Do We Need a New Climate Laboratory?

By Glenn Weinreb

One strategy for addressing climate change is to set up a new laboratory and task it with solving the entire climate problem.

Yet what might they do?

In theory, they could divide the problem into two primary parts and do R&D to the extent required to resolve each. One problem is carbon dioxide emissions (i.e., 40G_tCO_2/year), while the other is global warming (i.e., 0.3°C/decade).

To solve the carbon dioxide emissions problem, we need to figure out how to make green energy at a cost less than fossil fuel. Consumers would then switch to save money.

To solve the global warming problem, we need to figure out how to reflect sunlight back into outer space at a reasonable cost and without harm. We probably need to reflect approximately 1% of sunlight within ~15 years near the North and South poles. In theory, this could be done with airplanes that spray reflective gases into the upper atmosphere.

Financial Strategy

An R&D surge might be referred to as a "climate moonshot."

A moonshot would probably be funded by people who want to use their money to save the planet from climate change, as opposed to investors who seek a financial return. Planet saving and investing differ in multiple ways. Candidates for moonshot sponsorship include high-net-worth individuals, foundations, and governments.

In theory, sponsors could require produced materials be placed on the internet for open review ("open-source"). This would save time and money for multiple reasons, including the reduction of inaccurate claims.

When doing R&D, small money is spent before medium money, and medium before large. For example, within a moonshot initiative, $1M might support proposal writing, $10M might support doing detailed design work, and $100M might support building prototypes.

What to Develop?

Ultimately, we need to think about how to spend billions of dollars, to save trillions. Also, for no money, one person or one group of people, can design a moonshot program by putting together a list of things to develop. In other words, they can focus on the following question:

> *What is a list of things that if developed solve the entire climate problem?*

This article is an example list.

Climate Moonshot

Our proposed moonshot divides the climate problem into 10 different research areas, with roughly $1B allocated to each over 5 years. Total cost is expected to be approximately $10B. The initial development phase cost $100M and supports proposal writing, design modeling, doing rough designs, and developing experiments.

The 10 research areas are summarized as follows:

Moonshot Area I: Improve Climate Models

To bend the global warming curve, we need to reflect sunlight back into outer space. Before we do this, we need calculate to how much sunlight needs to be reflected, from where, and when. This requires climate models. However, existing models do not accurately predict observations. Therefore, a surge of funding is needed to improve them. More specifically, we need to improve our understanding of clouds, and of sunlight reflecting off air pollution (i.e. measure anthropogenic aerosol radiative forcing). *Reference videos:*

> The Climate Acceleration Problem [#6]
> https://www.youtube.com/watch?v=6r3Xag24iOI
>
> The Science of Global Warming [#7]
> https://www.youtube.com/watch?v=Por9aWKLdc4
>
> The Uncertainty of Climate Change [#8]
> https://www.youtube.com/watch?v=HoqX7uBaeKU

Moonshot Area II: Conduct Sunlight Reflectivity Experiments (SAI)

In theory, airplanes can spray sulfur-based gases into the upper atmosphere, to reflect about 1% of sunlight back into outer space, to offset global warming. For details, see Wake Smith's 2024 Cryosphere Paper, and for an example reflectivity plan, visit www.aplantosavetheplanet.org/rp.

Sulfur is already present in coal and oil, and is therefore released upon combustion—and sunlight reflects off air laden with sulfur. Therefore, we could harvest sulfur from carbon-based fuel before combustion, transfer it to an airplane, and emit it at a high altitude, instead of at ground level. High-altitude sulfur stays aloft for one to two years, while ground-level sulfur typically stays aloft for hours to days. Consequently, changing the emission site reduces the planet's temperature, without increasing total sulfur emissions. In a sense, we can solve the global warming problem by moving air pollution. According to one study, this would cost approximately $18B/year.

To better understand this, we need to develop airplanes that emit experimental quantities of material, and then monitor for days to weeks. *Reference videos:*

> Reflecting Sunlight [#9]
> https://www.youtube.com/watch?v=AJ-ddFDiA4w

Can Air Pollution Save the Planet? [#10]
https://www.youtube.com/watch?v=p4O2hv9tSDA

Moonshot Area III: Develop Large Automated Spray-Planes

To control global warming, we probably need large airplanes that can emit approximately 100 tons of material every several hours. To do this at a reasonable cost, we probably need a system that supports automated flying, automated refueling, and automated reloading. And we probably need 100 to 200 of these automated airplanes. But before we build hundreds of planes, we need to build one. In other words, we need to design and prototype an automated system that supports one large spray-plane. In theory, a Boeing 777 airplane can be modified to perform this task. For details, click here.

Moonshot Area IV: Automate Nuclear Power Construction

The first three Moonshot Areas cost roughly $3B over 5 years, and sets us up to reflect sunlight within ~15 years (i.e. building airplanes and airports requires an additional ~10 years). Ultimately, future leaders would need to compare reflecting, with not reflecting.

Also, we have a carbon dioxide emissions problem. And to transition to a green economy, we need to reduce the cost of 24/7 green energy to below that of fossil fuel. Fortunately, this is easy. We just need to automate the construction of nuclear power plants. More specifically, we need to develop custom machines that build these sites. This would cost little compared to the cost of a nuclear power plant. *Reference videos:*

Low-Cost Nuclear Power [#11]
https://www.youtube.com/watch?v=AIlbovU67wI

Automated Nuclear Power Construction [#12]
https://www.youtube.com/watch?v=afO0cy1l7Qo

How to Make $10 Trillion Dollars [#13]
https://www.youtube.com/watch?v=4gqmKGV1h5Y

Moonshot Area V: Co-locate Chemical Processing with Nuclear Power

To make chemicals without emitting carbon dioxide, at a cost less than the traditional approach, we need to co-locate chemical processing equipment with low-cost nuclear reactors. More specifically, we need to develop standards that define how this fits together.

Also, to reduce the cost of the processing equipment, we need to develop a transportation system that moves large platforms of chemical processing equipment from a shipyard or factory to a nuclear power site. For details, see videos #11 through #13, referenced previously.

Moonshot Area VI: Economic Fusion Moonshot

There are primarily two types of nuclear power: fission and fusion. Fission is the traditional form that generates electricity with uranium fuel. However, it is not popular due to meltdown risk, nuclear waste, proliferation risk, and cost. Fusion, on the other hand, does not have these issues; however, it

is still in development. In theory, we can accelerate development with a surge in funding for technologies used by fusion machines that by-design produce power that is competitive in an electricity market (i.e. focus on economic fusion). *Reference video:*

Fusion Moonshot [#14]
https://www.youtube.com/watch?v=CvZzGHSugy4

Moonshot Area VII: Develop Next Generation Solar Farm

In theory, we can reduce the cost of solar power by developing a technique for placing solar material directly onto soil. *Reference video:*

Next Generation Solar Farms [#17]
https://www.youtube.com/watch?v=3aOSrsZD2MY

Moonshot Area VIII: Develop Green Energy Standards

In a green new world, we need more standards that define how things fit together mechanically, electrically, and with communications. This includes standards for devices in automated buildings, standards for swappable EV batteries, and standards for ships powered by liquid ammonia. *Reference videos:*

Green Cars: Swappable Batteries [#15]
https://www.youtube.com/watch?v=jY_jNQ77FA8

Next Generation Building Automation [#16]
https://www.youtube.com/watch?v=T_obb_z77co

Moonshot Area IX: Develop High-Temperature Tunnel Boring Machine

To extract underground geothermal energy at a low cost, we need vertical tunnel boring machines that operate at high temperatures (*reference*).

Moonshot Area X: Develop Policy Making Tools

In theory, we can build a website that creates climate plans based on requirements specified by the website user. This would allow policymakers and concerned citizens to get a better sense of how to fix climate at the lowest-cost. *Reference videos:*

What is Our Climate Plan? [#4]
https://www.youtube.com/watch?v=aTzmZGHa9EM

What does a Climate Plan Look Like? [#5]
https://www.youtube.com/watch?v=IZLFWarYlbw

Lab Business Plan

A business plan for the new laboratory exists and it is open-source. Therefore, anyone can copy ("bifurcate") or modify for free via the CC BY 4.0 license. For original files, visit www.aplantosavetheplanet.org/lab.

The following videos provide a brief summary:

> Do We Need a $10B Climate Moonshot? [#20]
> https://www.youtube.com/watch?v=ihTGiOEKrns
>
> The Climate Solution is More R&D [#19]
> https://www.youtube.com/watch?v=LGPGiIDZoDA
>
> What is The World's Climate Plan? [#21]
> https://www.youtube.com/watch?v=9-nU31iTTUo

Can R&D Save the Planet from Climate Change?

In theory, we can set up a new laboratory and task it with doing R&D to the extent required to solve the climate problem. Globally, this might cost billions of dollars per year. However, the cost to initiate and oversee might be closer to $100M/year. In other words, financial support from one funding source might be small relative to total. Yet more importantly, a solution to the climate problem exists, and it is not blocked by politics or financial constraints.