XPRIZE Carbon Removal

By John Benson
April, 2021

1. Introduction

First I must say I personally have no interest in competing in the title contest. I’m perfectly happy in my present occupation. However, I do feel like this is a very worthy endeavor. From the source here.¹

XPRIZE officially launched the $100 Million XPRIZE Carbon Removal competition. In honor of the launch, XPRIZE founder Peter H. Diamandis sat down with Elon Musk, who is funding the competition through the Musk Foundation.

In February, the Tesla CEO announced he was teaming up with XPRIZE to manage the $100 million carbon capture prize he was donating to encourage innovators to develop CO2 removal solutions. Elon Musk’s recent interview with XPRIZE’s Diamandis marked the opening of registrations for the competition.

Musk advised competitors to go for pragmatic solutions. “It doesn’t need to be perfect. You know, it’s got to be something that [it] just…fundamentally if we scale it up, would it work. And that’s it.”

I would ask my readers, and fellow Energy Central contributors to forward this post to anyone that they believe might be interested in this competition.

Also, I have written frequently on this subject, and will reference my most recent and important posts below.

I am of like mind with Mr. Musk, there are many opportunities for negative (carbon) emissions without doing much development.

2. The Contest

Musk and Diamandis talked about some competition guidelines and pointed out three key factors that judges will consider when deciding which teams win the prize. To be considered for the award, teams must present a solution that could capture a minimum of 1,000 tonnes of CO₂ per year. Diamandis made it clear that XPRIZE judges will be looking at a team’s ability to actually capture carbon and not just their theoretical solution…

Besides showcasing a working and viable carbon removal solution or product, teams must be able to calculate the fully considered costs of their ideas. Musk explained that teams should consider aspects of their solution. For example, they should consider factors like environmental impact or if the solution could be turned into a useful product that could generate revenue. However, one important factor teams must know is that their solutions or productions must capture CO₂ with net negative emissions…

Teams will also need to prove that their solutions or products will contain the captured CO₂ for at least 100 years. Their solution must also be scalable to a gigaton level.

The team that wins first place will get $50 million of the $100 million prize from the Musk Foundation. Teams in second, third, and fourth place will split $30 million of the prize. Musk said the winners could use the prizes to start a company.

After the first year of the 4-year competition, XPRIZE will be awarded up to 15 Milestone Prizes of $1 million each to competitors that made the most progress. Up to $5 million of the prize money will be dedicated to awards for student teams. Musk noted that he is willing to increase the prize if more teams deserve recognition.

3. **Posts**

I am referencing three parts of *New Networks* below and other important posts therein.

3.1. **New NETWORKS, Part 1: BECCS**
This post covers sources of biomass that have the potential to contribute to carbon dioxide sequestration while fulfilling other human needs.


Part 1 includes links to the following earlier posts:

3.1.1. **Trees:**
This post explains the right way to do reforestation (replanting woodlands in areas that were previously cleared) and afforestation (planting woodlands in areas where there were no recent forests). This post also explores negative emissions technology using woody biomass.

https://www.energycentral.com/c/ec/trees

3.1.2. **NUTS**
This paper is about woody biomass, why, when and how we should use this for energy production. Oh yes, and it is also about everything nuts.

https://www.energycentral.com/c/cp/nuts

3.2. **New NETWORKS, Part 2: Mineralization**
This paper covers several potential methods using mineral incorporation (a.k.a. mineralization) to store and/or permanently sequester carbon dioxide (CO₂), the main greenhouse gas (GHG). Section 2 is about a simple process that will combine two hazardous industrial wastes, alkaline mineral waste and CO₂. This process creates a stable mineral that can be safely buried or perhaps used in long-lived structures. Others that are described in section 3 are similar methods already in use.


This includes a link to the following earlier post:

3.2.1. **Concrete Greenhouse**
This paper is about the cement and concrete industries, their energy use, GHG emissions, and how they might reduce the emissions in the future.

https://www.energycentral.com/c/cp/concrete-greenhouse
3.3. New NETWORKS, Part 3: Two Solutions

California has two challenges. One is the yearly batch of wildfires that keep getting worse every year. In 2020 the acreage burned was more than double any previous year, and other metrics were similarly dire.

The other challenge is that we have the most ambitious goals for mitigating climate change in the U.S.

One might think that the challenge from wildfires would be detrimental to our climate change goals, and indeed in most ways it is, but there is at least one synergy between these as described in the following paper.


Part 3 had a link to the following earlier post:

3.3.1. Tough Love, Part 2

Section 3.1 covered a recent discovery that was made by the University of California (Berkeley) working with ExxonMobil in an eight year project to improve the efficiency of amine CO2 capture and release. This project looked at exhaust typical of combined-cycle plants, but I would guess this can be adapted to clean biomass plants.


Also note that in the last paragraph of New NETWORKS, Part 3: Two Solutions I make a suggestion that to convert the mechanized chaparral harvesters from diesel operation to electric. Considering who is sponsoring this competition, perhaps Mr. Musk can partner with firms that make skid steer loaders (used for most of these machines) to use his power trains in EV versions of these.

Also note that California is having trouble reducing particulate diesel emissions from agricultural (off road) vehicles (see chart below)\(^2\). The suggestion above might be a good first step to Ag EVs.

---

\(^2\) Data for chart from US Environmental Protection Agency, “National Emissions Inventory (NEI)”; www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei
I decided to add two more of my earlier papers. For many carbon capture and sequestration (a.k.a. carbon capture and storage or CCS) processes, after capturing the CO$_2$, the penultimate step is to permanently sequester it, and the final step is to verify none escapes. The post below is a thorough review of sequestration and verification.

3.4. Verification of Geologic Greenhouse Gas Sequestration

Many types of negative (greenhouse gas) emissions technology and greenhouse gas reduction use carbon capture and storage (CCS) a.k.a. carbon capture and sequestration, which begs the question how effective is sequestration? This paper examines current techniques for greenhouse gas geologic sequestration, and requirements and techniques for verifying the effectiveness of this process.


Also I did a second post that looked at more information on sequestration sites, and several sequestration projects:

3.4.1. Geologic Greenhouse Gas Sequestration Projects

This post deals with like site selection, the business justification for CCS and a few projects.