Compact Syngas Solutions MicroHub: Delivering Decentralised Biomass Energy for Agro-Industry

850°C	4+	3	8
Peak gasification temperature — converts biomass to syngas	Distinct value streams from a single biomass input	Primary Outputs - Syngas, Biochar & residual by-products	Sequential process stages from feedstock to clean energy

OVERVIEW

What is Gasification?

Gasification is a thermochemical process that converts solid biomass, such as agricultural residues, wood waste, or tea prunings, into a combustible gas known as syngas (synthetic gas). Unlike combustion, which involves burning materials in excess oxygen, gasification takes place in a controlled environment with a limited supply of oxygen. This allows the biomass to break down into useful energy carriers rather than being fully burned.

Through this process, biomass is converted into three main outputs:

1. A combustible gas (syngas)
2. A carbon-rich solid (biochar)
3. Residual by-products (ash and condensates)

The syngas is then used as a fuel to generate electricity and thermal energy, making it well-suited to industrial applications such as tea processing. Together, these outputs create **four distinct value streams**: energy generation (heat and power), carbon sequestration, soil improvement and operational cost savings.

THE TECHNOLOGY

Compact Syngas Solutions MicroHub

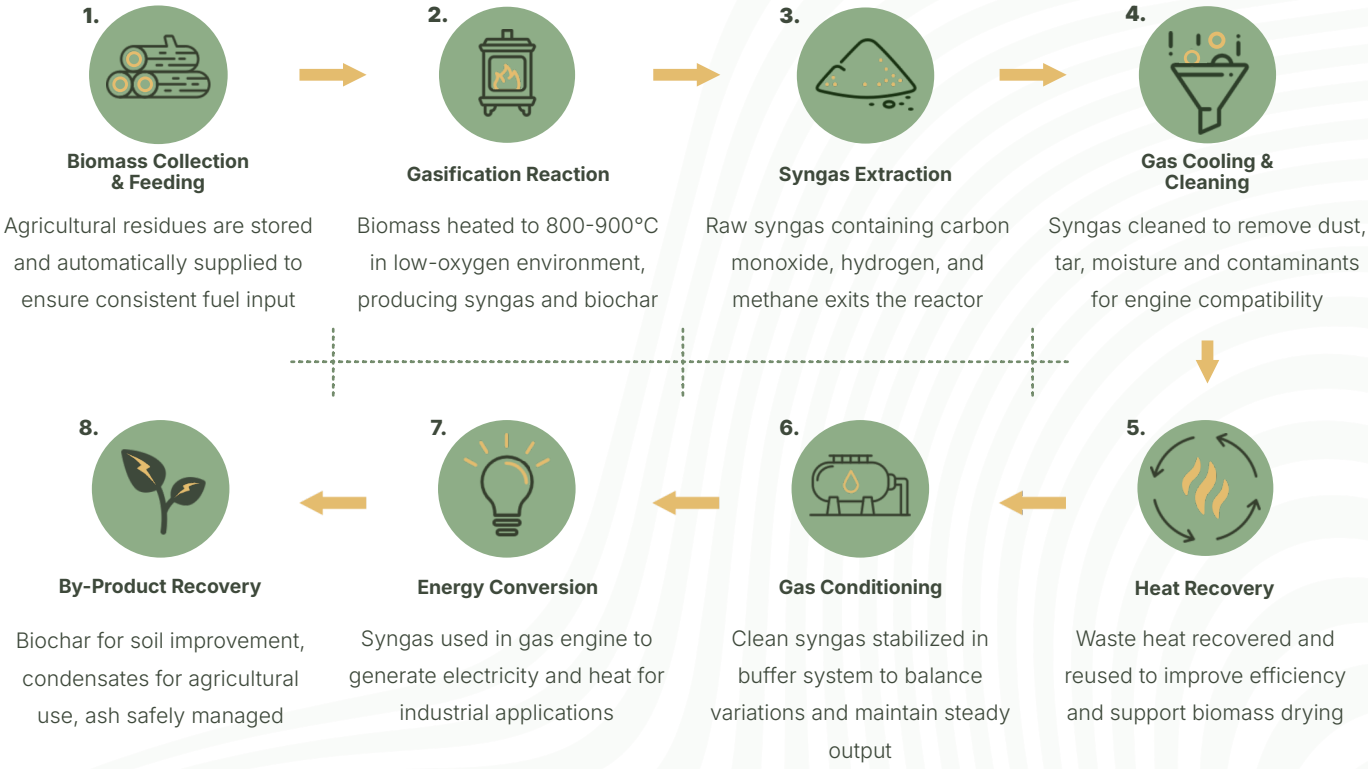
The **MicroHub** system developed by **Compact Syngas Solutions** is a modular biomass gasification platform designed for decentralised industrial energy generation. The system enables continuous, reliable industrial energy generation using locally available agricultural biomass. It integrates:

1. Automated biomass feeding
2. High-temperature gasification reactor
3. Gas cooling and cleaning system
4. Heat recovery components
5. Syngas buffering and conditioning
6. Engine-based power generation
7. Biochar recovery system

STEP-BY-STEP PROCESS

How the System Works

The MicroHub System



TECHNICAL COMPARISON

Gasification vs Pyrolysis

Understanding biomass conversion pathways for sustainable agriculture.

Feature	Gasification (MicroHub)	Pyrolysis
Oxygen Level	Limited oxygen	No oxygen
Main Purpose	Produce fuel gas for energy	Break biomass into material fractions
Main Output	Syngas (fuel gas)	Bio-oil, biochar, gases
Energy Use	Direct electricity + heat generation	Indirect / further processing required
System Output	Engine-ready fuel gas	Mixed outputs, not directly engine-ready
Co-product	Biochar	Biochar + bio-oil
Application Focus	Industrial energy systems	Fuels, materials, chemical feedstocks

Summary

This lighthouse demonstration, delivered through the **United Nations Industrial Development Organization (UNIDO) Accelerate-to-Demonstrate (A2D) Facility**, showcases the practical application of biomass gasification in industrial tea processing.

Implemented in partnership with **Browns Plantations Kenya Limited**, **International Institute of Tropical Agriculture** and **Supivaa Advisory Group**, the project demonstrates how **modular, decentralised energy systems** can deliver reliable **heat and power** using locally available biomass.

The system converts agricultural residues into **three primary outputs**, syngas, biochar and residual by-products, which are then utilised to generate heat and power for industrial use. Together, these outputs create **four distinct value streams** through energy generation, carbon sequestration, soil improvement and operational cost savings. This integrated approach **reduces emissions, lowers operational costs and strengthens energy resilience**, while also incorporating agronomic, environmental and social considerations.

As demonstrated through the **Greener Tea Project**, this model provides a **scalable pathway for decarbonising agro-industrial sectors**, with strong potential for replication across different industries and geographies.

About the Greener Tea Project

The Greener Tea Project is supported by the United Nations Industrial Development Organization (UNIDO) through its Accelerate-to-Demonstrate (A2D) Facility, advancing scalable, low-carbon energy solutions for industrial applications. The project focuses on replacing fuelwood with sustainable biomass systems to deliver reliable heat and power for tea processing while reducing emissions and costs.

Learn more, explore the technology and follow project progress at:

www.greener-tea.africa or contact info@greener-tea.africa

Project Partners

LEAD PARTNER

Compact Syngas Solutions: UK-based clean technology company and system integrator delivering the MicroHub gasification platforms.

www.syngas-solutions.co.uk

PROJECT HOST (KENYA)

Browns Plantations Kenya Limited: Host site and end-user, enabling real-world deployment within tea processing operations.

www.brownsplantations.co.ke/browns-plantation-kenya/

IN-COUNTRY PARTNERS (KENYA)

International Institute of Tropical Agriculture: Technical and research partner supporting biomass and environmental validation.

www.iita.org

Supivaa Advisory Group: Stakeholder engagement and GEDSI integration.

www.supivaa.com

Experience the Technology

Explore the MicroHub system through the Compact Syngas Solutions app, including an interactive virtual walkthrough and project content.

App download details are available via: www.greener-tea.africa

Acknowledgements

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