INTEGRATED ORGANIC SOLID WASTE MANAGEMENT FOR ZERO LANDFILL AND WASTE TO ENERGY

GREEN POWER

to utilize the CONVERTEUR system for CSR production and ADVANCED SMOLDERING for energy generation.

Presented by
GIE Africa AgroBio
www.africa-agrobio.com

INTEGRATED “ORGANIC SOLID WASTE” MANAGEMENT

ORGANIC SOLID WASTE

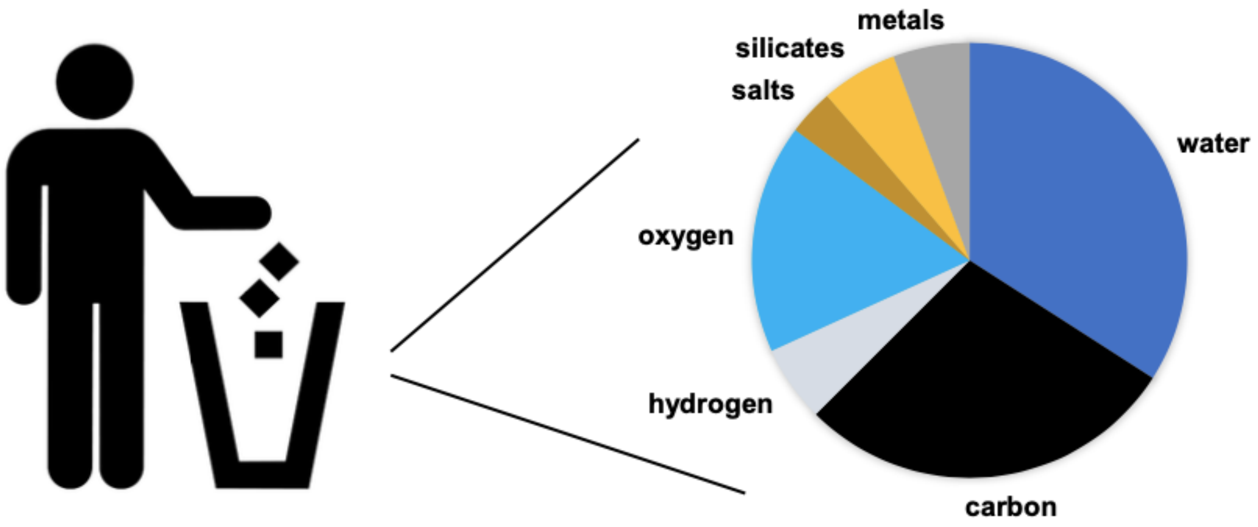
Organic Solid Waste refers to biodegradable waste materials derived from living organisms, including food scraps, yard waste, agricultural residues, and other organic materials that can decompose through biological processes.

These materials are often managed through composting, anaerobic digestion, or other waste treatment processes aimed at recycling nutrients and generating energy.

ORGANIC SOLID WASTE COMPOSITION

The main components of solid organic waste are:

- **WATER**, making up between 20% and 60% of their weight
- **CARBON**, **HYDROGEN**, and **OXYGEN**, accounting for between 40% and 60%
- **METALS**, **SALTS**, and **SILICATES**, making up between 5% and 20%



INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

Overview of current waste management practices

- Landfill
- Sorting & recycling
- Incineration
- Composting
- Anaerobic Digestion

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

Environmental Impact
Landfills risk groundwater contamination, methane emissions, and ecosystem disruption.

Space Limitations
Finding suitable land is difficult, especially in populated or sensitive areas.

Regulatory Compliance
Meeting strict environmental regulations is costly and time-consuming.

Public Opposition
Communities often oppose landfills due to health, odor, and property concerns.

Long-Term Management
Landfills require costly, ongoing management even after closure.

Financial Costs
Development and maintenance involve significant financial investment.

Waste Diversion Pressures
Growing emphasis on waste reduction challenges landfill viability.

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

Health Risks

Environmental pollution leads to serious health issues, including respiratory and cardiovascular diseases, especially in vulnerable groups.

Air Pollution

Air pollution from industries, vehicles, and agriculture harms health and contributes to climate change, requiring stricter regulations and cleaner technologies.

Soil Pollution

Soil pollution degrades land and contaminates the food chain, threatening food security and ecosystems, needing sustainable management.

Water Pollution

Water pollution contaminates drinking water and harms aquatic life, necessitating better wastewater treatment and protection of water sources.

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

Complexity
Diverse plastic types and grades complicate sorting and recycling.

Contamination
Food residues and other contaminants reduce recycling quality and efficiency.

Economic Viability
High recycling costs and lower value of recycled materials often make virgin plastics more attractive.

Infrastructure
Insufficient recycling facilities and technologies hinder effective plastic recycling.

Quality
Recycled plastics often have lower quality, limiting their use in high-value applications.

Public Awareness
Low public awareness and improper disposal practices affect recycling effectiveness.

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

Contamination

Glass can be contaminated with other materials, reducing the quality of recycled glass and complicating sorting processes.

Fragility

Broken glass can pose safety risks and challenges during sorting and processing, requiring careful handling.

Economic Feasibility

Recycling glass can be costly due to the need for specialized facilities and technologies, impacting economic incentives.

Limited Market

The market demand for recycled glass can be limited, affecting the profitability and sustainability of recycling programs.

Sorting Complexity

Different colors and types of glass need to be sorted accurately to ensure high-quality recycling, which can be labor-intensive and complex.

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

Contamination

Metal waste often includes non-metal materials or mixed metals, complicating sorting and reducing the quality of recycled metals.

Complex Alloy Composition

Various metal alloys require different processing methods, making it challenging to separate and recycle them efficiently.

Economic Viability

High costs associated with advanced sorting technologies and processing can impact the economic attractiveness of recycling metals.

Infrastructure Limitations

Insufficient recycling facilities and technologies can hinder effective metal recycling and processing.

Market Demand

Fluctuating demand for recycled metals affects the profitability and sustainability of recycling efforts

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

Emissions
Incineration releases pollutants, including greenhouse gases and toxic substances, which can harm air quality and contribute to climate change.

Ash Disposal
The process produces residual ash that can be hazardous and requires careful disposal or treatment, posing environmental and health risks.

High Costs
Building and operating incineration facilities can be expensive, including costs for technology, maintenance, and compliance with regulations.

Limited Waste Reduction
Incineration reduces waste volume but does not eliminate it entirely, and it can sometimes encourage continued waste production rather than reduction.

Public Opposition
Community concerns about health risks and environmental impact can lead to opposition and delays in facility development.

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

Contamination
Non-organic materials, such as plastics and metals, can contaminate compost, affecting its quality and usability.

Maintenance
Effective composting requires regular turning, moisture control, and temperature management, which can be labor-intensive and complex.

Space Requirements
Composting needs sufficient space and infrastructure, which can be challenging in urban areas or for large-scale operations.

Odor Management
Improperly managed composting can produce unpleasant odors, which may lead to complaints from nearby residents.

Slow Decomposition
The composting process can be slow, requiring time for organic materials to break down into usable compost, which can limit its efficiency.

INTRODUCTION TO WASTE MANAGEMENT CHALLENGES

KEY CHALLENGES

High Initial Costs

Setting up anaerobic digestion systems involves significant capital investment in infrastructure and technology.

Complex Operation

The process requires careful management of temperature, pH, and feedstock composition to maintain efficiency and prevent system failures.

Sludge Management

Digestate, the byproduct of anaerobic digestion, can require additional treatment or disposal, posing management challenges.

Gas Handling

The system produces biogas, which needs to be effectively captured, processed, and utilized to ensure safety and efficiency.

Limited Feedstock Variety

Anaerobic digestion works best with specific types of organic waste; feedstock with high levels of contaminants or variability can reduce performance and efficiency.

REGULATORY CONTEXT

United Nations Sustainable Development

United Nations Sustainable Development Goals (SDGs)

SDG 12: Focuses on substantially reducing waste generation through prevention, reduction, recycling, and reuse by 2030.

SDG 13: Emphasizes integrating climate change measures into national policies, including reducing CO2 emissions through improved waste management.

Summary

These international objectives align with the goals of the Energy Transition Law for Green Growth, reinforcing the commitment to sustainable waste management, reducing greenhouse gas emissions, and promoting a circular economy.

THE NEED FOR INTEGRATED WASTE MANAGEMENT

WHY A NEW APPROACH IS NEEDED

Traditional waste management methods are inefficient, unsustainable, and struggle to meet evolving regulations.

An integrated approach addresses these issues by improving efficiency, promoting sustainability, and ensuring regulatory compliance.

INTRODUCTION TO INTEGRATED WASTE MANAGEMENT

This approach aims for **Zero Landfill** by minimizing waste sent to landfills and promoting **Waste to Energy**, where non-recyclable waste is converted into energy.

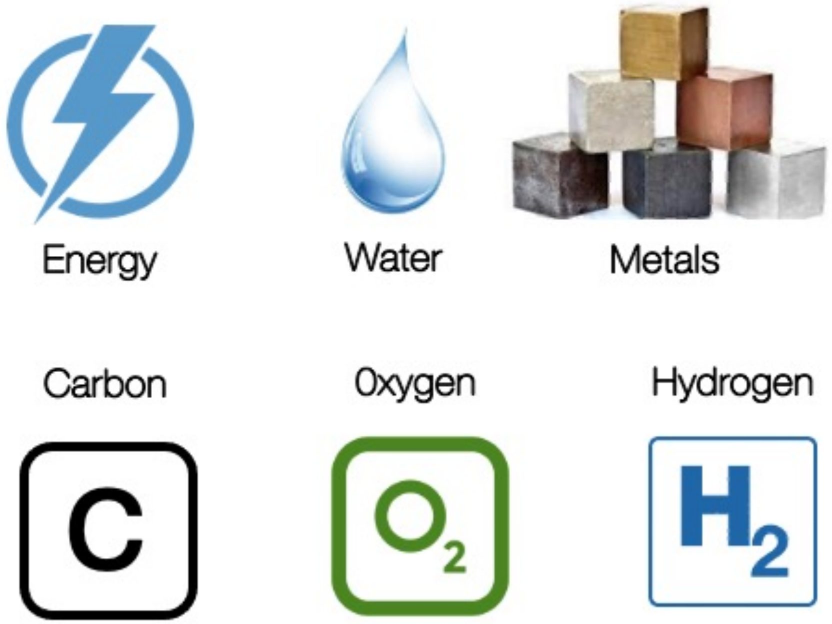
Together, these strategies form a comprehensive solution to modern waste management challenges, supporting environmental goals and resource efficiency.

OUR GREEN POWER
INTEGRATED WASTE MANAGEMENT APPROACH

ORGANIC SOLID WASTE

ABANDONED WEALTH

Organic solid waste is an important economic resource due to the valuable content found in its raw materials.



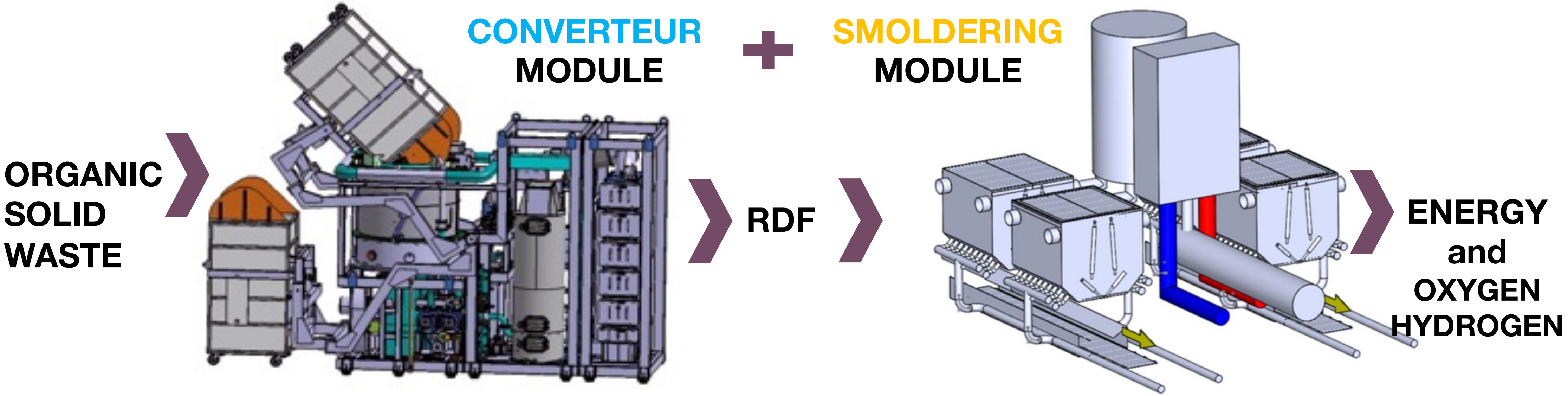
OUR GREEN POWER
INTEGRATED WASTE MANAGEMENT APPROACH

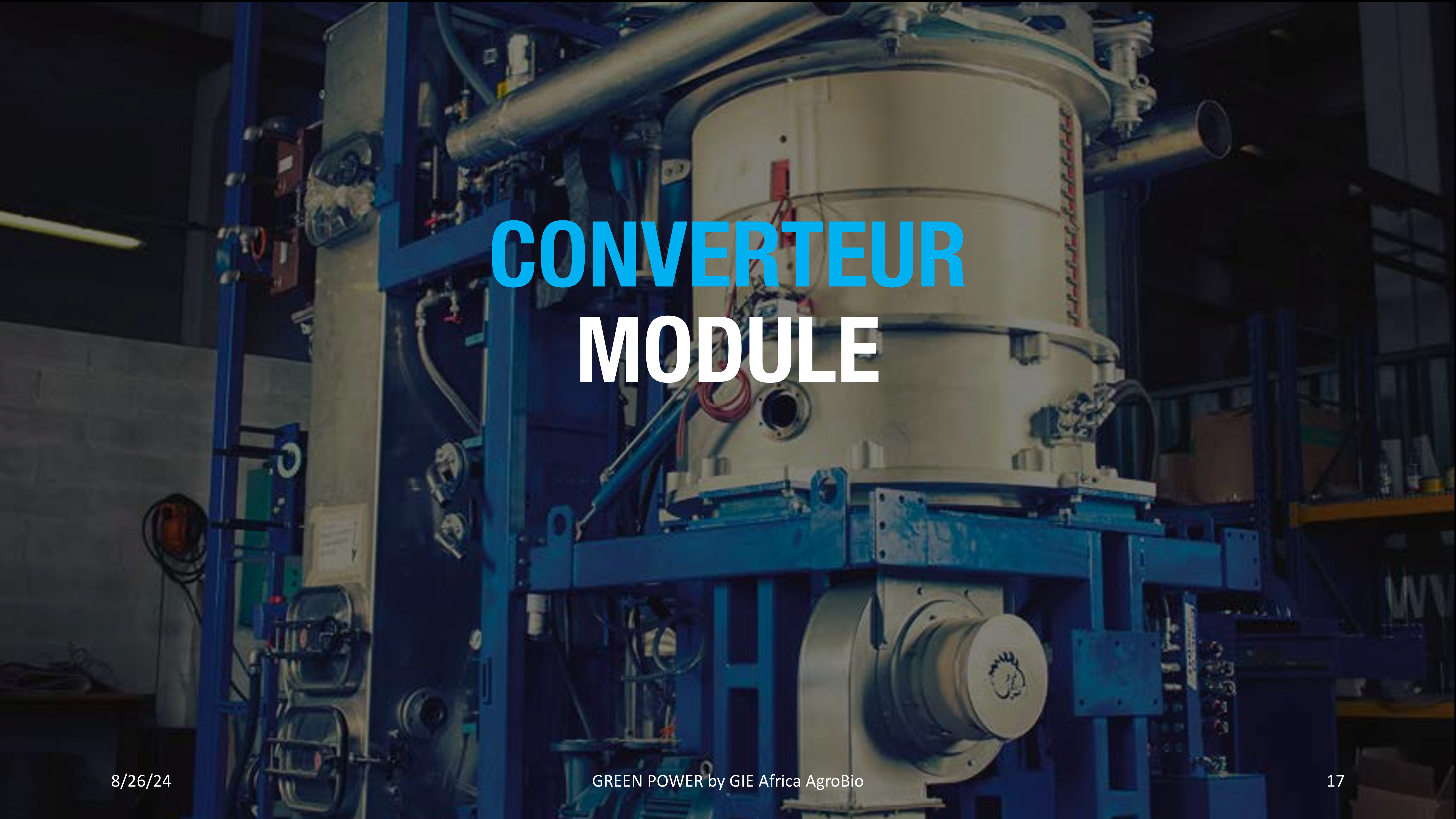
Directly converting organic solid waste into standardized **Refuse Derived Fuel** (RDF)

Recovery of water contained in the waste

Then directly valorize the **RDF** into **thermal** and **electrical energy, and more.**

Recovery of metals contained in the waste





CONVERTEUR
MODULE

INTRODUCING THE "CONVERTEUR" SYSTEM

CONVERT ORGANIC SOLID WASTE INTO STANDARDIZED REFUSE DERIVED FUEL (RDF)

- With or without sorting
- Without pollution
- Without health risks
- Recovery of all recyclable metals at the end of the process

INPUT WASTE TYPES FOR CONVERTEUR

- MUNICIPAL/URBAN SOLID WASTES
- NON-HAZARDOUS INDUSTRIAL WASTE
- COMMERCIAL ACTIVITY WASTE
- GREEN WASTE
- FOOD WASTE & BIOWASTE
- INFECTIOUS WASTE

INCLUDING
- METALS
- PLASTICS
- GLASS
- WOOD
- PAPER & CARDBOARD
- TIRES
- …

TYPES OF WASTES ACCEPTED






CONVERTEUR PROCESS

CYCLE

Three steps in just 30 minutes

1. SHREDDING

Unrecognizable

Volume reduction 80%

2. EVAPORATION

Sec

Weight reduction 50%

3. SANITIZING

Sterilization or pasteurization

CONVERTEUR OUTPUT

REFUSE-DERIVED FUEL

DRY
INERT
LIGHT
STABLE
STERILE
ODORLESS
LESS WEIGHT
LESS VOLUME

CONVERTEUR OUTPUT

REFUSE-DERIVED FUEL STANDARDIZED (EN 15359)

- MOISTURE CONTENT < TO 10%
- ENERGY CONTENT > 4 kWh/kg
- SIZE < 3 mm
- REDUCES THE ENVIRONMENTAL IMPACT OF GREENHOUSE GASES (CO2, METHANE, ...)

USE CASES OF RDF

1. ENERGY PRODUCTION

RDF is burned to generate heat and electricity, reducing fossil fuel use and supporting renewable energy.

2. COGENERATION

RDF enables simultaneous production of heat and electricity, enhancing energy efficiency through cogeneration systems.

3. BIODIESEL PRODUCTION

RDF's organic content can be processed into biodiesel, providing a sustainable alternative to conventional diesel fuels.

1 kg of waste into energy = 1 kg of CO_2 avoided from fossil sources.

BENEFITS OF USING RDF OVER TRADITIONAL WASTE DISPOSAL METHODS

1. Waste Reduction
RDF reduces landfill use by converting waste into fuel, extending landfill lifespan and turning waste into a resource.

2. Energy Generation
RDF provides an alternative energy source, producing electricity and heat, and reducing reliance on fossil fuels.

3. Reduced Landfill Dependency
Diverting waste to RDF reduces landfill pressure, mitigating issues like leachate and methane emissions.

4. Lower Environmental Impact
RDF typically results in fewer environmental issues compared to landfilling, with advanced pollution control technologies minimizing emissions.

5. Cost-Effectiveness
RDF can be more cost-effective than landfilling, with potential revenue from energy production and lower long-term management costs.

6. Resource Recovery
RDF processing allows for the recovery and recycling of valuable materials, supporting a circular economy.

7. Operational Efficiency
RDF streamlines waste management by consolidating processes and improving overall waste handling practices.

8. Reduced Greenhouse Gas Emissions
RDF helps lower greenhouse gas emissions by reducing landfill reliance and utilizing waste as a fuel source.

USER CONVERTEUR

- Municipalities
- Hospitals
- Ports
- Airports
- Catering companies
- Shopping centers
- Tourist centers
- Pleasure boats
- NATO navies (Italy, France, United Kingdom, Canada, Australia, …)

CONVERTEUR RANGE

HI 5000 MO
5000 liters of waste from 500 to 600 kg/h
Machine curb weight* 16000 [kg]
Footprint 8000x2500 – h 6500 mm

HI 2000 MO
2000 liters of waste from 600 to 800 kg/h
Machine curb weight* 14000 [kg]
Footprint 6700x2500 – h 6500 mm

HI 1000 MO
1000 liters of waste from 200 to 300 kg/h
Machine curb weight* 12000 [kg]
Footprint 6700x2500 – h 5900 mm

HI 400 MO
400 liters of waste from 100 to 150 kg/h
Machine curb weight* 2200 [kg]
Footprint 2300x1500 – h 1800 mm

...

Power consumption 0.4 to 0.6 [Kw/kg]
Capacity according to waste density
*Excluding weight and electrical cabinet footprint

ADVANCED SMOLDERING MODULE

INTEGRATED WASTE MANAGEMENT GREEN POWER WITH ADVANCED SMOLDERING MODULE FOR

- Reduce Risks to Human Health
- Recover All Recyclable Materials
- Zero Landfill
- Waste-to-Energy
- **Respect the Environment**

INTRODUCING THE ADVANCED SMODERING SYSTEM

The **eco-friendly solution** for directly managing **composite organic solid waste** or **refuse-derived fuel** standardized and transformed directly into **thermal and electrical energy** using the

Advanced Smoldering Technology.

ADANCED SMOLDERING TECHNOLOGY

ADVANCED SMOLDERING TECHNOLOGY

Advanced Smoldering is an oxidation technology that enables the thermal destruction of organic compounds, the recovery of inert materials, and the prevention of environmental pollution

ADVANCED SMOLDERING TECHNOLOGY

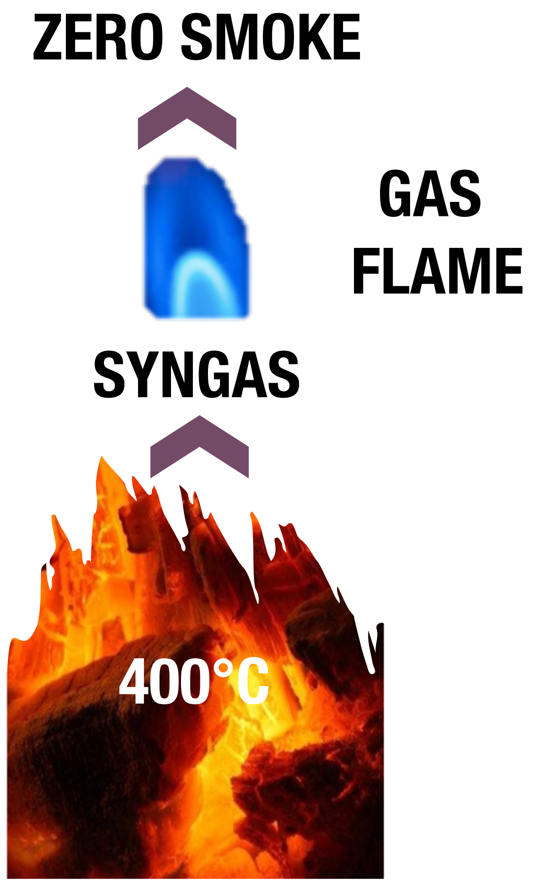
NO SMOKE = NO POLLUTION

Advanced Smoldering Technology continuously controls the **oxidation process**, thus preventing the formation of flames.

The process occurs slowly until all the organic compounds in the raw material are converted into a **synthetic combustible gas**.

During this phase, **no smoke or fly ash** is produced.

The **synthetic combustible gas** is then burned, achieving the same environmental effect as burning natural gas.



ADVANCED SMOLDERING TECHNOLOGY

KEY FEATURES

Process temperature: ≃ **400 °C**

Destruction of viruses and bacteria: **100%**

Heat recovery: **> 90%**

Metal recovery: **> 90%**

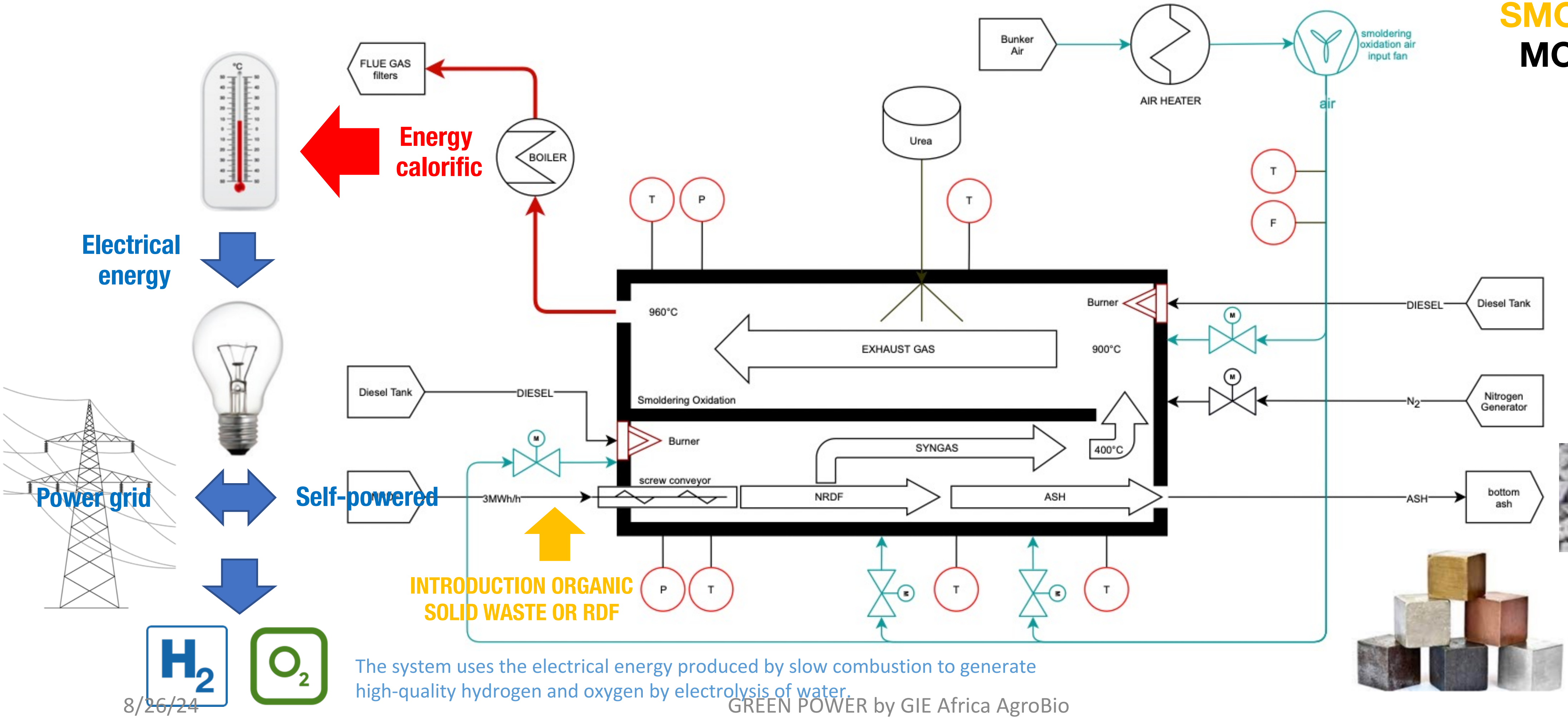
Inert ash: ≃ **3%**

Air pollution: **0% dioxins, furans, and particulates**

Contribution to reducing **greenhouse gas emissions**

ADVANCED SMOLDERING TECHNOLOGY PROCESS

SMOLDRING MODULES



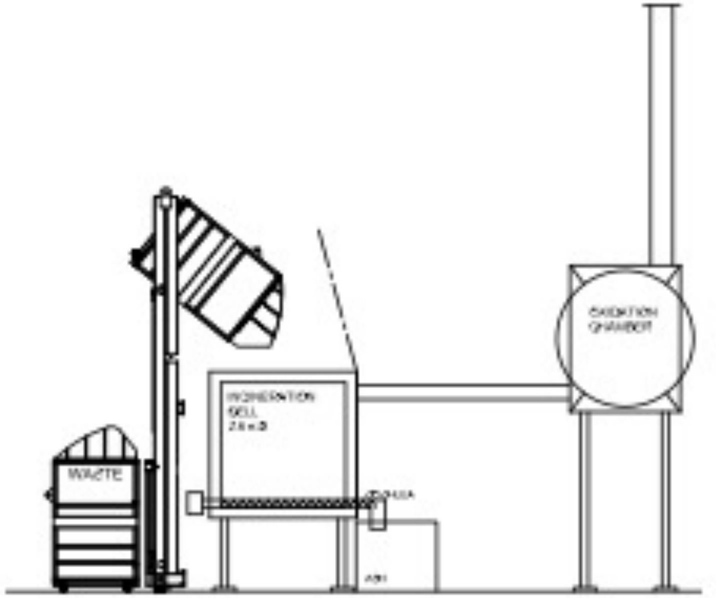
RECOVERY OF ALL METALS

The system uses the electrical energy produced by slow combustion to generate high-quality hydrogen and oxygen by electrolysis of water.

ADAPTABILITY & SCALABILITY OF ADVANCED SMOLDERING MODULES

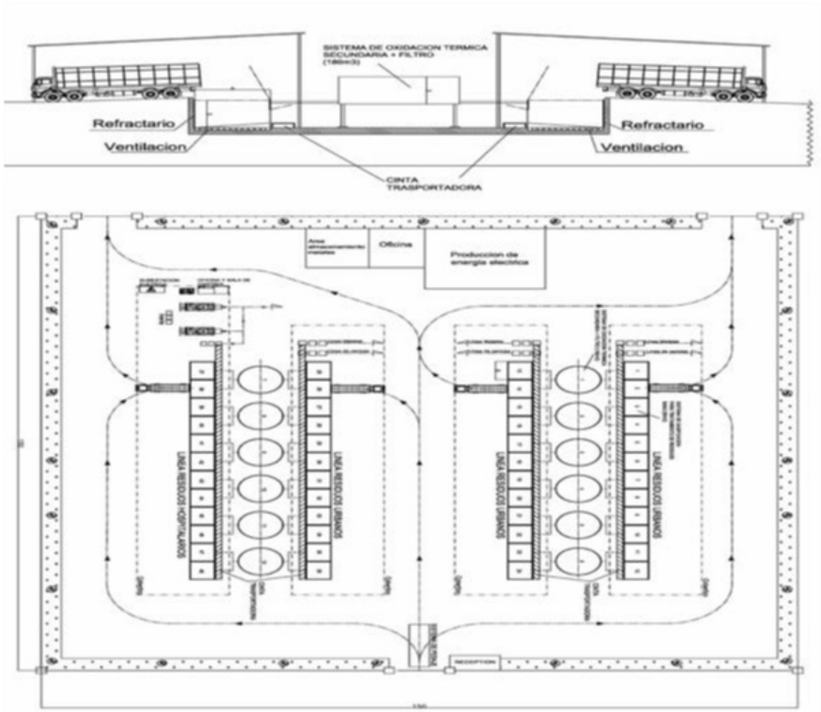
ADVANCED SMOLDERIG MODULES offer adaptability to various capacities for processing **organic solid waste** or **RDF**, ensuring flexibility for different waste types and regional requirements.

The systems are scalable, supporting operations from small to large-scale projects.



Module from 0.5 to 5 tons per day

Plant up to 1.000 tons per day



ENVIRONMENTAL BENEFITS
ADVANCED SMODERING

Compared to conventional solid waste incineration methods, the emissions from the system's exhaust gases have a significantly lower content of polluting components.

TOTAL ABSENCE OF DIOXINS AND FURANS
The system prevents their formation, unlike conventional incinerators, which require costly filters that don't fully eliminate health risks.

VERY LOW CONCENTRATION OF NOX AND SOX
The system prevents the formation of harmful NOx and SOx pollutants by using a sub-stoichiometric amount of air.

INSIGNIFICANT PARTICULATE EMISSIONS
The system minimizes particulate emissions to an insignificant level, preventing the release of harmful heavy metal particles

ENVIRONMENTAL BENEFITS

ADVANCED SMODERING

ESTIMATED
EMISSIONS
BY THE PLANT

POLLUTANT	UNIT	ADVANCED SMOLDERING EMISSION LEVEL	1/2 HOUR EU LIMIT	1-DAY EU LIMIT
CO	*ppm*	< 30	100	50
NOx	*ppm*	< 150	400	200
TOC	*ppm*	< 2	20	10
ASH	*ppm*	< 5	30	10
Hg	*ppm*	Not detectable	0,05	0,03
HF	*ppm*	< 1	4	1
Cd + Ti	*ppm*	Not detectable		0,05
HEAVY METALS	*ppm*	<< 0,5		0,5
HCl	*ppm*	<< 10	60	10
SO2	*ppm*	< 8	200	50
DIOXINS-FURANS	*ppm*	Not detectable		< 0,1

ENVIRONMENTAL BENEFITS

ADVANCED SMODERING

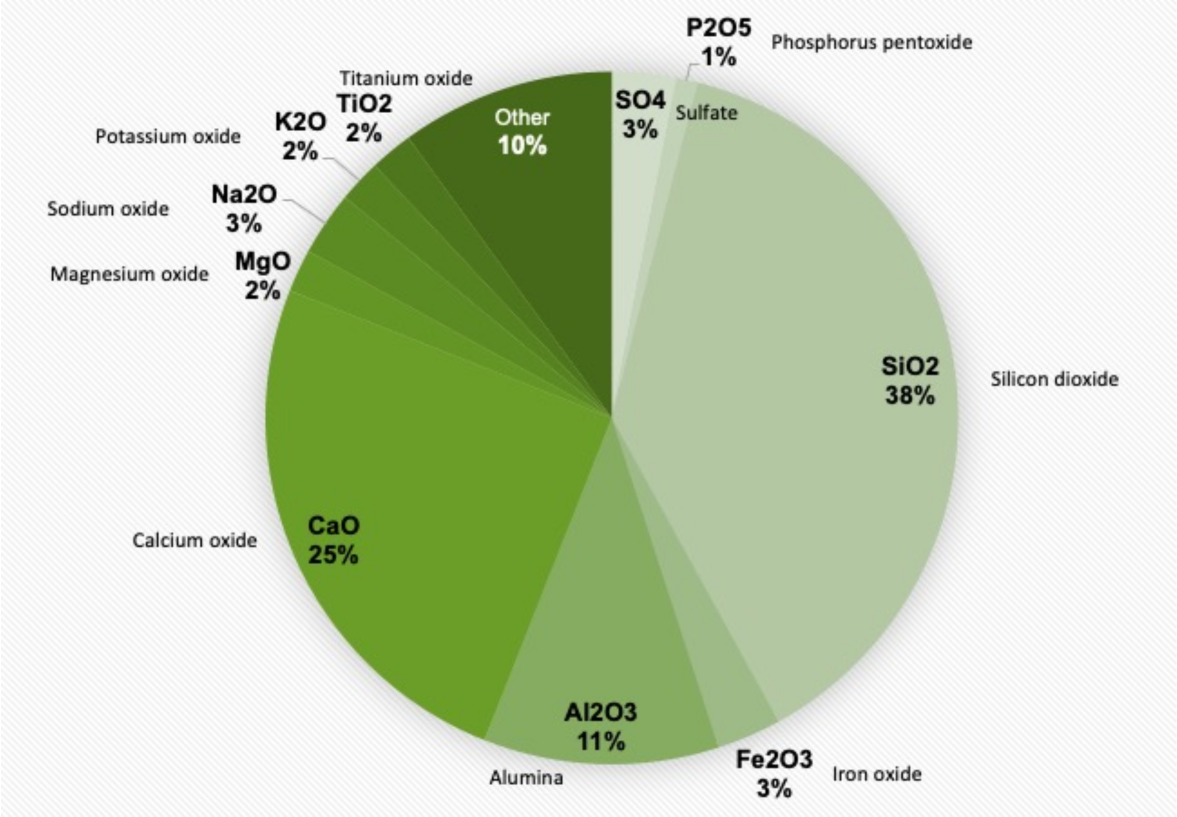
FINAL RESIDUE

INERT WHITE ASH
NO TRACE OF CARBON

THE ASH FROM THE TREATMENT IS INERT AND ITS CHEMICAL COMPOSITION IS SIMILAR TO THAT OF SAND.

*Depending on the waste processed

ASH COMPOSITION *



ENVIRONMENTAL BENEFITS

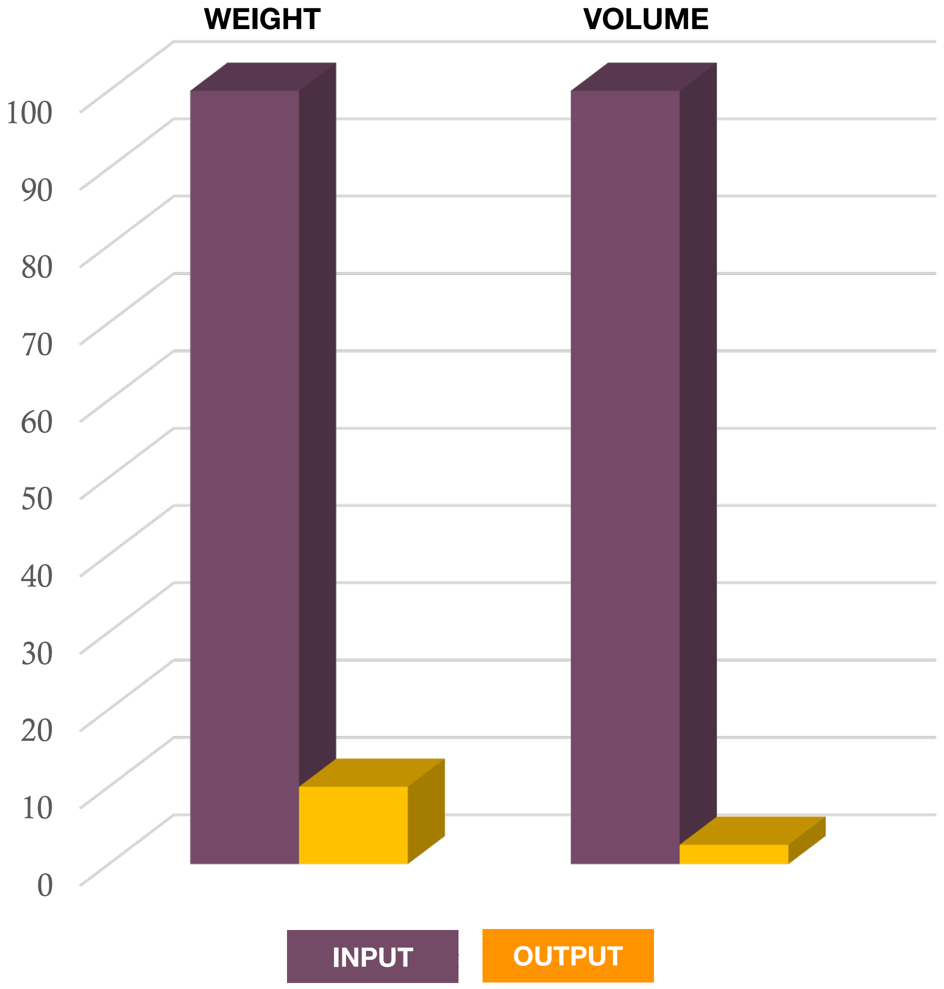
ADVANCED SMODERING

FINAL RESIDUE

INERT WHITE ASH
NO TRACE OF CARBON

WASTE INPUT AND ASH OUTPUT

THE ESTIMATED QUANTITY IS APPROXIMATELY 10% BY WEIGHT AND 3% BY VOLUME OF THE INCOMING WASTE.



ECONOMIC BENEFITS ADVANCED SMODERING

Advanced Smoldering Technology is a comprehensive solution that transforms waste management into an economically viable and environmentally responsible practice.

By reducing landfill use, generating and selling energy, recovering valuable by-products, and creating carbon credits, it offers multiple streams of economic benefits.

This makes it an attractive option for businesses, municipalities, and investors seeking to balance environmental sustainability with economic growth.

1.COST SAVINGS FROM REDUCED LANDFILL USAGE

Advanced Smoldering module significantly cuts costs by reducing the amount of waste sent to landfills.

This leads to lower landfill fees, prolongs the life of current landfills, and reduces environmental costs.

By diverting waste, businesses and municipalities save on disposal fees, delay the need for new landfill sites, and minimize potential environmental damage and associated fines.

ECONOMIC BENEFITS ADVANCED SMODERING

2. ENERGY PRODUCTION AND REVENUE GENERATION

Advanced Smoldering converts organic solid waste or RDF into valuable energy, providing significant economic advantages

- **Electricity Production and Sale**

The process generates electricity that can be used onsite or sold to the grid, turning waste into a profitable resource while reducing energy costs.

- **Heat Recovery**

The heat produced can be utilized in industrial processes, district heating, or agriculture, further enhancing economic benefits.

- **Carbon Credits**

By reducing landfill use and generating green energy, the process qualifies for carbon credits, offering an additional financial incentive through their sale.

3. VALORIZATION OF BY-PRODUCTS

The by-products of Advanced Smoldering —metals, water, and CO2-offer additional economic value through further processing

- **Metal Recovery from Ashes**

Metals can be extracted from residual ashes, enabling recycling and conversion of waste into valuable materials.

- **Water Valorization**

Water recovered from organic waste can be treated and repurposed for industrial use, agriculture, or sold as a resource, thereby reducing costs and adding economic value.

- **CO2 Utilization**

Captured CO2 can be used to produce hydrogen and oxygen through electrolysis, supporting the hydrogen economy and enhancing the environmental benefits of the process.

ECONOMIC BENEFITS ADVANCED SMODERING

4. JOB CREATION AND ECONOMIC GROWTH

The implementation and operation of Green Power Smoldering facilities stimulate the local economy by creating jobs and attracting investment.

- **Employment Opportunities**

Jobs are created in the design, construction, and operation of the facilities, benefiting the local workforce.

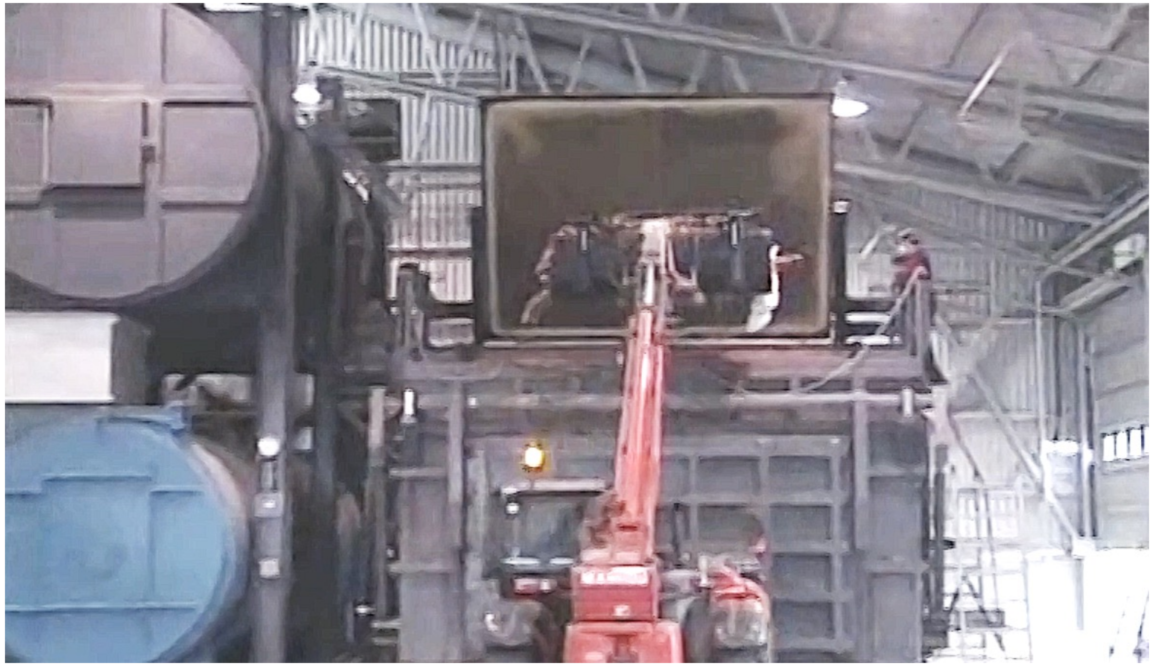
- **Support for Green Industries**

This technology supports green industries, fostering long-term economic resilience and growth.

- **Innovation and Investment**

The process encourages investment in sustainable technologies, driving innovation and positioning regions as leaders in waste management and renewable energy.

3 kg OF MUNICIPAL WASTE CONTAINS
THE SAME THERMAL ENERGY AS **1 KG** OF CRUDE OIL



USER'S ADVANCED SMOLDERING

- Municipalities
- Cities
- Hospitals
- Food industries
- Ports / Airports
- Army
- ...

Integrated Organic Solid Waste Management

GREEN POWER

GREEN POWER SOLUTION

How the CONVERTEUR & ADVANCED SMOLDERING systems work together

CONVERTEUR modules

These systems converts organic solid waste into standardized Refused Derived Fuel (RDF) standardized.

This transformation reduces the waste's weight by approximately 50% on average by removing water and decreases its volume by 80% through fine shredding.

These improvements significantly increase the calorific value of the RDF standardized.

Additionally, the process allows for prolonged storage of the waste, as it is dry and sanitized, and reduces the number of transports needed to bring it to energy conversion centers.

The goal is to install the converters as close as possible to the waste production sites.

ADVANCED SMOLDERING modules

These systems are capable of directly processing solid organic waste, whether it is pre-shredded or not, sorted or not, as well as standardized RDF (Refuse Derived Fuel) transformed by the CONVERTEUR modules.

Energy performance varies depending on the preparation of the organic solid waste, with optimal results achieved when exclusively using standardized RDF.

These systems generate thermal energy, which can be used for industrial applications before being converted into electrical energy to ensure the self-sufficiency of GREEN POWER sites. Any excess electricity can then be fed into the power grid.

GREEN POWER SOLUTION

EXAMPLE ORGANIZATION OF A GREEN POWER SITE

1. RECEPTION AREA

- Waste Reception
- Pre-griding
- Metal Recovery

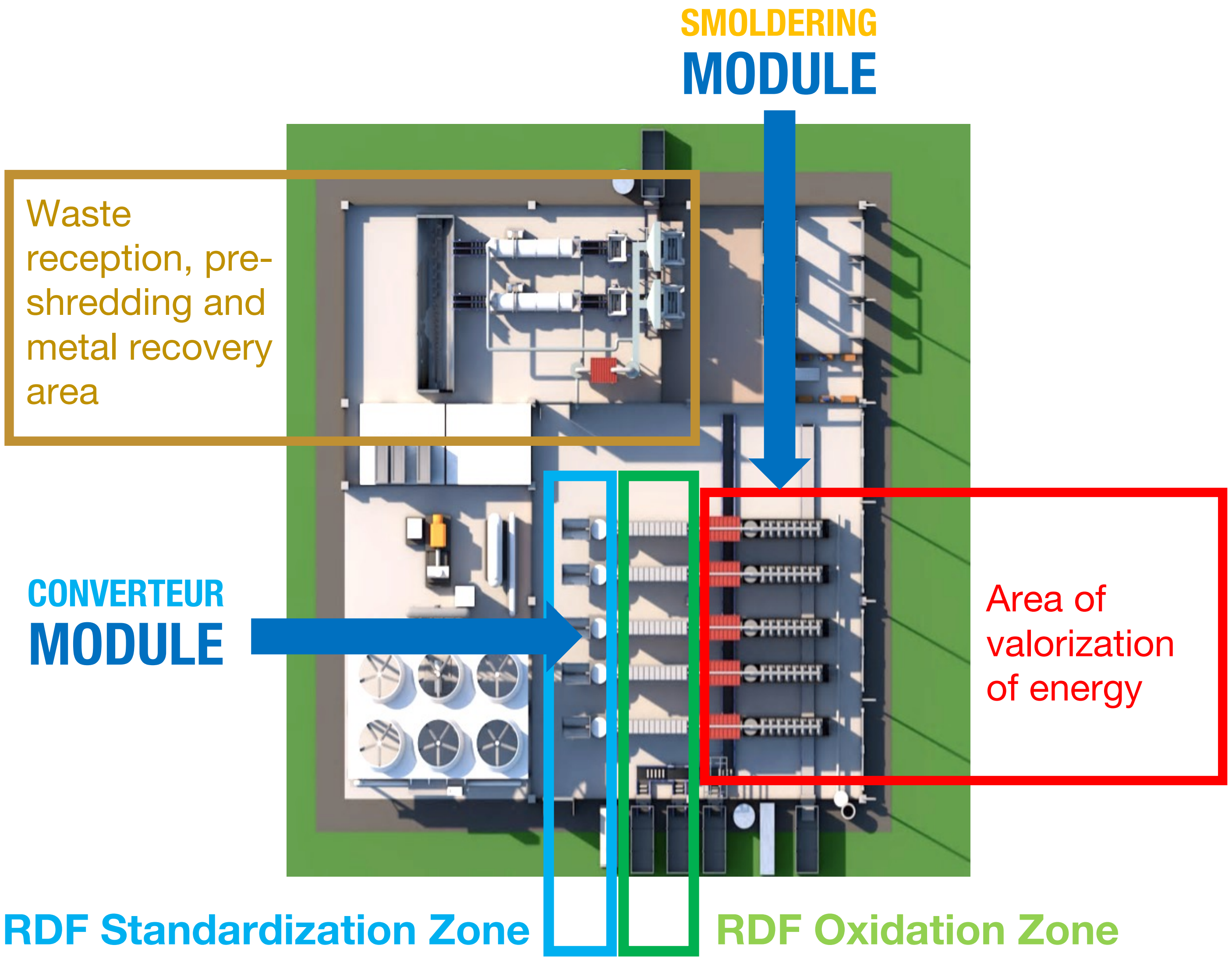
2. CONVERTER MODULES AREA

- Conveying Pre-Shredded Waste
- Waste Treatment In RDF

3. MODULES SMOLDERING AREA

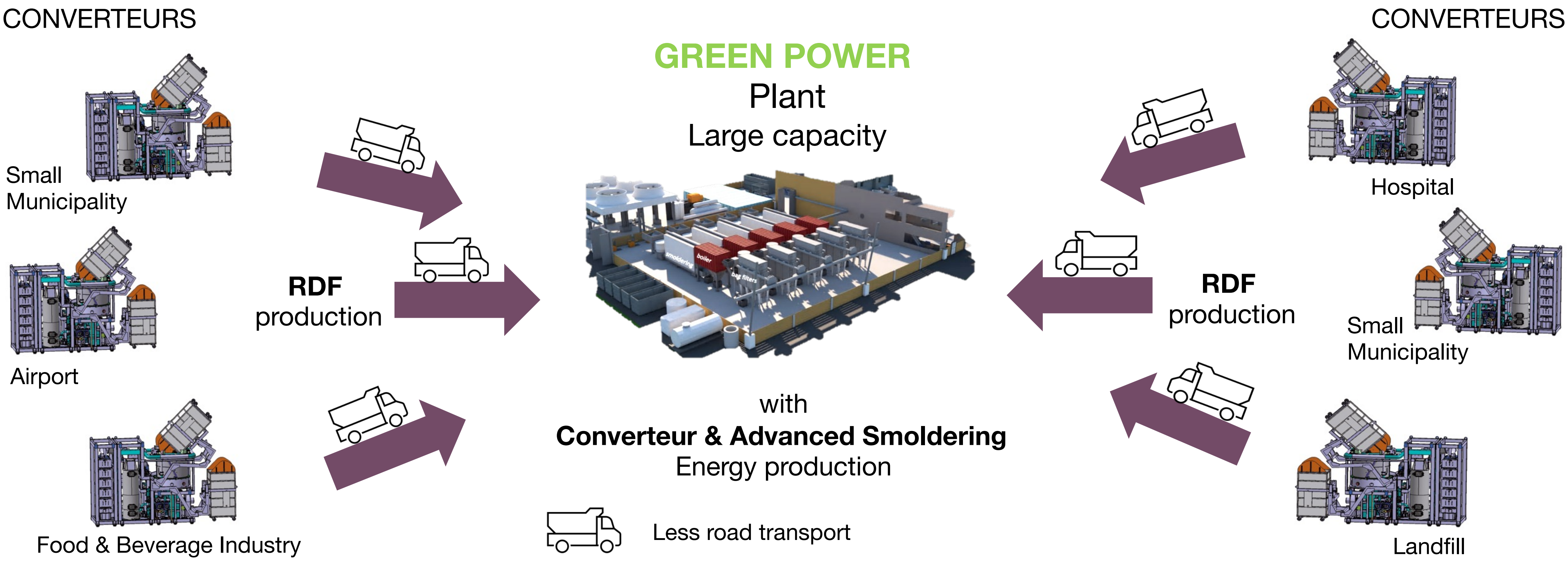
- RDF Routing & Power Supply
- RDF Treatment In Energy

4. POWER GENERATION AREA



GREEN POWER SOLUTION

Synergies in achieving ZERO LANDFILL & WASTE TO ENERGY



CONCLUSION
GREEN POWER SOLUTION

GREEN POWER INTEGRATED WASTE MANAGEMENT SOLUTIONS

ADAPTABLE ACCORDING TO THE PLACE OF PRODUCTION OF THE WASTE

- MUNICIPALITIES
- WASTE LANDFILLS
- FOOD AND BEVERAGE INDUSTRIES
- …

MODULAR ACCORDING TO THE QUANTITIES AND NATURE OF SOLID ORGANIC WASTE OLD OR NEW

SOLUTIONS POUR REPONDRE AUX OBJECTIFS DE

- REDUCED HEALTH RISKS
- POLLUTION REDUCTION
- REDUCTION OF LANDFILL WASTE
- REDUCTION IN THE VOLUME OF WASTE SORTED BUT NOT RECOVERED LOCALLY
- REDUCING THE ENVIRONMENTAL IMPACT OF LANDFILLS
- REDUCED RISK OF FIRE AND EXPLOSION
- REDUCTION OF ENVIRONMENTAL IMPACT THROUGH ENERGY RECOVERY FROM WASTE

ENVIRONMENTAL SOLUTION

INTEGRATED ORGANIC SOLID WASTE MANAGEMENT

- Transform organic solid waste directly on site into a dry, stable, sterile and odorless powder
- Converting solid organic waste and RDF into pollution-free energy
- Upgrading metals
- Valorization of CO2 and extracted water into Oxygen and Hydrogen

Presented by
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