

Proof of Concept for the E3i BioRefinery®

Innovative Solutions for Sustainable Bioenergy

The E3i BioRefinery[®] merges science and technology for efficient bioenergy production, focusing on financial and environmental stewardship. This document highlights its principles, innovations, and contributions to affordable renewable energy.

Introduction

Renewable energy is crucial because fossil fuels have limitations and pose risks. The E3i BioRefinery[®] quickly transforms organic material into liquid fuels and energy using advanced technology.

Core Principles

The E3i BioRefinery[®] is built on three principles: Efficiency, Environmental Stewardship, and Innovation.

Efficiency

Designed to maximize biogenic and hydrocarbon waste conversion with maximum feedstock utilization, the E3i BioRefinery[®] uses optimized processes and advanced engineering for high efficiency.

Environmental Stewardship

By using locally sourced feedstock and eco-friendly technologies, the biorefinery minimizes its carbon footprint and employs wasteto-energy processes that maximizes sustainability and reduces hazardous emissions.

Innovation

Incorporating the latest advancements in bioenergy production, the E3i BioRefinery[®] is a hub of innovation, from its AI assisted state-of-the-art material recovery facility (MRF) to its novel and highly-efficient pyrolysis process.

Technological Innovations:

The refinery's key technologies include:

Advanced Material Recycling Processes

Efficiently sorting solid waste through optimized AI systems with precision accuracy.

Pyrolysis Process

Using one-of-a-kind, specially designed pyrolysis process, E3i transforms complex carbon-based materials to high hydrogen rich gas and transportation-grade liquid fuels.

Transforming Waste into Commercial Products

The system converts municipal solid waste into products through the E3i biomass conversion process, yielding biochar (potentially graphene), wood vinegar (organic insecticide), and potable or agricultural grade water.

System Process Testing and Fuel Certification

The E3i BioRefinery[®] was tested in the United States at scale and resulting fuels were certified by two international independent laboratories in 2020.

Virtual Biorefinery Processing Testing

In 2020 E3i undertook the process of locating and securing each commercial-grade subsystem which would be used in the E3i BioRefienry® process. Specifically:

- Municipal Solid Waste (MSW) Collected (residential and commercial/retail waste)
- MSW Sorting via an AI Supported State-of-the-Art Material Recovery Facility (MRF)
- MSW Sizing via a State-of-the-Art Energy Feedstock Milling System
- Industrial Drying System Capable of Reducing Moisture Content to Spec.
- Industrial Pelletizing System Capable of Producing Spec. Feedstock Pellets
- Material Molecular Analyzing System Capable of Testing 100% of the Feedstock Volume
- Novel Pyrolysis System Which Converts the Solid Waste Feedstock to Syngas
- Gas to Liquid Process Which Reconstitutes the Syngas into Liquid Fuel
- Fuel Polishing System Which Upgrades the Fuel to Transportation-Grade ASTM D975 and EN590 Specs

With permission from the operator and manufacturers, E3i processed 50,000 lbs of MSW, producing 10,000 lbs of pellets converted into renewable diesel fuel using their pyrolysis system.

The subsystems used in the 2020 virtual test will be implemented at each E3i BioRefinery[®]. These subsystems have demonstrated effective performance in commercial environments. The test allowed E3i and its consultants to assess the integration of these subsystems for future installations.

Diesel Fuel Certification

Samples of the renewable diesel were tested by two major independent international labs. Both confirmed it met U.S. ASTM D975 standards and EU EN590 standards. This fuel was identical to fossil diesel, but not derived from crude oil.

Process and System Guarantees

Manufacturers Warranties

E3i receives a warranty from each subsystem manufacturer ensuring their subsystem meets standards during the plant commissioning for 30 days and the first year of operation. If it fails, the manufacturer will fix it at their expense within their liability limit.

Subsystem Integration Warrantee

A 115-year-old company, also the parent of the plant's O&M contractor, manufactures primary subsystems for the biorefinery. Their integration warranty ensures all subsystems work together as designed to produce renewable fuel. If an integration issue arises, they will resolve it at their expense up to their liability limit.

Technology Performance Wrap

An international insurance company issued a Technology Performance Wrap (TPW) policy for E3i's biorefinery plants after a 3-year study. The TPW covers the first 10 years of operation, supports performance beyond warranties, and provides financial support for operational costs and debt service, aiding the project lender with bridge funds in case of default until permanent solutions are found.

Process Trademarks and Utility Patents

United States Process Trademark

E3i applied for and in 2022 E3i was granted a Trademark from the United States Patent and Trademark Office (USPTO) for "E3i BioRefinery®".

United States Utility Patent

E3i applied for and in 2024 E3i was granted a process Utility Patent from the United States Patent and Trademark Office (USPTO) for E3i BioRefinery® "process".

International Utility Patent

E3i has a pending process utility patent from the European Patent Office for its "E3i BioRefinery® process". Their renewable diesel fuel is officially approved by the UK Department of Transport's RTFO agency. E3i is also pursuing a global patent through the PCT system.

Independent Process Evaluations

Independent Engineering Reviews

The E3i Biorefinery system has been reviewed and approved by several independent engineering teams, including TPW insurance underwriters, a global environmental certification consultancy, an independent engineering consultancy, the project's engineering and design firm, and the project's EPC contractor. Additionally, E3i is registered with a leading global certification organization that supports sustainable production systems.

Potential Impacts

The E3i Biorefinery's contributions to the renewable energy landscape include:

Energy Security

Providing a reliable source of renewable energy to enhance local and global energy security.

Economic Benefits

Generating economic benefits through job creation, local investments, and promoting bioenergy products. This sector presents significant investment potential by offering returns on sustainable projects, enhancing local economies, and contributing to global energy solutions. Investors can find opportunities in innovative technologies and growing market demands for renewable energy sources.

Environmental Impact

Reducing greenhouse gas emissions and promoting sustainable practices to mitigate climate change and preserve ecosystems.

Conclusion

The E3i BioRefinery[®] sets a new standard for bioenergy production with its commitment to efficiency, environmental stewardship, and innovation. It plays a significant role in the transition to renewable energy sources, offering visionary and practical proof of concept.