EDEN ENGINE

CO_2 Based Food Production

Phase 1 Whitepaper

December 2025

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Introduction

The global food system depends on farmland, seasonal weather, unpredictable supply chains, and resource intensive crops. This system has reached a limit. Land degradation, water shortages, and rising climate pressure affect every region of the world.

Eden Engine introduces a new approach. A compact reactor capable of converting CO2 directly into sugar. No farmland required. No growing season. No soil or sunlight. The goal is a fully controlled synthetic food production system that reduces environmental impact while increasing food security for every region of the world.

This whitepaper presents the vision, fundamentals, and global potential of the Eden Engine Phase 1 system.

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The Problem

Sugar is one of the most widely used ingredients on the planet. It is found in beverages, bakery products, packaged foods, pharmaceuticals, and thousands of consumer goods. Despite its low cost, the environmental footprint of sugar is enormous.

Today sugar production requires:

• More than fifty million acres of farmland
• Massive water consumption
• Heavy fertilizer use
• Large fuel inputs for planting, harvesting, and transport
• Deforestation in developing countries
• Volatile supply chains vulnerable to drought and weather events

The world needs a cleaner, more reliable source of essential food ingredients.

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The Eden Engine Vision

The Eden Engine is designed to create a future where food does not rely on agricultural land. Instead, essential ingredients are produced in small, modular systems powered by clean electricity. The long term vision supports:

• Rewilding millions of acres of farmland
• Reducing CO2 emissions at industrial scale
• Creating resilient food systems for populated regions
• Enhancing global stability by reducing dependence on commodity crops
• Enabling off grid and space based food production

The Eden Engine serves as the foundation for a post agricultural food system that supports humanity while restoring ecosystems.

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What the Eden Engine Does

Phase 1 of the Eden Engine focuses on producing sugar directly from CO2. The system uses electricity, water, and small amounts of nutrients to create food grade carbohydrates. The process does not use plants, farmland, or photosynthesis.

At its core, the system performs three functions:

1. Capture CO2
Ambient air or industrial exhaust is introduced into the system.

2. Convert CO2 into simple carbon building blocks
Clean energy drives a controlled reaction that transforms CO2 into useful carbon intermediates.

3. Assemble the carbon into sugar
A proprietary closed loop process creates high purity sugars that can be integrated directly into food manufacturing.

The technology builds on established scientific principles while introducing a new commercial architecture that allows continuous operation, modular scale, and real world reliability.

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Why Sugar First

Sugar is an ideal first target for CO2 based food production because:

• The chemistry is well understood
• Food companies use sugar in almost every product category
• Sugar has simple molecular structure compared to proteins and fats
• The demand is global and constant
• Factories can adopt on site production without changing recipes
• Sugar represents one of the largest agricultural land uses on Earth

If sugar can be produced sustainably without farmland, the impact extends far beyond a single ingredient.

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Global Impact

The Eden Engine Phase 1 system is designed to deliver measurable environmental benefits.

Land Restoration
Replacing agricultural sugar production could rewild more than fifty million acres of land worldwide.

CO2 Reduction
The system converts CO2 into food ingredients. When paired with renewable energy, this becomes a carbon negative process.

Water Conservation
Sugarcane is one of the most water intensive crops in the world. The Eden Engine uses only small amounts of water, most of which is recycled internally.

Reduced Supply Chain Emissions
Producing sugar inside factories eliminates long distance transport, milling, processing, and storage emissions.

Resilience and Stability
Regions facing drought, soil depletion, or unstable agricultural yields can maintain a steady and secure food supply.

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How the System Works
A High Level Overview

The process is designed to be simple for operators while maintaining advanced chemistry inside the reactor.

Step 1
CO2 Intake
The system draws CO2 from ambient air or from an industrial source.

Step 2
Energy Conversion
Clean electricity powers a controlled reaction that transforms CO2 into carbon based molecules suitable for food production.

Step 3
Closed Loop Carbon Assembly
A proprietary modular system converts these molecules into sugars such as glucose, fructose, and sucrose.

Step 4
Output and Integration
Factories receive liquid or dry sugar that can be fed directly into existing production lines. No change to recipes or equipment is required.

This architecture allows simple installation and reliable operation without the complexity of biological agriculture.

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Design Principles

The Eden Engine follows four core design principles.

Modular
Systems can be installed as single units or scaled into arrays for large facilities.

Closed Loop
Water and nutrients are recycled internally for minimal waste.

Fully Controlled
Every input and output is measured and optimized through onboard intelligence.

Energy Flexible
The system can run on solar, wind, grid, or future advanced energy sources.

These principles allow the Eden Engine to operate in diverse environments including urban centers, rural food plants, and extreme off grid locations.

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Roadmap

The Eden Engine is built in structured phases.

Phase 1
CO2 to Sugar Reactor
Prototype development
Energy optimization
Industrial pilot programs

Phase 2
Structured Food Components
Expansion into fruit tissue and more complex food structures

Phase 3
Global Deployment
Installation in food factories worldwide
Large scale environmental restoration

Phase 4
Space and Off Grid Systems
Closed loop food production for extreme environments and exploration missions

The long term mission is a fully programmable food production platform.

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Eden Engine as a Company

Eden Engine is a deep tech climate company built to deliver the next generation of food production systems. Our mission is to remove the environmental burden of agriculture while increasing access to food worldwide.

We are developing technology that converts CO2 into essential food ingredients using clean energy and fully controlled systems. Our goal is to provide a reliable, scalable, and sustainable solution that supports global food security while restoring ecosystems.

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