CMS

Clean Marine Shipping

BioH2Energy: GHG Reduction Hydrogen Maritime Hub for Decarbonisation at the Port of Port Louis

Isabela Tatu

Current Analysis

Decarbonisation of shipping & GHG reduction

Technology

Circular bio-derived fuels conversion to hydrogen for fuel cells

Implementation

Maritime Integration and adoption

Further Discussion

Introduction

Clean Marine Shipping (CMS) examines the potential of utilising circular bio-derived fuels for energy conversion employing hydrogen technologies (BioH2Energy) as a strategy for decarbonising maritime and port operations at the port of Port Louis, Mauritius.

Objective: To reduce GHG emissions and enhance sustainable development in Port Louis by integrating CMS technology to convert organic waste into valuable energy resources.

Clean Marine Shipping

1. Technology
2. Hydrogen Fuel Cell
3. Alkaline
4. Bio-derived Fuels
5. IP
6. Exclusivity

Isabela Tatu

25+ years in shipping and trading, metals, fuels and renewable energy. Led industry transitions and decarbonization efforts for 7+ years. Women in Hydrogen 50, TedX Impact Speaker

Nicholas Abson

British-born fuel cell expert, active in EU commission committees and academic research for 20+ years. Specializes in innovative fuel cell tech since the 1990s

Competitive & Unique Advantages

- Modular Alkaline Fuel Cell
- Large Electrode
- Liquid Electrolyte
- Exceptional Lifespan
- Lower Precious Metal
- Heat Generator
- Robust & Adaptable Design
- Water Source
- Non-exotic Materials
- Flexible Manufacturing

Technology Process

01

02

03

Waste-to-gas conversion

The initial process involves converting MSW, composed of organic materials such as food waste and processing waste, into a gaseous product through thermal decomposition.

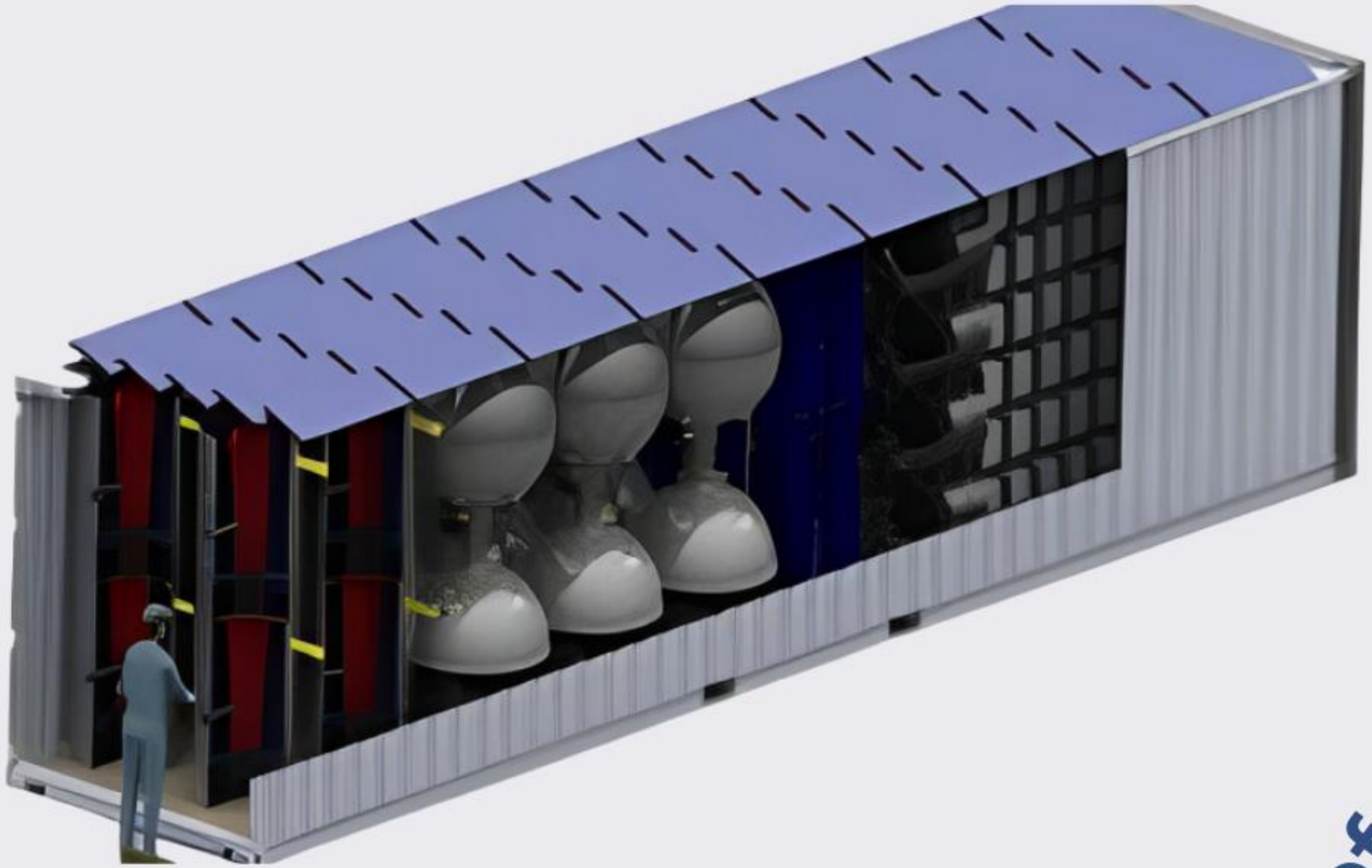
Gas-to-hydrogen conversion

The syngas produced during gasification undergoes further processing to increase hydrogen yield through the water-gas shift reaction.

Hydrogen-to-electricity

Hydrogen is converted into electricity using electrochemical processes, specifically fuel cells, known for their efficiency and safety.

Technology Process



Project Objective

The primary aim of this project is to utilise municipal solid waste (MSW) as a resource to eliminate CO2 and other greenhouse gases (GHGs) produced by the Port of Port Louis. By leveraging circular bio-derived fuels and hydrogen technologies the project seeks to decarbonise port operations, support maritime activities, and contribute to the broader environmental and economic goals of Mauritius.

Key Goals

Powering the Port

- Utilise advanced technologies to convert MSW into clean energy.
- Implement "cold ironing" to supply power to ships at berth.
- Ultimately, provide power to ships at sea.

Technological and Economic Development

- Develop and deploy advanced waste-to-energy technologies.
- Build local skills and manufacturing capabilities.
- Create economic benefits and support national sustainability objectives.

Environmental and Economic Impact

01 Emission Reduction

- GHG Reduction:
  - The 100-kWh system is expected to reduce overall greenhouse gases by eliminating approximately 1 ton of CO2 per day.
- Cost Efficiency:
  - The system will lower electricity costs and generate a revenue stream from bi-products, contributing to the economic sustainability of the port operations.

02 Future Technological Integration

- As the project progresses, other technologies such as anaerobic digestion and fermentation will be integrated to enhance waste processing and energy production capabilities.

Implementation Strategy

A 100kW BioH2Energy system will be installed at the port of Port Louis, with plans to expand to multiple megawatts systems

Phase 1: Initial System Establishment

Phase 2: Scaling and Expansion

Phase 3: Maritime Integration

Phase 4: Strategic Fuel Bunkering and Maintenance

Implementation Process

Implementation Initial Facility	• Initial Production Capacity: ∘ The first facility will have an initial production capacity of 100 kW per hour, translating to 2.4 MW per day. • Growth Timeline: ∘ Expansion of the facility will commence in the second year, with growth continuing as required to meet increasing demand and project milestones.
Purpose and Objectives	• Technology Trial: ∘ The primary objective of the initial 100 kW facility is to trial the technology. This includes assessing its technical performance, economic sustainability and effectiveness in emission reduction. • Skill Development: ∘ The facility will serve as a training ground, building the necessary skills among local personnel to operate and expand the technology.

First Steps in Implementation

1 System Overview

- Generation System Configuration:
  - The initial 100 kW generation system will be housed in a 40-foot shipping container, strategically located near the port's electrical distribution facility. This container will include:
    - Thermal gasifier
    - Gas conversion reactor
    - Gas separator
    - Aluminium hydrogen reactor
    - Fuel cell system
    - CO2 compressor
    - DC/AC electricity conversion inverter

2 Fuel Supply and Location

- Fuel Supply Chain:
  - Fuel for the generation system will be provided from a 20-foot container located at the waste collection site. This container will house a macerator and pelletiser to process the waste.
  - The main system components (gasifier, gas separator, fuel cell, and ancillary equipment) will be contained in the 40-foot container situated at the port.

3 Construction and Skill Transfer

- Construction Timeline:
  - The system will be constructed over an 18-month period.
- Skill Development:
  - During the construction phase, skills will be transferred to system operators and next-stage constructors to ensure local expertise in managing and expanding the technology.

4 Operational Readiness

- System Completion:
  - The system will be fully integrated, covering all processes from fuel production to energy output.
- Testing Phase:
  - A 12-month period will be dedicated to testing and skill development. During this time, additional systems will be planned for deployment, based on the initial system's performance and outcomes.

Deliverables for 100 kW Pilot Project

Electricity

- Annual Production: 876 MWh
- Total Lifetime: 10 years.

Water

- Annual Production: 12,264 m^3.

Bio Char

- Annual Production: 292 tons.

CO2 Reduction

- Annual Reduction: 72 tons through reformation of MSW compared to incineration.

Landfill Displacement

- Annual Displacement: 730 tons of MSW diverted from landfill.

Refrigerant Dry Ice

- Annual Production: 1,634 kg.

Expected outcomes with

CMS' TECHNOLOGY

Cost Reduction: Operational cost reductions through fuel savings and waste management efficiencies

Environmental Benefits: The system reduces emissions and decrease the volume of waste sent to landfills

Job Creation and Skill Development: The construction and operation of the BioH2Energy facilities will create jobs, reducing local unemployment rates and boosting the economy.

Revenue Generation: Projected to generate revenue from Electricity, water, bio char and dry ice

Thank You

For watching

Contact us

Isabela Tatu

Phone

+447971476386

Email

info@cms-ltd.co

www.cleanmarineshipping.co