Frontier

Limenet
Carbon dioxide removal prepurchase application
Summer 2024

General Application

(The General Application applies to everyone; all applicants should complete this)

Public section

The content in this section (answers to questions 1(a) - (d)) will be made public on the Frontier GitHub repository after the conclusion of the 2024 summer purchase cycle. Include as much detail as possible but omit sensitive and proprietary information.

Company or organization name

Limenet

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

Lecco, Lombardy, Italy

Name(s) of primary point(s) of contact for this application

Stefano Cappello

Brief company or organization description <20 words

Remove CO_2 as BiCRS, store it as pH-equilibrated-Ocean-Alkalinity-Enhancement.

1. Public summary of proposed project[1] to Frontier

a. **Description of the CDR approach:** Describe how the proposed technology removes CO_2 from the atmosphere, including how the carbon is stored for > 1,000 years. Tell us why your system is best-in-class, and how you're differentiated from any other organization working on a similar approach. If your project addresses any of the priority innovation areas identified in the RFP, tell us how. Please include figures and system schematics and be specific, but concise. 1000-1500 words

Limenet is working on a state of the art technology that generates measurable and permanent carbon removal using **limestone**, **electric energy**, **seawater** and **organic feedstocks** containing biogenic carbon coming from sustainable biomass, agricultural & livestock wastes, non-recyclable organic municipal solid waste (NR-MSW) or municipal sewage sludges: Limenet's process will store the CO_2 in an aqueous solution of calcium bicarbonate equilibrated with atmospheric CO_2 that is injected into seawater with the same background sea pH (pH Equilibrated Alkaline Solution).

[1] We use "project" throughout this template, but the term is not intended to denote a single facility. The "project" being proposed to Frontier could include multiple facilities/locations or potentially all the CDR activities of your company.

Limenet is accelerating a natural process that is part of the geological carbon cycle. The technology could be considered a BiCRS (Biomass Carbon Removal and Storage) process with the carbon storage using the same chemistry of OAE (Ocean Alkalinity Enhancement). Limenet calls the CO_2 storage process: **Buffered Ocean Alkalinity Enhancement** or **pH equilibrated Ocean Alkalinity Enhancement**.

Limenet leverages the nature of biomass as a DAC with the permanence and stability of the CO_2 stored in calcium bicarbonate as a pH-equilibrated OAE.

Limenet's technology permanently stores for thousands of years (> 10,000 years)[2,3] all the CO_2 produced by the process as calcium bicarbonates into seawater using a unique and completely innovative marine CDR (Mineral OAE) way of producing a pH Equilibrated Alkaline Solution.

Limenet's technology also produces, as co-product, carbon-free slaked lime that could be sold, generating an additional revenue, to decrease the CDR cost.

The technology consists of 3 different processes:

- An oxygen-steam gasifier (Gasifier) for low-grade feedstocks to generate a flow of high-temperature syngas.
- An indirect limestone calciner (Calciner) using oxycombustion of syngas as heat source to produce a flow of slaked lime and a stream of biogenic and fossil CO_2.
- A reactor (Mixer) generates calcium bicarbonates reacting seawater, fossil CO_2 and biogenic CO_2 produced by the calcination of limestone and by the oxycombustion of syngas and the slaked lime produced by the calciner.

[2] Renforth and Henderson, 2017. Assessing ocean alkalinity for carbon sequestration. Reviews of Geophysics, 55, 3, 636-674. https://doi.org/10.1002/2016RG000533
[3] ISOMETRIC, Dissolved Inorganic Carbon Storage in Oceans. https://registry.isometric.com/module/dic-storage-in-oceans/1.0

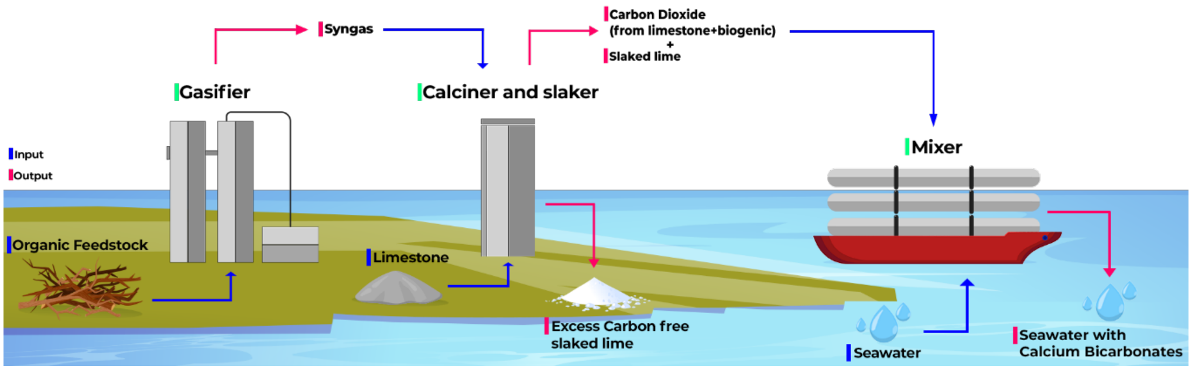

Figure 1 Limenet's 3 section process

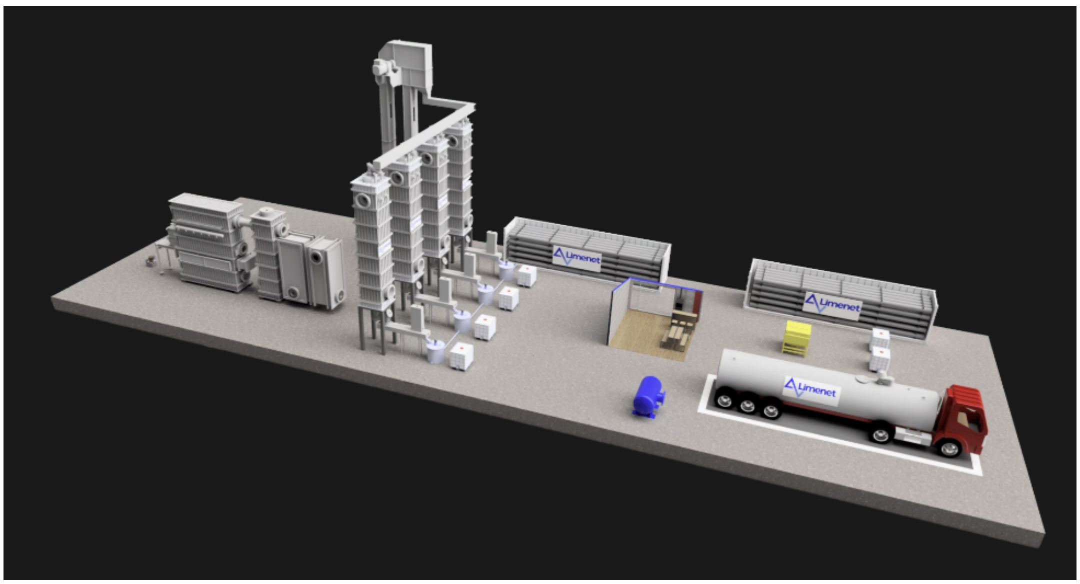

Figure 2 Plant 3D Rendering

Priority Innovation Area/Strengths:

- **Additional revenue on the sales of decarbonized slaked lime**:
    - **Co-product:** production of carbon free slaked lime that can be used either for storing additional CO_2 or for OAE or for sales into traditional lime markets or to produce decarbonized cement.

- **Use of available and cheap raw material for alkalinity production**:
    - Even though limestone availability is about 5,000 gigatons (Gt) within 10 km from the coastline worldwide[4], Limenet will prioritize the use of limestone fines already stored in the quarries because of practical use.
- **Low Electric energy consumption:**

- only 630 kWh/ton of negative emissions when biomass is used as feedstock.

- **Use of low-grade feedstocks containing biogenic carbon**:
  - possibility to use non woody biomasses wastes sourced from sugar cane mills, palm plantations, rice mills, rice plantations, corn plantations, etc.
  - possibility to use NR-MSW or municipal sewage sludges: the NR-MSW allows the generation of the heat for calcination at negative cost (tipping or gate fee for landfilling or incineration) while the biogenic part of the waste (usually around 50% in weight of the NR-MSW) generates negative emissions. All the fossil CO_2 generated by the combustion of the syngas produced by the gasification of the plastic material in the NR-MSW is duly stored in form of calcium bicarbonates into seawater.

- **Efficient use of biomass**:
  - considering as example a biomass constituted by forest residue with moisture content of 20%, the gasification process allows to make available approximately 1.5 ton of biogenic CO_2 per ton of biomass versus:
    - A pyrolysis bio-oil production facility with geological injection of the produced bio-oil, with the same biomass as input, will store only 0.85 ton of biogenic CO_2 per ton of biomass[5].
    - A pyrolysis bio-char production facility will store only 0.86 ton of biogenic carbon.[6]

- **Co-Benefits**:
  - using agricultural waste and NR-MSW that are left decomposing in the fields or are landfilled or incinerated will avoid GHG release.
  - using NR-MSW is solving an environmental problem in many urban contexts
  - injecting alkalinity into the ocean will counteract ocean acidification.
  - maximization of CO_2 captured and stored per ton of biomass used in the process.

- **Injection of a pH Equilibrated Alkaline Solution of calcium bicarbonate into the sea**:
  - Injecting the alkaline solution with the same seawater pH decreases the risk of abiotic and biotic carbonates precipitation. In fact, it avoids the risk of creating areas with excessively high pH in the seawater typical of OAE technologies. The injection of bicarbonates into the sea is done either from the coast through a submarine outfall or from a dedicated ship: it takes place after a rigorous control process to ensure compliance with established injection parameters. This process is based on precise parameter measurements made during the process rather than the use of theoretical models, ensuring a high degree of certainty regarding the amount of CO_2 transformed into bicarbonates.

- **Fast mineralization process of the CO_2**:
  - The Mixer completes the mineralization of the CO_2 into calcium bicarbonates in less than 4 minutes.

- **Measurement based MRV:**

[4] Caserini et al., 2022. The Availability of Limestone and Other Raw Materials for Ocean Alkalinity Enhancement. Global Biogeochemical Cycles, 36, 5, e2021GB007246. https://doi.org/10.1029/2021GB007246

[5] Charm | Carbon removal technology (charmindustrial.com)

[6] Roberts et al., 2010. Life Cycle Assessment of Biochar Systems: Estimating the Energetic, Economic, and Climate Change Potential. Environ. Sci. Technol. 2010, 44, 2, 827–833. https://doi.org/10.1021/es902266r

- all the parameters to assess the quantity and the quality of the CO_2 stored into seawaters are measured and verified.
- backed by more than 25 scientific papers, Limenet is using just science-based methodology for accounting from LCA to experimental studies.

- **Low cost of negative emissions:**
  - Affordable path to 100 $/ton[7] of negative emissions using biomass as feedstock or to well below 100 $/ton of negative emissions using NR-MSW.

- **Low physical footprint:**
  - a Limenet process plant of 100 ktons/year of negative emissions using biomass could be installed on 25,000 m^2.
  - a Limenet process plant of 100 ktons/year of negative emission using NR-MSW could be installed on 50,000 m^2.

- **Location flexibility:**
  - the location of Limenet plants does not depend on geological storage and it can be installed in any, even remote, coastal location in the world minimizing the transport of feedstocks.

- **Scalability:**
  - considering the availability of biomass wastes, NR-MSW and limestone, the Limenet process could scale up to multiple Gtons/year[8,9]of negative emissions.

- **Net negativity:**
  - Limenet technology allows to permanently (>10,000 years) store carbon dioxide into seawater calcium bicarbonates with an emission/removal ratio equal to 0.10. This means that for every ton of carbon stored, only 10% will be emitted due to the necessary operations".

- **Additionality:**
  - by using sustainable and certified waste biomass (SBP) or NR-MSW is possible to store carbon contained in it and avoid the release of other GHGs due to its burning or decay.
  - Limenet technology thus enables the storage of carbon from a raw material that would not otherwise be used to generate negative emissions.

- **Plants deployment**:
  - Limenet process is innovative but using already existing industrial equipment and known technologies that will allow a quick and consistent scale up.
  - Limenet plant design is standard, modular, with modules easily built in factories, transported and assembled.
  - Limenet will focus in industrializing the production of equipment partnering with world class manufacturing companies.
  - Limenet is building an experienced and international organization focused on BIM (building information modeling) engineering with senior consultants in the different

[7] Depending on the Electric Energy, Raw material, Cost of Capital
[8] Biomass Carbon Removal and Storage (BiRCS) Roadmap. https://www.osti.gov/servlets/purl/1763937
[9] Caserini et al., 2022. The Availability of Limestone and Other Raw Materials for Ocean Alkalinity Enhancement. Global Biogeochemical Cycles, 36, 5, e2021GB007246. https://doi.org/10.1029/2021GB007246

technologies used in the process.

b. **Project objectives:** What are you trying to build? Discuss location(s) and scale. What is the current cost breakdown, and what needs to happen for your CDR solution to approach Frontier's cost and scale criteria?[10] What is your approach to quantifying the carbon removed? Please include figures and system schematics and be specific, but concise. 1000-1500 words

Location and Scale:

Limenet is planning to build a complete industrial plant of 4k tons of net negative emissions in Augusta (SR, Sicily), Italy by Q3 of 2025. The plant would be a FOAK that will demonstrate a 24/7 operation using certified biomass for making negative emissions.

Augusta port was selected because of Limenet co-founder local network. Even though is not the best place for renewable electricity and availability of certified biomass it's close to the limestone quarry of one of Limenet financial partners and it has a very deep sea, more than 2000 m depth just few km outside the port.

Another key motivation for installing the FOAK plant in Augusta port area is that Limenet has already installed there its TRL7 Mixer: Limenet believes that it will be easier than in other locations to receive all the necessary permits given that Limenet knows the local authorities, the procedures and the local public opinion is already sensibilized on the project.

The main goal of Limenet FOAK plant is to demonstrate the technology and not to have a process with optimized cost. In this respect, even knowing that the best choice for Limenet will be the use of NR-MSW because of their negative cost, the decision to use the biomass as feedstock is because the use of any NR-MSW would have required a much complex and long permit procedure.

What Limenet is building:

The TRL8 project consists of two sections:

- The Slaked Lime Production Plant (Gasifier and Calciner) with CO_2 capture that will be installed at the port industrial area
- The ship (or barge for small operations) with installed the mixer for the generation of the pH Equilibrated Alkaline Solution

The slaked lime production plant is structured by the following main parts:

- A biomass storage
- A limestone storage
- One gasifier able to operate with steam and oxygen as gasification agents
- One calciner able to be fed by limestone fines and operate in oxy-combustion mode
- A high temperature heat exchanger to recover heat and improve the efficiency preheating the gasification agent
- A slaker to hydrate the calcium oxide produced by the calciner and generate the steam used by the gasifier and the calciner
- A reactor to produce a slurry of slaked lime
- A storage for the CO_2 produced by the calcination and by the syngas oxy-combustion

[10] We're looking for approaches that can reach climate-relevant scale (about 0.5 Gt CDR/year at $100/ton). We will consider approaches that don't quite meet this bar if they perform well against our other criteria, can enable the removal of hundreds of millions of tons, are otherwise compelling enough to be part of the global portfolio of climate solutions.

- A storage for the slaked lime slurry

LIMENET plant schematic

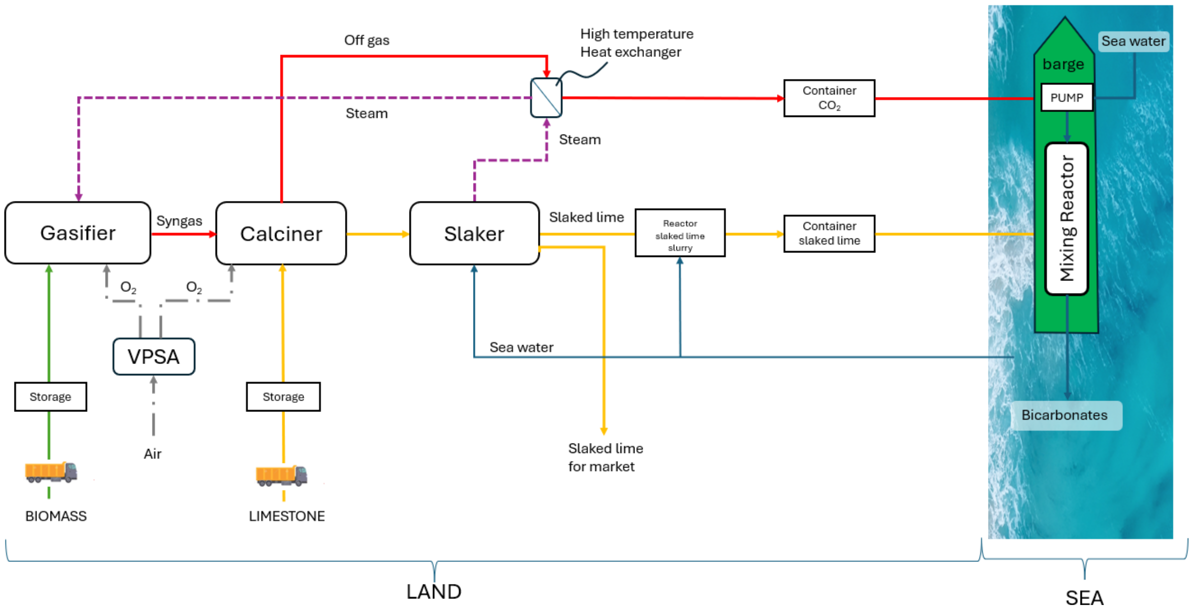

Figure 3 Limenet plant schematic

The barge will be structured by the following main parts:

- One daily storage of the CO_2
- One daily storage for the slaked lime slurry
- Two centrifugal pumps to pump the seawater to the two bicarbonate formation mixers
- Two Mixers (the same TRL7 mixer already tested) for mixing the CO_2 with the seawater flow and then for mixing the slaked lime with the acidic solution to form the calcium bicarbonates
- Two reels to allow the quick deployment of 300 m PVC hose into the sea for the deep injection of the pH Equilibrated Alkaline Solution
- All relevant monitoring instrumentation
- An electric battery for powering the barge during the navigation and during the generation of the pH Equilibrated Alkaline Solution

LIMENET barge

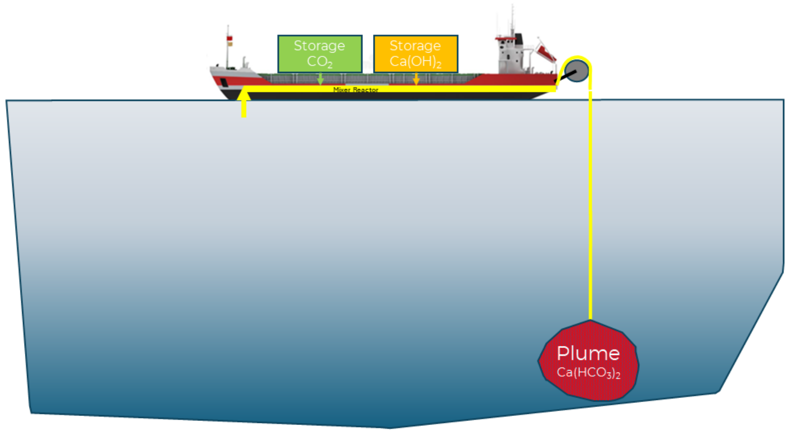

Figure 4 Limenet barge

The slaked lime production plant will work 24/7 while the barge once loaded the CO_2 and the slaked lime produced in one day by the plant, will navigate for few kilometers outside the port until the discharge point where, after deploying the flexible PVC hoses into the deep sea, the pumping of the seawater inside the mixer can start. The CO_2 and the slaked lime are then mixed with the water stream inside the Mixer and the pH Equilibrated Alkaline Solution is then discharged by the PVC hoses into the deep sea.

Once the CO_2 and the slaked lime are finished, the barge will recover the PVC hoses on the reels and navigate back to the port to be reloaded with CO_2 and slaked lime.

The discharge point will be agreed in advance with the authorities and will be always different to achieve the maximum plume dissolution with the surrounding seawater.

The scale of 4 ktons/year of negative emissions is enough to test the basic modules of all the technologies involved in the slaked lime plant in an already right industrial size. The only item that will not be tested in the real future industrial size (100 ktons/year of negative emissions) will be the ship that has significant economies of scale. Nevertheless, the design of the ship and its construction will be done by specialized companies, and it can be considered a fully mature technology.

To approach the Frontiers cost and scale, Limenet should scale up the size of the Slaked Lime Production Plants to enjoy the economies of scale and to reduce the specific cost of the organization and of the services.

Limenet would like to keep a modular approach of the Slaked Lime Production Plants to industrialize each component: the slaked lime module (gasifier, calciner, etc.) that optimizes the manufacturing and the logistic of the equipment to the site is 10 ktons/year of negative emissions.

The Slaked Lime Production Plants size that optimizes the organization and the services is of 100 ktons/year of negative emissions.

So, a Slaked Lime Production Plants for 100 ktons/year of negative emissions is formed by 10 parallel lines of 10k tons/year of negative emissions and only one ship of approx. 3000 DWT.

Due to the distributed nature of the biomass, Limenet prefers to deploy the technology in different places starting with small modular plants on a rolling basis, avoiding gigantic projects, long to deliver and difficult to finance. The minimum slaked lime plant that has an economic meaning, is the 10 ktons/year of negative emissions and Limenet will promote clusters of such modules on the territory delivering the CO_2 and the slaked lime to only one ship.

Cost Breakdown:

To achieve the Frontier goal price of 100$/ton of negative emissions, Limenet should install at least 100 ktons/year negative emissions plants in places where the waste feedstock and the limestone are available and "cheap" and with low LCOE (Levelized Cost of Energy).

To achieve a goal price well below 100$/ton at Frontier's scale, the best option is to use NR-MSW as feedstock: in this case, the revenue streams will be represented by the tipping fee of the NR-MSW, the negative emissions and the carbon free slaked lime sale.

What is needed to happen:

Carbon credits demand: enough demand for high quality carbon credit needs to grow to make the Limenet projects "bankable" The other challenge is to have enough initial demand to make the plant running at least at breakeven. This will help Limenet to make operational hours on its new technology helping to collect operational data, to grow experience and awareness of the problems and make Limenet more ready for the scaling up.

Verticalization of raw material supply chain to lower the logistic and intermediary cost.

Right location choice where to install the plant: low LCOE (levelized cost of energy), availability of local feedstocks affordable labour cost.

Sales of carbon free slaked lime to decrease the cost of the negative emissions.

Direct sales channel from carbon supplier to costumer will decrease the cost of brokerage.

Quantification of Carbon Removal:

The measure of the tons of CO_2 negative emissions will follow the Limenet methodology "*LM_V1_Methodology_Storage*" protocol which now is submitted for ISO14064-2 approval by third party verifier (RINA[11]).

The Limenet methodology is based on:

- the ISO 14064-2[12] which is a guide, at project level, for quantifying, monitoring and reporting greenhouse gas emissions or the increase in their removal
- "The GHG Protocol for Project Accounting", World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI).[13]
- "A Greenhouse Gas Accounting Framework for Carbon Capture and Storage Projects", Centre for Climate and Energy Solutions.[14]
- "Methodology for the quantification, monitoring, reporting and verification of greenhouse gas emissions reductions and removals from carbon capture and storage projects, Version 1.1., published by the American Carbon Registry[15]
- "Guidelines for Carbon Capture, Transport and Storage", WRI.[16]
- "Carbon Capture and Sequestration Protocol under the Low Carbon Fuel Standard",

[11] https://www.rina.org/en
[12] https://www.iso.org/standard/66454.html
[13] https://files.wri.org/d8/s3fs-public/pdf/ghg_project_accounting.pdf
[14] "A Greenhouse Gas Accounting Framework for Carbon Capture and Storage Projects", Centre for Climate and Energy Solutions.
[15] https://acrcarbon.org/wp-content/uploads/2023/03/ACR-CCS-v1.1.pdf
[16]https://www.researchgate.net/publication/281445774_Barton_B_J_Jordan_K_Severinsen_G_2013_Carbon_capture_and_storage_designing_the_legal_and_regulatory_framework_for_New_Zealand_Centre_for_Environmental_Resources_and_Energy_Law_Hamilton_New_Zealand/link/55e7d52408ae65b638996108/download

California Air Resources Board.[17]

The Limenet methodology is based on the Isometric protocol on OAE (V1.0)[18]. Limenet is expected to be accredited into the Isometric supplier registry in the near future.

For this project an independent third party, RINA, has the task of certifying the methodology by checking its agreement with the reference ISO 14064-2 and verifying it following ISO 14064-3[19] through field audit analysis by assessing the correct application of the methodology through logs, reports and direct observations and by checking that the results obtained comply with the methodology used. Certification and verification of a methodology ensures that the practices adopted are effective, efficient and conform to standards.

The amount of CO_2 removed is calculated as the difference between the baseline scenario and the CO_2 removals summed all emissions due to electricity and fuel consumptions. The detailed calculations, measurements and equations used to estimate, and after plant construction to effectively calculate, the carbon removals of our project are defined and described in the Limenet storage methodology.

c. **Risks:** What are the biggest risks and how will you mitigate those? Include technical, project execution, measurement, reporting and verification (MRV), ecosystem, financial, and any other risks. 500-1000 words

The greatest risks Limenet is facing on the FOAK TRL8 project:

Project execution risks:

-*Industrial scale-up*: transitioning from a pilot plant to a commercial facility presents significant challenges. The Augusta TRL8 project will serve as a first-of-its-kind pre-commercial plant, demonstrating the 24/7 operational capabilities of this new technology.

→To mitigate this risk, Limenet will test in advance all the key technologies and modules that will be used in the TRL8 project. Limenet already tested a gasification plant of the same needed power working in oxycombustion in Latvia with our partner Hyrogas and Limenet will test the calciner that will be installed in the TRL8 project in Q3 2025 while the TRL7 mixer that will be installed on a barge for the TRL8 project is under test at the Augusta port.

-*Feedstock supply chain:* the risk is not finding certified low cost/low LCA feedstock. To mitigate this risk:

→Limenet has long-term agreements for the supply of Agro-industrial waste (from wineries, olive oil mills and olive growers) produced in the project area.

→Limenet aims to verticalize its own supply chain to have best prices and not dependency on third party.

[17] https://ww2.arb.ca.gov/sites/default/files/2020-03/CCS_Protocol_Under_LCFS_8-13-18_ada.pdf
[18] https://registry.isometric.com/protocol/ocean-alkalinity-enhancement#introduction
[19] https://www.iso.org/standard/66455.html

-*Team growth*: the risk is not finding the right talent at the right time.

→Limenet is raising equity funding to structure the future team. Talent is hard sometime to find, that's why Limenet is followed by specific headhunters.

-*Permits*: the risk will be the lengthening of the timeline for obtaining permits for the TRL8 project.

→Limenet is mitigating this risk through the help of an environmental engineering consultancy company and installing the TRL8 project in an industrial area of the Augusta (Italy) port where should be "feasible" to get permits for industrial activities. In the same municipality, the TRL7 mixer has already received all the permits to discharge the calcium bicarbonate rich waters into the sea. The authorities that issue the permits for the TRL8 project are the same as the TRL7 mixer.

Scientific risks:

The main risks related to Limenet CO_2 storage in form of calcium bicarbonates into seawater are:

-*Abiotic precipitation*: it is a chemical process that occurs when the Ω aragonite in the plume that the pH Equilibrated Alkaline Solution forms with the seawater exceeds the value of 5 for about 5 hours.[20]

-B*iotic precipitation*: This process involves marine organisms, in particular corals and other calcifying organisms, in the formation of calcium carbonate ($CaCO_3$) due to alkaline seawater.

→These uncertainties are minimized using the results of the experiments done in the port of La Spezia (Italy) by Limenet, Politecnico di Milano and Bicocca University of Milano using mesocosms filled with alkaline seawater produced by the Limenet process.

- *Abiotic precipitation*: the experimental results (Varliero et al., 2024) [21] show that, to avoid the abiotic precipitation of the bicarbonates it is needed a proper mixing of the pH Equilibrated Alkaline Solution discharged from the Limenet process with the seawater to guarantee a final Ω aragonite below 5 within about 5 hours [22].
- *Biotic precipitation*: the tests done by the Bicocca University on the biotic precipitation of calcium bicarbonates in the mesocosms installed in La Spezia show that the increase of the biological activity due to increase of alkalinity of seawater is minor and that, with a proper plume dilution, it could be considered negligible. These results are in line with other similar mesocosms studies performed by other universities [23].
- *Abiotic/biotic precipitation*: The Augusta port location is ideal for the TRL8 project installation because it can benefit from an extremely deep sea in front of the port where a proper mixing of the plume with the surrounding seawater can be easily achieved.

[20] Moras et al., 2022. Ocean alkalinity enhancement – avoiding runaway $CaCO_3$ precipitation during quick and hydrated lime dissolution, Biogeosciences, 19, 3537–3557. https://doi.org/10.5194/bg-19-3537-2022
[21] Varliero et al., 2024. Assessing the limit of CO_2 storage in seawater as bicarbonate-enriched solutions. Ready to be submitted to Molecules.
[22] Moras et al., 2022. Ocean alkalinity enhancement – avoiding runaway $CaCO_3$ precipitation during quick and hydrated lime dissolution, Biogeosciences, 19, 3537–3557. https://doi.org/10.5194/bg-19-3537-2022
[23] Riebesell et al., 2023. Mesocosm experiments in ocean alkalinity enhancement research. Guide to Best Practices in Ocean Alkalinity Enhancement Research, Copernicus Publications, State Planet, 2-oae2023, 6. https://doi.org/10.5194/sp-2-oae2023-6-2023

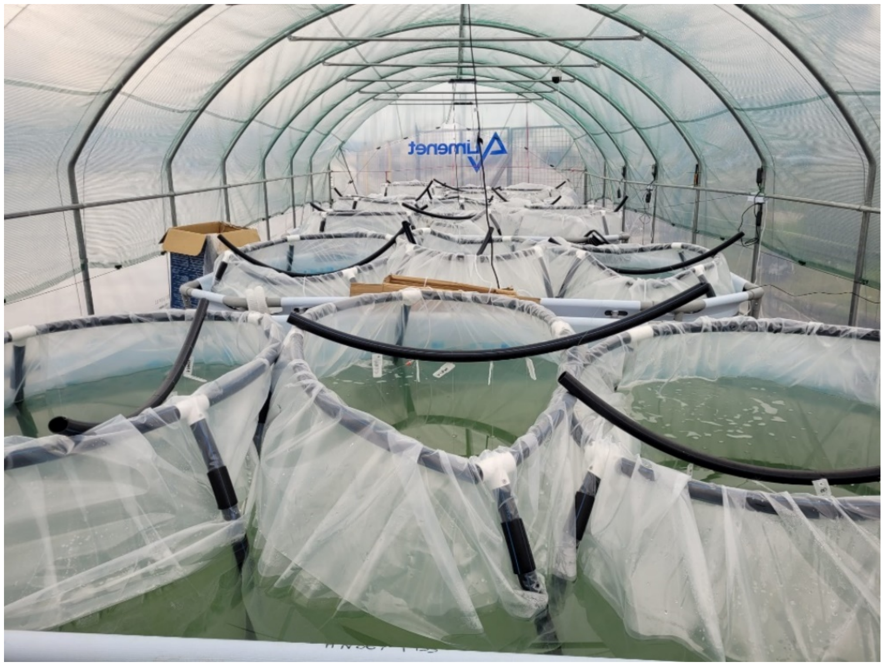

Figure 5 Mesocosm experiment for assessing abiotic/biotic precipitation and biotic impact on different concentration of pH-equilibrated-calcium carbonate

Social acceptance risks:

-*Social acceptance* is crucial for the development and the success of marine CDR technologies.[24] These may be seen as a false solution to address climate change and their adoption could diminish the efforts to reduce emissions. This problem (moral hazard problem) can negatively influence the acceptance level. Other factors are concerns about environmental impacts on the marine ecosystem and the energy required for the process. Another issue is the "not-in-my-backyard" syndrome, where communities recognize the project's importance but don't want it developed locally.

→To minimize this risk, Limenet decided to install the TRL8 project in the same municipality of Augusta where the TRL7 mixer is installed because the population and the authorities are already aware of the project, and we received positive feedback. Limenet has already organized community engagement activities such as public events to explain the technology and deliver scientific public education on climate change. Limenet will promote the following activities for the TRL8 project:

- External Communication: Limenet emphasizes the role of CDR technologies in fighting climate change during scientific dissemination events to increase social awareness, understating and supporting marine CDR to address the moral hazard challenge.

- Community Engagement and Feedback: Limenet aims to build a transparent and long-lasting dialogue with the local community. The *Public Awareness and Scientific Dissemination* activities are:

  - Educational Initiatives: Limenet plans events in local schools to educate the younger generation about climate change and innovative technologies, fostering acceptance.
  - Public Events and Surveys: Limenet organizes events to present the technology and gather community feedback, conducting surveys to assess perceptions and adjust accordingly. These events highlight local benefits like reducing ocean acidification, local employment, and relying on local suppliers to increase acceptance.

○ Risk Management and Community Concerns: The project includes evaluating risks and implementing measures to mitigate potential negative impacts on communities, like land-use and visual impacts, to maintain social acceptance. **Carbon credits demand:** -*Demand*: The risk is that insufficient early-stage demand for the FOAK could prevent a new project from becoming "bankable". →Limenet is working to propose the credits to different RFP procurement pathways such as Frontier. →Limenet is exploring other typologies of business models that could co-finance, for the short-term, the industrialization of the technology. The business model is to provide to the market a technology able to produce decarbonized slaked lime.

d. **Proposed offer to Frontier:** Please list proposed CDR volume, delivery timeline and price below. If you are selected for a Frontier prepurchase, this table will form the basis of contract discussions.

Proposed CDR over the project lifetime (tons) *(should be net volume after taking into account the uncertainty discount proposed in 5c)*	348 tons
Delivery window *(at what point should Frontier consider your contract complete? Should match 2f)*	8 tons by Q4 2024 40 tons by Q4 2025 300 tons by Q2 2026
Levelized cost (\$/ton CO_2) *(This is the cost per ton for the project tonnage described above, and should match 6d)*	660 \$/ton CO_2
Levelized price (\$/ton CO_2)[25] *(This is the price per ton of your offer to us for the tonnage described above)*	870 \$/ton CO_2

[24] Oschlies et al., 2023. Guide to Best Practices in Ocean Alkalinity Enhancement Research, Copernicus Publications, State Planet, 2-oae2023, https://doi.org/10.5194/sp-2-oae2023
[25] This does not need to exactly match the cost calculated for “This Project” in the TEA spreadsheet (e.g., it’s expected to include a margin and reflect reductions from co-product revenue if applicable).