Synthis

TKS x UNEP Challenge

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TKS The Knowledge Society × 

Executive Summary

Problem

Over the past 70 years, scientists have warned us of the effect of climate change and its detrimental impact on our planet. More than 85% of the world lives in areas affected by climate change. Millions of lives have been claimed due to its affect. And it's still counting. Why? Because **talking about change doesn't work anymore**. We need to incentivize it.

Solution

Our solution to this problem is to turn the world's most abundant waste byproduct (CO_2) into a **resource**. Through the use of artificial starch synthesis and the use of bio-batteries, we would be able to theoretically convert CO_2 into pure electrical energy at a speed that is on par with solar panels, while capturing and converting carbon 8.5 times faster than plants. This would create a **Breathing Generator**, while being able to generate power at all times.

Results

Effectively tapping into CO_2 and converting it into an abundant resource would give us access to **43.1 billion tons of CO_2** that we can potentially turn into electrical energy. This would essentially **reverse our carbon footprint** while simultaneously creating a new type of renewable energy. With this leverage, we can become a **disruptive innovator** if we sell this energy significantly below standard prices, forcing new and current companies to adopt the same processes, accelerating this practice.

Problem #1: More than 5 million deaths per year are caused by climate change

Effects of Climate Change:

- Climate change has the ability to increase the frequency in droughts, storms, heat waves, rising sea levels, melting glaciers, and warming oceans
- Extreme weather conditions, at both hot and cold temperatures, contribute to 9.4% of deaths yearly
- Climate change also has the potential to destroy agriculture and land, harming humans and animals, and having a major day to day impact on the lives of many

Problem #2: The Energy Crisis

Effects of Energy Crisis:

- In addition to the growing problem of climate change, we are in the midst of an energy crisis
- It is not because of the availability of resources and energy, but rather because of our consumption pattern
- We are taking energy and resources that are supposed to be used in future generations

Solution

Synthis

Generators that can turn CO_2 into electrical energy through artificial starch synthesis and the use of bio-batteries (sugar) to convert starch to energy.

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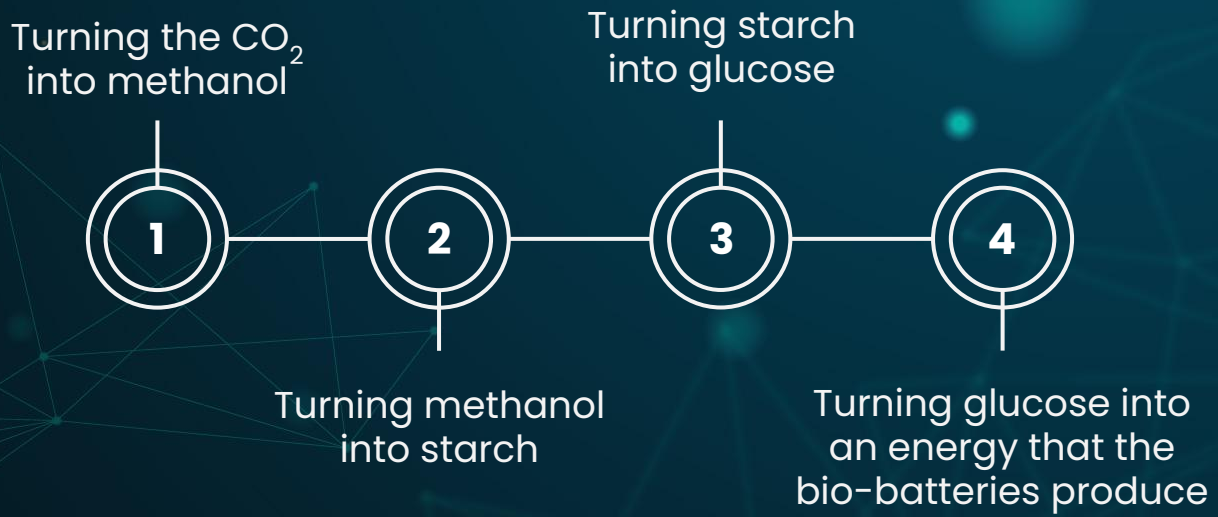
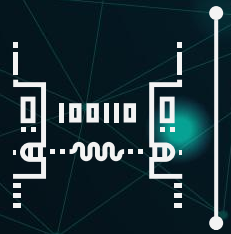
Our process would simultaneously create a new disruptive renewable energy, while posing a feasible carbon capture device

4 Step Process



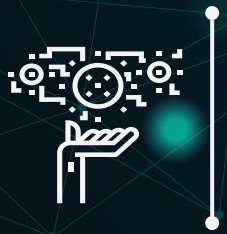
Step 1: CO_2 Conversion to Methanol

- This process is 8.5 times more efficient than photosynthesis
  - Converting CO_2 and hydrogen gas to methanol
    - Solar energy is used for electricity and to produce hydrogen from water electrolysis
      - This process converts solar energy to starch 3.5 times more efficiently than plants.



Step 2: Methanol to Starch

- Use of carbon capture in order to trap methanol molecules.
  - As more molecules of methanol are generated, the enzymatic processes involved in the carbon capture can be used to create starch.
    - This involves trapping carbon dioxide from its emission source and then storing it in a place deep underground for later use.



Step 3: Starch into Glucose

- Involves a combination of starch along with an enzyme to catalyze the starch
  - Using industrialized amylase and 155° water to convert the starch into maltodextrin through hydrolysis, thus leading to the production of glucose

Step 4: Glucose into Energy

- Using the glucose/maltodextrin product from step 3, we can create reusable energy that has 15% maltodextrin fuel that with energy densities of 596 Ah kg^{-1} which is equivalent to 8 watts per battery .
  - This energy can be stored within bio batteries
    - However, since the bio batteries exert a small amount of power, we would need a large scale of these bio batteries

Case Study #1: Chinese Academy of Sciences

- Researchers at the Chinese Academy of Sciences have identified a new technique that can convert CO_2 to usable starch
  - Researchers reduced CO_2 to methanol through inorganic compounds and then pieced together glucose molecules to create starch using enzymes
  - This is done through an 11 core reaction using artificial starch anabolic route

850% faster

This process converts CO_2 to starch at a rate of 22 nanomoles of starch per minute, which is 8.5 times faster than photosynthesis.

Step towards the future

Through more advancement it is reduced to a level economically comparable with agricultural planting in the future, it is expected to save more than 90% of cultivated land and freshwater resources

Concerns:

- Extremely energy intensive
- Still has technical bottlenecks, but those can be solved with a bit of engineering

Case Study #2: University of Virginia

- Researchers at the University of Virginia have developed a way to to use sugar as a viable source of energy production through the use of glucose molecules
  - The solution of 15% maltodextrin enables the sugar battery to have energy densities of 596 Ah kg^{-1}, which is 10 times higher than lithium ion batteries
  - The battery also produce a total of 0.8 mW/cm which is 8 watts per sugar battery, with a current density of 6mA/cm with controllable conditions

Comparison

This conversion from glucose to pure electrical energy is significantly more optimal than solar panels since conditions is solely based on sugar.

Concerns:

- Low power output with high density
- Produces water and CO_2
- Research was discontinued due to internal Conflicts with director.

Case Study #3: University of Illinois

- Larry Curtiss and other researchers at the University of Illinois have found a way to convert CO_2 into reusable fuel
  - The researchers used a metal compound called tungsten diselenide
  - They fashioned it into nanosized flakes to maximize the surface area and expose its reactive edges
- The reaction was done in a similar way to nature, where protons, electrons, and CO_2 all react together to create carbon monoxide and water

Efficiency

The reaction occurred with minimal loss of energy, meaning that there is a lower cost to recycle CO_2

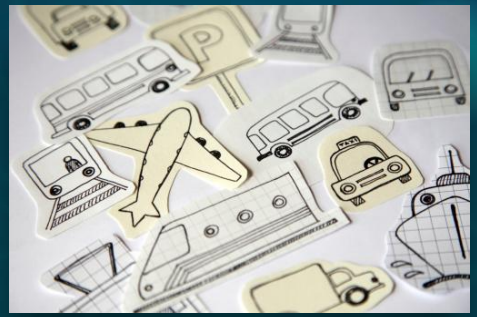
Cost Efficient

Curtiss claims that out of all the hydrocarbons that they burn, this reaction was the most economically efficient due to the use of the sun, which can prove to have a big impact in the future

Concerns:

- Maintaining the efficiency of the tungsten diselenide for future experiments
- Improving economic efficiency when scaling catalysts

Practical Uses of the Energy Made from Carbon Dioxide



Useful fuels for Cars, Trucks, Planes

Chemical feedstock for a wide variety of products

Soap from clean O_2 extraction

The electrical infrastructure of 3rd-world countries

What we need from the UN: Funding

1. Find a space to implement multiple bio batteries
2. Gain access to labs and facilities to perform the carbon capture process
3. Buy catalysts for chemical reactions
4. Buy components and equipment to construct our bio batteries

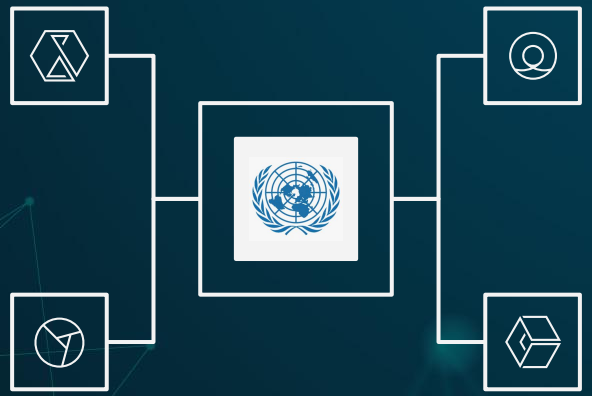
Our Plan

We will use the United Nations base to raise awareness for our idea

Awareness

Marketing

By utilizing different marketing strategies we will be able to spread the word



By turning CO_2 into energy we will be able to create a new, renewable energy source

Impact

Help

The United Nations will help to fund a variety of things like lab space and researchers

THANKS!

Do you have any questions?

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