Introduction

🌱 This document serves as a comprehensive collection of **problem statements** submitted by nour partner climate companies. Each pitch highlights specific issues they face, potential solutions, and some resources to get started, presenting opportunities for awesome AI-based hacks.

🌎 But, we also want to emphasize that participants have the freedom to think **beyond the provided prompts**. If you have an original idea or identify another climate-related challenge that aligns with the scope of this hackathon, we welcome your innovative contributions.

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[LIVE] Heirloom | Utility Tariff Analysis 🧾

👀 **Description**

(Adapted from a [March, 2022 white paper summary] *A scalable direct air capture process based on accelerated weathering of calcium hydroxide* by Noah McQueen, Mireille Ghoussoub, Jennifer Mills, and Max Scholten) (est. 3min to present)

The removal of CO2 from air has become critical to achieving net zero emissions by mid-century and minimizing the dangerous effects of climate change as an additional piece beyond wide scale decarbonization. Scalable direct air capture (DAC) technology, paired with mineralized carbon storage, can offer a path to removing ambient carbon dioxide (CO2) at the gigatonne scale. Heirloom's DAC process uses earth-abundant minerals, namely calcium carbonate (CaCO3), also known as limestone, plus renewable energy to capture CO2 directly from air. Large towers of calcium minerals scrub CO2 from the air. A high temperature reactor regenerates the material to release the CO2 and make it reactive again. The released CO2 is collected and stored in tanks, before being transported to a mineralization site. These sites are typically decommissioned wells or a specialized concrete. This highlights the additional need for supporting systems, such as renewable electricity generation, geologic or other mineral storage, and transportation infrastructure, whether vehicles or pipelines, in order to scale DAC.

All of this infrastructure requires complex permitting and navigation of government, NGO, and public utility regulations, guidelines, and tariffs. Navigating and making sense of utility tariffs alone is a difficult and tedious task as it varies dramatically on state, regional, district, and municipal levels and involves many long documents.

🌿 **Workflow Detail**

Workflow Steps:

1. Research, read, analyze
2. Consult officials in gov, NGOs, and utilities for insight and requirements
3. Synthesize data into an actionable strategy

🚀 **Potential Solutions**

An AI tool that can find, ingest, and make sense of the best utility strategy, requirements, and key stakeholders for a given region(s) and their infrastructure would be highly beneficial for the deployment and scaling of DAC and adjacent technologies.

- California CARB on CO2 removal: https://ww2.arb.ca.gov/news/carb-approves-unprecedented-climate-action-plan-shift-worlds-4th-largest-economy-fossil-fuels
- Federal Support for Carbon Removal: https://www.catf.us/resource/carbon-capture-provisions-in-the-inflation-reduction-act-of-2022/
- Federal DAC Hub Funding: https://www.energy.gov/oced/regional-direct-air-capture-hubs
- Public Opponents of Carbon Removal: https://www.ciel.org/organizations-demand-policymakers-reject-carbon-capture-and-storage/

[LIVE] Heirloom | Life cycle analysis automation ♻️

Presenter: Derek Gann, Senior Devices Engineering @ Heirloom

👀 Description

The removal of CO_2 from air has become critical to achieving net zero emissions by mid-century and minimizing the dangerous effects of climate change as an additional piece beyond wide scale decarbonization. Scalable direct air capture (DAC) technology, paired with mineralized carbon storage, can offer a path to removing ambient carbon dioxide (CO_2) at the gigatonne scale. Heirloom's DAC process uses earth-abundant minerals, namely calcium carbonate ($CaCO_3$), also known as limestone, plus renewable energy to capture CO_2 directly from air. Large towers of calcium minerals scrub CO_2 from the air. A high temperature reactor regenerates the material to release the CO_2 and make it reactive again. The released CO_2 is collected and stored in tanks, before being transported to a mineralization site. These sites are typically decommissioned wells or a specialized concrete. This highlights the additional need for supporting systems, such as renewable electricity generation, geologic or other mineral storage, and transportation infrastructure, whether vehicles or pipelines, in order to scale DAC.

All of this infrastructure requires navigating a complex and diverse chain supply, transportation, and energy needs. In order to properly account for the impact of any given DAC deployment there needs to be a comprehensive life cycle analysis (LCA) performed to gauge the carbon intensity of all inputs into the system. Third party LCA analysis can cost upwards of $100k and typically must be done for each and every deployment. This accounts for all carbon emission scopes. Scope 1 emissions are the emissions directly from a source, in this case a DAC deployment. For any DAC process to be successful, this needs to be a negative number and verifiable in order to verifiably produce negative emissions. This falls under the scope of measurement, reporting and verification (MRV) and is a main input to the LCA. For Heirloom's process, this is accounted for internally, with high accuracy, and is the simplest piece of the LCA. The difficulty comes with Scope 2 and 3 emissions. Scope 2 accounts for the carbon emitted from direct energy inputs. This might be a mix of grid energy, natural gas, directly sourced renewables, etc. The carbon intensity of energy sources varies wildly by location, region, and technology, and is additionally complicated by the use if renewable energy credits (RECs) which attempts to offset dirty fuel with clean sources by purchasing credits. The quality and impact of those credits also varies wildly by source and accounting method, whether yearly, hourly, or somewhere in between. Scope 3 emissions account for the value and supply chain - otherwise known as the embodied emissions - and this is influenced by procurement, regionality, regulations, and technologies used in the supply chain. Scope 3 also must ultimately account for all upstream and downstream activity of a deployment as well, including R&D activities, waste streams, employee travel, etc. Scope 2 and 3 emissions account for all opex and capex inputs to a deployment and must be completely negated and surpassed by DAC's negative scope 1 emissions in order to have an impact. Producing these LCAs requires extensive research, complex synthesis of data sources, and production of an accurate model to predict the total carbon impact magnitude and uncertainty.

🌿 Workflow Detail

Workflow Steps:

1. Start with known supply chain and deployment inputs - e.g. steel, concrete, mechanical and electrical hardware, etc - look for vendor source information
2. If vendors have direct reports and analysis of their product LCA, feed this directly into deployment LCA
3. If vendor does not have data on their LCA, use most analogous research reports on embodied emissions estimates for given class of goods
4. Estimate operational upstream and downstream embodied emissions based on employees, shifts, travel
5. Create model for scope 2 emissions based on various energy sources/ mixes and REC purchasing and accounting methods
6. Synthesize data together into model for deployment LCA prediction w/ uncertainty bounds

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🚀 Potential Solutions

An AI tool that can find, ingest, and synthesize carbon emissions data to produce LCA models for different energy sources, raw material sources, technology providers, and transportation methods.

🌵 **Challenges**

Identifying and associating the relevant information correctly may be challenging as the information is not presented in a standardized format. LCA emissions for any given class of goods can vary greatly depending on source/ region/ etc. Modeling is complex synthesis of many inputs.

[LIVE] Blumen Systems | Land Use Planning 🛰️

Presenter: Hannes Boening, CEO @ Blumen Systems

👀 Description

30% of the continental US is made up of public land. The vast majority of this land is located in resource rich areas including Nevada, Utah, and Alaska. In fact, 90% of geothermal resources are located on federal land! Transitioning our primary energy supply to renewable sources, mining for battery metals, and building new infrastructure requires massive amounts of public land use.

BUT, deciphering how best to use this land and site projects under different regulatory regimes is a major bottleneck in our ability to quickly deploy new technologies and develop the new resources we need in this country.

Land use restrictions are the first major regulatory hurdle that clean energy and minerals companies have to reference before pursuing onshore development opportunities. These documents are dense and site-specific and contain critical information that may restrict or enable a project's success.

Your task will be to find a way to make it simple for developers to access this information for a prospective development on federal lands.

🌿 Workflow Detail

Workflow Steps:

1. Parse the project SOW to identify key inputs and project specs like size, location, commodity type, and technical specs
2. Identify the land use plan governing the area in which the proposed project will be located
3. Determine what restrictions the local land planning documents place on the activities outlined in the project scope. These may include but are not limited to
    1. Minerals
    2. Right-of-ways
    3. Geological considerations
    4. Access roads
4. Construct a table outlining the restrictions placed on this project in the given LUP and why they apply to this project

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🚀 Potential Solutions

Index the LUPs and store the associated vectors in the vector DB of your choosing (Pinecone, Chroma, Weaviate, etc.)

Store the given project SOW in a separate vector DB

Use Mapbox GL to attach LUP shapefiles to a map of the US and identify the LUP to query for a given project

Use LangChain to build refine chains that examine the vector database and reference the project SOW and determine what restrictions apply to the given project

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🌵 Challenges

Chaining is elusive and refine chains may not work for this use case. Be very thoughtful about what method you use to chain responses.

Choosing a chunk and overlap size is a bit of an art for a dense document like a LUP, be sure to play around with these hyper-parameters before going too deep.

Getting specific answers to general queries is hard. Break down each query as much as you can.

📓 Data

BLM Land Use Plans:
https://drive.google.com/file/d/1t2qAYc9vkTk9RnMnJjKP92_wXi3Jn2al/view?usp=sharing

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🧺 Additional References

Example Project EA for testing:

https://drive.google.com/drive/u/0/folders/144t2Bh30bLxUu_alQX-gsIoAkYx2Rig_

Background Reading on Land Use Governance:

https://www.oecd.org/regional/regional-policy/land-use-United-States.pdf

[LIVE] Perennial | Carbon Registry Doc Generator 📝

Presenter: David Schurman, CTO @ Perennial

👀 **Description**

In the world of carbon offsets, registries are a crucial resource that provide a transparent and accountable framework for tracking and verifying the legitimacy of offset projects and their associated emissions reductions. By maintaining comprehensive records of offset transactions and associated information, registries enable the accurate quantification, reporting, and auditing of carbon offsets, ensuring their credibility and promoting trust among stakeholders.

The problem: These “comprehensive records” often take the form of long, manually-generated PDF documents describing the project activities, how emissions reductions will be achieved, and independent validation of the project’s claims. The challenge is to use AI to assist in the generation (optional: review as well) of registry documentation. These documents are public on registry databases such as Verra and CAR, providing ample training/prompting data. Think “TurboTax” for carbon registries.

🌿 **Workflow Detail**

Workflow Steps:

1. Identify the key components and sections required in some category of registry documents
2. Identify the “must-haves” of content for those sections
3. Obtain these must-haves from the user. For example, numerical data like anticipated emissions reductions, categorical data like project activities undertaken, or descriptive data like project or stakeholder details.
4. Generate section-by-section documentation using the user-specific information with the structure and content of a registry document.
5. Allow for edits, corrections, prompts for images or visual assets, and insertion of those images or assets.

🚀 **Potential Solutions**

This could be viewed as a parsing & prompting problem for LLMs. Using the corpus of available examples below and some interface or method of obtaining user-specific data, use the LLM to craft descriptions in a predefined structure and in the style of past available examples.

🌵 Challenges

- These documents are quite lengthy and will likely exceed the max input/output character count for most LLMs.
- There is a high degree of technical language in these documents, and generating output that feels like it was written by a scientist might be a challenge.
- These documents contain headers, body text, tables, and visual assets. Preserving this mixed structure in the generated output could be a challenge.
- Scraping documents from public registry databases like those linked below could be time-consuming.

📓 Data

- Verra Registry
- Climate Action Reserve Registry
- Examples pulled from these databases here.

🧺 Additional References

[List any more references that could be useful to the hackers!]

[LIVE] Perennial | Segment Anything Field Boundary Editor 💡

Presenter: David Schurman, CTO @ Perennial

👀 Description

One of the biggest, most difficult to automate challenges in the digital agriculture space is the collection and refinement of agricultural field boundaries. This is especially important for regenerative agricultural programs, because errors in the field boundary will result in an under or over-estimation of the climate benefit achieved by that farm by introducing errors in the effective area. Field boundaries almost always include roads, buildings, trees, or non-planted areas that shouldn't be there, as many are drawn by the farmer themselves. Polygon boundary refinement is also a common issue across practically all geospatial problems.

The challenge is to use a segmentation tool like Segment Anything to identify these field boundaries from satellite imagery, or to assist in the editing/refinement of them through a UI toolset.

EDIT: By popular demand, more data has been added (1000s of public field boundaries) to the data folder.

🌿 Workflow Detail

Workflow Steps:

1. Start with a rough guess at the field boundary, perhaps from a public map or a hand-drawn polygon.
2. Use a SAM-assisted workflow to help remove parts of the boundary that shouldn't be there and include parts that should.

🚀 Potential Solutions

Per the title, this is probably mainly a UI problem with some clever calls to SAM based on the provided context. The main goal is to make an easy and efficient interface for doing a currently very difficult manual task with the help of AI.

🌵 Challenges

- The context images are very season-specific and dependent on location
- Need to maintain geographic coordinates throughout the process, not just relative pixel coordinates

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📓 Data

- You can find some example field boundaries from the 2008 Common Land Unit dataset with context images here.

🧺 Additional References

- segment-geospatial: a library for using SAM with geospatial data
- Example notebook

[LIVE] Lithos Carbon | Parsing Freeform Farmer Conversations into Structured Data 🧑‍🌾

Presenter: Henry Liu, Head of Engineering at Lithos Carbon

👀 **Description**

To reach net-zero emissions, experts agree that we'll not only need to massively reduce but also *remove emissions* from the atmosphere to the tune of 10–15 billion tons a year by 2050. That's 2–3x the USA's annual emissions. **This is an absolutely massive scaling project, and humanity is only 0.04% of the way there. Many existing carbon removal solutions are either infrastructure-heavy or costly, making it hard to implement them as wide or as fast as required.**

🪨🌋 **Rocks are nature's method for carbon removal.**

Rock weathering isn't something that most people think about every day (unless you work at Lithos). But it's one of the most vital parts of the Earth's carbon cycle — and one of the reasons that the Earth doesn't look like [Venus](https://www.esa.int/Science_Exploration/Space_Science/Venus_Express/Greenhouse_effects_also_on_other_planets#:~:text=For a really strong greenhouse,carbon dioxide%2C a greenhouse gas.). Scientists have known about this cycle for half a century.

This natural process is estimated to draw down around 1.1 billion tons of CO_2 every year. But in exposed natural rock, this process takes *thousands of years*. The idea of *enhancing* this process was first proposed about a decade ago. **By deploying this process in managed cropland, we're able to speed up the process to remove carbon in human seasons, rather than over geologic millennia.**

🌽🚜 **Scaling with Farmers**

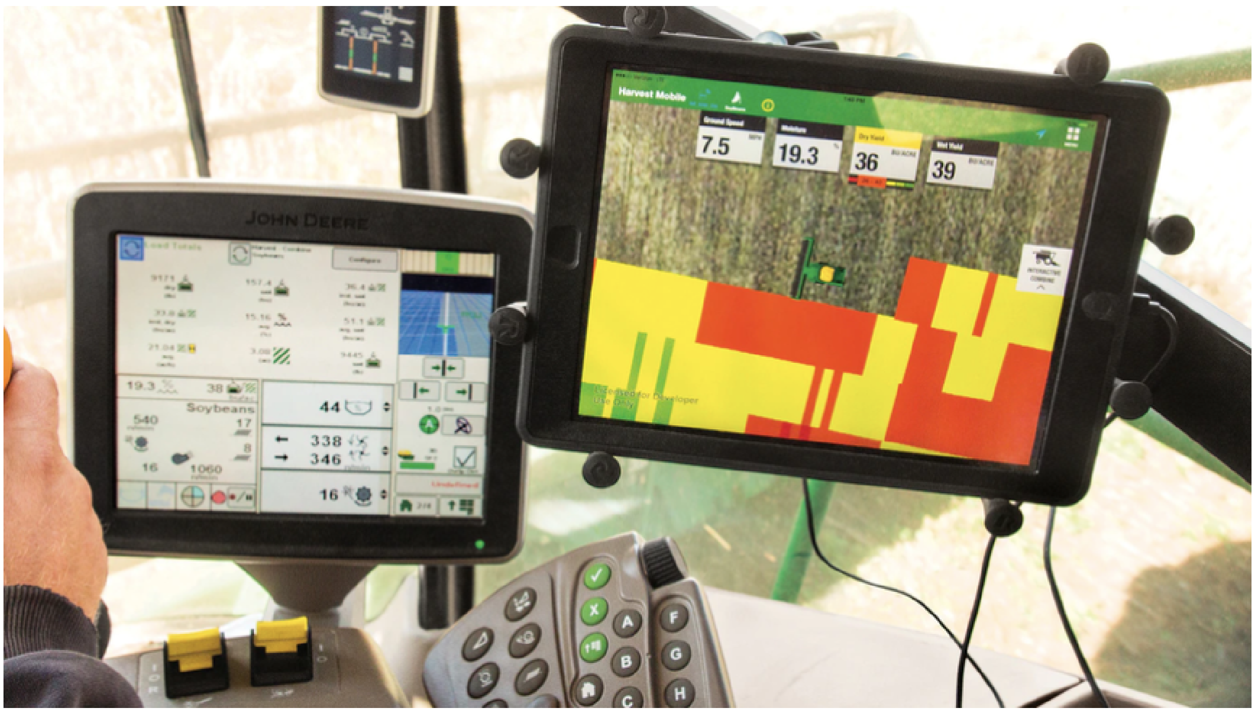
Lithos captures CO2 by using an abundant, naturally occurring mineral called basalt. We recycle existing, post-industrial stockpiles (cheap, no additional mining) where basalt has already been crushed down to a fine dust. We spread the basalt dust on farms. When the basalt breaks down in farmlands, it captures atmospheric CO2 and stabilizes it as permanent sequestration. The basalt application can provide numerous co-benefits: increased crop yields (we've seen up to 10-40% improvements in previous deployments), improved soil health and topsoil regeneration, and enhanced crop resilience to pests and droughts.

By partnering with farmers, we unlock over 340 million acres of corn, soybean, and other cropland in the US alone. These farms are also already equipped with the equipment to spread rock dust (farmers spread hundreds of millions of tons of [rock dust](#) and other fertilizers per year).

🌿 Workflow Detail

We work tirelessly to optimize the farmer experience, which is a really interesting cohort of users to build product for! [98% of farms in the US are family farms](#), but this runs the gamut from a few acres of specialty crops to advanced, tens of thousand acres operations.

Modern farming can be very tech-integrated, with equipment that can cost over $1M+ and are outfitted with GPS, radar, and other sensors that monitor and upload metrics to the cloud.



🧑‍🌾💬 AI Assistant: freeform conversations → structured data

Despite the proliferation of precision agriculture, **farming is fundamentally still face-to-face. That means we spend a lot of time in freeform conversation with farmers (which yes, includes good old-fashioned phone calls 📞).**

I'm not sure how they do it, but farmers will be able to tell you all 15 fields they manage, quirks of each of them, and also remember that on a specific field they put down 150 lbs/ac of nitrogen, 200 lbs/ac of potash, and that it rained for 2 weeks before planting.

💡 **Using AI to pull structured information out of these conversations, flag potential issues and blockers, run sentiment analysis, and also guide the conversation based on a**

text description/checklist would be extremely powerful.

🗺️🛰️ Bonus Geospatial "OCR" + Field Boundary Extraction

Farmers often have printed/PDF maps of their fields, which **are encoded into the USDA FSA GIS database but this is no longer publicly available 🙈.

Given a map which shows a field boundary and associated general coordinates (to get satellite imagery from), how can we extract the field boundaries into polygons?

🚀 Potential Solutions

1. Will have an audio stream coming in, construct an accurate live transcript as our deployment manager speaks to a farmer.
2. For example, our deployment manager might ask "what are the fields that you're planning to put the most aglime down on?". The farmer might respond "oh, probably Wheeler East with 4 tons and 3 tons on Kettle Road". Farmers love to chat so this will not be the only piece of information you'll get!
3. Monitor for key pieces of information and start populating a structured table:

Field	Acres	Lime	Crop	Timeline	Notes
Wheeler East	50	4 tons	Green Beans		
Kettle Road	70	3 tons		3 weeks from now	Had problems with pH here

This could also identify potential external data to pull in. For example, if we ask "when are you planning on planting" and the response is "3 weeks from now", this could look up the weather forecast over the next 3 weeks and flag if for example there's predicted to be a heavy rainstorm at the last weekend.

1. We have an overall document/checklist that's written in human readable language internally. The AI assistant could read this as additional context and prompt the deployment manager for things that could be helpful to ask next or highlight things that are missing.
2. Post-call, there might be one-off text messages or conversations from which key info should be extracted. For example, the deployment manager might text "how did the delivery go?", and the response would be "good, we got 10 trucks yesterday, but it was too wet for the rest so we think it'll be thursday next". This could be parsed into structured output, e.g.

```
[
  {
```

```
    "event":"delivery",
    "date":"2023-05-24",
    "trucks":10,
    "status":"completed"
  },
  {
    "event":"delivery",
    "date":"2023-05-24",
    "status":"delay",
    "new_window_start":"2023-05-25",
    "new_window_end":"2023-05-26",
                    "notes": "too wet"
  }
]
```

🌵 Challenges

- The transcription (speech to text) is not great here with out-of-the-box software (but we haven't tried very hard to tune things)i. Gets worse when there are accents involved!
- Farm terminology is pretty specialized, so embeddings will need to be constructed (e.g. "bush hogging" = mowing grass/weeds on a field). Probably need to scrape forums/articles/publications to understand a corpus of management practices (different cover crops, tillage implements, names of fertilizers, etc.)
- For the geospatial field boundary extraction, the maps are sometimes camera photos of PDFs (heh).
    - A potential approach might be to match key points between the PDF image and the satellite image from the provided coordinates

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📓 Data

See Google Drive Folder with:

- Conversation.m4a is the audio from the call
- Transcript.txt is the raw, unedited output (from Otter.ai). I added some notes/corrections in the italicized brackets
- 3 field boundary map examples, with the associated coordinates

[LIVE] Open Earth Foundation | Automated Data Harmonization

💡 **Title: Automated Data Harmonization Presenter: Evan Prodromou, Director of Open Technology, Open Earth Foundation**

👀 **Description**

Climate accounting data covers important aspects of how actors deal with climate change:

- Annual emissions data (current and historical)
- Emissions targets (reduction goals, target year)
- Action plans (Collections of policy steps to achieve a target, estimated impact)

Both public and private actors track climate accounting data — corporations, countries, states and provinces, cities, even individual emissions sites like factories and farms.

Open Earth Foundation, Data Driven Labs and the Climate Action Data 2.0 community have developed a unified schema for climate accounting data, and a file format based on this schema.

Source data for climate accounting is available from regulators, academic papers, international organizations. But harmonization of source data to the Open Climate schema is a time-consuming manual process.

We'd like to make it easier for a data engineer to convert a source dataset to the harmonized schema.

🌿 **Workflow Detail**

Workflow Steps:

1. A data engineer identifies a data set with relevant data about emissions, targets, or climate actions.
2. The data engineer provides the data set, or samples, to the automated harmonization tool.
3. The tool creates code to harmonize the data set to the standard schema.
4. The data engineer runs the harmonization code.
5. The data engineer verifies that the information in the harmonized data set matches the information in the source data set.

🚀 Potential Solutions

Provide the OpenClimate schema documentation for context.

Use the headers and randomly sampled rows from the data set to give context to the data set. There may also be documentation for the source data format.

Generate code in an easy-to-run programming language used often by data engineers, like Python or R.

Consider means for verifying the transformed data, such as a reverse transformation that can be run to see if the original data is matched.

🌵 Challenges

- Data sets are primarily comma-separated text files (CSV) with the first row being the column names.
- The source files can be hundreds of megabytes long, which makes it impossible to submit the entire file.
- Missing data or invalid data.
- Invalid data that was inserted for human readers, like “N/A” or “Not available at this time”
- Not every column in the source data will have a corresponding field in the harmonized data set. Some might be ignored.
- Fields in the source data may need to be combined (multiplied, added) or disentangled (a list of values in a single column)
- Source data may use different identifier schemes, languages, or naming conventions
- Source data may provide different units

📓 Data

The Open Climate project includes dozens of raw and processed data sets harmonized by human developers.

[LIVE] Terradot | Carbon Registry PDD Automation

Presenter: Sasankh, Co-Founder of Terradot

👀 **Description**

An important piece in registering a carbon project on a carbon registry e.g. Verra, CAR, Gold Standard, is to generate a PDD (Project Description Document). The PDD serves as a comprehensive blueprint for the carbon project, providing essential information and documentation required for the project's validation and verification. These projects can take various forms, such as renewable energy installations, afforestation (planting trees), energy efficiency improvements, or methane capture from waste sites.

However, the process of generating a PDD can be time-consuming and often requires special consultants. This is preventing many projects from being registered and adding an extra layer of expenses to setting up a carbon project. Carbon projects have the potential to reduce net GHG emissions by gigatons of CO2e. There is great potential to take advantage of recent generative AI advances (LLMs) to make creating a PDD seamless.

🌿 **Workflow Detail**

Workflow Steps:

The Project Design Document serves as a comprehensive blueprint for the carbon project, providing essential information and documentation required for the project's validation and verification by a recognized carbon standard or certification body. It typically includes the following key elements:

1. Project Conceptualization: Identify the carbon mitigation or removal opportunity and develop a clear project concept. This could involve activities such as renewable energy generation, reforestation, energy efficiency improvements, or waste management initiatives.
2. Baseline Assessment: Conduct a thorough assessment of the current baseline situation to establish the reference point against which the project's impact will be measured. This involves quantifying the baseline emissions or carbon stocks, considering factors such as historical data, local conditions, and relevant standards or methodologies.
3. Additionality Assessment: Determine the project's additionality by demonstrating that the emission reductions or carbon removals achieved are additional to what would have occurred in the absence of the project. This involves evaluating alternative scenarios and methodologies to substantiate the project's environmental integrity.
4. Methodology Selection: Identify and select the appropriate methodology or methodologies to quantify and monitor the project's emission reductions or carbon

removals. This step involves considering recognized standards, guidelines, and protocols provided by relevant carbon certification bodies or international organizations.

5. Project Design and Implementation Plan: Develop a comprehensive project design and implementation plan that outlines the project's objectives, activities, timeline, and resource requirements. This includes detailing the technology or practices to be employed, specifying monitoring and reporting procedures, and ensuring compliance with applicable regulations and standards.
6. Co-Benefits Assessment: Assess and document the sustainable development co-benefits associated with the project. This involves identifying potential social, economic, and environmental co-benefits and evaluating their significance and contribution to local communities or ecosystems.
7. Financial Analysis: Conduct a financial analysis to evaluate the project's economic viability and sustainability. This includes estimating the project's costs, revenue streams, and potential financial mechanisms such as carbon credits, grants, or investments.
8. Stakeholder Engagement: Engage relevant stakeholders throughout the PDD development process, including local communities, project developers, regulatory authorities, and potential investors. Seek input, address concerns, and ensure transparency and inclusiveness in decision-making.
9. PDD Compilation and Review: Compile all the necessary information and data into a comprehensive PDD document. Review the document thoroughly, ensuring accuracy, clarity, and adherence to relevant standards or guidelines.
10. Validation and Registration: Submit the PDD to a recognized carbon standard or certification body for validation and registration. This involves a detailed assessment of the PDD's compliance with the chosen standard, including reviews by independent experts or validators.
11. Monitoring and Verification: Once the project is registered, implement the monitoring and verification plan outlined in the PDD. Regularly collect data, measure emissions or carbon removals, and report the results according to the agreed-upon procedures.

🚀 Potential Solutions

- Finetune an off-the-shelf LLM with PDDs to help generate a PDD draft with interactive prompts from a user

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🌵 Challenges

- The ability to work across various registries e.g. Verra, CAR, Gold Standard (to simplify could just pick one)
- The ability to generate PDDs for various methodologies e.g. methodology for soil carbon improvement and methodology for forestation can be very different

📓 Data

[If relevant, link to any data sources people can use as a starting point]

- Verra’s Methodologies: https://verra.org/methodologies-main/
- Search/scrap existing Verra PDDs that have been submitted: https://registry.verra.org/app/search/VCS/All Projects

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🧺 Additional References

https://www.carboncreditcart.com/the-carbon-credit-lifecycle/

https://www.carboncreditcart.com/carbon-credits-101/

Greenwork | Understanding Contractors

👀 Description

Greenwork helps climatetech companies partner with contractors — HVAC, electrical, solar, etc. — to get their technology installed at scale. To create a great experience for the contractors, we need to understand what they focus on so we can approach them with relevant offers. If our understanding of what they do is vague or wrong, our experience can become spammy for them.
If we are able to match the right climatetech hardware companies with the right contractors, more awesome climate-saving products will get installed sooner, and more contractors will grow their businesses and create more jobs.

We would get a lot of value out of a model that can read a contractor's website and understand:

- Which products they install (solar, batteries, heat pumps…)
- What kinds of buildings they work on (Residential, Multi-Family, Commercial, Industrial)

🌿 Workflow Detail

- Ingest a list of contractor business names and websites
- Programmatically return a table with new columns for Products Installed and Building Segments, each of which can have any number of values drawn from a pre-defined list

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🌵 Challenges

- Contractors' websites are not in any standard format
- Information may be split across many pages of the website
- The same product may be referred to in multiple ways (e.g. "Mini-spit heat pumps" and "Ductless heat pumps")
- Sentence understanding, and not just word count numbers, is likely necessary (e..g "We don't work on commercial buildings" should not get classified as Commercial)

📓 Data

- Classifying the 347 CALSSA contractors would be a fantastic start (link)

The Big Wild | Modeling Nature-Based Carbon Sequestration

👀 Description

The U.S. Department of Agriculture (USDA) reported in 2017 that there were approximately 2.04 million farms spanning 900 million acres in the country. Since the 1970s, government-backed programs like subsidies and crop insurance have prompted farmers to convert wetlands into agricultural land, leading to the loss of valuable ecosystem services such as water filtration, flood control, and carbon sequestration. Since the mid-1950s, the U.S. has lost about 16.8 million acres of wetlands, with over 2 million acres of vegetated wetlands drained and filled. Wetlands, often compared to rain forests and coral reefs for their rich biodiversity and contribution to global cycles of water, nitrogen, and sulfur, also function as carbon stores, thereby mitigating climate change. The Farmable Wetlands Program (FWP), part of the 1990 Farm Bill, offers financial incentives to landowners for restoring and protecting wetlands on their properties. The program aims to enhance groundwater quality, trap pollutants, prevent soil erosion, and create habitats for various wildlife species.

An initiative called **The Big Wild** is building an application to facilitate the use of FWP, to make a significant climate impact. The FWP, run by the Farm Services Agency through the Conservation Reserve Program, works towards restoring previously farmed wetlands and their buffers, with a goal of restoring up to one million acres of farmable wetlands and associated buffers.

🌿 Workflow Detail

Workflow Steps:

1. Parse the project FWP to identify key inputs, clickable questions/prompts, and project specs like size. Soil type, and technical specs such as agricultural purposes on adjacent lands/chemical + pesticide usage.
2. Visually engage the farming community with easy prompts, inputs accessibility, calculation and access to calculations & reports for the U.S. incentivized FWP.
3. **Prompts engaging landowners through the specific eligibility requirements and questions for the Farmable Wetlands Program.**
4. Identify the purpose, geolocation, soil type, size, hydrology, and technical specs such as agricultural purposes & usage on adjacent lands/chemical + pesticide usage.
5. land use plan for the area in which the proposed project will be located.
6. Determine what restrictions the local land planning documents place on the activities outlined in the project scope. These may include but are not limited to.
    - Minerals
    - Right-of-ways
    - Geological considerations

- Access roads

7. Infographics: Create visually appealing infographics that display important Wetland data, techniques, hydro and biodiversity cycles, and best practice. Use colors, icons, and charts to make the information easy to understand and visually appealing.
8. Create an area for geospatial mapping and or Aerial photography: Capture stunning aerial photographs of farmland wetlands, & biodiversity, from a drone or an elevated position. These images provide a unique perspective and can showcase the scale and beauty of agricultural impact.
9. Create time-lapse videos that show the growth of crops from planting to harvest or the construction of a greenhouse or barn. These videos can be captivating and demonstrate the progress and hard work involved in farming.
10. Present a series of before and after photos that showcase the transformation of a piece of land through effective soil conservation practices, terracing, or reforestation efforts. This visual representation can be powerful in demonstrating the impact of sustainable farming methods.
11. Share photographs or videos of successful farmers and their achievements. Highlight their innovative techniques, high-yield harvests, or successful animal husbandry practices. These success stories can inspire and motivate other farmers.

🌵 Challenges

- Create a calculator to estimate annual carbon sequestration from plants and soil.
- Create a personalized page for individual landowners to monitor and calculate Biodiversity impact and ground water recharge annually.
- Create a page for visual access for all farmers (by choice) to see other wetland projects. They should not have access to make changes, only see the how, why and impact.

📓 Data

For full details, see here.

[Office Hours 12-1] Crux

Clean energy development is poised to boom, but we urgently need to make sustainable finance more efficient to move as quickly as needed. The Inflation Reduction Act (IRA) will make hundreds of billions of dollars of tax credits available to companies building facilities or producing clean power and materials. And for the first time, these credits are transferable – creating a new and powerful market mechanism to fund energy transition projects. The market for transferable tax credits needs new standards, more buyers, expanded financial products, and purpose-built software.

Crux is the ecosystem for developers, tax credit buyers, and financial institutions to transact & manage transferable tax credits. Our network & tools streamline transactions, provide access to a large market, and reduce risk & increase trust.

Here are a few AI products that would help accelerate our mission:

1. Automate prospecting - a significant amount of information is publicly available about renewable energy developments and potential buyers of tax credits. Developers discuss projects with communities in open fora, submit applications for interconnection, and announce new developments via press releases and other mediums. Public companies discuss tax management strategies in quarterly/annual filings, investor presentations, and quarterly calls. Could AI be used to intake significant unstructured communication, rank leads, and automate target-specific prospecting?
2. Automate diligence summaries - projects have many supporting documents and underlying information. Tax credit buyers will often hire accounting, legal, and specialty tax credit firms to perform diligence. Could AI intake project documents and produce automated diligence summaries?
3. Tax credit education + qualification tool - many developers -- particularly smaller ones and novel technologies -- don't know which credits they qualify for. Could ChatGPT or some other model engage with developers, ask key questions, and share information on qualifications? Perhaps the tool could also be used to qualify leads.

Crux founder Alfred Johnson will be available for office hours from 12-1 PM PT, join the conversation [here]() at that time.

Eli

Eli is building digital infrastructure to make it easy for everyone to access the capital they need to decarbonize their lives. Eli's Incentive API allows users to determine eligibility for government and utility rebate programs for things like installing a heat pump hot water heater, purchasing an electric vehicle charger, or upgrading their home's insulation. There are thousands of these programs across the U.S. that will drive trillions of dollars in consumer spending over the next decade. The API is powered by a complex rules based system, somewhat similar to a mortgage origination engine. Eli takes in user data and applies this complex set of rules to determine eligibility across these thousands of programs. One area where AI could help Eli scale faster is by streamlining the process of discovering incentive programs, and ultimately ingesting and structuring the eligibility rules for the programs. To start, a first step would be to determine which incentive programs exist in a given area.

Problem to solve: We need to find and collect incentive and rebate programs that exist in a given geographic area. Typically we're asked for this in a format like "Can you serve up all the incentives in the DC/Virginia area for heat pumps and solar?" and we need to sift through the universe to collect those programs that exist (program names, URLs, incentive types they offer, and other simple metadata), then pipe them into our ingestion workflow to be able to structure and return them through our API. Basic googling and calling around works fine for this but it can become labor intensive and it would be fun to see how AI can speed that up.

There are many sources of aggregated information about incentive programs, but they are very rarely comprehensive and sometimes inaccurate. These include electric utility websites, state energy offices, and nonprofits that promote clean energy and electrification. We can use these sources as a starting point but we need to ingest as much information as possible then sift through it and check for accuracy.

Proposed automation: ProgramsGPT
Build a research assistant that can organize various aggregate sources (state energy office websites, utility sites, nonprofits that aggregate incentive information, etc) into groups of programs, so we can ask it questions about what's available based on those sources (or, even better, it finds the sources itself).

Epoch Biodesign

At Epoch Biodesign, we engineer enzymes to break down unrecyclable plastics into valuable, low-carbon chemical ingredients. These can then be used to manufacture everything from new plastics to sustainable fertilisers.

One challenge we face is that before starting the development of a new enzyme, we need to conduct a literature search to understand what work has been completed elsewhere. These literature searches can sometimes take weeks of someone's time. If we had a tool that could summarise academic/patent literature and extract key information, we could dramatically reduce the time it takes to begin a new product development campaign and pre-empt technical roadblocks that we could have accounted for earlier.

This would save *loads* of time for us and other scientists. If we want to start a new project we have to spend a significant chunk of time deep diving into the literature before we can really begin.

Pachama

We are a startup with the mission of restoring nature to solve climate change. We help originate, finance and commercialize forest carbon sequestration projects (reforestation and conservation) that can issue carbon credits which companies can use to take responsibility for their carbon emissions. We use satellite data and AI to measure and monitor carbon on forests as well as other risk factors that might affect these projects.

There are many ideas that we have but have not yet had time to work on. Here a few:

- A model to measure biodiversity in different ecosystems, which could be used to establish baselines from which to enrich ecosystems.
- A model to predict fire risks.
- A model to detect and measure tree coverage
- A model to detect and measure coastal ecosystems biomass

Living Carbon

Background
Forest carbon project development involves a time-consuming process of reaching out to landowners and finding parcels of land that are suitable for project development. Living Carbon develops high-quality afforestation / reforestation projects on marginal land, which include our photosynthesis-enhanced poplars engineered to capture and store more carbon. Our land partnerships team uses land cover classification tools derived from remote sensing imagery to identify mineland and pastureland that is suitable for these projects.

Problem
Land cover classification datasets are often several years old by the time they are released and don't always reflect the most recent conditions. This is because the creation of land cover maps requires a lot of expert input and checking for accuracy, which is a highly manual process that often takes years.

Idea
Land cover classification similar to NALCMS's 30-m resolution product:
https://www.mrlc.gov/data/north-american-land-change-monitoring-system.

Time range
The most recent remote sensing imagery possible (2021 or 2022).
Data source: Sentinel II (~5m) or Landsat (~30m)

Steps required in developing a land cover dataset:
1. Create/use a baseline land cover map.
2. Ingest new spectral data for the land cover classifications.
3. Employ a technique such as classification decision trees to assign land cover classes based on spectral patterns.
4. Employ validation techniques to ensure accuracy.
5. Export the resulting land cover classification in raster format.

Lun

Lun, a climate tech startup out of Denmark, is on a mission to help homes decarbonize fast — starting with heating systems and swapping out boilers for electric heat pumps.

What are heat pumps? The technology is a low carbon form of heating which is based on the principle of refrigeration that offers an alternative to environmentally unfriendly options like oil and gas-fired boilers. At a basic level, heat pumps work by using electricity to transfer heat from one place to another, so they're able to both heat a house in winter and cool it in summer (or at least up to a balance point at which a supplemental system may be required).

Lun's software, which is currently in an alpha release with an undisclosed number of testers in Denmark, aims to take some of the strain out of installation assessments, design and planning, as well as handle other business elements like taking payments. It's providing tradespeople with a suite of tools for gathering relevant data from householders and automating suitability assessments — doing the latter by drawing on public and/or open data (such as satellite imagery), as well as feeding in data from OEMs (such as price, specifications), as well as property type/location etc, to try to find the best match between a job and a professional installer.

Specific products that Lun could use help with:

- From a picture/3d scan of a boiler room with a gas or oil boiler room, how could a boiler room with a heat pump look like? (Stable Diffusion/ControlNet)
- From a satellite picture, find where a heat pump external unit can be placed or not within parcel boundaries (Segment Anything)
- From a random list of parts (and their manuals) for a heat pump installation, create an "ikea-like" step-by-step guide for the installer (ChatGPT)
- From a heat pump quote and part list, create a personalised video to present the offer

Lemon Energy

Lemon is a climate tech based in Brazil, with the mission to bring affordable renewable energy to everyone in Brazil through the use of technology. Our first product is a marketplace of renewable distributed generation directed at SMBs: we connect small businesses to renewable power plants (solar, hydro and biomass) in multiple regions of Brazil, allowing these customers to get a 10-20% discount on their electricity bill. All they need to do is sign up on our website and they will be connected to a power plant, with no upfront costs or cancellation fines. We do not own our power plants, we build a marketplace and liaise with Distribution Companies to provide customers and Generation Companies a delightful experience. Simple, affordable, renewable.

1. Energy consumption forecast: every month we need to run a process called energy allocation, this entails assigning a percentage of the energy of a power plant to each customer associated with it through our marketplace - forecasting each customer's consumption is key to a perfect match, but this is challenging as we only have 12 data points per customer per year (the monthly energy bills) - clusterization could be key here

2. Energy generation forecast: same as above, but here the challenge is forecasting how much energy a power plant will generate - it may seem straightforward for solar power plants but it is not (and to make things more interesting, the seasonality of solar in Brazil is opposite to the seasonality of consumption)

3. Credit score: assigning a credit score to customers is key to KYC at Lemon but could also help us fine tune the energy allocation process mentioned above (we could adjust the energy allocated to customers based on their probability of delinquency) - here we could also try to forecast whether a certain consumer unit will close up shop (that happens quite a lot with small businesses in Brazil)

4. Energy allocation algorithm: take all of the input above and run an algorithm to maximize customer service levels, power plant utilization and Lemon's returns - probably an iterative algorithm operating on pre-defined business rules

Carbon Crusher

About Carbon Crusher
We are Carbon Crusher. We make carbon negative roads. For every 60F of roads we refurbish today, we remove 1T CO_2 from the atmosphere.

Our product is a “triple climate innovation sandwich” of 100% re-usage of road materials, 100% bio-based Co_2 sequestering binders developed in our bio laboratory and in partnership with academic institutions, and our SkyRoads “eyes in the sky” end sensor optimized customer & efficiency platform.

We deliver this through a Crushing as a Service (CRAAS) delivery model, where we together with local contractor partners that provide basic equipment and manpower provide carbon negative roads to the end customers. We’re re-thinking road refurbishment and innovating in an industry that has not seen much innovation since the Roman ages, we have over the last year expanded to 4 countries and are now preparing ready to enter “HyperCrush” mode from 2023-24 and onwards:

- Scaling up CRAAS customer base in EU and US
- Bringing our next level Bio Binder portfolio (10x ing our Co_2 sequestering capacity, introduce regenerative roads++), SkyRoads platform and suite of smart crushers to life
- Spread the CC mission and inspire people to think in new ways of how to tackle the climate challenge

Our mission is to move the planet from gray to green; By making all roads carbon negative, use the biosphere to heal the atmosphere, and inspire minds to think in new ways about how to to crush it and tackle the climate change challenge, Carbon Crusher aim to unlock more than 1 GT of Co_2 taken out of circulation, every year.

Some useful links:
- https://www.fastcompany.com/podcasts/world-changing-ideas
- https://podcasts.apple.com/us/podcast/the-carbon-crusher-crushing-kidney-stones/id1501277630?i=1000555449661
- https://www.fastcompany.com/90732232/this-norwegian-startup-makes-carbon-negative-roads
- https://www.carboncrusher.io/

CARBON CRUSHER PROMPTS / AI PRODUCTS:

1. **Based on the above info about Carbon Crusher, your own intent, interest and creativity, and the gigantic potential in AI, we would love you to freely come up with a prompt/AI product that we can use in Carbon Crusher! The palate is yours! Surprise us, and help us crush it & heal our planet!**

2. **Alternatively, check out one of these**
    a. **CC Sales Public Prospect workflow;** find all relevant counties in state X, relevant road manager, phone & email, premade excel into hubspot, auto send emails++
    b. **SkyRoads data workflow;** find available road data, enter into database, apply AI filter for damages and if CC method applicable, draft offer with cost & Co2 savings++
    c. **BioOne & BioNext workflow;** Get/approximate info on CC Bio Roadmap (top 10 binders/additives/products); why, what and how we are developing it; propose better ways to shorten timelines for development; ID other relevant additives and materials to add to the BioRoadmap; frequently auto-update++

Woodoo

Woodoo is a French biomaterials startup transforming low-grade wood into high-performance, low-environmental impact materials. We believe in a sustainable industrial future built on wood, using innovative and pioneering processes.

Our SLIM product is a wood you can see through and touch-sensitive used for Smart Surfaces.

- Reduction of costs and processing time
- Emission-free and recyclable
- 3x lighter than glass

See attached deck.

SPUR

How should land uses downtown evolve? How can the city incentivize the reuse of underutilized buildings?

SPUR has developed policy imperatives to introduce more housing through the conversion of underused office buildings, and Mayor London Breed and Board President Aaron Peskin have jointly introduced legislation to relax planning and building codes to create more flexibility for conversion projects. Beyond the code reforms, more could be done to incentivize conversions where it makes sense for property owners to pursue that pathway. However, only 40% of buildings are physically suitable for residential uses, and many of these buildings would not be financially feasible to redevelop. Therefore, further diversifying land uses will require other policies and strategies, such as adapting existing buildings to accommodate academic institutions and exploring the potential to create entertainment districts.

However, we still have very limited information on the inventory of downtown office buildings to determine what the current uses on ground floor are upper floors are, who the owners are, what their debt burden is, and whether energy or seismic upgrades would be required for reuse. A database that combines the information and assesses the potential future options would be tremendously useful for developers, planners, and investors.

Resources:
https://www.spur.org/publications/research/2023-03-28/office-residential-conversion-san-franciscos-changing-real-estate

Rubbish.love

Can I recycle this?

Idea is simple: given an object, output whether or not something is recyclable in your current county (based on GPS location).

Likely needs to leverage computer vision!

General Prompt

🚀 If you have original ideas, you don’t have to hack on the prompts above! 🚀

Your hack should use LLMs to solve a climate problem. You can use the judging criteria to guide your original hack.