

## Carbon sink certificate – for CO<sub>2</sub>eq potential

ID of C-sink certificate: cs-jeqy-f6cu-3a2n-gdya

**Sonnenerde GmbH**  
**Oberwarter Strasse 100**  
**7422 Riedlingsdorf**  
**Österreich**

EBC Producer ID: co-at-34  
GPS of production: 47.3300432692775,16.153561287932853

The Carbon sink potential of the mentioned batch is certified according to the following standard:



### BIOCHAR BASED CARBON SINKS

#### Data of batch:

EBC Batch ID	ba-at-34-1-5
Amount of produced biochar (dry matter)	100.00 t
C-sink potential of biochar (dry matter)	55.5 %
C-sink potential per ton of biochar (dry matter)	2.04 t CO <sub>2</sub> eq
C-sink potential of total amount of produced biochar (dry matter)	203.57 t CO <sub>2</sub> eq

Frick, 24.04.2024



Hans Matzenberger  
President of board of  
directors



Franziska Staubli  
Director

**Certification details of Carbon sink potential**

Biomass	Type of biomass (EBC feedstock ID)	AG-05	
	Total amount of biomass (DM) used for the certified batch	300.00 t	
	Emissions due to fertilization	0.00 t	CO <sub>2</sub> eq
	Transportation of biomass to pyrolysis site	2.07 t	CO <sub>2</sub> eq
	Preparation of feedstock	8.91 t	CO <sub>2</sub> eq
	Emissions for drying of feedstock	0.00 t	CO <sub>2</sub> eq
	Feedstock storage emissions	0.00 t	CH <sub>4</sub>
	<b>Total biomass related GHG emissions without CH<sub>4</sub> per batch</b>	<b>10.98 t</b>	<b>CO<sub>2</sub>eq</b>
Pyrolysis	Source of electric energy used on site	Renewable	
	Emissions due to electricity consumption for entire pyrolysis plant incl. post pyrolysis treatment	0.00 t	CO <sub>2</sub> eq
	Emissions due to LPG and other external fuel for reactor heating	8.04 t	CO <sub>2</sub> eq
	Emissions due to carrier gas	0.00 t	CO <sub>2</sub> eq
	CH <sub>4</sub> -emissions of pyrolysis unit	0.03 t	CH <sub>4</sub>
	<b>Total pyrolysis related GHG emissions without CH<sub>4</sub> per batch</b>	<b>8.04 t</b>	<b>CO<sub>2</sub>eq</b>
Methane	Total methane emissions	0.03 t	CH <sub>4</sub>
	Amount of compensated methane emissions	0.00 t	CH <sub>4</sub>
	Type of methane compensation	none	
	Total non-compensated CH <sub>4</sub> emissions per batch	0.03 t	CH <sub>4</sub>
	<b>Total non-compensated CH<sub>4</sub> emissions in CO<sub>2</sub>eq per batch (@GWP20 of 86)</b>	<b>2.58 t</b>	<b>CO<sub>2</sub>eq</b>
Margin of security	<b>10 % of total GHG emissions (incl. GWP 20 of CH<sub>4</sub>) per batch</b>	<b>2.16 t</b>	<b>CO<sub>2</sub>eq</b>
Total emissions	<b>Total GHG emissions in CO<sub>2</sub>eq per batch</b>	<b>23.76 t</b>	<b>CO<sub>2</sub>eq</b>
	Total GHG emissions in C per ton of biochar (DM)	0.065 t	C
Energy	Carbon neutral thermal energy per batch	289.00	MWh
	Carbon neutral electricity per batch	0.00	MWh
Biochar	Amount of biochar (DM) produced per certified batch	100.00 t	
	H/Corg ratio	0.24	
	C-content	62.0 %	
	<b>C-sink potential</b>	<b>55.5 %</b>	<b>of DM</b>
Data per ton of biochar	Total GHG emissions per t biochar (DM)	0.24 t	CO <sub>2</sub> eq
	CO <sub>2</sub> eq content per t of biochar (DM) [gross C-sink]	2.27 t	CO <sub>2</sub> eq
	C-sink potential in t CO <sub>2</sub> eq per t of biochar (DM) [net C-sink]	2.04 t	CO <sub>2</sub> eq
Data of batch	C-sink potential in t CO <sub>2</sub> eq of total amount of produced biochar (DM)	<b>203.57 t</b>	<b>CO<sub>2</sub>eq</b>

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The biochar batch ba-at-34-1-5 produced by Sonnenerde GmbH has carbon sink potential of 55.5 %. Each ton of biochar from the certified batch has a carbon sink potential of 2.04 t CO<sub>2</sub>eq.

The carbon sink potential of 55.5 % provides the percentage of a mass unit of biochar that, on a dry matter base, can be considered as a temporal carbon sink. For example, a big bag containing 131 kg biochar (dry matter) has a carbon sink potential of (131 kg \* 55.5 % CS) = 72.71 kg C which is the equivalent of 266.59 kg CO<sub>2</sub>eq per big bag.

The production of 1 t of biochar (dry matter) caused emissions of 238 kg CO<sub>2</sub>eq (65 kg C) due to feedstock production, transportation, storage, preparation and operation of the pyrolysis plant and methane emissions during both biomass storage and the combustion of the pyrolysis gases. These emissions were deduced from the carbon sink value of the biochar.

The CO<sub>2</sub> emissions of the combustions of the pyrolysis gases used for energy production are considered as carbon neutral as the feedstock for the pyrolysis originated from forest management residues.

The CH<sub>4</sub> emissions were measured repeatedly during regular operation on at least three pyrolysis plants of the same type. The methane values are thus subject to some uncertainty regarding start-up and shut down of the process or possible problems during regular operation. For this reason, a margin of 50 % was added to the measured CH<sub>4</sub> emissions. It was guaranteed that the feedstock is never stored longer than 30 days before drying to below 20% water content, therefore no CH<sub>4</sub>-emissions due to self-heating were considered. All electricity used for the production was provided as renewable, carbon neutral energy.

Neither the carbon expenditures necessary to transport the biochar from the production site to the location of the final C-sink (via a merchant and/or processor) nor the carbon expenditures when manufacturing or blending the biochar into a carbon sink product are considered so far. These emissions must be deduced as soon as a C-sink certificate or an offset service is generated for an end customer based on this C-sink potential certificate. Equally, when applied to soil, only the carbon fraction that is persistent after 100 years (C<sub>sink100</sub>) or any other EBC-defined sequestration period should be traded as C-sink certificate.

During the biochar production, 289.00 MWh thermal and 0.00 MWh electric energy were produced. As all GHG emissions of the entire process were deduced from the biochar carbon sink potential, this thermal energy is completely carbon neutral. The total certified amount of carbon neutral heat will be provided at the end of the batch.

The present EBC carbon sink certificate for CO<sub>2</sub>eq potential at factory gate is valid for the biochar batch ba-at-34-1-5 and can be used for carbon sink certification and trade procedures.