

Carbon project:

Bavarian Biochar, Reiden, Germany



Puro.Earth **511285**



A Cool Effect onsite report

June 2025

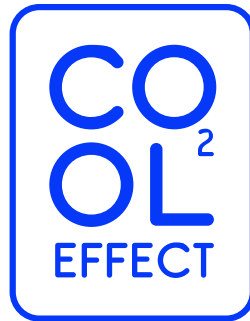
Durable CDR:
Biochar



As part of Carbon Done Correctly, Cool Effect conducts a site visit after completing scientific due diligence and ensuring the GHG integrity of each project we represent. Sometimes visits take place before we purchase credits and sometimes after.

The site visit is intended to see operations of the project firsthand, gather information on any outstanding questions, meet the project management team, see them in action and assess project interactions with the local community.

Our team also focuses on gathering details on how revenue from the sale of carbon credits is being used. We look for evidence of how income from previous years has been applied and we discuss funding for future expansion.



Project specifications

Name of project:

Bavarian Biochar,
Reiden, Germany

Project type:

Biochar

Standard:

Puro 511285

Methodology:

Puro Biochar 2022



Expected issuance:

1,500 per year

Crediting periods:

6 years

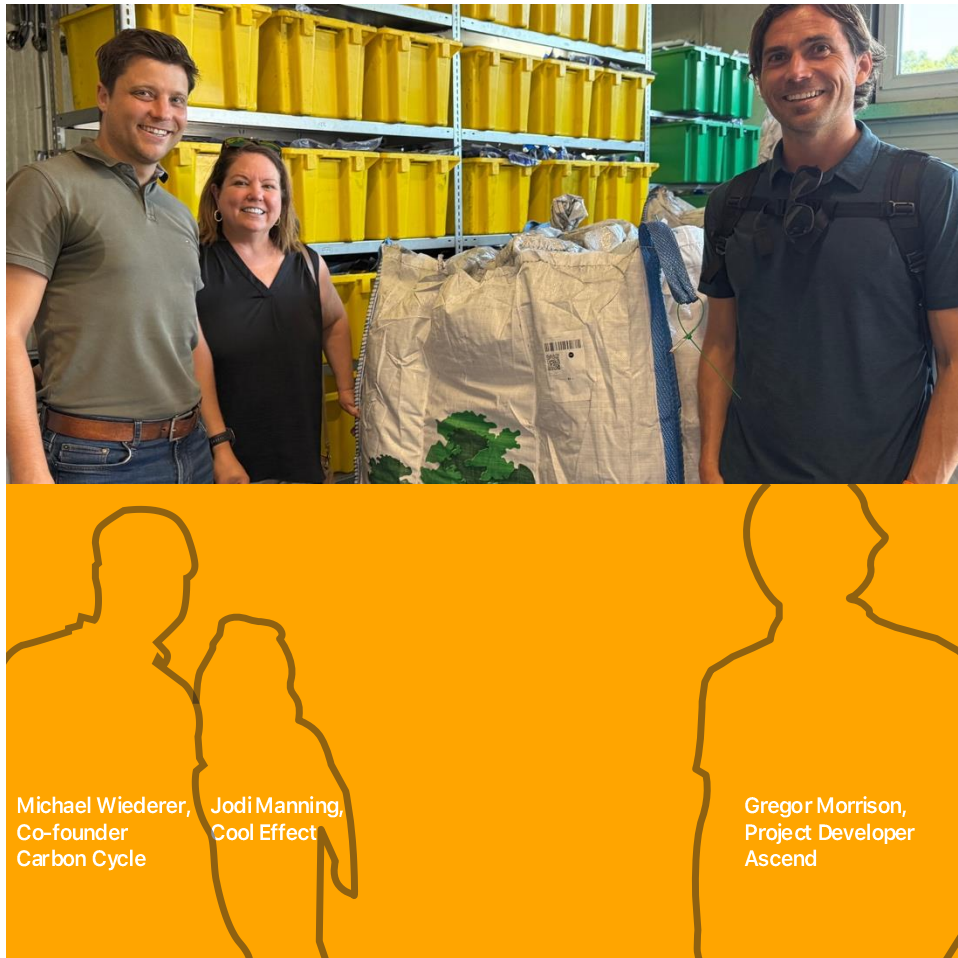
This visit was conducted by Jodi Manning and marked Cool Effect's first trip to Reiden, Germany.

This facility is home to Carbon Cycle, which produces and distributes the biochar. The tour was conducted by Michael Wiederer who is 1 of 4 owners of Carbon Cycle and Tabias Smith who is the project manager. Carbon Cycle is responsible for all day-to-day operations of creating the biochar.

This facility is Carbon Cycle's only operation.

We were joined by Gregor Morrison from Ascend who is the project developer. Ascend handles all documentation necessary for verification and issuance of credits by Puro.Earth. Ascend also handles marketing and sales of the carbon credits.

Ascend represents multiple biochar manufacturers around Europe and is expanding to the US.



3 pillars

- 
- Quality
 - How is the revenue used?
 - Future opportunities

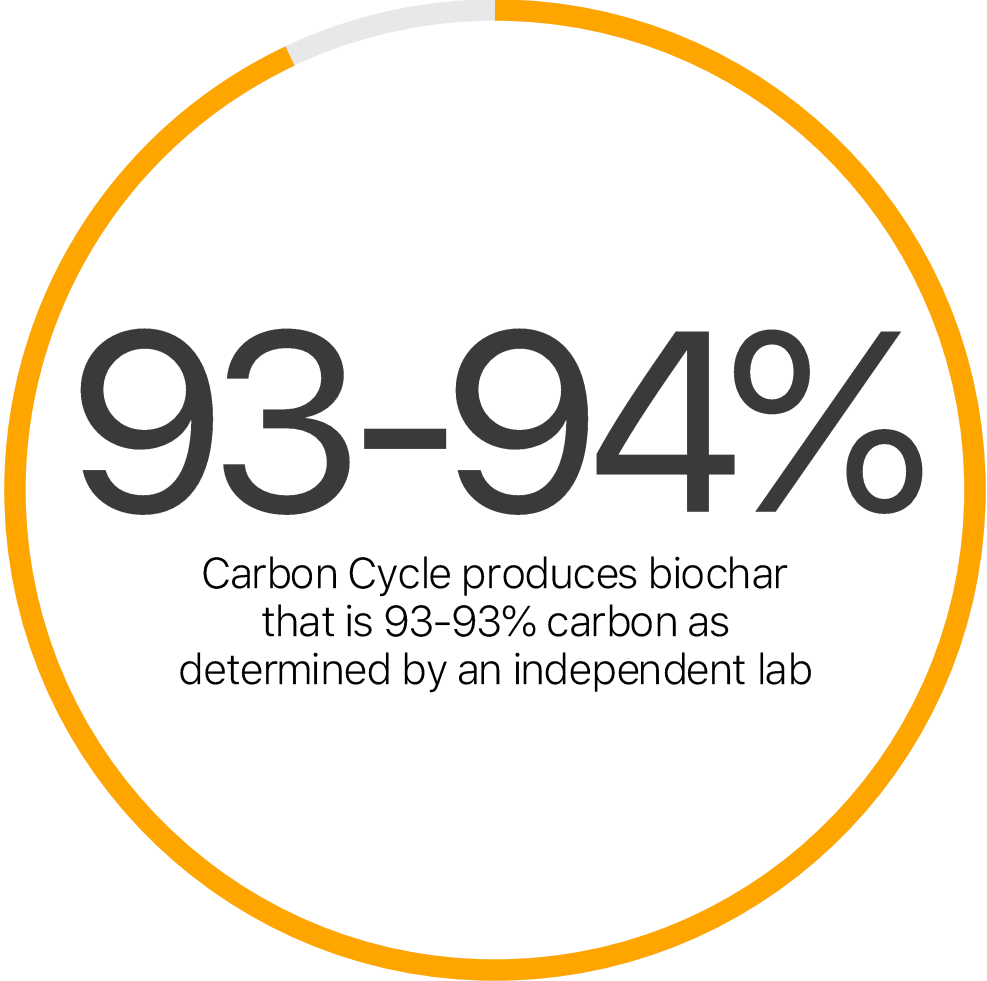
Quality

This facility is 100% devoted to creation and distribution of biochar. Carbon Cycle considers itself an industrial operation and there are no other businesses on the property.

All biochar "batches" have to be tested in an independent lab. Carbon Cycle consistently produces biochar that is 93-94% carbon. This number puts them in the "high quality" category. They must meet 90% for Puro.Earth certification.

Components contributing to high quality:

- Raw source material
- State of the art pyrolysis reactor
- Rigorous batch testing



93-94%

Carbon Cycle produces biochar
that is 93-93% carbon as
determined by an independent lab

Quality: Raw carbon feedstock

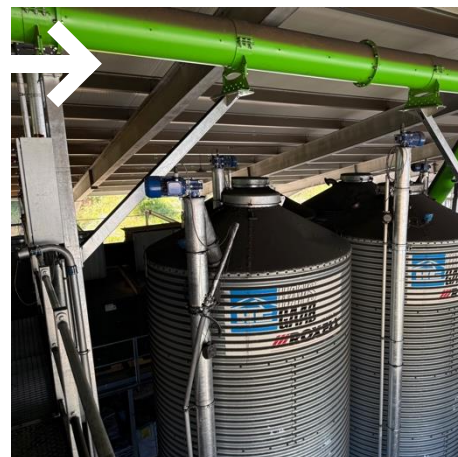
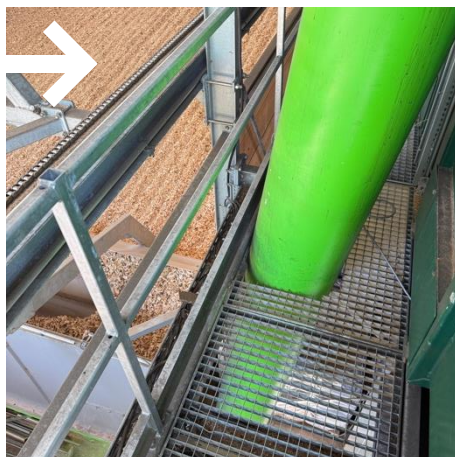
- Sourced from Bavarian Forest Farmers Company, a cooperative forest with sustainable harvesting.
- Must come from 50-100kilometers from the biochar facility to prevent creation of additional emissions from the project.
- Looks like wood chips and arrives in big loads which are stored in a covered part of the facility as part of the automated process.
- Is wood that cannot be used for construction and would otherwise just decompose on the forest floor.

Gregor added that there is a rigorous system/accounting for trucks, fuel, transport



Quality: State-of-the-art pyrolysis reactor

Raw material is raked into the shoot and deposited into the pyrolysis reactor



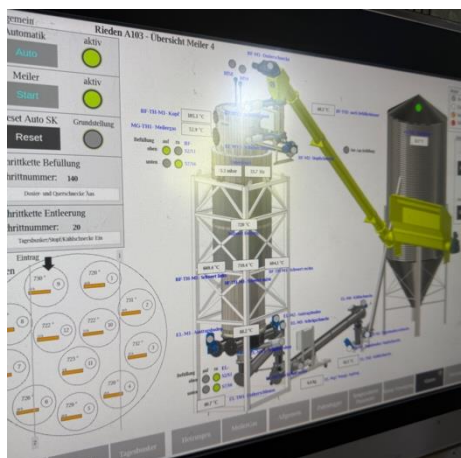
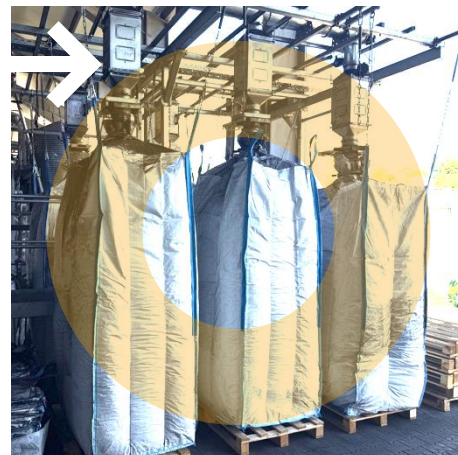
The Pyrolysis Reactor is where the organic material is heated up to 800°C (1472°F) in an oxygen-free environment. This is a critical component. The absence of oxygen prevents the material from burning and allows the carbon to remain in a solid form (biochar) instead of turning into ash or carbon dioxide gas.



Pipes carry feedstock to the reactor.



Biochar is collected and stored in bags after processing.



The entire process is monitored with data captured for each stage.



Each batch has a set of samples set aside and sent to an independent lab for analysis



Once the process is completed, it is prepared for sale.

Quality: Rigorous testing

- The raw materials are meticulously weighed and tracked from the time they enter the facility, through the process of creating the biochar (pyrolysis) and to the end sale.
- During pyrolysis, the automated process tracks hundreds of pieces of data and aggregates it on a batch-by-batch basis. If a batch produces an anomaly, the batch is destroyed.
- Each batch of biochar sold contains a QR code. They end user must scan this code then answer a series of questions on how the biochar was used.

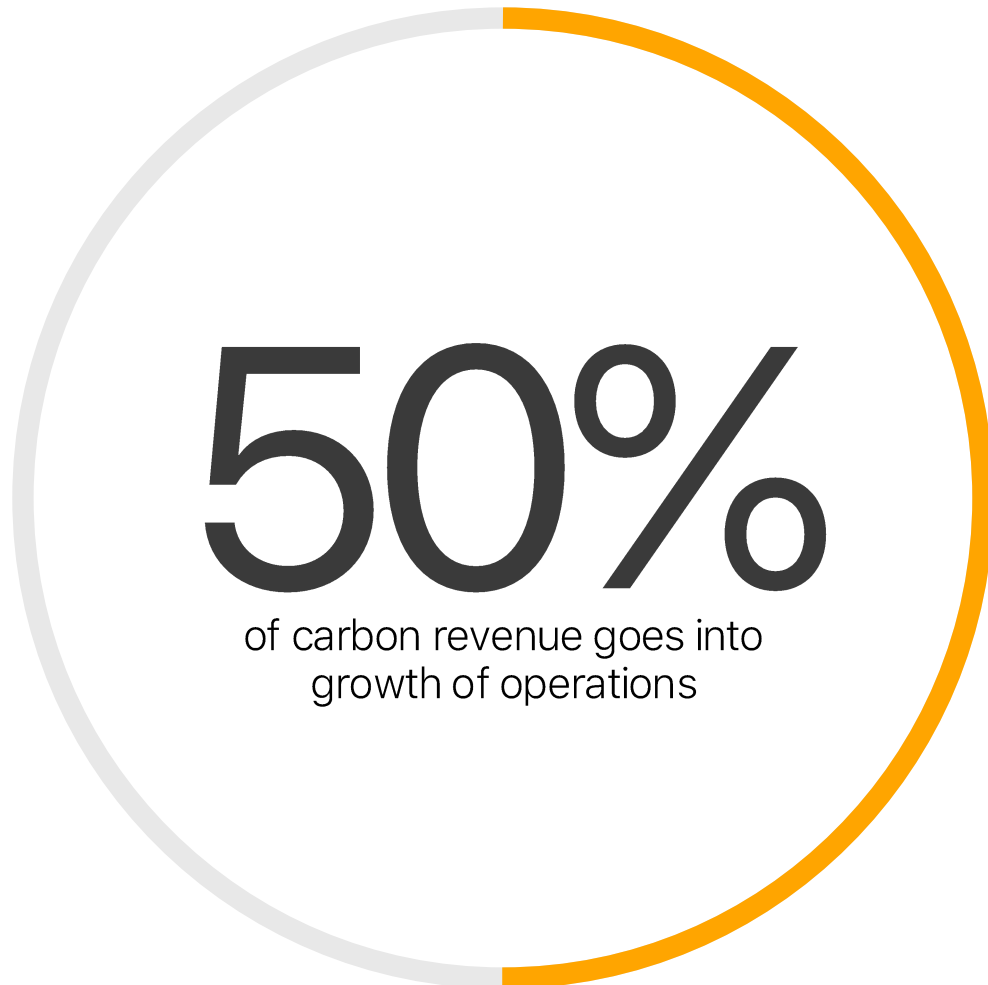


- All biochar "batches" have to be tested in a lab.
- Carbon Cycle consistently produces biochar that is 93-94% carbon.
- This number meets requirements for a "high quality" designation and permits other sales opportunities, such as use in animal feed, highly regulated, because it becomes part of human consumption.
- They must meet 90% carbon composition for Puro.Earth certification.

How is the revenue used?

Carbon Cycle purchased a new pyrolysis machine in 2024, which is a CTS40.

- Previously they only had 1 machine which was a CTS20.
- Carbon Revenue funded ~7-8% of the new CTS40 which cost \$4-\$5 million euros
- Owner Michael adamantly stated (in robust German) that the project would not exist without carbon revenue, that they could not make a profit, that their opportunities are many but that they are limited by up front capital and that they are assessing the best ways to use future revenue



How is the revenue used?

Carbon Cycle launched in 2016 with a \$10M investment.

- They produced and sold their first biochar in 2020 with model CS20.
- From 2020–2024, they produced 300–350mt annually
- In 2024, they acquired model CTS40
- Their production for 2025 has risen to 1,500–1,600mt annually
- They have the space to add 2 more CTS40s but they lack the capital to purchase additional reactors
- Their costs include labor, feedstock and servicing the initial loan.
- Among other benefits, the CT40 produces differing sizes of biochar for different end uses.



How is the revenue used?

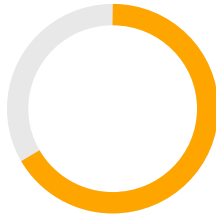
Revenue from carbon credits was planned into the business model prior to launch. 50% of revenue goes to subsidize the purchase of biochar by "customers".

Carbon Cycle has multiple customer types. Different customer types have a different pricing approach and need different "granule" size. This is another benefit of the CTS40.

Agricultural customers make up 60-70% of Carbon Cycle's sales, but only a small portion is for fertilizer.

Farmers for fertilizer

- Small portion
- they have had a lot of problems getting them to adopt the biochar



Feed for livestock

- This is currently their largest portion of sales.
- Biochar is mixed into feedstock to help reduce diarrhea in cattle, sheep and other livestock. Because the biochar is sold as part of the food chain, it has to be tested and meet criteria for quality by "EBC" which is the German governing body similar to USDA

Organic gardening fertilizer

- Rising customer base but very price conscious
- ~10-20% of sales

Landscaping

- Large pieces that are not subject to EBC regulation
- Small amount of sales, but less cost to produce because it does not need to be tested



Future opportunities

Carbon Cycle has increased their production 4.25x by upgrading their technology and keeping a consistent process dedicated to producing high-quality biochar capable of multiple applications.

As a result they have been approached by numerous interested parties for development of additional revenue streams.

Additionally, the facility produces a surplus of energy which they continue to evaluate on a cost/benefit ratio.

328%

Increase in biochar production with the CTS40 reactor

4.25x

the previous output



Future opportunities

Carbon Cycle has been approached by several end buyers asking to create specific types of biochar. Multiple distributors have asked them to make "active" charcoal for human consumption which is used as a health supplement but it would require a different type of machine so this option would be longer term.

A more promising area would be use of biochar in substrate for concrete and asphalt. This is currently a small percentage of sales, but they see future growth which could be propelled by an additional increase in production.

- A pilot test has been completed with the biochar added to asphalt for a small airport. Results will be forthcoming.
- They are currently evaluating new concrete distributors and are hopeful that this will open a new source of income for them.
- Carbon Cycle noted that this is a very precise system and that the carbon benefit belonged to the seller (Carbon Cycle) to ensure that there is no double counting.
- They also mentioned that there will be some impact on their business from politics and the Green Deal Directive. It could make for more opportunity in the industrial sector because distributors and end users of the substrate will be required to show lower emissions.



Future opportunities

Carbon Cycle completely powers 100% of its own operations with energy produced during the process of creating biochar.

They have a surplus of energy and are looking at ways to use it, but it is complicated, and many options would require investment.

- 15% byproduct is hydrogen. They would like to capture this but both the systems for capture and transport are costly.
- They are looking at using the energy to provide hot water to the local community and are currently in talks with the community leaders. They were not clear whether they would be compensated for this partially or fully. They said they are still discussing details on how this would work.
- They could pump the energy back into the grid but are not currently set up for this.





Appendix



Insights
Updates

Additional information

Soil Content / CO₂ testing

- They have done some testing with the Bavarian Farmers Association, but the test did not produce official results.
- One conservation farmer who made an unofficial test on his soil, saw the carbon content rise from 3.0 to 3.8. This was promising enough to consider building an official testing scheme in the future.

Moisture Level

- The moisture level is dependent on the end customer—what are they using it for?
- Generally, the moisture level is around 20% but when it is ground to dust, it can be 1%. But they don't like that because then it is flammable. Each "fractional size" has a different moisture content but it is always less than 20%
- CTS40 controls this factor, another improvement over the CTS20

Credit Calculation

- Quantification of credits is based on the percentage of carbon remaining in the biochar applied to agricultural fields after 100 years.
- According to the project's 2024 Audit Report, Carbon Cycle's net carbon removal is 2.9 tonnes CO₂e (or carbon credits) per tonne of dry biochar.
- In general terms, credits are quantified by multiplying the quantity of biochar produced times the carbon content of the biochar times the percentage of the carbon expected to remain after 100 years, minus the lifecycle emissions associated with the production of the biochar, multiplied by 3.67 to convert carbon to CO₂-equivalent.

Ascend receives up to 20% for project development

Carbon Cycle receives a minimum 80% of total revenue after deductions and registration fees have been accounted for