournal | 24.01.2022 | 22:45 Uhr 6 Min | Available until 07.03.2022.

TASKS:

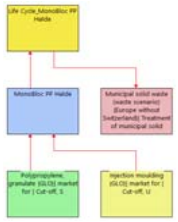
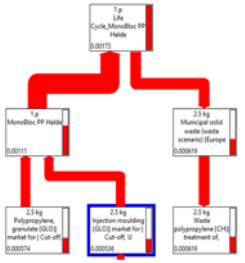
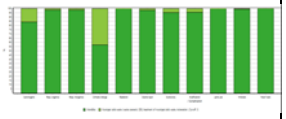
1. Research the production process and distribution of the Monobloc
2. From what and how is polypropylene produced and PP granules manufactured?
3. Price and sales figures in Germany, Uganda and Vietnam
4. Research and discuss its image in these three countries. Are there similarities/differences?

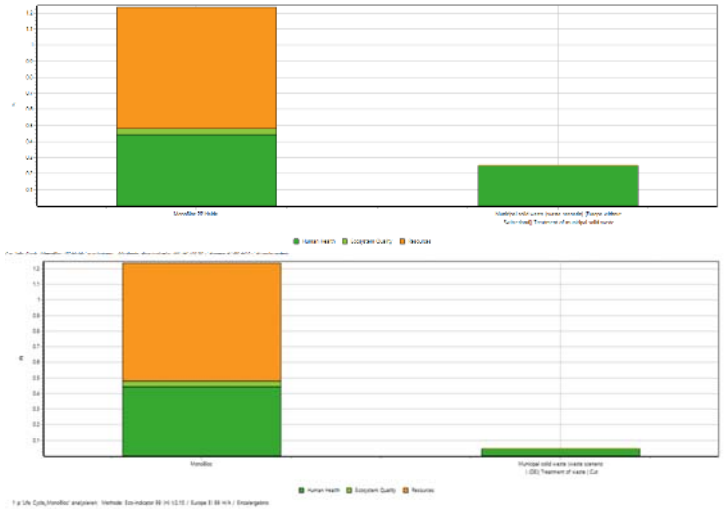
As sources, for example, Youtube videos and the offer of the NDR are available.
https://www.ndr.de/fernsehen/sendungen/kulturjournal/Ein-Plastikstuhl-erobert-die-Welt-Kinofilm-ueber-Monobloc,kulturjournal8340.html In addition, there are features and a podcast about the Monobloc at https://www.ndr.de/nachrichten/info/podcasts/Monobloc,monobloc104.html.

AB 2 The application of the LCA software tool "SimaPro5

Using the example of the consumer product "Monobloc", a simple life cycle analysis with two different disposal scenarios, landfilling and incineration, is to be carried out using the database tool "SimaPro5". The 3rd disposal variant, the so important recycling of the PP, is unfortunately not offered by SimaPro5 in the DEMO variant. To get also this function with the data sets, a license must be acquired!

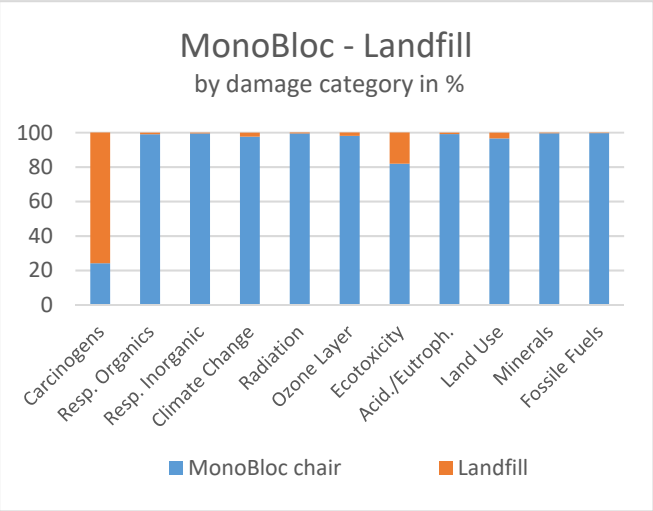
Step	OBJECTIVES	HOW TO DO
A	**Definition of the functional unit**	**The functional unit of this LCA is a plastic chair "Monobloc".** **It consists of 2.5 kg of polypropylene granules. It is formed into the chair by injection molding.**
		What happens to it after use? **The chair can be deposited or burned.**
B	**Process Flow** With the "Previous" button you go back one step in the input	In the "LCA Wizard Demo" wizard, select the variant→ LCA including the assembly. 2. then→ 1. assembly, as no further work steps are to be illuminated here. 3rd/4th Product Name→ Monobloc with addition "Stockpile or Incineration or Recycling". 5. number of units considered Amount in life cycle→ **1** P(iece) 6. asked if materials should be added→ Yes 7. you can choose from Metals, Plastics, Paper and Chemicals→ Plastics 8. the next selection offers various plastics→ Polypropylene, granulate (GLO = global) market for Cut-off, S 9. entering the amount Amount→ 2,5 kg 10. wizard asks if more materials are needed→ no, but a processing process should be added. 11. what type of process ? in this case→ processing of materials 12. the next selection offers different techniques for processing plastic→ Injection molding (GLO) market for Cut-off, S 13. enter the amount; Amount of processed material→ 2,5 kg 14: Wizard asks if further processes are needed for the monobloc→ **no** 15. wizard asks if other processes are added to the Monobloc life cycle?→ **no** (This is confusing here!) 16. wizard asks if a waste/waste scenario should be added to the life cycle monobloc?→ **yes** 17a. Group Landfill on heap selects→ Municipal solid waste (Europe without Switzerland) treatment ..., landfill I Cut-off, S 17b. Group Incineration selects→ Municipal solid waste (Europe without Switzerland) treatment ..., incineration I Cut-off, S 18. wizard asks for further additions or links→ no 19. here ends the LCA Wizard; select→ next 20. the process should be saved→ yes 21. 16 LCAs are free in the DEMO version; select→ ok 22. enter the name of the monobloc with the addition "stockpile or incineration or recycling" and save with ok. 23. who wants to add comments. 24. in the wizard view - LCA Wizard Demo - **Product Systems** the data set for the Monobloc can be retrieved for the following analysis.

C	**Inventory Analysis**  The button Enlarges the view. 	25. in the wizard view - LCA Wizard Demo - **Product systems** the data set for the Monobloc can be called up. The system tree appears and the selected LCA parameters are listed in the list on the left. ATTENTION: Here can still be exchanged now. After confirmation of the new input the SimaPro5 tool calculates the basic data again. However in the demo version then a completely new process is created (one has only 16 processes free). In the license version, however, can be saved under a new name or simply overwritten. Select the "Network" in the "Calculate" tab at the top left. Optionally, additions can still be inserted here. **The evaluation method** used **is called Eco-indicator 99 (H) V2.10 / Europe EI 99 H/A.** It is standardized and complies with the guidelines required by law for determining relevant data on life cycle analysis in accordance with DIN ISO 14040 - 14044/2006. Now the SimaPro5-Sceen should be wide open, otherwise you will not find the button "Calculation" at the very bottom right! The program now calculates all inventories of the network relevant to the LCA monobloc, stockpile (or incineration; or recycling). This may take a little time! Please do not interrupt. The network opens. In it, all materials and processes belonging to the Monobloc system are linked in the form of a SANKEY flow chart. Also included is the energy required to process the PP pellets (using an electricity mix) and disposal. (Also indirectly included are the raw materials and processing required for production, which were completely neglected when the LCA Monobloc was created under B using the Wizard! This is something for advanced users...) 30. a view as a tree does not succeed, because loops are included, which cannot be displayed in the demo version.
D	**Classification**	31. now the real ANALYSIS begins! This **sequence D to I** must be followed to ensure that standardization and weighting produce comparable results.
E	**Characterization**   These can be selected with the buttons.	By clicking on the "Impact assessment" tab, the SimaPro5 tool calculates the impact of the monobloc on 11 impact categories, the so-called subsystems. Based on the resources used and emissions released from them, metrics are determined for each subsystem, which are incorporated into three overarching assessment categories - human health impacts, environmental impact, and resource use. This is the first - but not yet standardized - result of this LCA! The figures for the 11 impact categories can be displayed (as a total, as material/process-related and disposal-related data) in both tabular and graphical form. It is also possible to choose other colors. Effects in categories 1, 4, 7 and 8 can already be identified. For beginners, the units (e.g. MJ surplus, PDF*m2yr) are new. For a first comparison and a better representation, the percentage was used here.

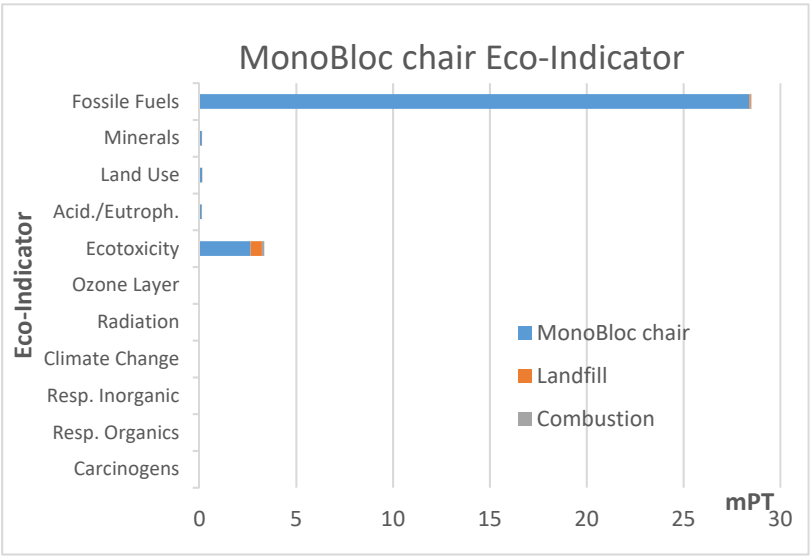
F	**Damage assessment**	34. in the first damage assessment, the three overarching assessment categories - human health burdens, environmental impact, and resource use - are established and the unit Pt is introduced. **1 Pt (Eco Point) stands for 1/1000th of the annual environmental load of an average European citizen.**
G	**Normalization**	35. clicking→ ensures comparability of the considered 11 categories
H	**Weighting**	36. click→ weights the different indicators mapped in a category in correct relations to each other.
I	**Interpretation**	37. click→ to get the final result. 1.49 pt for the monobloc and landfill. 1.29 Pt for the monobloc and combustion. [0.47 pt for the monobloc and a recycling] Only with license version The production of the monobloc made of PP is of course at the expense of fossil resources (orange) and energetic resources. This has a significant impact on health. Especially the carcinogenic potential has to be mentioned. If the chair is ultimately landfilled, the resources it contains will remain unused. Fossil-based plastics in particular contain a high energy density that would be better put to secondary use or else recycled. A comparison with data from combustion, possibly coupled with electricity generation or district heating, illustrates this. 

WS 3 DATA SHEET LCA "Monobloc" and the problem with plastic waste

As an example the results from the LCA with SimaPro5 for scenario „Monobloc and landfill" is shown:



Impact Category [%]	MONOBLOC	Land Fill
Carcinogens	24.2	75.8
Resp. Organics	99	0.98
Resp. Inorganic	99.5	0.518
Climate Change	97.6	2.35
Radiation	99.5	0.515
Ozone Layer	98.1	1.9
Ecotoxicity	81.9	18.1
Acid./Eutroph.	99.1	0.853
Land Use	96.6	3.37
Minerals	99.6	0.363
Fossile Fuels	99.7	0.262



Group discussion / expert round / group puzzle

The final **presentation of the results (**via keynote, powerpoint, padlet or as poster) and **discussion** (as group puzzle / panel discussion / expert round) succeeds in communicating the results from the group work to the entire learning group.

TASKS/QUESTIONS:

1. Which categories of damage are particularly affected by the production of the Monobloc.
2. What are the health, environmental, and resource impacts of the two disposal scenarios?
3. Why is landfilling so harmful to health and has a negative impact on the environment?
4. Explains how the climate change damage category affects combustion.

The free DEMO version in the Education variant can be downloaded for this purpose. Under the link https://simapro.com/licences/#/education the download of a 30-day demo variant is possible, which allows a linking of up to 40 participants.