PROJECT PLAN

PROJECT: EVERGY COAL PLANT

LOCATION: JEFFREY ENERGY CENTER, ST MARYS, KANSAS

DATE: APRIL 2024

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1. Carbon Optimum Introduction and Cooperation objectives

I. Carbon Optimum Introduction

According to the Fifth Assessment Synthesis Report presented in Copenhagen by the Intergovernmental Panel on Climate Change (IPPCC) to counteract the irreversible effects of climate change greenhouse gas emissions, CO2 emissions need to decrease by as much as 70% globally by 2050 and to reduce to zero by 2100. The implementation of such reductions pose substantial technological, economic, social, Carbon Optimum has developed a technology to capture, neutralize and transform industrial CO2 emissions into products with applications in a range of markets including energy, pharmaceuticals, nutrition, cosmetics, and bio-technology. Using a sophisticated technology to accelerate the power of nature, Carbon Optimum hopes to provide a feasible mitigation pathway for the CO2 emissions.

This technology was researched, developed, and tested by a group of international scientists. Over $50M has been invested to this point.

II. Cooperation objectives

With increasing regulatory pressure, industrial emitters are seeking partners and solutions to lower or neutralize their CO2 emissions. Most recently, the EPA finalized a suite of standards to reduce pollution from fossil fuel-fired power plants.

Carbon Optimum has entered into an agreement with Evergy, a utility operating in the Midwest of the U.S., to neutralize 9 million tons of CO2 yearly with 3,805 PBRs at the Jeffrey Energy Center, a coal power plant in the state of Kansas, in order to make them carbon neutral. Carbon Optimum operates and maintains the PBRs. Evergy is leasing the land to Carbon Optimum, providing wastewater and electricity, and cleaning the CO_2. The total estimated project cost, at full capacity, is $809M. This will be done in phases starting with a capacity up to 200 PBRs.

Carbon optimum

2. Market forecasting, sales planning, production planning

The demand of commodities Carbon Optimum produces has ongoing demand: biocrude, biofertilizer, and natural products.

I. Market forecasting

Globally, the demand for natural products is expected to increase at a fast pace in the years to come. The projected growth is supported by the fact that the demand for natural products (antioxidants, natural colorants, omega 3, etc.) remained surprisingly strong during the period of worldwide economic recession, which significantly affected virtually all business sectors around the globe. Natural components coming from marine phyto- plankton find application in several areas: today, however, they are mainly used in food products, cosmetics, animal feed, etc. While the growth of demand for these molecules is evident due to their unparalleled benefits, there are factors which further drive the growth such as increasing population, rising demand for fast moving consumer groups and cosmetics. A major trend in the natural product market is the growing consumer consciousness of their benefits, because of which more and more consumers are choosing products containing natural molecules (with different activities).

Biofertilizers are shown to be more nutrient rich for the soil with a global market size estimated to be worth around USD 9.14 billion by 2032 from USD 3.14 billion in 2022 and growing at a compound annual growth rate of 11.27%.

The global biomass power market size is expected to reach USD 203.61 billion by 2030. The market is expected to expand at a CAGR of 6.0% over the forecast period. The growing concerns about Greenhouse Gas (GHG) emissions have resulted in favorable policies and regulations for renewable energy, which has been the key factor driving the growth of this market.

II. Production planning

Carbon Optimum Jeffrey’s Energy Center, Kansas plant is planned initially for 200 photobioreactors on 2.5 acres of land with an investment of $75 million. It then scales to 3,805 total on 48 acres.

It will be operated with a product mix that initially maximizes profitability, hence prioritizing high value products followed by biofertilizer then biocrude oil. Carbon Optimum has existing buyers and commitments for yearly production volume.

Because of the adaptability of the technology to product demand, each photobioreactor will be able to produce different strains to fulfill contracts for different products.

Photobioreactors	CO_2 emissions removed year 1 (tons)	CO_2 emissions removed year 2 onward	Biomass harvested year 1 (kg)	Biomass harvested year 2 onward (kg)
1000	473,260	2,365,000	5,993,333	255,200,000

The biomass density in each PBR starts at 3 g/L year 1 and increases to 66 g/L by year 2. Each PBR will produce 116,000 kg/year of biomass in year 1 and 2,552,000 kg/year of biomass in year 2. Half of the biomass is harvested each day leading to 5,993,333 kg/year harvested year 1 and 255,200,000 kg/year in year 2 onward. Microalgae is grown in smaller tanks and transferred 2 times in larger tanks until it reaches the final 30,000 gallon tank.

	year 1	year 2 onward	PBR dedicated
biofertilizer (kg)	5,598,333	255,105,000	199
nutraceuticals (kg)	395,000	395,000	1
Total			**200**

Products prioritized for year 1 are high value products for nutraceutical and food companies and biofertilizers. Once density increases to 66 g/L carbon negative biocrude can be produced for oil and gas refineries to produce sustainable aviation fuel and carbon neutral oil mixed with their existing supply.

All products can all be made from - nannochloropsis (best for crude oil), Chlorella (best for biostimulant), Dunaliella, Porphyridium Cruentum, Haematococcus Pluvialis. Omega 3 and phycoerythrin are subproducts of the biomass. Any high value products in small volumes can be produced in the smaller tanks used in growth transfers.

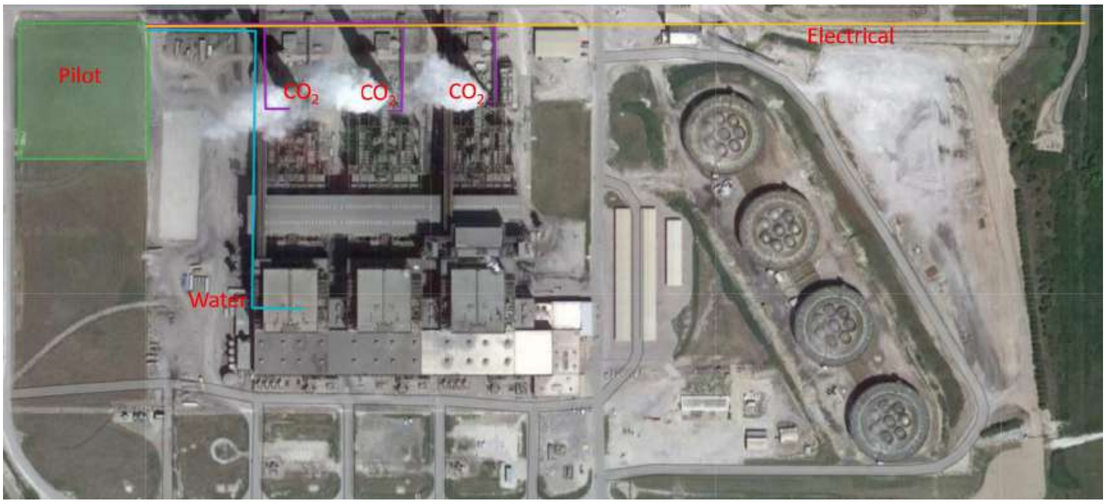
Among other advantages over other technologies, the photobioreactor design is the most important. It allows for the capacity to scale up to commercial stage processing with continuous production. The first requirement is product standardization. Thus, the reactor here is one that does not require any changes in the industrial application; only the number of reactors per plant changes. The key aspect in the reactor design is the homogeneity. This means the volume of the reactors is perfectly homogenized to a continuous circulation, guaranteeing all the reactors operate under the same conditions: same cell concentration, same pH, same Tª, same rate of oxygen dissolved, etc. There are sensors to control everything happening in the reactor, allowing for full automation. If all the reactors are well homogenized, every reactor will have the same conditions with the reactors around it, so to automate control of the reactors for the whole plant is as simple as controlling only some of them. Having this homogenous and controlled culture we can also guarantee the homogeneity of quality and quantity at the same time, i. e. product standardization.

3. Site location

Located next to the Jeffrey Energy Center, a coal power plant in the state of Kansas. Warehouse is available for lab and storage. Water and electricity is ready to access.

4. Overall plot plan of the facility

We have access to 50 acres of which we will start with 2.5 acres for the initial 200 PBR facility. Maps of the area are shown below.



The different parts of the facility are described below:

<u>Inoculum Area</u>

The inoculum is the amount of the microalgae solution needed to be able to start the culture growth in the photobioreactor field. Microalgae is grown initially in 1,000 gallon tanks (2) then transferred to 10,000 gallon tank (1) then transferred to the final 30,000 gallon tank which then splits among the 600 tanks. There will be an exclusive indoor area for this purpose located just in front of the photobioreactor field. It will be composed of:

- Culture room: from the original strain, which is kept under strict light and temperature conditions, to the hundreds of liters that will be used for filling the outdoor photobioreactors, are in this room. Light and temperature conditions are very well controlled in this room.
- Exit inoculum zone: through this zone, the inoculum will head to the photobioreactor field.
- Transition and disinfection zone: to disinfect any person coming to the culture room.
- Laboratory: to control the state and evolution of the culture located in the culture room.

Photobioreactor Area (Culture Growth)

This area is intended for the installation of photobioreactors that contain the culture. Each reactor has a piping and fitting system for the charge and discharge of the tank, as well as compressed air plus CO_2 and the tempering of the culture. Each of these lines has cutting valves to isolate each reactor from the rest of the installation, cutting can be performed in case of maintenance or production needs.

These photobioreactors are placed on a foundation slab to provide flatness and to distribute the loads transmitted to the ground. Electromechanical and tempering installations necessary for operating the industrial process are in this area.

Mass production of phytoplankton is done in 30,000 gallon stainless steel tanks. These photobioreactors (PBRs) cultivate microalgae in a closed and fully controlled automated environment. By controlling all the parameters that are extremely important in the growth of microalgae such as light, CO2, nutrients (mostly nitrates and phosphates), water, flow, etc, we can produce very High-Quality products with homogeneous and steady characteristics (required by the end users such as pharma, food). Using high-volume PBRs is key. More production, more CO2 capture, and less surface use. These PBRs also allow cultivation and growth of different types of strains for different products. Each PBR is isolated (individually) which permits in case of contamination to stop the affected PBR and not lose all of the crop which is not feasible with any of the technologies.

Tank area

This area is intended for the tanks needed in the plant. It will be installed near the culture area and have three types of tanks:

- **Salty water tank**: this tank will store the water coming from the sea or any other source. Initially 30,000 gallons are needed per PBR then 0.5-1% of the volume will need to be replenished each day as the rest is recycled back into the tanks from daily extractions. The water is filtered and treated before cycled back into the PBRs

- **Auxiliary CO2 tanks**: two 2,000 ton tanks will supply one day's worth of CO2 for the 600 PBRs. This is to be used for maintenance or any malfunction.

Industrial Processing Area

This is the downstream process to produce the final products located in the warehouse. The biomass is processed here to produce fertilizer and crude oil. The main processes include: sea water filtration, air compression, air/CO_2 mixing, culture pumping, nutrient pumping, mechanical separation and drying.

Offices for staff (managing and maintenance) and laboratories (production and culture inoculum/growth) will also be here.

5. Pre-Assessment of infrastructure requirements

A geotechnical study will be done first. Then, the engineering firm will refresh the execution plan for the civil work which include:

- Foundations slabs, flooring and paving
  - Forming foundation slabs with reinforced concrete. Some are already installed.
  - Filling natural limestone gravel into the trenches.

- Structures
  - Reinforce concrete structures needed for the tanks

Mechanical installations (both, hydraulic and pneumatic) and electrical installation:

- Piping for liquids and gasses, manual valves, fitting, compressors and pumps.
- Fire protection: detection and extinction.
- Sanitation network.
- Ventilation.
- Air Conditioning.
- Plumbing.
- Compressed air.
- Electric transformation center if necessary.
- Electric delivery center.
- Low voltage installation.
- Security installation.
- IT installation.

6. Preliminary material and equipment list

Material list

- Concrete
- Ready mix-concrete elements
- Electro Welded steel lath
- PN16 PE piping: DN25, DN32. DN40, DN50, DN63, DN75, DN90, DN110
- PN16 PPR piping: DN32, DN40, DN50, DN63, DN75, DN90
- PERT-Al-PERT piping: DN20, DN25, DN32
- PE fitting
- PE tubing
- Tubing connectors
- PPR fitting
- PERT-Al-PERT fitting
- Butterfly manual valves
- Ball manual valves
- Solenoid valves
- Motorized valves
- Electrical cabinets
- Switchboards
- Power wires
- Differential switches
- Magneto-thermal switches
- PMMA tubes for the photobioreactor columns
- PVC plates for the photobioreactor bases & lids
- Galvanized steel for the photobioreactor structure

Equipment

- Sand filter
- Microfiltration cartridges
- Compressors
- Air filtration
- Air dryer
- Treatment CO2 extraction unit
- See water pumps
- Reactor pumps
- Harvesting pumps

- Filling pumps
- Cross filtration feeding pumps
- Centrifugation feeding pumps
- Vitamins pumps
- Metals pumps
- Nitrates pumps
- Phosphates pumps
- pH sensors
- Temperature sensors
- Conductivity sensors
- Spectrophotometer
- Absorbance sensors
- Viscometer
- Geothermal heat pumps
- Heat exchangers
- Cross flow filtration unit
- Centrifugation unit
- Drying unit
- Extractor/purification unit
- Photobioreactors (tubes, bases and lids, structures)
- HTL Hydrothermal Liquefaction unit

<u>Lab list</u>

Furniture

- Wall bench
- Central bench
- Sinks
- Wall cupboards
- Lower cupboards
- Drawers under cabinet
- Chemical products cabinet

Equipment

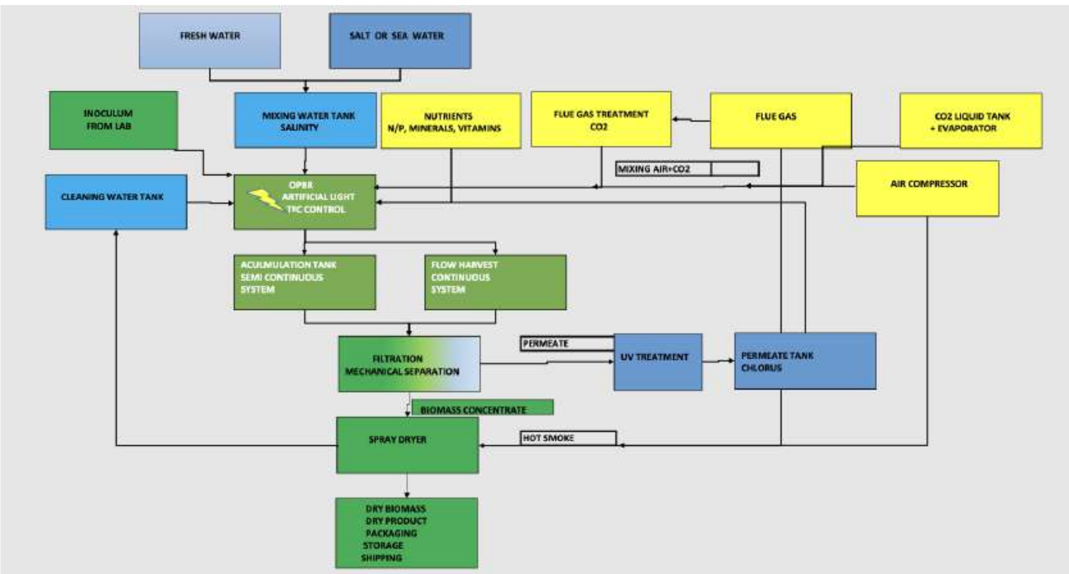
- Sterilization oven
- Autoclave
- Flow chamber
- Microscope
- Microcentrifuge
- Fridge
- Fridge
- incubator
- stove
- phosphate sensor

- nitrate sensor
- water filtering system
- Incubator stove
- Viscosimeter
- pHmeter
- Analytical balance
- Dishwasher
- Moisture analyzer
- Laminar flow cabin
- Gas extraction
- Fume hood air-conditioning unit
- UV Equipment
- PC
- Light and temperature control system
- Fluorescent lamps
- Spectrophotometer
- Grolux® spotlights
- Active carbon filtering
- 0.5-micron filtration
- Vortex
- Standard weights; scale
- Vacuum pump

Materials

- Test tubes
- Carboys 10 L
- Carboys 20 L
- Carboys 1000 L

7. Process description



1. Capture and treatment of the exhaust gasses from industrial flue gas. CO_2 extraction extraction with scrubbers separating SOx and NOx.

2. The CO_2 is first dissolved into the water then captured by the microalgae from artificial photosynthetic process in the PBRs.

3. Once the culture reaches the appropriate cell concentration, part of it is emptied, harvested out for processing.

4. The first stage of the downstream process is a mechanical separation of the water from biomass (microalgae cells) with centrifugation:

   - Water free of cells returned to the closed system; over 99% of the total water content is recycled back.
   - Concentrated biomass is wet.

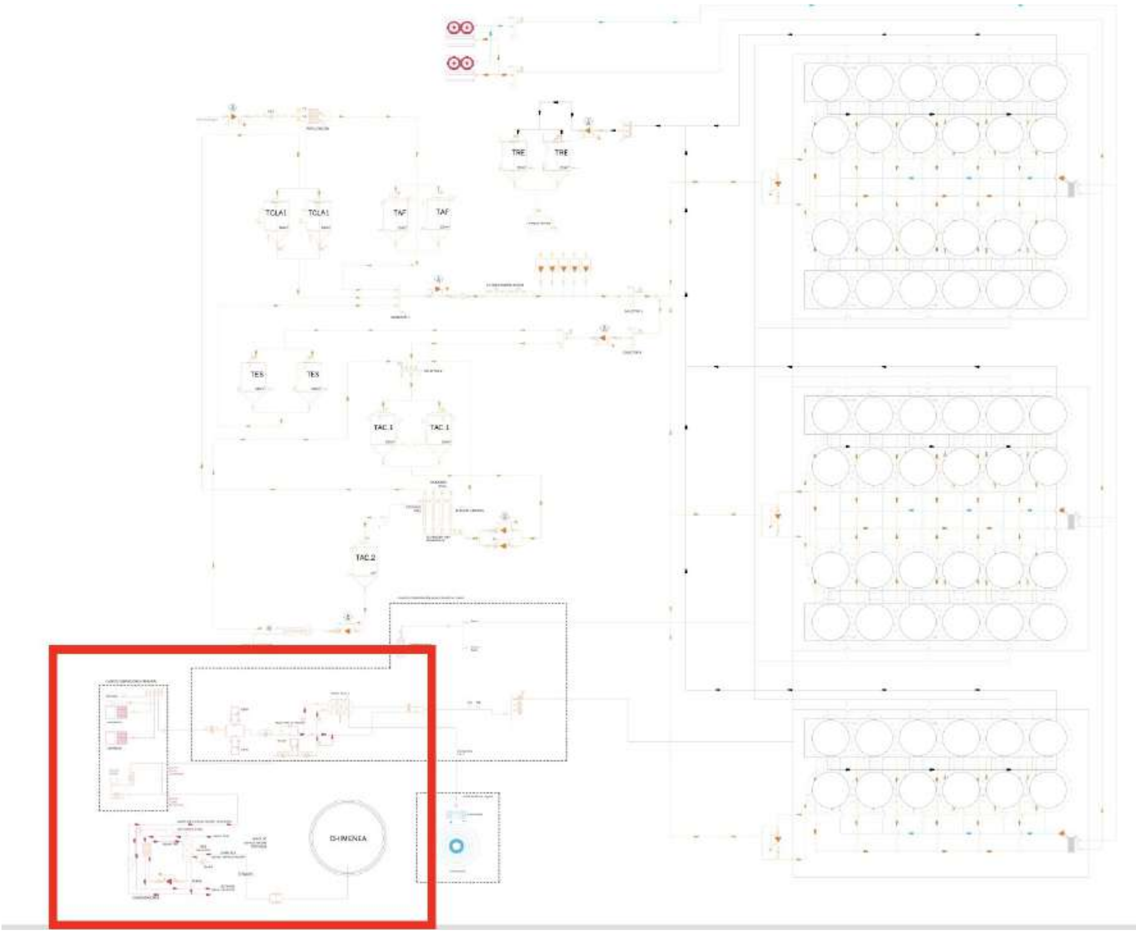
5. Once the concentrated biomass is obtained, product production begins.

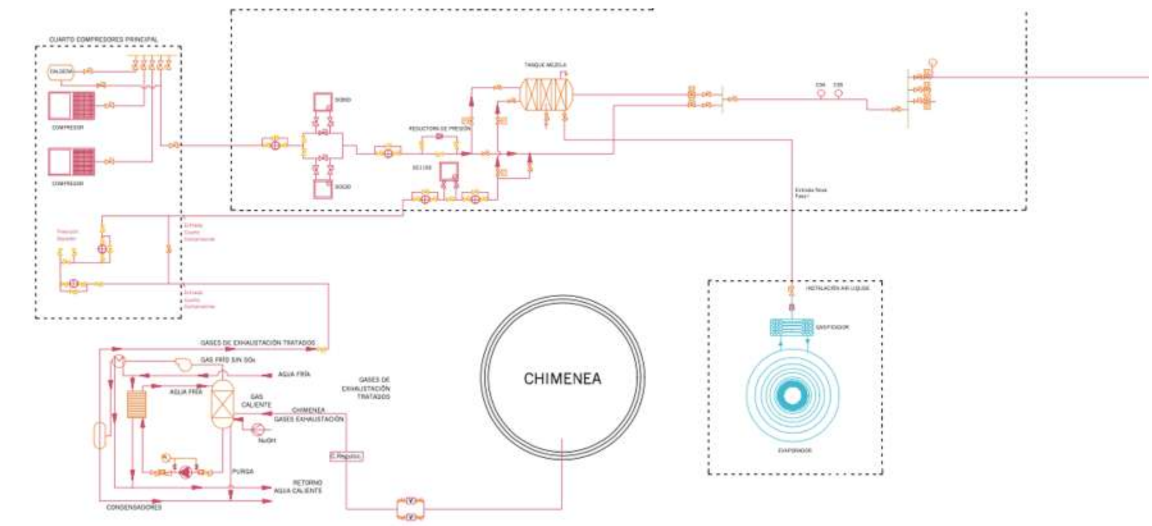
   - Nutraceuticals, cosmetic and pharmaceutical products are separated out.
   - The wet biomass obtained from the centrifuge is dried to produce fertilizer.
   - Biomass is also processed into crude oil through HTL (Hydrothermal Liquefaction)

6. Processes and culture growth are monitored and controlled by the central control unit. The central control unit is mainly composed of the industrial PC, the SCADA (Supervisory Control And Data Acquisition) and the electrical panel for the power of certain control components.

7. Sensors and detectors are installed throughout and accurately detect, measure, and monitor continuous CO_2 flow and quantity at the intake (source) and output. Equipment is from a German company called Dräger. The device features a display screen to provide real-time readings of CO_2 levels, amounts and have additional indicators or alarms to alert when concentrations reach certain thresholds to our PBR.

   CO_2 capture from flue gas to PBRs with sensors throughout





CUARTO COMPRESORES PRINCIPAL
TANQUE MEZCLA
REDUCTORS DE PRESIÓN
GASES DE EXHAUSTACIÓN TRATADOS
GAS FRÍO SIN SOx
AGUA FRÍA
AGUA FRÍA
GAS CALIENTE
CHIMENEA
GASES EXHAUSTACIÓN
NaOH
PURGA
RETORNO AGUA CALIENTE
CONDENSADORES
GASES DE EXHAUSTACIÓN TRATADOS
CHIMENEA
GASIFICADOR
EVAPORADOR

8. Engineering, procurement and construction

- Water:
  - Availability and capacity of seawater, brine (desalination plants), fresh water and brainy water.
  - Complete water analysis: pH, temperature, conductivity, salt concentration, carbonates, phosphates, ammonium, sulfates, nitrates, sodium, chloride, potassium, magnesium and some metals as Fe, Cu, Mo, Mn, Zn, B, Co.
  - Microbiology, submerged and floating macrophytes.

- Geotechnical:
  - Geotechnical study of the site, distance to the sea, phreatic zone, digging capacity, slope stability, plasticity index, cohesion, ground bearing capacity, compressibility, shear, standard penetration tests, elasticity module, Poisson's ratio.
  - Soil characteristics: inorganic substrate, minerals, soil type (sandy, chalky, stony), adhesion, absorption, erosion.

- Applicable regulations:
  - Pressure equipment regulations
  - Low and high voltage regulations
  - Building heating system regulations
  - Water supply and sanitation regulations
  - Technical Building Code or equivalent
  - Fire protection regulations
  - Telecommunication regulations
  - Need for Environmental Impact Assessment or equivalent
  - Standards for basic study of health and safety.
  - Environmental, noise, planning, waste and emissions regulations

- Civil work execution:
  - Slabs and concrete installation.
  - Trenches
  - Warehouse for process equipment, offices and lab
  - PBRs foundations, pavements and claddings
  - Tanks area

- Mechanical/electrical:
  - Connection to the major networks: sanitation, drinking water, medium/low

voltage, telecommunication

  - Electrical delivery/processing/transformation center.
  - Piping for liquids and gasses, manual valves, fitting, compressors and pumps
  - Fire protection: detection and extinction.
  - Sanitation network
  - Ventilation
  - Air Conditioning
  - Plumbing
  - Compressed air
  - Low voltage installation
  - Security installation
  - IT installation

- PBRs:
  - Vendor install PBRs
  - PBRs interior assembly and installation at site

- Tempering system: control and monitors culture temperature. Equipment to generate the cooling, i.e. the pipes, the valves, the pumps and the exchanger units.

- Mechanical separation: filtration and centrifugation of biomass.

- Control system: automates plant operations, monitoring, alarms. Includes all the sensors (temperatures, pH, nutrients concentration, flows, CO_2 percentage, levels), electrovalves, motor inverters, the SCADA, the communication between the SCADA and every component of the plant.

- Drier unit: dries and stabilizes the biomass after mechanical separation processes.

- Extraction unit: extract the high value products from the biomass post mechanical separation.

Carbon Optimum engages local engineering company to address regulatory requirements: environmental factors, local health and safety regulation, geotechnical characteristics of the land, mechanical characteristics, and applicable technical regulations. The local suppliers will be engaged for civil work and installing the mechanical facilities (electrical, hydraulic, and pneumatic). Carbon Optimum will engage with local PBR and component vendors. Local workers are hired for plant maintenance and support.

9. Plant residuals/waste

Two types of waste are generated at the plant:

- o Laboratory waste from the analysis and processing of samples.
- o Industrial waste generated in final product processing.

Authorized waste management firm will manage all laboratory and industrial waste. The industrial waste will be discharged through the regular sewage handled by local Waste Water Treatment Plant.

Laboratory waste includes:

- Acidic solutions (5% HCl in weight) and alkaline (sodium hydroxide 5% in weight) with absence of free solid waste.
- Analysis Reagents (absence of free solid waste) such as formalin (1% in weight) and etc.
- Uncontaminated empty glass container (absence of free liquid waste) as empty reagent bottles.

Industrial waste includes:

- Acidic and alkaline solutions used in the cleaning of the cross-flow filtration and centrifuge: sodium hydroxide solution (1% in weight) and hypochlorite (0.2% in weight), rinse water of sodium hydroxide / hypochlorite, acid solution (1% in weight) and rinse water of the acid solution.
- Aqueous solution with biodegradable enzyme product (P3-ultrasil 53) for cleaning the cross-flow filtration. Enzymatic product solution (0.5% in weight) and rinse water of the enzymatic solution.

The only source of gas emission occurs during the biomass drying process which includes solid particulates and odors. The equipment installed to minimize this type of emission is:

- An exhaust duct made in mild steel.
- A condensing scrubber connected with the exhaust duct, which is made in 304 stainless steel and a small recirculation pump for the scrubber liquid, a spray system for the humidifying section and a condensing section. The scrubber has a demister at the top to remove entrained droplets for the cleaned exhaust gas

stream exiting the scrubber.

- An exhaust fan installed downstream of the scrubber. It is a centrifugal fan with high tensile steel backward blades.

10. Construction and cost timing

CAPEX	$28,500,001
OPEX (year 1)	$32,975,196
Total Expenses	**$61,475,197**

ACTIVITY	Start	DURATION (work days)	End
FUNDED	1-Sep		
PLANNING	1-Sep	30	13-Oct-2024
CIVIL WORK			
Land movement, trenches and concrete slabs for PBRs	13-October-24	60	5-Jan-2025
Warehouse cleaning, renovations & improvements	13-October-24	45	15-Dec-2024
Tanks installations (water)	13-October-24	30	24-Nov-2024
Waste management	13-October-24	60	5-Jan-2025
Health and Safety	13-October-24	60	5-Jan-2025
INSTALLATIONS			
Office and Lab. Implementation (set up)	01-Nov-24	30	12-Dec-2024
Mechanical Installations	01-Nov-24	45	2-Jan-2025
Electrical Installations	01-Nov-24	45	2-Jan-2025
PBRS			
Structure and Mounting Kits	01-Nov-24	60	23-Jan-2025
Setup and Installation 200 PBRs	01-Nov-24	60	23-Jan-2025
PROCESS			
Downstream Operation - Installation of Filtration	02-Jan-25	30	13-Feb-2025
Installation of Mechanical Separation (centrifugation)	02-Jan-25	45	6-Mar-2025
Installation of Processing & Drying	1-Mar-25	45	2-May-2025
Control and Tempering System	15-Nov-24	45	16-Jan-2025
Treatment CO2	01-Nov-24	30	12-Dec-2024
INOCULUM AREA			
Inoculum set up tanks from 50 L to 10 000 L OPBR	01-Nov-24	30	12-Dec-2024
Inoculum set up tanks from 60 000 L OPBR - 120 000 L PBR (full scale)	01-Nov-24	30	12-Dec-2024

11. Staff and training

	Headcount year 1	at Full Scale
Plant Manager/Scientist	3	3
Assistant Plant Manager	2	2
Lab. technician/Engineer	3	3
CTO Technology and management	2	2
Workers, employees	12	18
Chief Maintenance	2	2
Maintenance	6	6
Engineering	2	2
Biologist & Chemical Dept.	3	3
Downstream Process (technician)	2	2
Downstream Assistant	5	5
Biotech CO2, drying, software	3	3
Handling, Packaging	10	12
TOTAL	**55**	**63**

The table represents the people involved in the day to day facility work. Local suppliers will supply material (valves, pipes, pumps, etc) and services (local health and safety regulation, environmental advisors, laboratories, etc).

The construction requires:

- Local companies for: the civil works, geotechnical studies of the land, mechanical, electrical and pneumatic installations, guaranteeing Health and safety during the construction.
- PBR vendor for installations.

Training:

1. The Plant manager, Engineer and biologist will do their first phase training at the Jeffrey's plant addressing: mechanical installation, electrical installation, reactors, etc.
2. Shift Manager and Operator: Their training starts at the same time plant construction

starts covering civil work, mechanical installation, electrical installation and reactors, to be able to carry out the maintenance of the plant and fix any kind of problem that occurs.

3. Biologist and lab technician: Carbon Optimum biological staff is there to launch microalgae growth and trains additional staff when facility is up and running