

# Impact of material selection on the CO2 footprint of NSP



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# Why bother?

- SDG13 → Take urgent action to combat climate change and its impacts
- Growing demand
- Funding policies
- Approach for nature based solution
- Right thing to do

## Ihr persönlicher Footprint

Nicht schlecht! Damit sind sie deutlich besser als der deutsche Durchschnitt. Mit unseren Tipps und Ihrem politischen Engagement für Klimaschutz können Sie Ihren Fussabdruck weiter verringern. Im persönlichen Gespräch können Sie ausserdem Spuren bei anderen Personen hinterlassen.

Ihr Wert

9.92 Tonnen CO<sub>2</sub>

Deutscher Durchschnitt

12.37 Tonnen CO<sub>2</sub>

Weltweiter Durchschnitt

6.41 Tonnen CO<sub>2</sub>

**Global Aim: 2 to. per capita**

Würde die gesamte Weltbevölkerung so vorbildlich leben, bräuchten wir nur

**2.38 Planeten**



# Standard Material



- Concrete
- Iron
- Wood

- Liner PE/PP/PVC
- Filtermaterial
- Floor covering / natural stones

# EPDs and CO2eq Data

## Available Data

- <https://www.environdec.com/library>
- <https://epd-online.com> (german platform)

EPD-Tool Dashboard Public EPDs Account Creating own EPDs EPD information SuPIM Logout

Search published EPDs

Clicking on the thumbnail or the national flag takes you to the detail page of an EPD document.

Preview

Preview	Product	Manufacturer	Main category	Category	PCR	Declaration number	Declaration type	DIN standard	Language
	Kebony Clear (Bauholz)	Kebony AS	02 Building products	Structural timber products	Solid wood products	MR-NEF-EPD-KEB-20160002-DE	Core-EPD	EN 15804+A1	
	Kebony Character (nordische Kiefer) Fassadenverkleidung	Kebony AS	02 Building products	Structural timber products	Solid wood products	MR-NEF-EPD-KEB-20160003-DE	Core-EPD	EN 15804+A1	

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# EPDs and CO2eq Data

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MNR	X

# EPDs and CO2eq Data

## European Product Declaration

		Product stage	Assembly	Use Stage	End of Life	Beyond			
Environmental impact									
Parameter	Unit	A1- A3	A4	A5	B1-B7	C1	C2	C3	D
GWP	kg CO <sub>2</sub> -eqv	-549,42	75,22	0,00	0,00	0,00	5,31	1459,43	-485,19
ODP	kg CFC11-eqv	0,00016	0,000015	0,00	0,00	0,00	0,0000001	0,000071	-0,000063
POCP	kg C <sub>2</sub> H <sub>4</sub> -eqv	0,390	0,015	0,00	0,00	0,00	0,0010	0,052	-0,06
AP	kg SO <sub>2</sub> -eqv	9,32	0,30	0,00	0,00	0,00	0,020	0,87	-1,15
EP	kg PO <sub>4</sub> <sup>3-</sup> -eqv	1,27	0,060	0,00	0,00	0,00	0,0041	0,33	-0,62
ADPM	kg Sb-eqv	0,00300	0,000260	0,00	0,00	0,00	0,000019	0,000084	-0,00005
ADPE	MJ	14692,70	1232,80	0,00	0,00	0,00	86,73	404,50	-7255,97

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources; INA: indicator not assessed (due to a lack of specific data) and that the values are considered to be insignificant.

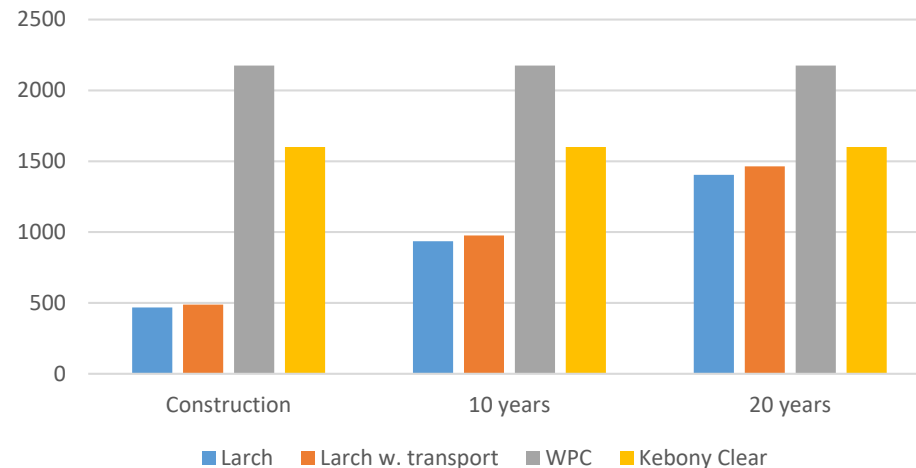
Source: [https://kebony.com/system/files/prodfiles/NEPD-407-287-EN\\_Kebony-Clear--Radiata-.pdf](https://kebony.com/system/files/prodfiles/NEPD-407-287-EN_Kebony-Clear--Radiata-.pdf)

# Examples – Wood / WPC / Recycling

CO2 Emission estimation											
BV:											
ID-Nummer	Database [Bibliographie treeze, Schweiz, version 2.2:2016] ÖkoBauDat [www.oekobaudat.de, Stand Mai 2021] EPD Plattform [https://epd-online.com/, Stand Juli 2021]	Density/ Volume	Bezug	Treibhaus- gasemissionen [ohne Berücksichtigung recycling]			Qty	Unit	Greenhouse Emission in CO2eq		
				BV:							
				Total	Fabrication	Elimination			Total	Fabrication	Elimination
		kg/m <sup>3</sup>		kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq		kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq	
09	Wood	kg/m <sup>3</sup>									
9.16	Larch, 34 mm w/o transport	660,8	kg	0,425	-1	1,80	1	m <sup>2</sup>	9,36	-30	39,6
9.27	WPC, Average Germany, 21-38 mm, 30 yrs, inkl transport	-	m <sup>2</sup>	43,5	1,03	42,4	1	m <sup>2</sup>	43,5	1,03	42,4
9.28	Kebony Clear, Deck, 30 yrs, Transport Standard EU, 34 mm	680	kg	1,46	-0,70	2,15	1	m <sup>2</sup>	32,0	-15	47,4
9.29	Kebony Character, Cladding, 40 yrs, Transport Standard EU	640	kg	0,637	-1,12	1,76	1	m <sup>2</sup>	14,0	-25	38,6



kg CO2eq for 50 m<sup>2</sup> wood deck





# Examples - Concrete

## Available Data

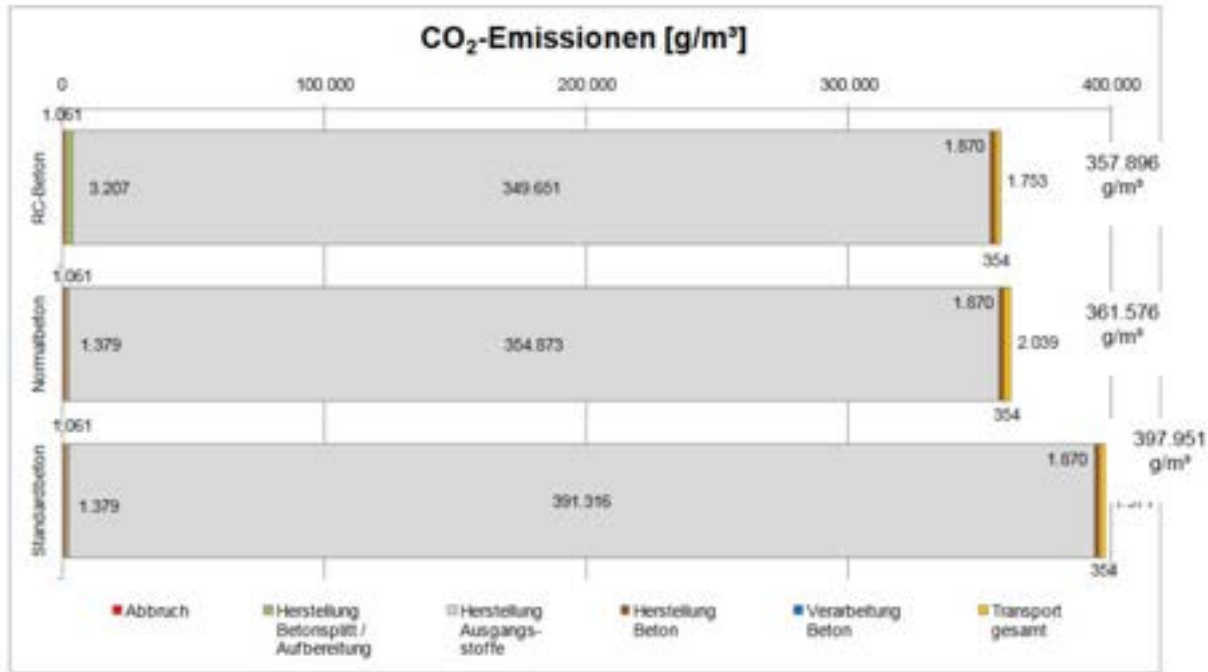
CO2 Emission estimation							
BV:							
ID-Nummer	<b>Datebase</b> [ <i>Bibliographie treeze, Schweiz, version 2.2:2016</i> ] <i>ÖkoBauDat</i> [ <i>www.oekobaudat.de, Stand Mai 2021</i> ] <i>EPD Plattform</i> [ <i>https://epd-online.com/, Stand Juli 2021</i> ]	Density/ Volume	Qty	Unit	Greenhouse Emission in CO2eq		
					BV:		
					<i>Total</i>	<i>Fabrication</i>	<i>Elimination</i>
					kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq
<b>02</b>	<b>Beton</b>	<b>kg/m<sup>3</sup></b>					
2.4	Beton C20/25 (w/o reinforcement)	2.400	1	m <sup>3</sup>	<b>204</b>	<b>183</b>	<b>21,1</b>
2.5	Beton C25/30 (w/o reinforcement)	2.400	1	m <sup>3</sup>	<b>223</b>	<b>202</b>	<b>21,1</b>
2.6	Beton C30/37 (w/o reinforcement)	2.400	1	m <sup>3</sup>	<b>246</b>	<b>225</b>	<b>21,1</b>
2.7	Beton C35/45 (w/o reinforcement)	2.400	1	m <sup>3</sup>	<b>275</b>	<b>254</b>	<b>21,1</b>



- Only Cradle to Gate
- Transport not included
- Use of Portland vs. Fly ashes

# Examples - Concrete

## Regular vs. Recycling



RC Material → 10% reduction of CO<sub>2</sub>eq Emission with further potential

# Examples – Impact of Transport

CO2 Emission estimation											
BV:											
ID-Nummer	Datebase [Bibliographie treeze, Schweiz, version 2.2:2016] ÖkoBauDat [www.oekobaudat.de, Stand Mai 2021] EPD Plattform [https://epd-online.com/, Stand Juli 2021]	Density/ Volume	Bezug	Greenhouse Emission in CO2eq (w/o recycling)			Qty	Bezug	Greenhouse Emission in CO2eq		
				Total kg CO <sub>2</sub> -eq	Fabrication kg CO <sub>2</sub> -eq	Elimination kg CO <sub>2</sub> -eq			Total kg CO <sub>2</sub> -eq	Fabrication kg CO <sub>2</sub> -eq	Elimination kg CO <sub>2</sub> -eq
BV:											
<b>01</b>		-									
1.4	Transport, Standard Truck	1000,000	kg/km	<b>0,090</b>	0,090		50,000	km	<b>538</b>	<b>538</b>	<b>0</b>
1.5	Transport, Standard Truck	1000,000	kg/km	<b>0,090</b>	0,090		150,000	km	<b>1.614</b>	<b>1.614</b>	<b>0</b>
2.6	Beton C30/37 (w/o reinforcement)	2.400	kg	<b>0,102</b>	0,094	0,009	50	m <sup>3</sup>	<b>12.285</b>	<b>11.229</b>	<b>1.056</b>
2.6	Beton C30/37 (w/o reinforcement); Recycling material	2.400	kg	<b>0,092</b>	0,084	0,008	50	m <sup>3</sup>	<b>11.056</b>	<b>10.106</b>	<b>950</b>
		-									
	TOTAL Standard								<b>12.823</b>	<b>11.767</b>	<b>1.056</b>
	TOTAL RC								<b>12.670</b>	<b>11.721</b>	<b>950</b>

→ Sole focus on material is not enough but transport is crucial

# Examples – Foam Glas Gravel

→ Some Companies offer RC material with 50% reduction of CO<sub>2</sub>eq



Foam Glas Gravel might be alternative for the bassin bottom with an CO<sub>2</sub>eq of 44 kg/m<sup>3</sup>

→ Recycling Material

→ Difficulty statics





# Examples – Floor covering / natural stone

BV: Ebrach Freiraum											
ID-Nummer	<b>BAUMATERIALIEN</b> <b>Datengrundlage</b> <i>[Bibliographie treeze, Schweiz, version 2.2:2016]</i> <i>ÖkoBauDat [www.oekobaudat.de, Stand Mai 2021]</i> <i>EPD Plattform [https://epd-online.com/, Stand Juli 2021]</i>	Rohdichte/ Flächen- masse	Bezug	Treibhaus- gasemissionen <i>[ohne Berücksichtigung recycling]</i>			Menge im BV	Bezug	Summe THG Emmission in CO2 Äquivalenten		
				Total	Herstellung	Entsorgung			Total	Herstellung	Entsorgung
				Total	Fabrication	Elimination		Total	Fabrication	Elimination	
				kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq		kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq	kg CO <sub>2</sub> -eq	
<b>Bodenbeläge</b>		<b>kg/m<sup>2</sup></b>									
	Betonpflasterstein, 8 cm	188	m <sup>2</sup>	<b>23,2</b>	23,2	k.a.	1580	m <sup>2</sup>	<b>36.705</b>	<b>36.705</b>	k.a.
	Betonpflasterstein, 8 cm, Wiederverwendung Bestand (80%)	188	m <sup>2</sup>	<b>23,2</b>	23,2	k.a.	836	m <sup>2</sup>	<b>19.421</b>	<b>19.421</b>	k.a.
	Natursteinplatte hart, Außeneinsatz, Herkunft 50% China, 43% EU, 7% Dt., 8 cm	k.a.	m <sup>2</sup>	<b>30,8</b>	28,7	2,07	1580	m <sup>2</sup>	<b>48.683</b>	<b>45.417</b>	<b>3.266</b>



→ Re-Use of existing material with significant impact

# Examples – Plastic

Parameter	Unit	Material					
		PE-HD	PE-LD	PE-LLD	PP	PVC	EPDM*
GWP	kgCO2/kg	1,80	1,87	1,79	1,63	1,9	3,6

Source: [https://epub.wupperinst.org/frontdoor/deliver/index/docId/5866/file/5866\\_Kunststoffeinsatz.pdf](https://epub.wupperinst.org/frontdoor/deliver/index/docId/5866/file/5866_Kunststoffeinsatz.pdf)

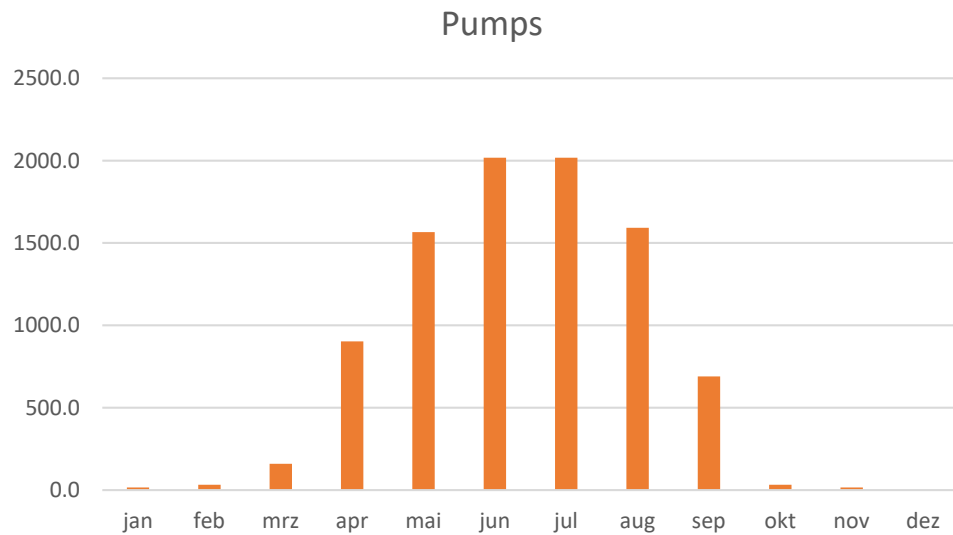
Study by the Wuppertal Institute (2015)

\*epd online, processed material



# Additional sources for emission

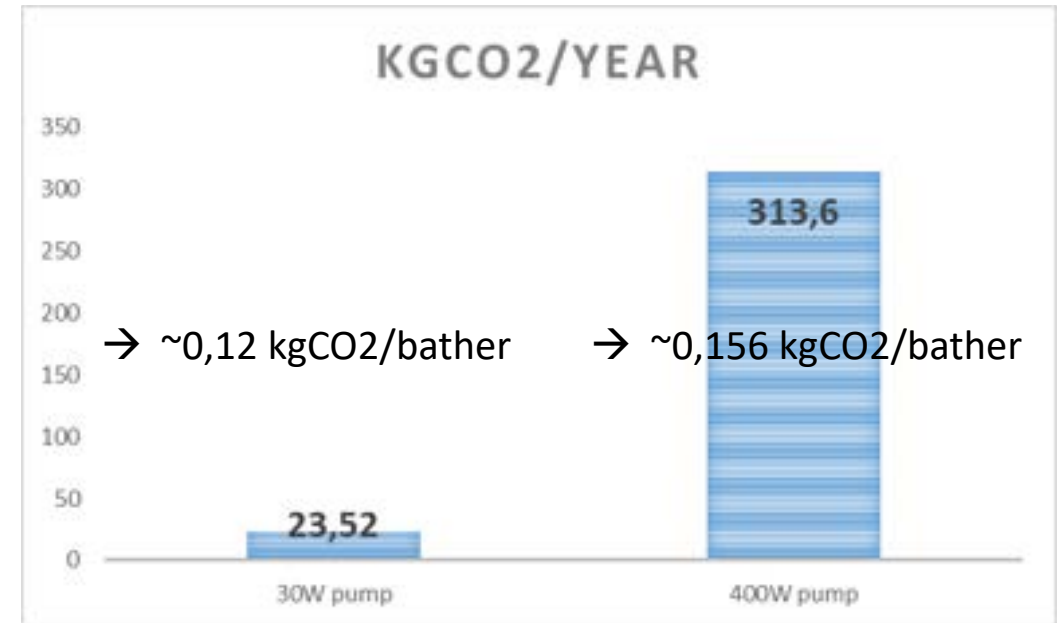
## Pumps & Consumables



→ About 9000 kWh/year → at 0.49 kgCO<sub>2</sub>eq/kWh

→ 4,410 tons CO<sub>2</sub> for an energy optimized public pool with a capacity for **1700** bathers per day

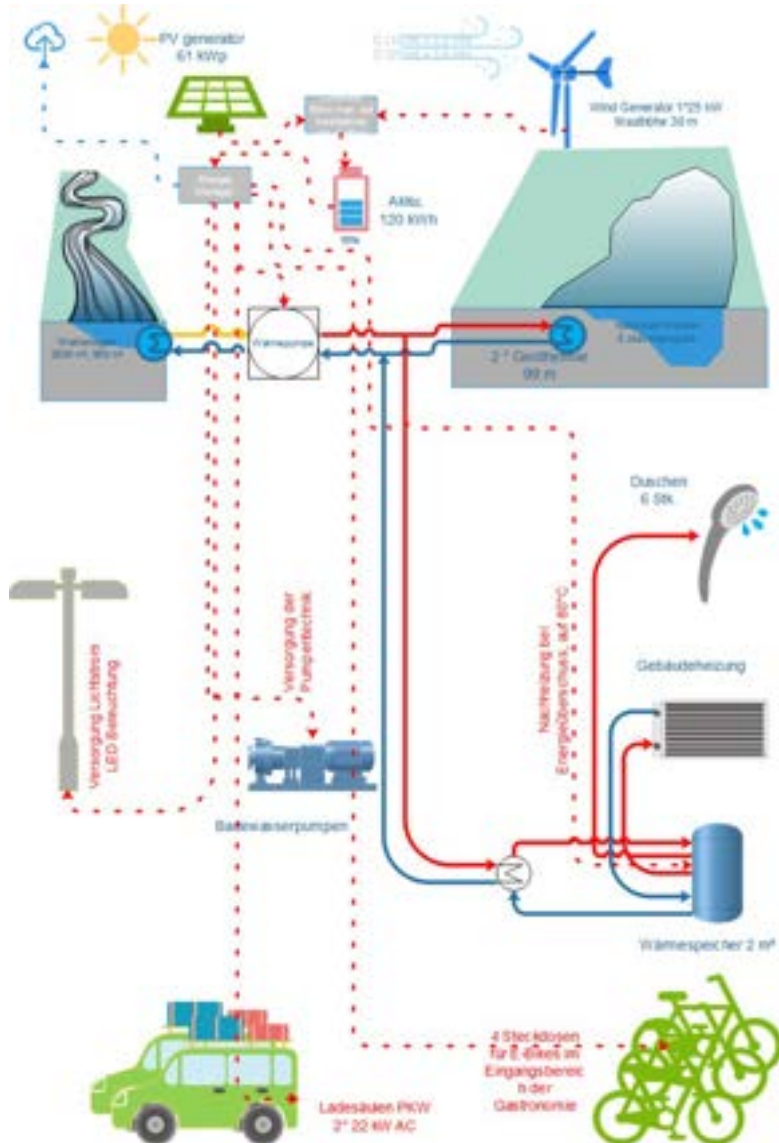
→ At 50.000 per year → 0.09 kgCO<sub>2</sub>/bather



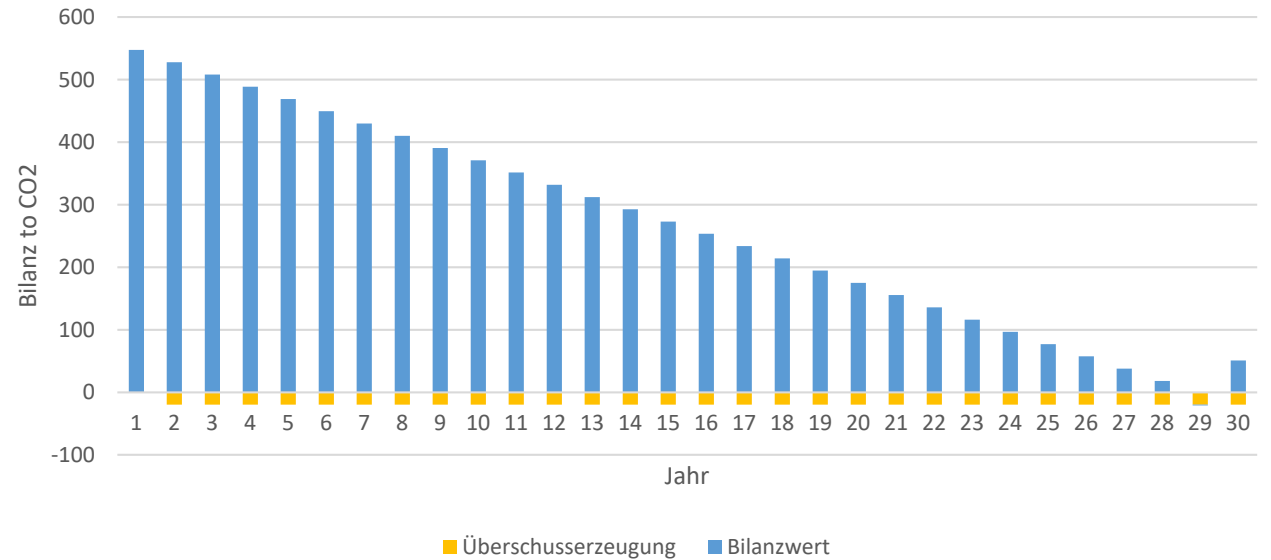
\*Assumption pump operation 200 days/yr and 8 hrs/day use on 100 days with 2 bathers



# Long Term Balance



CO2 Balance over 30 yrs



# Conclusion

- Demand for climate friendly solutions is there
  - Lack of quantification and qualification data
  - Many producers promote climate friendly but get there by compensation methods
- Zero Emission Operation might be possible, Zero Emission construction not

