Frontier

Earth Repair Global, Inc.
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

Earth Repair Global, Inc.

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

Madison, Wisconsin, United States of America

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

Quentin Philippe, Hamp Thornton, Gopal Ananth

Brief company or organization description <20 words

Earth Repair Global ("ERG") is an integrated direct air capture and ex-situ mineralization business

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

[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.

Our process addresses a priority innovation area (or area of focus) identified in the RFP, namely that of DAC where:

1) our technology intrinsically integrates DAC with ex-situ mineralization, offering an alternative to geological storage;
2) we have a novel (unique and patented) approach that utilizes the thermodynamic favorable nature of mineralization reactions to drive DAC, substantially reducing the energy cost for carbon removal;
3) we are competitive with existing technology, thanks to – among others – an additional revenue stream (i.e. a cement replacement product) and very low energetics.

Earth Repair Global ("ERG") permanently sequesters CO_2, captured from the air using a solvent-based DAC process, into a supplementary cementitious material ("SCM"), commonly used in the concrete industry. The key differentiator of our technology is that we directly couple DAC and ex-situ mineralization. The advantage of our approach over other DAC or mineralization technologies, and thus why we are best-in-class, is manifested in four key aspects:

Firstly, our technology utilizes the thermodynamically favorable nature of mineralization reactions to drive DAC, substantially reducing the energy cost for carbon removal. In our process, the alkaline solution for DAC is continually regenerated through mineralization reactions without the need for other sources of energy such as pressure or heat. The underlying scientific innovation, i.e., the acceleration of aqueous mineral carbonation through an autocatalytic basification mechanism, has been peer-reviewed through several scientific journal articles published by the University of Wisconsin-Madison team. As a result, our carbon removal is very energy efficient, with less than 200 kWh of energy used to capture and sequester permanently 1 ton of CO_2. This is among the lowest energy requirements for engineered CO_2 removal, thereby providing ERG a unique capability to reach <$100/t-CO2 removal cost. In addition, this mineralization reaction in an alkaline environment delivers fast reaction speed (see Error! Reference source not found. on kinetics).

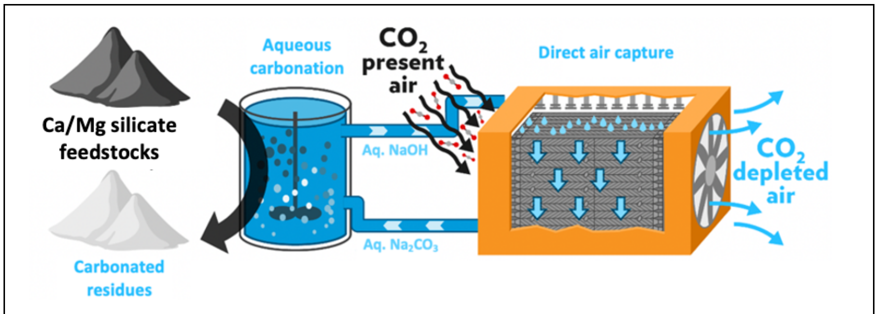
Secondly, because the scientific principle is generally applicable to calcium and magnesium silicate minerals, our technology can use a wide range of mineral feedstocks to remove CO_2 from the air, such as industrial mineral wastes (fly ash, steel slag, mine tailings, etc.) and natural minerals (wollastonite, basalt, and serpentinite). As such, ERG can scale fast using readily accessible and low-cost industrial mineral waste feedstocks and scale to >0.5 Gt/yr using abundant natural ultramafic/mafic minerals.

Thirdly, ERG permanently stores CO_2 in the SCM product that is sold to the concrete industry to supplement or replace Portland cement, the product with the highest economic value and highest carbon footprint in concrete. The CO_2 is stored in the SCM (and thus concrete) for more than 1,000 years. This removes the need for expensive transportation and storage infrastructure (e.g., pipelines and underground caverns).

Fourthly, the sale of the SCM product provides a reliable revenue stream to ERG, allowing it to withstand uncertainties in the voluntary carbon market. Demand for SCM is driven by (1) improved concrete properties using SCM vs cement; (2) lower price than cement; (3) additional environmental benefits by reducing the usage of Portland cement. Freshly produced coal fly ash has been the main source of SCM, the supply of which has diminished rapidly with the retirement of coal fired power plants, while demand has only increased as the concrete market continues to grow. ERG's process can reclaim ponded and landfilled fly ash and meet concrete performance specifications after carbon mineralization. We can also use other sources of feedstocks to generate high-quality SCMs.

ERG's technology is a two-step process cycle using carbonate and hydroxide solutions to rapidly liberate Ca and Mg cations and alkalinity from aluminosilicate minerals (see **Figure 1**).

In the first step of our process, a mineral feedstock is mixed with a high-pH carbonate solution (pH>10). The high pH condition encourages silica dissolution, liberating Mg and Ca from the silicate network for carbonation. The carbonation reaction further basifies the solution by forming a hydroxide.



Reaction 1:	$CaMgSi_2O_6$ (s) + $2Na_2CO_3$ (aq) + $2H_2O$ --> $CaMg(CO_3)_2$ (s) + 4NaOH (aq)+ $2SiO_2$ (s)
Reaction 2:	2NaOH (aq) + CO_2 (g) --> Na_2CO_3 (aq) + H_2O

Figure 1. Illustration of ERG's coupled carbon capture and mineralization process.

The mineral carbonation is performed in a continuous stirred tank reactor (CSTR) and the key parameters affecting the reaction kinetics are particle sizes of the mineral feedstock, liquid-to-solid ratio (typically between 20-30 L/kg), solution pH (0.5-2 M NaOH), and soluble CO_3^{2-} concentration ($[CO_3^{2-}]$ =1-1.5 M). Error! Reference source not found. shows the carbonation kinetics of the fly ash of our commercial partner that will be used in the Pilot demonstration. The fastest kinetics is achieved at high pH during the first 2 hours of reaction. For continuous operation, the residence time is selected balancing a trade-off between fast kinetics and high mineralized CO_2 per unit feedstock (i.e., CO_2 content) and is generally around 2-3 hours.

In the second step, the hydroxide solution is transferred to a liquid-air contactor where it absorbs CO_2 from the atmosphere. This step is similar to commercialized DAC using strong hydroxide liquid solvent. Here, an air contactor is used to pass air over the liquid films created on structured packing materials. The air contactor is designed to match the mass flow of captured CO_2 to the mass flow of mineralized CO_2 in the carbonation step. Key parameters for the air contactor include the packing material design (determining the liquid surface area per unit volume and pressure drop at a given air velocity), size (e.g., cross section and bed depth), and operating air velocity. Air contactors for strong hydroxide solvents have been well modeled, and their operation can be predicted accurately given a solvent solution. During this DAC step, the hydroxide solution is converted back to carbonate solution, which is then circulated back to the first step to carbonate fresh alkaline mineral feedstock.

Through the two-step process, CO_2 is captured from the air and permanently stored (i.e. over 1,000 years) as solid carbonates, and the hydroxide solvent solution is regenerated through the carbonation reaction under ambient conditions. Carbonated residues, containing fine precipitated carbonates and high-silica mineral residues, can be filtered from the solution, dried, and used as SCM (supplementary cementitious material) to replace or supplement Portland cement for making concrete.

It should be noted that ERG meets Frontier's additionality criteria. ERG is removing carbon from the air which otherwise would not have been removed.

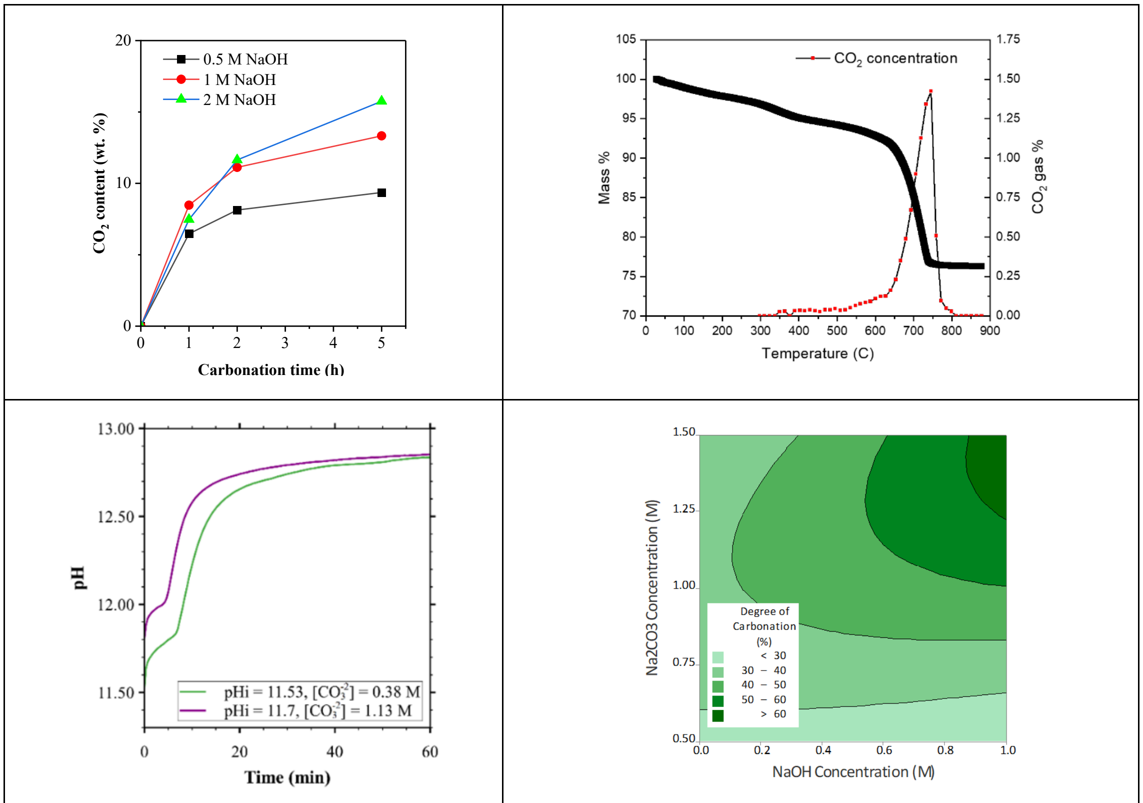


Figure 2. (**Top left**) Carbonation kinetics of ERG's commercial partner fly ash at different solution pH (0.5-2 M NaOH), collected from batch carbonation experiments using liquid-to-solid ratio of 25 L/kg and $[CO_3^{2-}]$ =1.5 M. The raw ash has a median particle size of 7.71 µm and 0.9 wt. % loss-on-ignition. Its maximum CO_2 content achievable is 17.3 wt. %, based on its CaO content. CO_2 contents in the carbonated ash are determined using thermogravimetric analysis (TGA) with the evolved gas analyzed by gas chromatography (GC). (**Top right**) Example TGA+GC plot showing weight loss and CO_2 concentration in the evolved gas (N_2 balanced) due to $CaCO_3$ decomposition between 550-800 °C. (**Lower left**) Hydroxide generation (pH increase during mineral carbonation) with two initial pH (pHi) and two $[CO_3^{2-}]$. (**Lower right**) Contour plot showing conditions to achieve different degrees of carbonation for ERG's commercial partner fly ash, which is used for designing the Pilot 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?[2] What is your approach to quantifying the carbon removed? Please include figures and system schematics and be specific, but concise. 1000-1500 words

What are you trying to build? Discuss location(s) and scale.

ERG is developing a 1,500-ton CO_2 per year capture and sequestration/utilization pilot project (the

[2] 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.

"Pilot") at a site made available by our feedstock partner in the US. The Pilot will demonstrate ERG's ability to provide carbon removal services at 1,500 t-CO_2/year scale by processing landfilled coal ash from our partner's site. This project is expected to be the first commercial project in the US. that directly couples direct air capture and ex-situ carbon mineralization.

What is the current cost breakdown, and what needs to happen for your CDR solution to approach Frontier's cost and scale criteria?

- Current cost breakdown

For the Pilot, we envisage capex of roughly US$2.5m. The main process components are the filtration unit, air contactor and the carbonation reactor followed by the balance of plant systems. To this capex cost, we need to add installation and commissioning costs, and engineering costs. These additional costs are approximately the same as the capex cost. As a result, the total plant cost amounts to slightly more than US$6m. Additional funding will be required for indirect costs and site development costs (~US$400k). See details in the TEA. We used four sources to estimate the costs: 1) quotes by equipment providers; 2) an online database providing process equipment cost estimates to the chemical industry (adjusting for inflation); 3) literature; 4) private engineering third-party report.

- Cost criteria

Section 6.a. highlights how we anticipate to drastically reduce the costs to meet Frontier's cost criteria (i.e. below US$100/ton CO_2):

- Capex: lessons learned from the Pilot and FOAK will help in reducing the $/ton costs, but further work with equipment suppliers on optimization, sizing, and modularization will also have to be done to achieve the 100$/ton goal;
- Cost of financing: long-term CDR credits and SCM offtake contracts, technology track-record all lead to lower risk, and as a result, to higher leverage ratios, lower cost of debt and equity;
- Fixed Opex: major lever, as the number of individuals to operate is virtually constant for much larger plant scales;
- Water usage: we will optimize our water consumption rates in our process along with further wastewater recycling treatments to minimize makeup;
- Make-up (i.e NaOH): we will have to optimize the washing cycle (thanks to experience with previous filters and washing procedure);
- MRV: we will benefit from a more mature MRV industry.

It should be noted that before we achieve these cost reductions, ERG is expected to be very quickly a profit-making business. This will accelerate the growth. ERG's business plan involves making a profit on each ton of SCM it sells to the concrete industry. SCM replaces ordinary Portland cement, which is not only the highest value product in the manufacturing of concrete, but also the one emitting the most CO_2.

For instance, for the Pilot, we envisage using landfilled calcium-rich fly ash from our partner. Our partner has indicated that the cost for the feedstock would be close to US$0/ton (i.e., practically free) delivered at the gate of the Pilot facility, which will be located on or near the feedstock property. The reason for such a low price being that the feedstock – in its current form – has a negative value: our partner is incentivized under newer regulations to excavate a large quantity of coal ashes from legacy landfills to newer ones that would meet more stringent environmental requirements[3].

Our partner is working with an SCM marketer. The SCM marketer puts our partner's production fly ash to beneficial use. The SCM marketer is constantly interested in using new sources of feedstock to sell as SCM.

The SCM marketer is interested in our ability to generate value from the landfilled calcium-rich fly ash from our partner. We are uniquely positioned to do so because, by processing it through carbonation, we convert the feedstock to good quality SCM with consistent performance. We have performed comprehensive testing of the feedstock and showed the carbonated coal ash provide the desired

[3] See here or here.

cementitious properties (including physical and chemical properties as specified in ASTM C618, ASTM C1897 cementitious reactivity, ASTM C39 concrete strength, etc.) to be sold as an SCM.

As a result, the SCM marketer would also take delivery of the carbonated feedstock once it has been processed. The selling price of our carbonated residue is expected to be aligned with SCM market prices, since it meets the same standard requirements.

The selling price for the SCM on the market fetches US$75-120/ton, depending on the market[4]. We estimate that a margin of ~US$30/ton on the SCM alone would allow to cover all the cost of transforming the feedstock into an SCM and capturing and sequestering CO_2. In other words, should we achieve a margin at or more than US$30/ ton on the SCM, we could sell the CO_2 carbon removal credit at less than US$100/ton CO_2 and still make a profit on the CO_2 carbon removal credit.

Keep in mind that for every ton CO_2 captured and permanently sequestered, we would have to process between 5 and 10 tons of feedstock, depending on the type of feedstock. In other words, a margin of US$30/ton SCM corresponds to a US$150 – US$300/ton CO_2 margin, which is estimated at larger scale (not for the Pilot) to cover the costs for the entire operation.

To limit market risks for the business, our preferred business model is that of a tolling agreement, whereby a feedstock supplier provides us with a feedstock at the gate of the facility and commits to taking delivery of the carbonated residue (i.e. the SCM), and at the same time, pay the ERG facility a processing fee (or tolling fee).

- Scale

The key to reaching the scale of 0.5 Gt CO_2 / yr is to ensure ERG's carbon removal operation won't be limited by availability of the input energy, key materials, and capital. Below, we discuss the key variable components, (1) electricity, (2) water, (3) make-up (i.e. NaOH), (4) feedstock, (5) capital, and explain why ERG's scaling to 0.5 Gt CO_2 / yr can be achieved.

On (1), electricity is the main energy input for ERG's carbon removal operation: at 170 kWh of electricity per ton CO_2 captured and sequestered, we believe that we are one of the most energy-efficient carbon capture and sequestration process, and as a result, we do not envisage that our electricity consumption should be an impediment to scale. In particular, we want to emphasize that our scalability is **not** limited by the availability of low-cost renewable energy.

On (2), water: we use a traditional solvent-based air contactor. There are evaporative losses in the air contactor, which depend on the ambient conditions. These evaporative losses vary depending on the facility location. We estimate that these would be between 5m^3 to 15m^3 per ton CO_2 captured and sequestered. Solvent-based air contactors are conceptually very similar to cooling towers used by thermal power plants, chemical plants, and commercial HVAC systems, but with much less evaporation thanks to a lower operation temperature. Given that cooling towers are commonplace at most industrial facilities around the world, we do not envisage that water consumption for solvent-based air contactors would be a limiting factor.

On (3), make-up (i.e. NaOH): it is one of the highest volume chemicals produced in the US[5] and globally. The make-up stream is small and can be minimized by good filtration and washing.

On (4), feedstock: ERG is confident that it can secure large quantities of feedstock at a low price and transform them into SCMs.

[4] For instance, see here, where they refer to a price of cement of US$150/ton in the US, and a discount for fly ash (an SCM) of 20% to 50%, depending on the market. These prices are in line with the conversation with have had with industry experts, our commercial partners and our advisors.
[5] See for instance here.

We can work with three categories of feedstock: (a) industrial mineral waste; (b) mine tailings; (c) ground natural minerals. The flexibility for ERG's technology to process a wide range of mineral feedstocks ensures the ability (1) to scale fast using readily accessible and low-cost industrial mineral waste feedstocks and (2) to scale to >0.5 Gt/yr using abundant natural ultramafic/mafic minerals.

A few numbers should indicate the vast potential of capturing and permanently sequestering CO_2, but also manufacturing an SCM.

- We have tested our carbonation reaction with serpentine, and it works very well. As a matter of fact, the collected data is very encouraging given the fast reaction speed. An SCM can be manufactured from serpentine with our process, provided that the particle size is 100 µm or less.
- It the U.S. alone, serpentinite has large CO_2 sequestration potential. Examples of deposits on the East coast are listed below[6], although serpentinite is even more abundant along the West coast.
  - Puerto Rico: 22.7 Gt-CO_2
  - Vermont: >15 Gt-CO_2
  - Pennsylvania-Maryland-DC region: >33 Gt-CO_2

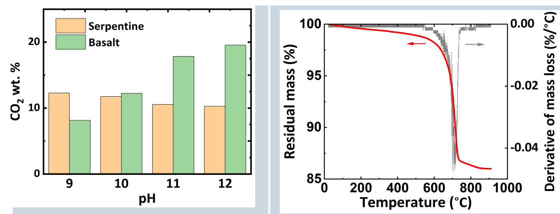


Figure 3. (left) Results on mineral carbonation using serpentine and basalt samples. Both samples are rocks crushed to #4-#8 sieve sizes (2.36-4.75 mm). The serpentine sample are fiber bundles and basalts are sand-like particles. The samples are carbonated for 24 hours in 1 M Na_2CO_3 solution (adjusted to different pH values with NaOH) at a liquid-to-solid ratio of 20 ml/g. CO_2 content is quantified based on weight loss of the carbonated sample between 500-800 °C in thermogravimetric analysis (TGA). (right) An example TGA result of carbonated serpentine.

Mineralized CO2 contents (wt. % of carbonated mineral) of 10% was achieved with the serpentine samples after 24 hours. This translated to mineral carbonation levels (in terms of % MgO carbonated) between 26.5-31.7% for the serpentine sample.

We are currently testing several sources of serpentine and olivine, coming from a U.S. mine in the state of Washington. We are confident that we can sell the carbonated serpentine at an SCM market price of US$75-120/ton and procure it for less than US$45/ton at the gate of our facility, thereby covering the cost of the entire SCM processing facility. This will naturally have to be further demonstrated, but preliminary discussions are encouraging.

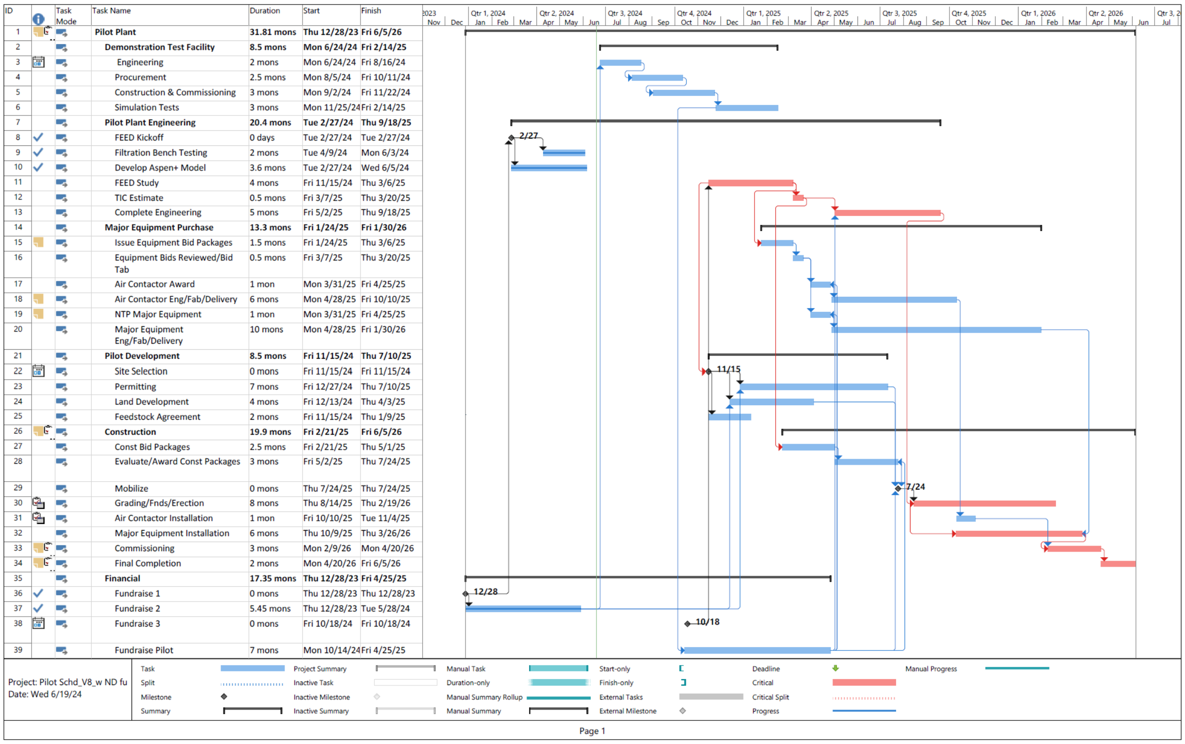
Regarding feedstocks such as industrial mineral waste, focusing on fly ash alone, the current production is estimated at 1.2 Gt/year. And plenty of it is in landfills (e.g 2.5 Gt in the US alone). We would also like to refer to the work by Phil Renforth : "*7 billion tonnes of alkaline materials are produced globally each year as a product or by-product of industrial activity. […] these materials have a carbon dioxide storage potential of 2.9–8.5 billion tonnes per year by 2100* ".[7]

On (5), capital: we believe that we should be more capital efficient compared to competing capture and sequestration solutions given that (a) we have a secondary revenue stream as an SCM; (b) our system does not have dedicated regeneration equipment (and as a result, capex should be, on a like-for-like basis, lower); (c) our process does not require first-of-its-kind equipment, thereby reducing the uncertainties in the capital requirements when scaling up.

To get to the scale required, ERG must ensure to deliver on its roadmap.

The first step of the roadmap is to build the Pilot (see the project Gantt chart below).

[6] 1. Goff, F.; Guthrie, G.; Lipin, B.; Fite, M.; Chipera, S.; Counce, D.; Kluk, E.; Ziock, H. *Evaluation of Ultramafic Deposits in the Eastern United States and Puerto Rico as Sources of Magnesium for Carbon Dioxide Sequestration*; LA-13694-MS; Los Alamos National Lab. (LANL), Los Alamos, NM (United States), 2000. https://doi.org/10.2172/754045.
[7] "The negative emission potential of alkaline materials", https://www.nature.com/articles/s41467-019-09475-5



In the first phase, ERG will complete the Pilot engineering and issue major equipment contracts. In the second phase, ERG will mobilize the contractor to prepare the site. Equipment will be delivered to the site and installed. Commissioning of the Pilot will be completed during this phase. In the third phase, ERG will operate the Pilot and implement lessons learned and process improvements before going to continuous operation.

Following the Pilot, ERG will build its first commercial plant (at a capacity of 25,000 ton CO_2 per year). We envisage that this commercial facility should be operational by 2028. After that, facilities of larger scales, benefitting from all economies of scale, would be deployed, with the first 250,000 ton CO_2 per year facility envisaged to be operational by 2030.

Each plant consists of modules (i.e. multiple trains). These modules can easily be rolled out at different locations. We will build plants to achieve a climate relevant impact of at least 0.5Gt CO_2 per year between 2052 and 2057 based on current estimates of number of plants to be built. The timeline depends on our ability to mobilize capital and the supply chains.

What is your approach to quantifying the carbon removed?

ERG's ex-situ mineralization technology offers easily verifiable CO_2 removal. In ERG's process, the CO_2 content as a weight percentage within the input feedstock ($w_{CO2,\ feedstock}$, typically <1%) and the mineral product ($w_{CO2,\ product}$, typically 8-16%) can be accurately quantified using well established material characterization method, e.g., thermogravimetric analysis coupled with evolved gas analysis. Similarly, at the CO_2 capture side of the system all necessary parameters can be accurately recorded with widely used industrial sensors at the air contactor inlet and outlet.

At steady state, material balance is established between the mass flow of mineralized CO_2, and CO_2 captured from the air, respectively given by:

$$m_{mineralized\ CO2} = m_{feedstock} \times (w_{CO2,\ product} - w_{CO2,\ feedstock})$$

$$m_{captured\ CO2} = m_{air} \times (C_{CO2,\ inlet} - C_{CO2,\ outlet})$$

where $m_{feedstock}$ is the mass flow of the mineral feedstock, and m_{air} is the mass flow of air (calculated from air velocity, density, and the air contactor inlet cross-section area).

Balancing the captured CO_2 and mineralized CO_2 continuously provides highly accurate quantification of the carbon removed.

With regards to measurements, the air contactor will be fully instrumented with industrial quality and calibrated sensors with redundancy for continuous measurements. These sensors will measure and record the air properties (ambient conditions and velocity) as well as the average incoming and outgoing CO_2 to quantify the capture rate. The mass flow of mineralized CO_2 will be quantified by analyzing samples from the feedstock and SCM product streams by an off-site accredited lab using standard analytical instruments (e.g., TGA or combustion analyzer). The SCM sampling protocol will follow "ISO 2859: *Sampling procedures for inspection by attributes*". Adjustments to sampling frequencies will be implemented during test runs. The control system will record historical data and have a sequence of events capability that helps in diagnosing and post-processing. All data will be tabulated and analyzed for mass balance, the overall CO_2 removal, and uncertainty quantifications.

The project team will keep full dataset from the project and submit them together with the MRV plan and a summary report to an independent carbon registry for 3rd party verification. ERG has started the certification process with *Puro.earth*, a leading verification service providers in the engineered carbon removal sector.

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

There are six primary risks for the Pilot that are being focused on.

1 – Technical risk, that could delay the project development and permitting. While ERG is expected to operate continuous processes at its pilot and commercial plants, the prototype of the process (developed at the UW-Madison lab) has been operated in batch mode because the filtration of the SCM is done in batch due to space constraints. ERG is developing a larger lab near UW-Madison that will allow the filtration process to be continuous. The simulation lab will raise the TRL level from a 4 to a 5 and provide data for chemical and water makeups, MRV, and subsystems like wastewater treatment. The larger lab will also help us develop better system control methodologies. The system will have continuous in-situ instruments providing data continuously recorded in a data acquisition system that is shared with the engineer of record and UW-Madison. This step will further de-risk the Pilot project and provide a more accurate total installed cost estimate before we stick a shovel in the ground.

2 - Inconsistency of the feedstock from industrial mineral waste. Mineral waste landfills contain materials generated from decades of operations, which often show variations in physical and chemical properties. We will implement a robust sampling and characterization protocol to maintain consistent process performance. We will also make sure our equipment, primarily the filtration equipment, can work with the variability of the feedstock. This can be confirmed with bench top testing performed by our filter equipment suppliers. After the Pilot, consistent feedstocks like natural minerals remove the variability of the feedstock but will require more infrastructure to extract and process.

3 – Commercial risk delaying development phase. We are relying on commercial partners to be able to access the site and secure feedstock supply. Ideally, we would like to ensure that we also have the SCM and CO_2 credit offtakes secured before starting the construction of the project. We do not control these commercial partners, and as a result, there could be delays. To mitigate these risks, we are proactively communicating with our partners to ensure that (1) we understand their interests very well, and (2) they have all the information they need about our process and business. Also, we are securing alternatives should the base case not materialize.

4 – Project execution: Pilot delays from construction onwards. This risk is being mitigated with clear scopes of work, divisions of responsibilities, and specifications for our technical partners. An overall project schedule will be maintained by our general contractor (“GC”), that will take input from all technical partners including the engineer, equipment suppliers, subcontractors, and ERG. ERG will use a GC to perform the Pilot work to avoid contracting with multiple subcontractors. Using a GC to manage the subcontractors and own the schedule will help mitigate delays and change orders. In addition, agreements for equipment and construction will have schedule liquidated damages to encourage on time delivery. ERG’s team is and will be further strengthened by professionals from the engineering/procurement/construction (EPC) industry that understand turnkey projects to help up mitigate problems before they materialize during the engineering, construction, and commissioning.

5 – Project execution: cost overruns - this risk is being mitigated by taking verification steps shown in **Figure 3** and sharing the results with our partners. The main reason for taking the verification steps is for ERG to plan, budget, and schedule the work and avoid delays and cost overruns that occur with poor planning. Sharing the results of each step with our partners maintains trust and transparency as we strive to be good fiduciary stewards with our partners. To help stay on track with each step, ERG uses a 3rd party engineering firm, Hunt, Guillot & Associates to help execute the work. ERG’s internal goals, plans, and scopes are being verified by our engineer as they work on the details of the FEED study and total installed cost estimate. In addition to performing the work for the FEED study, our engineer acts as an independent engineer and provides guidance to ERG on technical issues in advance to avoid unplanned delays. The FEED study allows the engineer to perform the necessary engineering to develop process drawings, general arrangements, equipment bids, and material quantities for the Pilot estimate and construction bid packages. This level of effort also acts as a feasibility study to make sure all systems of the process are thought through and quantified. This keeps the ERG team grounded and makes sure we are paying attention to all parts of the process, both primary and subsystems. Understanding the Pilot total installed costs along with equipment delivery durations allows us to properly plan and budget the Pilot and limit the number of costly surprises for us and our investors.

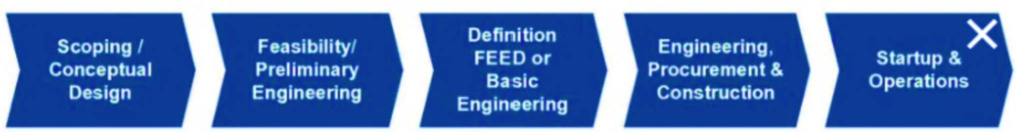


Figure 3

6 – Securing financing.

We refer to section 2.k. to detail how we will secure the financing.

7- Regarding the measurement, reporting and verification (MRV) and ecosystem risks, these are not relevant for us. As detailed in Section 1(b), the Pilot will be fully instrumented, with redundancy, gathering and recording accurate data, along with third-party verification by a qualified independent entity. Risks to the ecosystem, expected to be very minimal already due to the nature of materials and handling involved in our process, will be further mitigated by ensuring that the storage and disposal will fully follow the federal, state, and local requirements.

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)*	285
Delivery window	Q3 2036

(at what point should Frontier consider your contract complete? Should match 2f)	
Levelized cost ($/ton CO_2) *(This is the cost per ton for the project tonnage described above, and should match 6d)*	2,600
Levelized price ($/ton CO_2)[8] *(This is the price per ton of your offer to us for the tonnage described above)*	1,750

[8] 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).