Carbon Removal Purchase Application

General Application

Company or organization name

Collaboration between Haifa University (Israel), Coastal Research & Management (commercial company, Germany), GEOMAR, Sofia University & Varna University.

Company or organization location (we welcome applicants from anywhere in the world)

Israel, Germany, Bulgaria

Name of person filling out this application

Ram Amar

Email address of person filling out this application

ramamar@hey.com

Brief company or organization description

We are a group of researchers concerned about the climate and the obligation to remove CO2 from the atmosphere. Our idea is theoretical, and therefore it is not a commercial undertaking, but if proved, it can have a significant impact.

1. Overall CDR solution (All criteria)

a. Provide a technical explanation of the proposed project, including as much specificity regarding location(s), scale, timeline, and participants as possible. Feel free to include figures.

The C Sink concept consists of collecting clean biomass and sinking it in deep, anoxic (oxygen lacking) water. Clean biomass (plants, seaweed, crop residues, tree cuttings) take up CO_2 for photosynthesis, therefore capturing CO_2 from the atmosphere. In anoxic waters, biomass decomposes extremely slowly, effectively storing the carbon on the sea bottom for centuries. The largest anoxic body of water in the world is the Black Sea. and it is surrounded by fertile lands. Turkey and Ukraine together grow 300M tons of produce per year. With rivers like the Danube leading from farmlands to the sea, transporting crop residues downstream allows this method to be cost-efficient. In a way, the concept accelerates a natural solution where terrestrial biomass is washed during storms to rivers and then to the oceans. Aside from crop residues, seaweed can be grown in the deep Black Sea and then sunk in place. Be it terrestrial or aquatic biomass, C Sink has an additional benefit aside from carbon removal: seaweed cleans the water and feeds other organisms, and terrestrial biomass is largely a waste management problem.

The initial challenges of this project include proving the efficiency of sequestration, verifying limited environmental effects, creating social and political support, and solving engineering challenges of sinking biomass as well as floating and clearing in case of emergency. Pyrolyzing the biomass may be integrated into the process in order to create a more inert carbon substance (for longer sequestration duration) and perhaps to implement a sinking solution.

If all is successful, an operation of collecting biomass from Bulgaria and/or Romania, shipping it on barges down the Danube, and sinking it to the bottom of the Black Sea can be carried out in under $50/tCO2 . In addition, creating a 1m thick layer of biomass equivalent to 1GtCO2 on the bottom of the Black Sea, will take up less than 1% of the area of the Black Sea. Both estimates can be found in this spreadsheet.

b. What is your role in this project, and who are the other actors that make this a full carbon removal solution?

My personal role (Ram Amar) is that of an entrepreneur and project manager. If the academic research proves valid, the initiative may evolve into an end to end company collecting biomass from farmers, factories, and municipalities and sinking it in the Black Sea for carbon credits. A more likely turnout would be that the waste management industry would take up the collection and transportation of biomass, and then C Sink can evolve to the verification and monitoring solution and/or to the processing and sinking solution.

c. What are the three most important risks your project faces?

1. Limited sequestration duration (due to faster than assumed decomposition)
2. Intolerable environmental damage

3. Lack of social/scientifical/political acceptance

d. If any, please link to your patents, pending or granted, that are available publicly.

- *n/a*

2. Timeline and Durability (Criteria #4 and Criteria #5)

a. Please fill out the table below.

	Timeline for Offer to Stripe
Project duration	2 years
When does carbon removal occur?	An insignificant amount of carbon will removed during the research project (less than 100t), and if the research succeeds, we will try to grow the amount of carbon 2x year over year.
Distribution of that carbon removal over time	The project will start in the lab in the 1st year, and will move to the Black Sea in the 2nd year. All of the (limited) amount of carbon will be sequestered in the Black Sea experiment.
Durability	Biomass in anoxic conditions will decompose over a century or more.

b. What are the upper and lower bounds on your durability claimed above in table 2(a)?

The lower bound on durability can be just a couple of years, as is the case with terrestrial biomass that is eaten by organisms that live in the sea. In the Pacific Ocean, wood is eaten by snail like worms in a short period of time. Since the Black Sea is anoxic (from depth of about 150m), no such animals live on the sea floor.

Upper bound on durability is thousands of years, as is the case with wrecked wooden ships on the bottom of the Black Sea, which have been remarkably preserved for a few thousands of years.

c. Have you measured this durability directly, if so, how? Otherwise, if you're relying on the literature, please cite data that justifies your claim. *(E.g. We rely on findings from Paper_1 and Paper_2 to estimate permanence of mineralization, and here are the reasons why these findings apply to our system.* OR *We have evidence from this pilot project we ran that biomass sinks to D ocean depth. If biomass reaches these depths, here's what we assume happens based on Paper_1 and Paper_2.)*

The purpose of this project is to measure and verify the durability.

d. What durability risks does your project face? Are there physical risks (e.g. leakage, decomposition and decay, damage, etc.)? Are there socioeconomic risks (e.g. mismanagement of storage, decision to consume or combust derived products, etc.)? What fundamental uncertainties exist about the underlying technological or biological process?

The fundamental uncertainties in the biological process are the rate of decomposition as well as the products. Under anoxic conditions, anaerobic decomposition will take place, but at what rate, and what will occur with the resulting methane. That is the purpose of the experiment.

In addition, there can be social objections as this idea resembles dumping trash in the Black Sea which is already very polluted.

Lastly, initial conversations put waste biomass at competition with BECCS or just plain "leave on the field for local composting". We believe that there's enough biomass for all use cases. BECCS also requires very clean and specific types of biomass (otherwise degradation of the furnaces and heat exchangers can occur faster).

e. How will you quantify the actual permanence/durability of the carbon sequestered by your project? If direct measurement is difficult or impossible, how will you rely on models or assumptions, and how will you validate those assumptions? *(E.g. monitoring of injection sites, tracking biomass state and location, estimating decay rates, etc.)*

The aim of the project is to develop methods of direct measurements. In the experiment, perhaps the biomass will be deposited within plastic containers equipped with sensors, to keep the products of the decomposition within a monitored volume of water. In operational mode, sensors will be scattered and will measure changes in concentration of various chemicals (CO_2, methane, sulfites, etc.) as well as mass and volume of deposited material.

3. Gross Capacity (Criteria #2)

a. Please fill out the table below. **All tonnage should be described in metric tonnes here and throughout the application.**

	Offer to Stripe (metric tonnes CO_2) over the timeline detailed in the table in 2(a)
Gross carbon removal Do not subtract for embodied/lifecycle emissions or permanence, we will ask you to subtract this later	100 tCO_2
If applicable, additional avoided emissions e.g. for carbon mineralization in concrete production, removal would be the CO_2 utilized in concrete production and avoided emissions would be the emissions reductions associated with traditional concrete production	*0*

b. Show your work for 3(a). How did you calculate these numbers? If you have significant uncertainties in your capacity, what drives those? *(E.g. This specific species sequesters X tCO_2/t biomass. Each deployment of our solution grows on average Y t biomass. We assume Z% of the biomass is sequestered permanently. We are offering two deployments to Stripe. X*Y*Z*2 = 350 tCO_2 = Gross removal. OR Each tower of our mineralization reactor captures between X and Y tons CO_2/yr, all of which we have the capacity to inject. However, the range between X and Y is large, because we have significant uncertainty in how our reactors will perform under various environmental conditions)*

We assume average carbon content of biomass is about 50%, so ratio of biomass to CO_2 is 0.5*3.4 = 1.7 . If our Black Sea experiment will include 3 truck loads of biomass (each truck carries 20 metric tons) it would be the equivalent of 100 tCO_2. We also assume that the biomass, when sunk to a depth of more than 1000m with no oxygen, will break down over centuries, so we hope to see no measurable breakdown within the first year.

c. What is your total overall capacity to sequester carbon at this time, e.g. gross tonnes / year / (deployment / plant / acre / etc.)? Here we are talking about your project / technology as a whole, so this number may be larger than the specific capacity offered to Stripe and described above in 3(b). We ask this to understand where your technology currently stands, and to give context for the values you provided in 3(b).

If the research proves our assumptions, then this concept can reach gigaton scale relatively quickly. The Black Sea region is one of the most fertile areas in the world, and therefore biomass residues are abundant. Agricultural produce tops 300M metric tons per year (data retrieved from FAO and summarized in a pivot table can be found here). We assume biomass residues reach at least the same number, and the means to transfer such quantities already exist.

d. We are curious about the foundational assumptions or models you use to make projections about your solution's capacity. Please explain how you make these estimates, and whether you have ground-truthed your methods with direct measurement of a real system (e.g. a proof of concept experiment, pilot project, prior deployment, etc.). We welcome citations, numbers, and links to real data! *(E.g. We assume our sorbent has X absorption rate and Y desorption rate. This aligns with [Sorbent_Paper_Citation]. Our pilot plant performance over [Time_Range] confirmed this assumption achieving Z tCO_2 capture with T tons of sorbent.)*

We rely on techno-economic analysis performed by SE Strand, 2009 and on a follow up paper examining the rate of decay of terrestrial biomass. The Black Sea provides "easier" conditions, as it is anoxic (slower decay than in the deep ocean) and distance from agricultural lands is shorter.

e. Documentation: If you have them, please provide links to any other information that may help us understand your project in detail. This could include a project website, third-party documentation, project specific research, data sets, etc.

- n/a

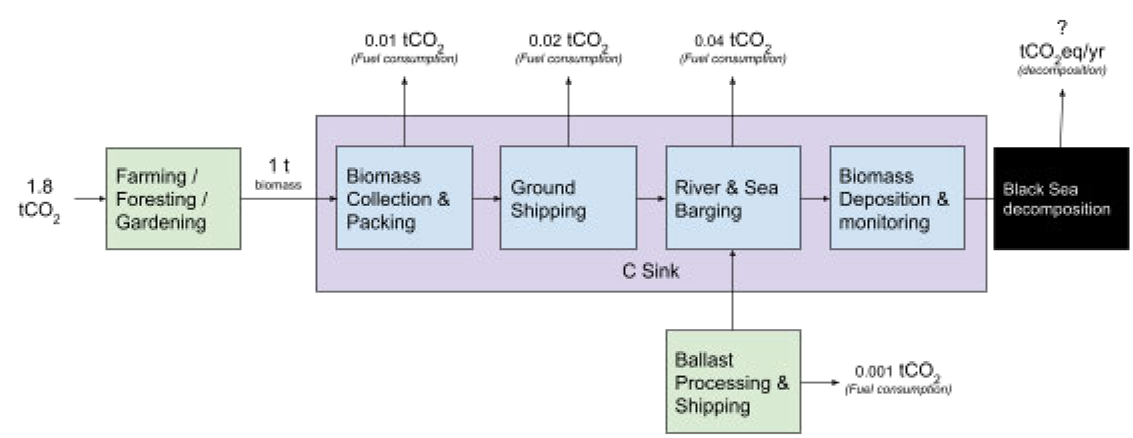
4. Net Capacity / Life Cycle Analysis (Criteria #6 and Criteria #8)

a. Please fill out the table below to help us understand your system's efficiency, and how much your lifecycle deducts from your gross carbon removal capacity.

	Offer to Stripe (metric tonnes CO_2)
Gross carbon removal	100 tons

Gross project emissions	10 tons
Emissions / removal ratio	0.1
Net carbon removal	90 tons

b. Provide a carbon balance or “process flow” diagram for your carbon removal solution, visualizing the numbers above in table 4(a). Please include all carbon flows and sources of energy, feedstocks, and emissions, with numbers wherever possible *(E.g. see the generic diagram below from the CDR Primer, Charm’s application from last year for a simple example, or CarbonCure’s for a more complex example).* If you’ve had a third-party LCA performed, please link to it.



c. Please articulate and justify the boundary conditions you assumed above: why do your calculations and diagram include or exclude different components of your system?

The diagram includes only the basic process, as this is still theoretical. Numbers are taken from SE Strand, 2009 and rounded up / doubled as a precaution. This process could be expanded in the future to include: compensation for nutrients removed from the biosphere (nitrogen, phosphorus, etc.), pyrolyzing the biomass, different deposition methods (aside from ballasting).

d. Please justify all numbers used in your diagram above. Are they solely modeled or have you measured them directly? Have they been independently measured? Your answers can include references to peer-reviewed publications, e.g. Climeworks LCA paper.

Numbers were not measured, but taken from SE Strand, 2009

e. If you can't provide sufficient detail above in 4(d), please point us to a third-party independent verification, or tell us what an independent verifier would measure about your process to validate the numbers you've provided. (We may request such an audit be performed.)

<100 words

5. Learning Curve and Costs (Backward-looking) (Criteria #2 and #3)

We are interested in understanding the learning curve of different carbon removal technologies (i.e. the relationship between accumulated experience producing or deploying a technology, and technology costs). To this end, we are curious to know how much additional deployment Stripe's procurement of your solution would result in. (There are no right or wrong answers here. If your project is selected we may ask for more information related to this topic so we can better evaluate your progress.)

a. Please define and explain your unit of deployment. (*E.g.* # of plants, # of modules) *(50 words)*

No experience yet. Forward looking the unit of deployment would be "collection region", a region from which we would get all the necessary biomass collection agreements and plan an exact transportation process to the Black Sea.

b. How many units have you deployed from the origin of your project up until today? Please fill out the table below, adding rows as needed. Ranges are acceptable if necessary.

Year	Units deployed (#)	Unit cost ($/unit)	Unit gross capacity (tCO_2/unit)	Notes
2021	0			*<50 words*
2020	0			*<50 words*

2019	0			*<50 words*
...				

c. Qualitatively, how and why have your deployment costs changed thus far? *(E.g. Our costs have been stable because we're still in the first cycle of deployment, our costs have increased due to an unexpected engineering challenge, our costs are falling because we're innovating next stage designs, or our costs are falling because with larger scale deployment the procurement cost of third party equipment is declining.)*

n/a

d. How many additional units would be deployed if Stripe bought your offer? The two numbers below should multiply to equal the first row in table 3(a).

# of units	Unit gross capacity (tCO_2/unit)
1	100 tCO_2/unit

6. Cost and Milestones (Forward-looking) (Criteria #2 and #3)

We ask these questions to get a better understanding of your growth trajectory and inflection points, there are no right or wrong answers. If we select you for purchase, we'll expect to work with you to understand your milestones and their verification in more depth.

a. What is your cost per ton CO_2 today?

The cost per tCO_2 during the 2 years of research would be $5000.

If the research succeeds, the future cost of sequestering a tCO_2 would be $50

b. Help us understand, in broad strokes, what's included vs excluded in the cost in 6(a) above. We don't need a breakdown of each, but rather an understanding of what's "in" versus "out."

The costs of a proven C Sink method ($50/tCO2) would include the costs of collecting, packing, shipping and depositing the biomass in the Black Sea (see break down).

The costs of the research would include all of the above and: salary of a PhD student (for 2 years), salaries of 3-4 research partners (part time), sensors, lab time, boat time, and travel

expenses. The research team would be responsible to carry out the scientific research as well as the stakeholders engagement to create social & political acceptability.

c. List and describe **up to three** key upcoming milestones, with the latest no further than Q2 2023, that you'll need to achieve in order to scale up the capacity of your approach.

Milestone #	Milestone description	Why is this milestone important to your ability to scale? (200 words)	Target for achievement (eg Q4 2021)	How could we verify that you've achieved this milestone?
1	Lab experiment	The lab experiment is required to demonstrate the biomass breakdown process (rate & products) as well as the measuring capability, in a simulated Black Sea environment.	Q4 2021	We will publish a scientific paper and provide all evidence necessary
2	Biomass Deposition Permit	This milestone will show success in the stakeholder engagement process, resulting in a permit to continue the experiment in the Black Sea	Q1 2022	We will provide a copy of the permit
3	Black Sea experiment	Success in this experiment will enable	Q2 2023	We will publish a scientific paper and provide all the evidence

i. How do these milestones impact the total gross capacity of your system, if at all?

Milestone #	Anticipated total gross capacity prior to achieving milestone (ranges	Anticipated total gross capacity after achieving milestone (ranges are	If those numbers are different, why? (100 words)

	are acceptable)	acceptable)	
1	0	0	
2	0	0	
3	0	0	As previously stated, the current state of the C Sink concept is to prove its validity, and not to develop a biomass supply chain.

d. How do these milestones impact your costs, if at all?

Milestone #	Anticipated cost/ton prior to achieving milestone (ranges are acceptable)	Anticipated cost/ton after achieving milestone (ranges are acceptable)	If those numbers are different, why? (100 words)
1	$5000	$5000	
2	$5000	$5000	
3	$5000	$50	Reaching this milestone means C Sink is a concept that works, and implementing it relies mostly on existing transportation methods.

e. If you could ask one person in the world to do one thing to most enable your project to achieve its ultimate potential, who would you ask and what would you ask them to do?

The biggest hurdle seems to be public acceptance of this concept, therefore I would ask the editor of the National Geographic to write a piece supporting research of ocean carbon removal methods, with an emphasis on biomass burial.

f. Other than purchasing, what could Stripe do to help your project?

Public support of researching this concept would go a long way.

7. Public Engagement and Environmental Justice (Criteria #7)

In alignment with Criteria 7, Stripe requires projects to consider and address potential social, political, and ecosystem risks associated with their deployments. Projects with effective public engagement tend to do the following:

- Identify key stakeholders in the area they'll be deploying
- Have some mechanism to engage and gather opinions from those stakeholders and take those opinions seriously, iterating the project as necessary.

The following questions are for us to help us gain an understanding of your public engagement strategy. There are no right or wrong answers, and we recognize that, for early projects, this work may not yet exist or may be quite nascent.

a. Who are your external stakeholders, where are they, and how did you identify them?

Our stakeholders include environmental NGOs, cities (and residents) on the shore of the Black Sea, environmental protection government offices, technically in all countries surrounding the Black Sea, but mostly in Bulgaria, Romania, and Ukraine. We are in the process of creating and prioritizing a list of the stakeholders in Bulgaria and Romania.

b. If applicable, how have you engaged with these stakeholders? Has this work been performed in-house, with external consultants, or with independent advisors?

So far we recruited to our research team marine scientists from Bulgarian universities, and a politician from the Black Sea Institute. We are also collaborating with GEOMAR, a well known oceanic research institution in Germany, and receiving feedback from them.

c. If applicable, what have you learned from these engagements? What modifications have you already made to your project based on this feedback, if any?

From our research group we've learned that the Black Sea is very polluted and suffering from a high concentration of sulfides (H_2S), so as a result, measuring sulfide concentration was added to our experiment program. We've also learned that crop residues are often destined for on-field composting or for energy, and that countries and local authorities spend a lot of money on organic waste management. From our collaboration with GEOMAR we've added marine biomass (seaweed) to the types of organic matter that we will evaluate.

d. Going forward, do you have changes planned that you have not yet implemented? How do you anticipate that your processes for (a) and (b) will change as you execute on the work described in this application?

We anticipate that as we make progress with NGOs and authorities we will add criteria for measuring the environmental impact of biomass in the sea.

e. What environmental justice concerns apply to your project, if any? How do you intend to consider or address them?

In a way, environmental justice is what we want to verify. Aside from validating the rate of breakdown, we want to make sure life in the Black Sea is not affected: the microorganisms that live on the bottom of the Black Sea should continue to live, no invasive species should be introduced, no effects to the oxic zones of the Black Sea, where fish and dolphins live, no effects to the beaches, and perhaps one last concern is the archaeological artifacts (wrecked ships) on the bottom of the Black Sea.

11. Legal and Regulatory Compliance (Criteria #7)

a. What legal opinions, if any, have you received regarding deployment of your solution?

none

b. What permits or other forms of formal permission do you require, if any? Please clearly differentiate between what you have already obtained, what you are currently in the process of obtaining, and what you know you'll need to obtain in the future but have not yet begun the process to do so.

We will need to obtain a permit for dumping organic matter in the Black Sea. Technically, the London Convention / London Protocol do not prohibit this kind of action (ships out in the sea may dump clean organic waste), but in marine exclusive economic zones dumping permits are required for any kind of material.

c. In what areas are you uncertain about the legal or regulatory frameworks you'll need to comply with? This could include anything from local governance to international treaties. For some types of projects, we recognize that clear regulatory guidance may not yet exist.

We are uncertain what the regulatory framework for scaling the C Sink concept (if proven successful) to millions of tons would be.

12. Offer to Stripe

This table constitutes your offer to Stripe, and will form the basis of our expectations for contract discussions if you are selected for purchase.

	Offer to Stripe
Net carbon removal (metric tonnes CO_2)	90 tCO_2
Delivery window (at what point should Stripe consider your contract complete?)	Q2 2023
Price ($/metric tonne CO_2) ***Note on currencies:*** *while we welcome applicants from anywhere in the world, our purchases will be executed exclusively in USD ($). If your prices are typically denominated in another currency, please convert that to USD and let us know here.*	$5000

Application Supplement: Biomass

(Only fill out this supplement if it applies to you)

Feedstock and Physical Footprint (Criteria #1)

1. What type of biomass does your project rely on?

Any type of non toxic, clean, organic waste. Municipal green waste, agricultural residues.

2. Are you growing that biomass yourself, or procuring it, and from whom?

We plan to procure it from farmers or municipalities. From our experience in Israel, local authorities pay for biomass removal, or collect and transport it on their expense.

3. Please fill out the table below regarding your feedstock's physical footprint. If you don't know (e.g. you procure your biomass from a seller who doesn't communicate their land use), indicate that in the table.

	Area of land or sea (km^2) in 2021	Competing/existing project area use (if applicable)
Feedstock cultivation	N/A (procuring waste biomass)	
Processing	0.1 km^2 (yard for collecting biomass, loading with ballast, and preparing for shipping)	
Long-term Storage	270 m^2 on bottom of Black Sea	

4. Imagine, hypothetically, that you've scaled up and are sequestering 100Mt of CO_2/yr. Please project your footprint at that scale (we recognize this has significant uncertainty, feel free to provide ranges and a brief description).

	Projected # of km^2 enabling 100Mt/yr	Projected competing project area use (if applicable)
Feedstock cultivation	N/A (procuring waste biomass)	

Processing	10 km^2	
Long-term Storage	100 km^2/yr	

Permanence, Additionality, Ecosystem Impacts (Criteria #4, #6, and #7)

5. How is your biomass processed to ensure its permanence? What inputs does this process require (e.g. energy, water) and how do you source these inputs? (You should have already included their associated carbon intensities in your LCA in Section 6.)

Frankly, we do not know yet. Our assumption is that the biomass will require virtually no treatment (aside from shredding or compressing). But we plan to also test pyrolyzed biomass and compare its rate of decay.

6. (Criteria 6) If you didn't exist, what's the alternative use(s) of your feedstock? What factors would determine this outcome? *(E.g. Alternative uses for biomass include X & Y. We are currently the only party willing to pay for this biomass resource. It's not clear how X & Y would compete for the biomass resources we use. OR Biomass resource would not have been produced but for our project.)*

Alternative uses are composting, gasification, or sending to landfill.

7. We recognize that both biomass production and biomass storage can have complex interactions with ecological, social, and economic systems. What are the specific negative impacts (or important unknowns) you have identified, and what are your specific plans for mitigating those impacts (or resolving the unknowns)? *(200 words)*

Answering this question is the purpose of our research. We expect very little effect on the ecosystem of the bottom of the Black Sea, as not many organisms live in anoxic environments.

8. Biomass-based solutions are currently being deployed around the world. Please discuss the merits and advantages of your solution in comparison to other approaches in this space.

Biofuel, BECCS, Gasification, etc - the sequestration efficiency as well as the ease of scale of these methods is lacking, when compared to C Sink. Biochar - sequestration efficiency is comparable, but scaling capacity is more difficult. Perhaps there's potential to combine biochar as part of the processing of biomass before sinking. Composting - most of the carbon is released back to the atmosphere.

Application Supplement: Ocean

(Only fill out this supplement if it applies to you)

Physical Footprint (Criteria #1)

1. Describe the geography of your deployment, its relationship to coastlines, shipping channels, other human or animal activity, etc.

If the research is successful, the C Sink concept will ship biomass down the Danube river, through the shortcut tunnel to Constanta, and out into the depth of the Black Sea (~2000m deep, 150km south east from Constanta. See bathymetric map). These are normal shipping routes connecting Black Sea countries to the Mediterrenean Sea. The deposition site will be far off shore, and much deeper than the oxic layer (top 150m of the Black Sea).

2. Please describe your physical footprint in detail. Consider surface area, depth, expected interaction with ocean currents and upwelling/downwelling processes, etc.

    a. If you've also filled out the Biomass supplement and fully articulated these details there, simply write N/A.

Assuming we dump a layer 1m thick of biomass, every ton of CO_2 will take up $2.7m^2$. $1GtCO_2$ will take up $2700km^2$ which is <1% of the surface area of the Black Sea. The currents in the Black Sea are cyclic and enclosed in the Black Sea. This is due to the very narrow and shallow connection to the Mediterrenean Sea. In addition, the up/down welling is virtually non-existent, again because of the flow of freshwater from rivers and narrow connection to the Med. Sea. This causes the layers of water to stay unmixed, and that's how the Black Sea became anoxic.

3. Imagine, hypothetically, that you've scaled up and are sequestering 100Mt of CO_2/yr. Please project your footprint at that scale, considering the same attributes you did above (we recognize this has significant uncertainty, feel free to provide ranges and a brief description).

    a. If you've also filled out the Biomass supplement and fully articulated these details there, simply write N/A.

N/A

Potential to Scale (Criteria #2 and #3)

4. Building large systems on or in the ocean is hard. What are your core engineering challenges and constraints? Is there any historical precedent for the work you propose?

> We don't plan to build large systems in the Black Sea. One possibility is to have a sinking terminal floating in the Black Sea, which will serve as a down-bound elevator. If you're asking yourself why would we want that, here is the explanation. Adding ballast to the biomass is a pain. We have an assumption that if the biomass is sunk to a depth of ~30m, the water pressure would compress the air out of the biomass and from there it will sink on its own. Building an elevator/conveyor belt to take biomass down to that depth could be a solution. The rest of the aspects of scaling this solution rely on existing supply chains and political will.

Externalities and Ecosystem Impacts (Criteria #7)

5. How will you quantify and monitor the impact of your solution on ocean ecosystems, specifically with respect to eutrophication and alkalinity/pH, and, if applicable, ocean turbidity?

> We plan to measure the release of CO_2, methane, sulfides, pH, particles and to sample living organisms. Those measurements will be carried out on various types of biomass with various preprocessing (shredding, compressing, packaging, pyrolyzing, etc.). Our research group also specializes in marine environmental assessments.