carbonfuture

Playbook for Biochar Producer and Wholesaler

How to get compensated for effective climate protection services through carbonfuture

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2 Overview

2.1 Why carbonfuture?

In order to limit global warming below catastrophic levels, significant emission reductions are essential but by no means sufficient. There is already too much CO_2 in the atmosphere, and we must capture and safely store billions of tons over the next decades. That is, we need carbon sinks. Carbon sinks are fundamentally different to emission reductions. Scalable and readily available nature-based technologies are rare but available:

- Carbon forestry
- Soil organic carbon
- Biochar

Many emission compensation schemes realized in various carbon markets already exist. However, very few strictly distinguish between carbon sinks from emission reduction projects (e.g. renewable energy). In addition, all existing schemes are vague on the duration of carbon sequestration. Third, the measurability, verifiability of carbon credits is weak and therefore may create a lack of trust. Many of them are oversupplied and require additionality which seems irrelevant for negative emission technologies (NET) and true carbon rebalancing. The carbonfuture platform was created to address these shortcomings of existing schemes. In contrast to other carbon markets, carbonfuture offers:

- True carbon sinks only
- Carbon sink stability over 100 years[1]
- Guaranteed unalterable documentation and end-to-end auditability on the carbonfuture Blockchain[2][3]

2.2 What is carbonfuture and What's in it for You as Biochar Producer and Wholesaler?

The carbonfuture platform provides both a registry and a trading platform for carbon sinks. Each individual carbon sink is represented and unalterably documented on the carbonfuture blockchain by a **cf-Certificate**.

Biochar-based sinks are the starting point and first use-case for carbonfuture. In reimbursing them, carbonfuture injects money into the biochar value chain and fosters the creation of an additional revenue stream for biochar applications.
For biochar-based sinks, the cf-Certificates are based on two elements described below, the **Production Certificate** and the sink documentation as evidenced by the **carbonfuture Coupon**.

[1] If a sink cannot be guaranteed to be fully stable over 100 years, e.g., through decomposition processes, more carbon must be stored initially in order to guarantee 1 ton over 100 years on average (a physicist would speak of "100 ton years")
[2] The applied blockchain technology is IBM Hyperledger, a non-energy intensive technology
[3] We use a permissioned blockchain and guarantee data confidentiality; accordingly, we do disclose sensitive sink details only to admitted auditors and not to the general public

2.2.1 The Biochar Production Certificate

The **biochar producer** registers the production certificate of the pyrolysis facility. The production certificate assesses the percentage of a mass unit of biochar which can be considered as a carbon sink, net of emissions related to feedstock preparation and pyrolysis. There are two aspects to the production certificate:

- The pyrolysis plant must be certified. This includes in particular an assessment of the emissions and energy consumption of the pyrolysis process. The manufacturer of your pyrolysis plant must provide the required information on this to the reviewer.
- The individual production process must be certified. This includes an assessment of the feedstock production and preparation process and the energy used. It will become part of the general EBC[4] certification beginning in Q2 2020.

Currently, the EBC is the only issuer of eligible production certificates. Carbonfuture may also accept production certificates by other issuers if they adhere to comparable standards. We encourage alignment and collaboration between the respective national, regional and global standards and the EBC in order to ensure comparability and a level playing field.

2.2.2 The carbonfuture Coupon[5]

Biochar as a raw material comes in a huge variety of qualities and respective price levels. In addition, biochar has a vast range of potential applications ranging from filtration material, construction additive to agricultural use. Not all of these applications lead necessarily to a stable carbon sequestration and hence to not qualify as a stable carbon sink.
Therefore, the key to creating an accurately quantified carbon sink based on biochar lies in confirmation and documentation of the actual carbon preserving application of the material. To ensure that the biochar is used in a manner that does actually sequester the carbon, the **biochar wholesaler** together with the end user must document the use of the material on the carbonfuture platform.
This documentation validates the actual sinks in a very granular way. For each shipping of biochar from the wholesaler to the end user, an individual carbonfuture Coupon, filled out and signed by the end user of the biochar, provides the required evidence. Furthermore, with this document, the end user warrants to transfer all rights that come with the respective carbon sink creation.

2.2.3 Linking production and sink certificates in the cf-Certificate

The Production Certificate and the carbonfuture Coupon are linked on the carbonfuture platform. After validation of both documents, carbonfuture issues a cf-Certificate for each individual sink. This cf-Certificate represents the claim on the climate service provided by the sink and therefore has value. After issuance, it is assigned to the registrar of the sink (which is typically the wholesaler or the end user), who is then the registered owner of the cf-Certificate.

[4] EBC stands for European Biochar Certificate, issued by the Ithaka Institute
[5] An example of the carbonfuture Coupon is provided in the Appendix

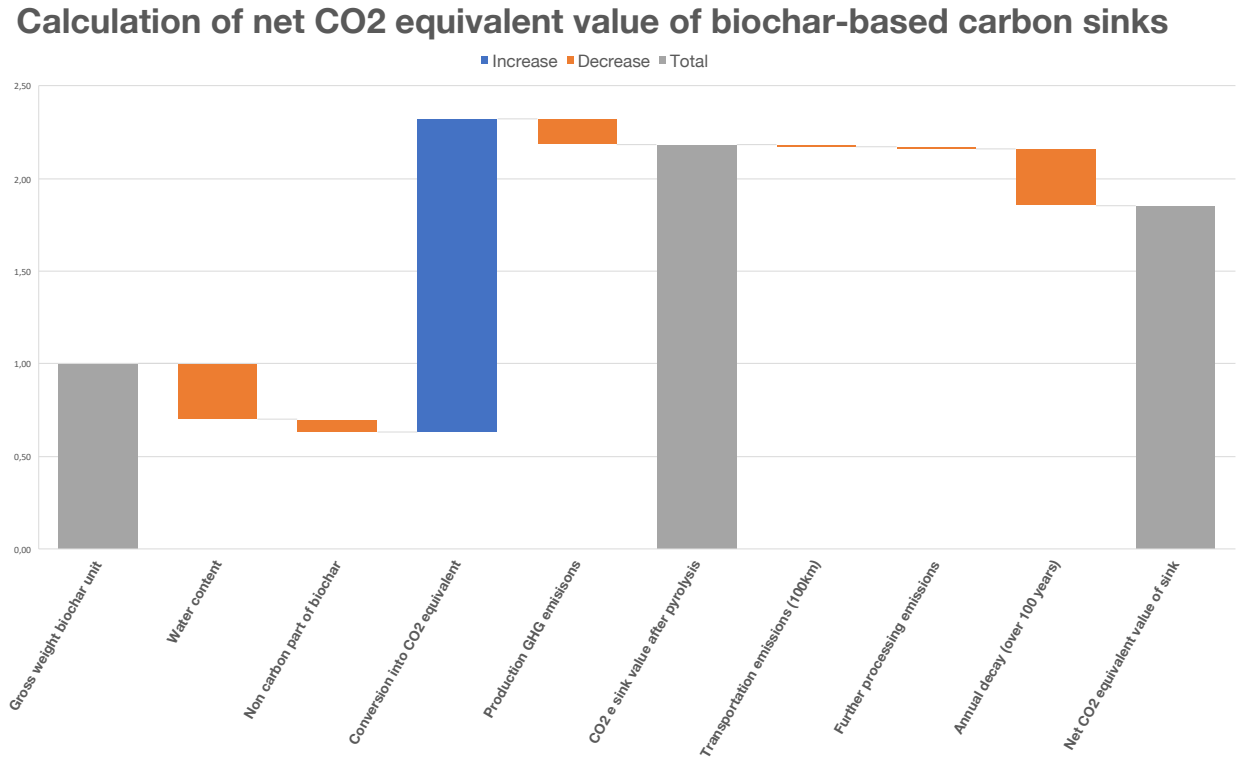
2.2.4 Cash-Flows

The owner of the cf-Certificate may sell it to any entity which acts as Broker on the carbonfuture platform. Initially, carbonfuture GmbH will act as the primary Broker and will buy cf-Certficates from the sink registrar (e.g., the wholesaler). As the marketplace evolves, we expect and encourage new Brokers to join.

In summary, carbonfuture only compensates the sink registrar in exchange of the cf-Certificate. However, both the biochar producer and the end user are key contributors to the climate service. The producer sells certified biochar, and the end user signs the Coupon, providing relevant data and substantiating the claim related to the climate service (i.e. carbon sequestration). These two parties deliver their service to the wholesaler and, strictly speaking, the monetary compensation is subject to the respective contractual relations. Together with our pilot partners we currently have a model where the sink registrar reimburses the end user in eschange of a signed carbonfuture Coupon. In this model, the sink registrar keeps a handling margin and the end user receives a fair share. The biochar producer benefits as the demand for the certified product is strengthened and better prices can be realized.

In buying the cf-Certificates from the wholesaler, carbonfuture injects money into the biochar value chain and fosters the creation of an additional revenue stream.

3 Calculation of the CO2 Equivalent Value of Biochar-Based Sinks



In order to calculate the net CO2 equivalent value of a biochar-based sink, the following calculation steps are performed.

- All deductions based on dry mass biochar which are made to come up with the net CO2 sink value after pyrolysis (i.e., at production site), are provided by the (EBC) production certificate, namely the non-carbon part of the biochar and the production emissions
- The conversion of the gross weight of a unit biochar into dry mass needs to be provided by the sink registrar, either based on individual measurement of moisture content (the protocols must be stored and disclosed upon request) or based on bulk density measurements.
- Further deductions for transport and processing are based on data provided by the sink registrar on the carbonfuture platform. The respective calculations are performed by carbonfuture. The annual decay is determined to be 0.3% provided the production certificate asserts H/Corg < 0.4. This decay rate is a conservative estimation based on Lehmann, Johannes & Abiven, Samuel & Kleber, Markus & Pan, Gen-Xing & Singh, Bhupinder Pal & Sohi, Saran & Zimmerman, Andrew. (2015). Persistence of biochar in soil. Biochar for Environmental Management: Science, Technology and Implementation. 235-282. (see Figure 10.5).

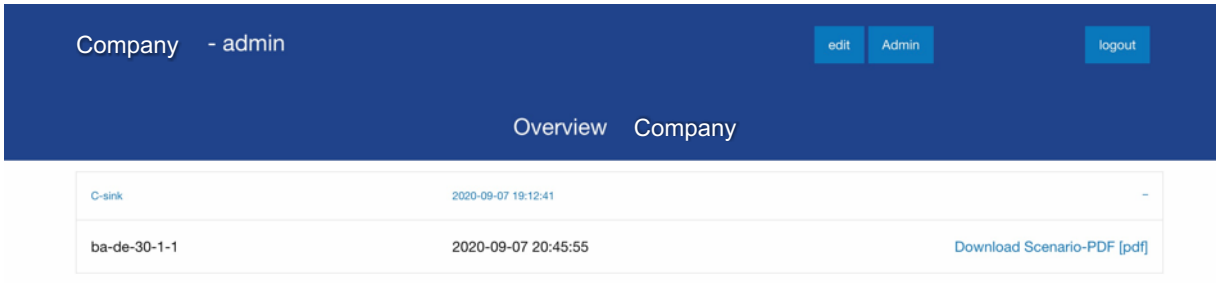
4 Detailed Manual

4.1 Biochar Producer: Assessment and Registration of the C-Sink Potential

4.1.1 Step 1: Application for the EBC-Sink certificate at the Ithaka institute

The EBC-sink certificate is issued by the Ithaka institute, Arbaz, Switzerland. The Ithaka institute is a third party and completely independent from carbonfuture. The EBC-sink certificate is currently issued exclusively for EBC- or IBI-certified biochar producers. You may apply for EBC certification at https://www.european-biochar.org/en/registration. You will receive an account for your company on the EBC system and request C-sink certification as follows:

Login into the EBC company site:



After login with the company password, press “edit”

Select under “scenario” the batch number you want to register for C-sink certification and press “load scenario”.

Complete then the different sections of the form sheet and save it:

Section 2: Biomass feedstock

Biomass feedstock production and preparation

ID	name	unit	value	result
C010	Type of feedstock		please select	
C020	Feedstock ID from EBC positive list			n/a
C030	Type of wood		please select	
C040	PEFC Forest Certification		please select	
C050 / H2C	Average water content of feedstock	%		n/a
C060 / annı	Amount of feedstock (DM) processed for the certified b	t		n/a
C070 / dies	Diesel consumption for feedstock preparation (chipping	liter		n/a
C080 / E_B	Energy consumption in KW for feedstock preparation (c	kWh		n/a
C090	How is the electricity used in the production generated		please select	
C100 / dist	Average transport distance of feedstock from source to	km		n/a
C110	Do you dry the feedstock before the pyrolysis?		please select	
C120	How do you dry the feedstock?		please select	
C125 / dies	How much diesel equivalent is used for drying per t (DM	liter		n/a
C130	Duration of biomass storage before pyrolysis or drying	days		n/a
C140 / CO2	C-consumption per t of processed feedstock	kg	0.0	0 kg

save

Section 3: Pyrolysis

Pyrolysis

ID	name	unit	value	result
D010	Type of pyrolysis		Please select	null
D020 / htt	Highest Treatment Temperature	°C		n/a
D030 / gas	Carrier gas			
D040 / BC_	Average biochar yield in relation to feedstock DM	%		n/a
D050	Type of quenching or post pyrolytic treatment		please select	
D060	Use of pyrolytic gases		please select	
D080	Storage of freshly produced biochar		please select	
D100	Who issued the emission certificate?			
D110 / CH4	CH4 emissions per t of feedstock (DM)	kg		n/a
D120 / PM:	Particulate matter emission per t of feedstock (DM)	kg		n/a
D130 / E_p	Electric energy consumption of pyrolysis unit per year	kWh		n/a
D135 / E_m	lectricity generated that is used for the pyrolysis plant?		please select	
D136 / CO2	CO2eq of electricity used for the pyrolysis plant	g CO2eq / k		n/a
D137	What fuel is used to preheat the pyrolysis			
D139 / preh	How much fuel is used to preheat the pyrolysis in t per	t/year		n/a
D140 / CO2	CO2-expenditures due to methane emissions per t of b	kg	NaN	kg
D143 / CO2	CO2-expenditures due to electricity consumption per t	kg	NaN	kg
D146 / CO2	CO2-expenditures due to preheating of pyrolysis per t	kg	NaN	kg
D148 / CO2	CO2-expenditures due to pyrolysis per t of biochar	kg	NaN	kg
D150 / C_lc	C-consumption due to pyrolysis per t of biochar	kg	NaN	kg
D160 / C_lc	C-consumption of feedstock preparation per t of bioch	kg	NaN	kg

save

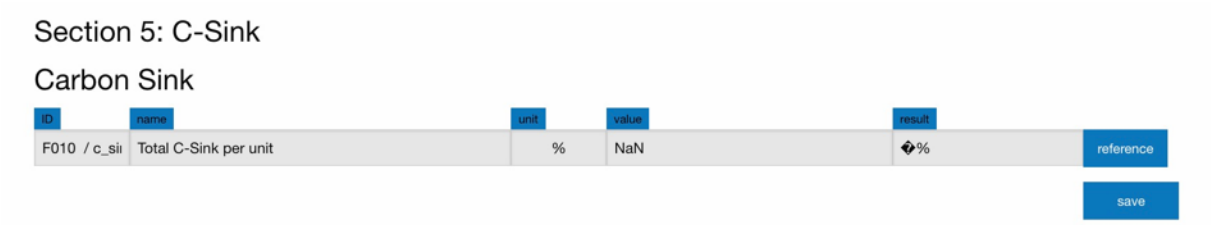
Section 4: Biochar characterization

Biochar analysis

ID	name	unit	value	result
E010 / BC_	C-content	%		n/a
E020 / HCc	H/Corg			n/a
E030 / H2C	Water content	%		n/a
E040 / bulk	Bulk density	kg / l		n/a

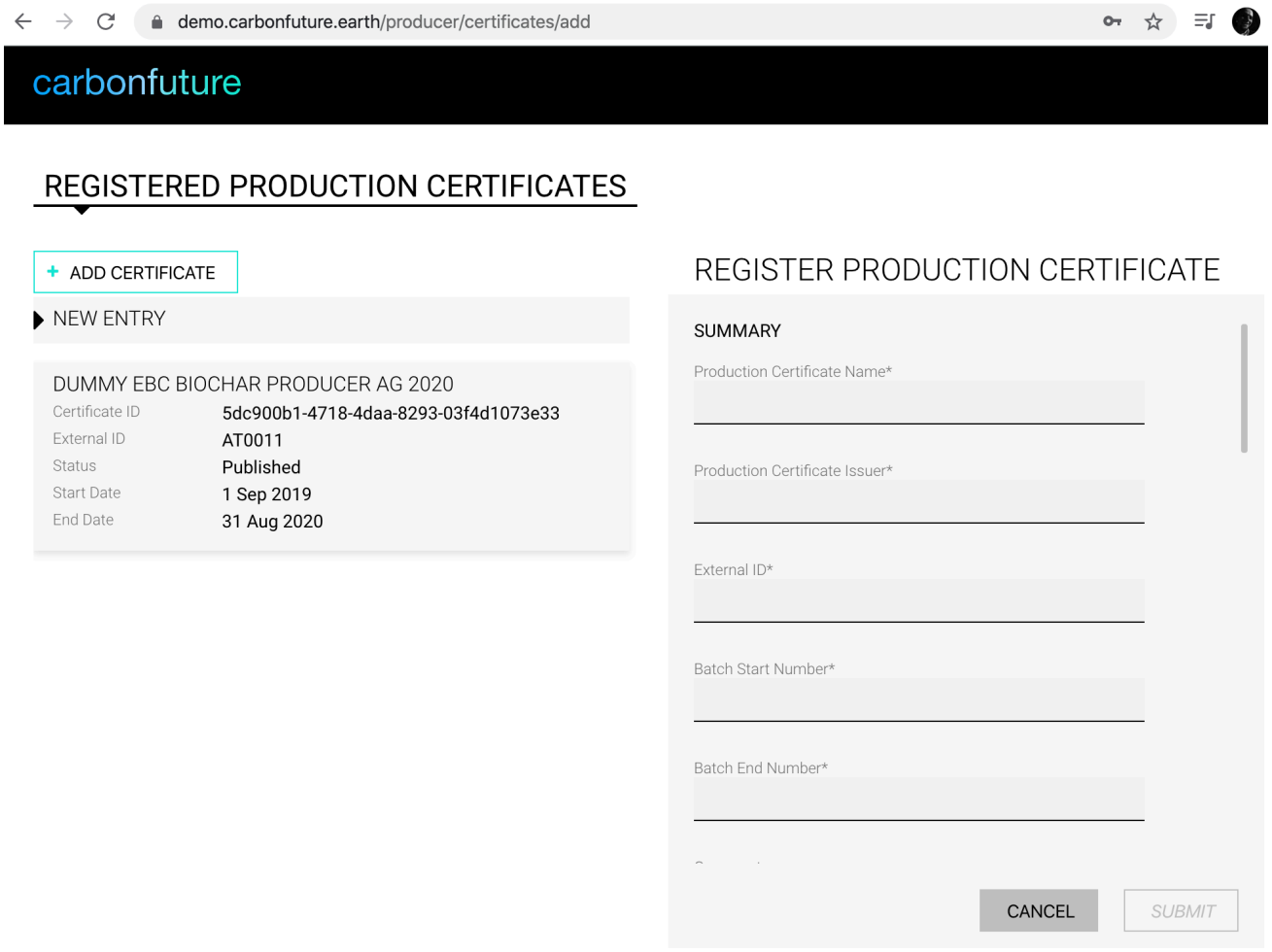
save

Once completed, the formsheet will calculate the C-sink potential of the biochar at the factory gate. This is the key value determining the quantification of the C-sink values of the C-sinks created through carbon preserving application of the material.



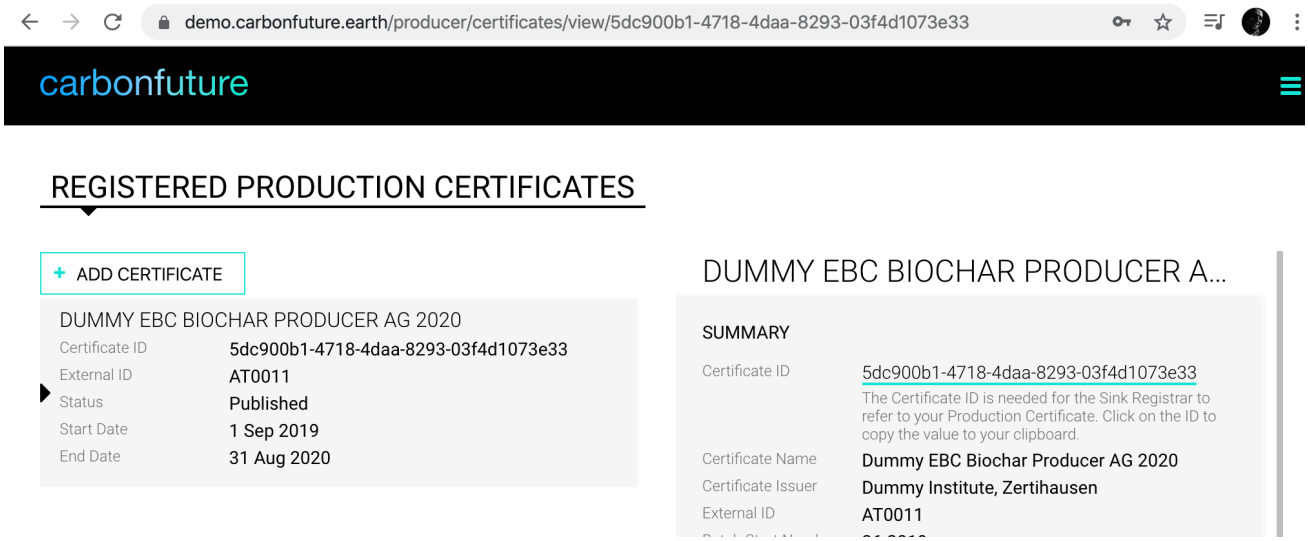
4.1.2 Step 2: Registration of the EBC-sink (“production”) certificate on carbonfuture

Once the Biochar Producer has been certified and a carbon sink potential has been calculated for their biochar production facility as above, an account can be set up on the carbonfuture platform (https://platform.carbonfuture.earth/). Production certificates can be registered in a simple web-form on the carbonfuture platform where the relevant values are entered, most importantly the **C-sink potential**, and the pdf certificate will be uploaded. This has to be done only once for each production certificate. The current EBC[6] production certificates are typically valid for the duration of one year.



[6] Currently, the EBC sink certificate is the only eligble production certificate on carbonfuture

In order to register a sink based on the biochar produced under your production certificate, the ID of your production certificate will be needed. This ID is generated automatically by the carbonfuture platform. Accordingly, you need to provide this information to the wholesaler of your biochar. Clicking on the ID (top of detail view) on copies it into your clipboard and you can just paste it into an email:[7]

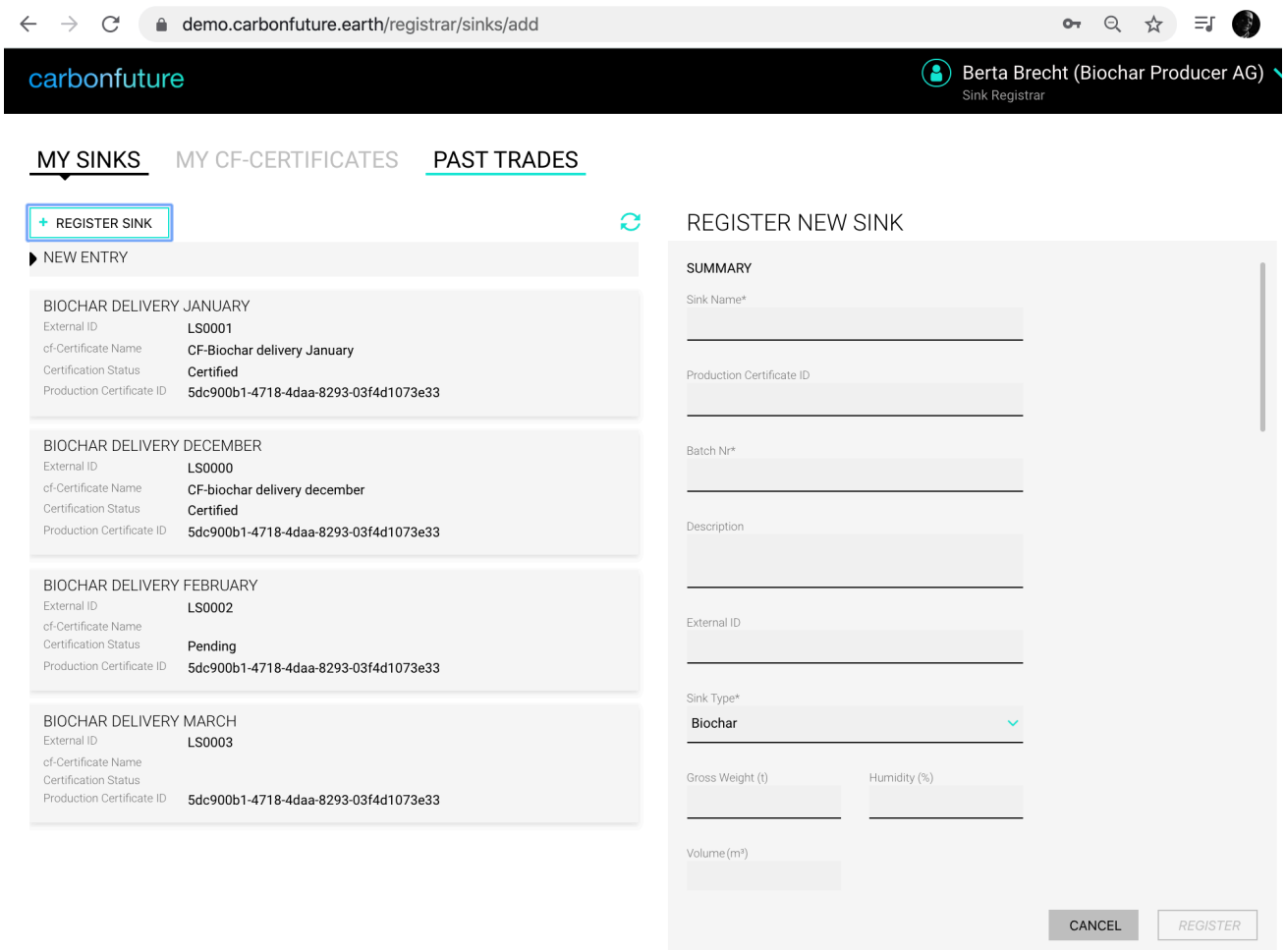


4.2 Step 2: Wholesaler / Sink Registrar

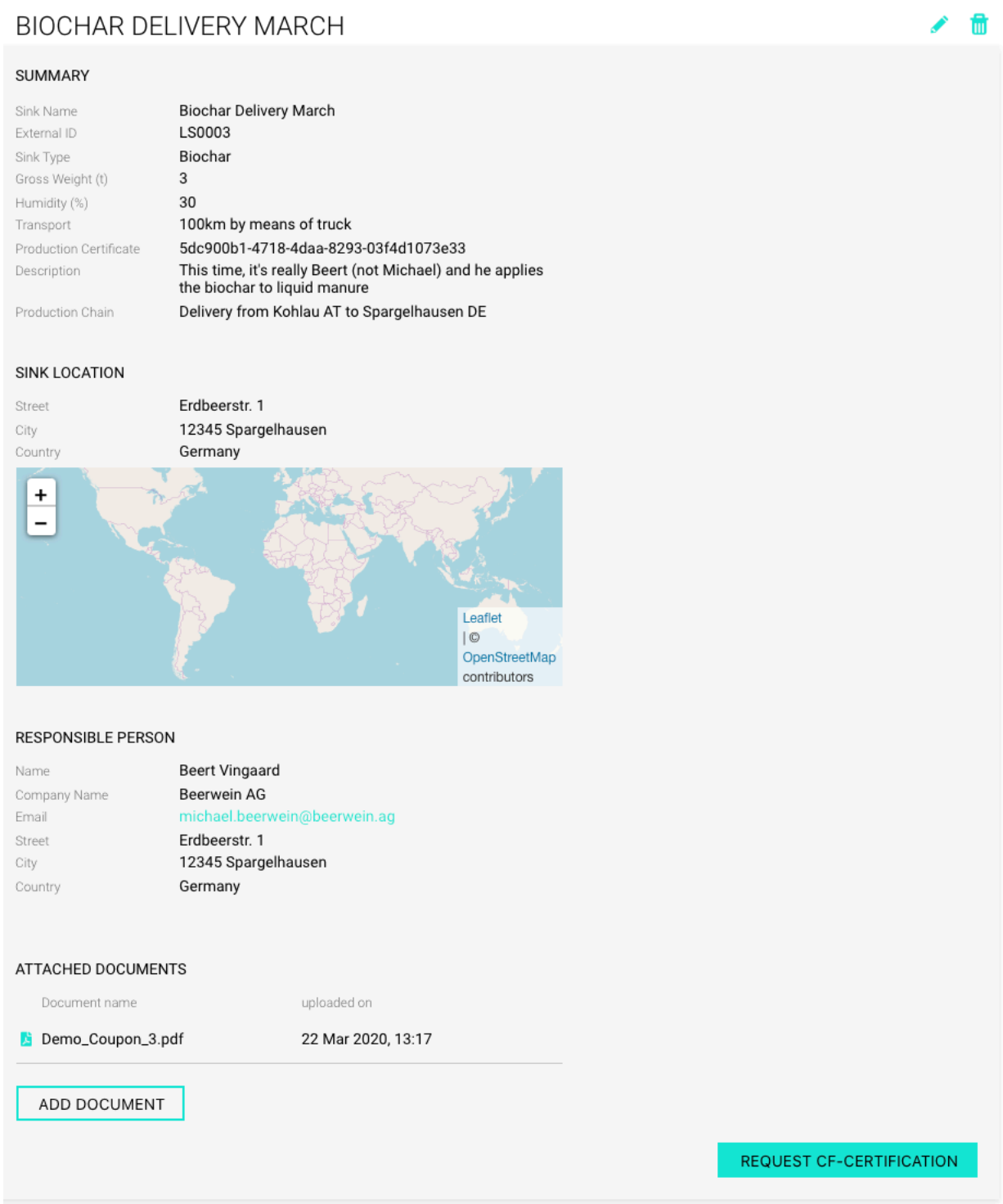
Biochar sold for use in soils, feed additives, building materials or other uses that will sequester carbon, can proceed to the next step in the cf process. Required information includes:

- Production certificate ID number
- Relevant post production data including gross and dry weight of the material, transport means (e.g. truck, train) and transport distance
- Upload the carbonfuture Coupon, which is filled out and signed by the end-user; with this document, the end-user confirms the application of the biochar in a carbon preserving manner, and the client confirms to transfer all rights related to the climate service provided by the biochar application (including but not limited to getting public or private funding for the same climate service, or using it for the own sustainability report[8])

[7] This will be simplified and more automated using QR codes printed on shipping notes and big bag labels soon
[8] For the avoidance of doubt: Referencing to participation in carbonfuture climate services in own marketing activities is possible, provided it is clear that the carbon balance is sold and the claim on it is made by a third-party. This is to prevent explicit and implicit double counting.

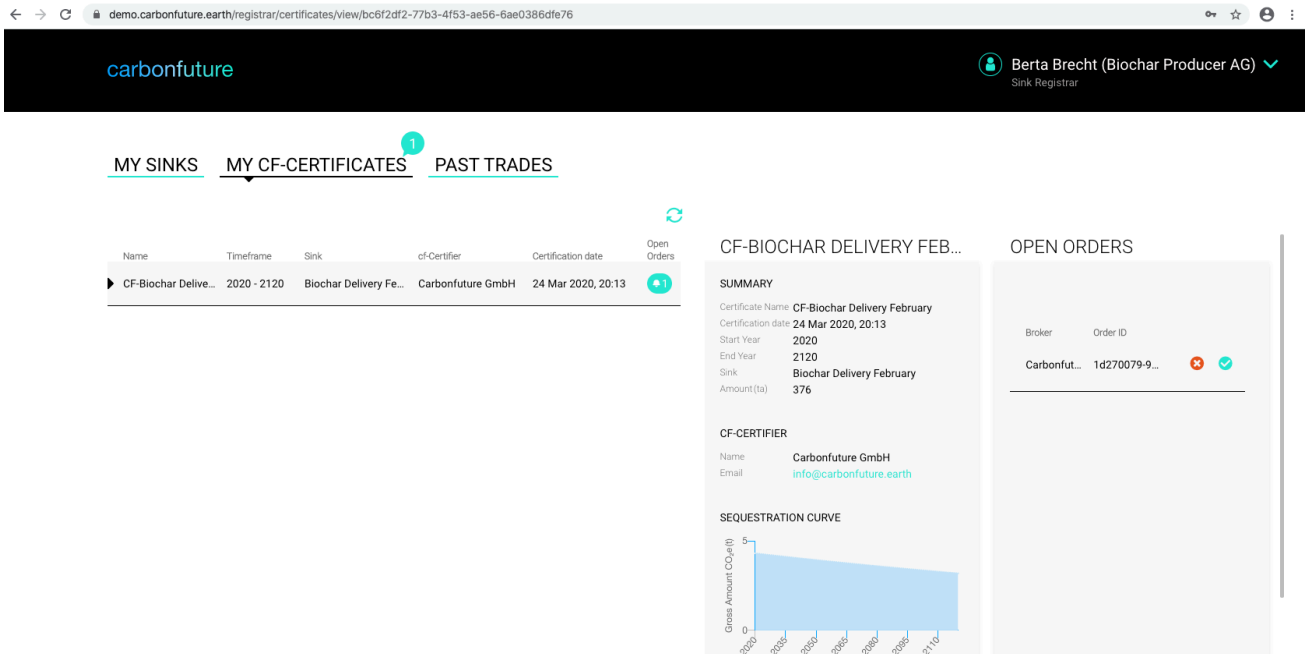


Once the sink registration is complete, it is eligible for purchase by the Broker. For this, the sink registrar must request cf-Certification by carbonfuture:



Carbonfuture will then validate the information and issue a **cf-Certficate**. This cf-Certificate represents the rights on the climate service provided. Accordingly, this is the certificate which actually has value.

The owner of the cf-Certrificate can offer this certificate for sale to a broker on the carbonfuture platform. Once the broker has ordered your cf-Certificate, you see the open order.



After you accepted the broker's buy order, ownership of the cf-Certificate will be transferred to the broker[9].

[9] In the currently established workflow with carbonfuture acting as broker, we are reimbursing the selling party through a self-billing note (so we need the selling party's bank details and VAT-Reg. No. as applicable).

5 Appendix: carbonfuture Coupon

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CO_2-Senken Zertifikat
carbonfuture Coupon

To be filled out by the biochar wholesaler / sink registrar		**Return coupons to**
Name / firm		Email:
Date		
Shipping note (external ID)		
Batch-No.[1]		
Quantity[2]	Gross weight t	Volume m³
Optional Information	Coupon-No.	Sealing-Nr

[1] *Alternatively, the production date may be provided*
[2] *Either gross weight or volume must be provided*

To be filled out by the end client / biochar user		
Name / firm		
Address	**Head Office**	**Address / location of sink if different**
Street		
City, ZIP		
Country		
Type of application (please tick as appropriate)	☐ Direct soil application ☐ Compost additive ☐ Liquid manure treatment ☐ Bedding for farm animals ☐ Feeding of farm animals	☐ Sillage additive ☐ Additive for anaerobic digestion (biogas facility) ☐ Biochar-based organic fertilizer
Optional / if needed: Bank details for payments from wholesaler to biochar user		
IBAN		
BIC		
Tax No.		

By signing this document, the biochar user confirms and agrees:

- The biochar and the manure (in case of biochar application as bedding or feeding) and the digestate (in case of anaerobic digestion) will be brought into soil and will **not be burnt or pyrolyzed.**
- He or she explicitly warrants that **the claim on the carbon sink service provided is transferred** to the wholesaler / sink registrar indicated above. He or she will not claim any rights related to this service. In particular, he or she will not claim any such rights in relation to any private or public subsidy or support program in the context of soil organic carbon or as part of the CO2 accounting in his or her own sustainability report.
- He or she explicitly agrees that his or her **data** which is registered and stored in relation to the referenced sink may be used by carbonfuture. They will be made public in an anonymized way, e.g. as part of statistics on the carbonfuture platform. In addition, they will be disclosed in complete and not anonymized form for control and audit purposes to persons who are authorized for this by carbonfuture or under the EBC certificate.

Optional:

☐ I consent to the **publication of the exact sink location** on the carbonfuture platform

Place and date _____ Signature biochar user _____

Version 1.8