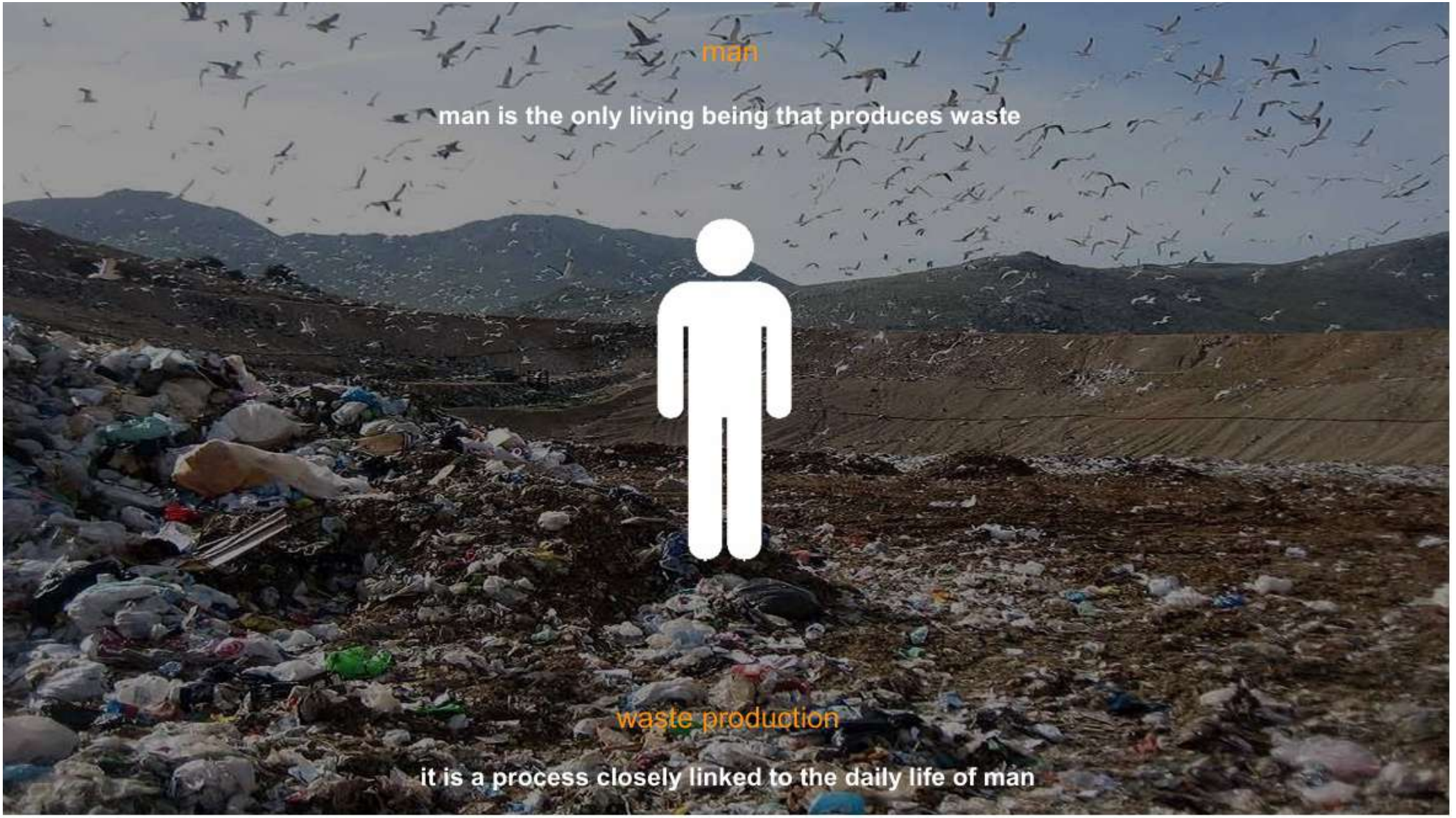
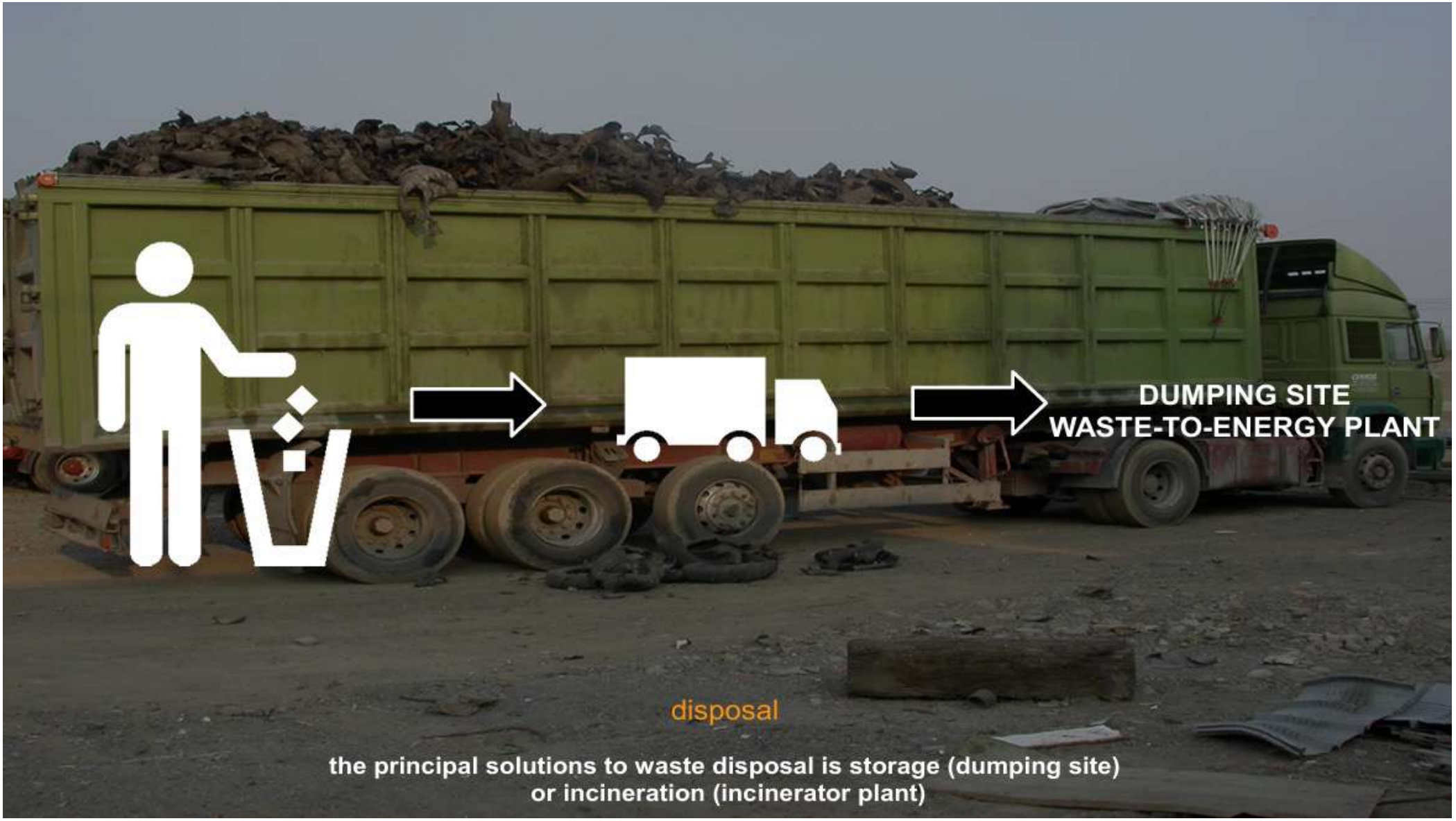
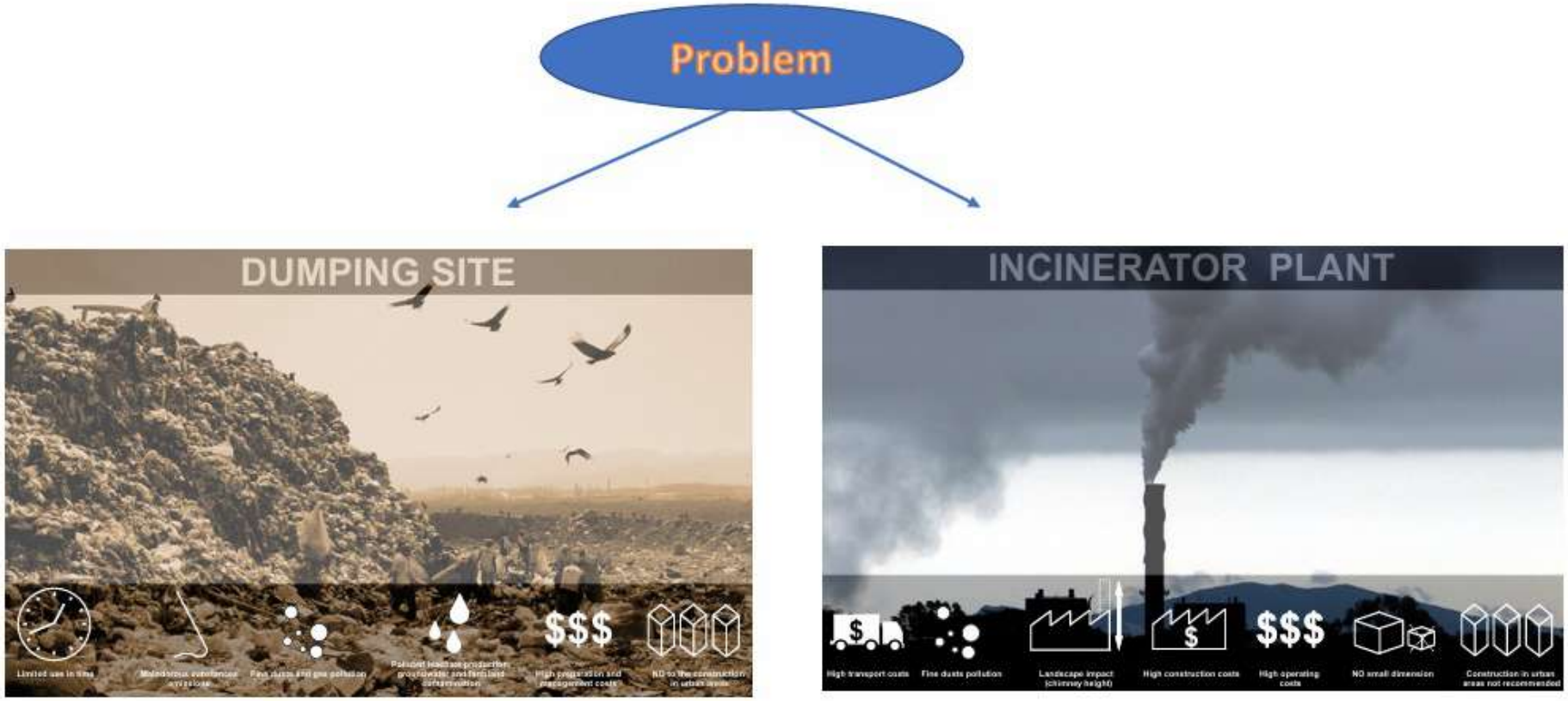
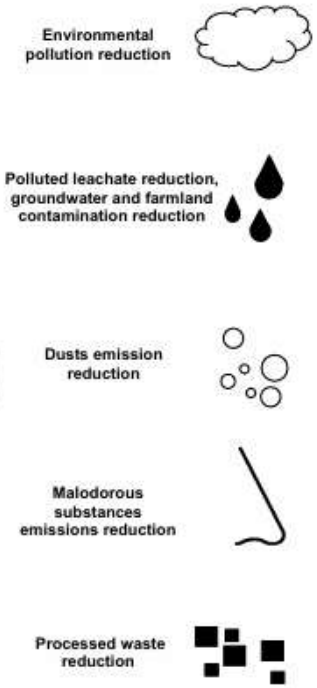

man
man is the only living being that produces waste
waste production
it is a process closely linked to the daily life of man

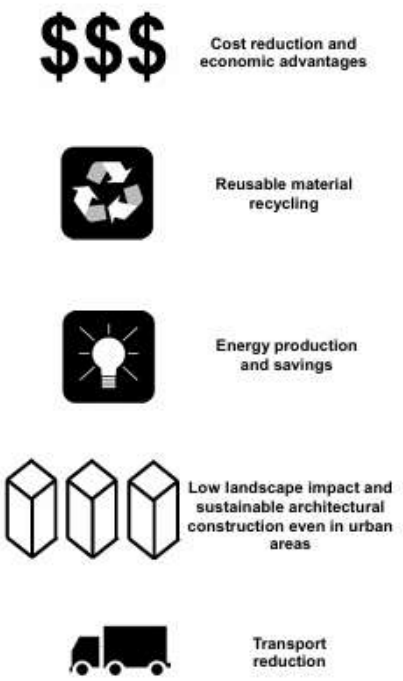

DUMPING SITE
WASTE-TO-ENERGY PLANT
disposal
the principal solutions to waste disposal is storage (dumping site)
or incineration (incinerator plant)


Problem
DUMPING SITE
$$$
INCINERATOR PLANT
$
$
$$$

Is there a solution? are there reliable and already functioning technologies that can be adopted to prepare a better future for our sons while preserving our planet?



an efficient system should aim at the pursue of these objectives



Presentation company

the company taking care of system installations of environmental products for the disposal of municipal, industrial and hazardous waste, resulting in the recovery of electricity and heat, as well as photovoltaic systems and innovative treatments for thermal energy

Our vision

designs, build and operates facilities for eco-friendly energy production. New insights, concepts, and opportunity inherent in the energy market and environmental impacts are analyzed and developed by a team of qualified engineers with the aim of transforming them as soon as possible in products and solutions

Material Typology

Municipal solid waste – Pneumatics – Hospital wastes – Kitchen wastes – Urban green – Contaminated oil, Polypropylene and natural absorbents – Diesel filters from cars, ships, locomotive and other various vehicles – Car oil filters – Plastics – Manufactured paper pulp/mix with other wastes – Some inflammable gases – Inflammable liquids – Oxidizers/organic Peroxides – Sawdust, mud and ashes – Furniture's – Paint waste – Railways sleepers – Rubber polymers – Biomass – PVC tubes – Wood waste – Animal wastes – Skin waste – Oils – Car fluff – Construction waste (wood, plastics, paint, packaging) – Excluded Radioactive and explosives waste

TWO vs Incinerator

Incineration

Formation of toxic dioxins and furans, particularly in the presence of plastics containing PVC and other materials that form dioxins and furans when they burn. These toxins end up in the waste streams via three pathways: • By decomposition, as smaller parts of larger molecules; • "Reforming" when smaller molecules combine together; and / or • Simply passing through the incinerator without changes. Incineration does not allow the control of these processes and all cleaning operations take place after combustion

TWO vs Incinerator

Thermo Oxidation

Is significantly different and cleaner than incineration: • In the high temperature environment of Thermo oxidation, larger molecules such as plastics are completely broken down into the syngas components, which can be cleaned and processed before any further use; • Dioxins and furans need sufficient oxygen to form or reform and the oxygen-deficient atmosphere in the thermo oxidation system in question does not provide the necessary environment for their formation or reform; • Dioxins need fine metal particles in the drain to reform; the syngas coming from the primary cells is treated endothermally in the secondary chamber thus purifying the same, which will then be transformed into steam by means of a special recovery boiler for the production of energy (this cannot happen in incineration, which requires post-cleaning combustion)

Comparation

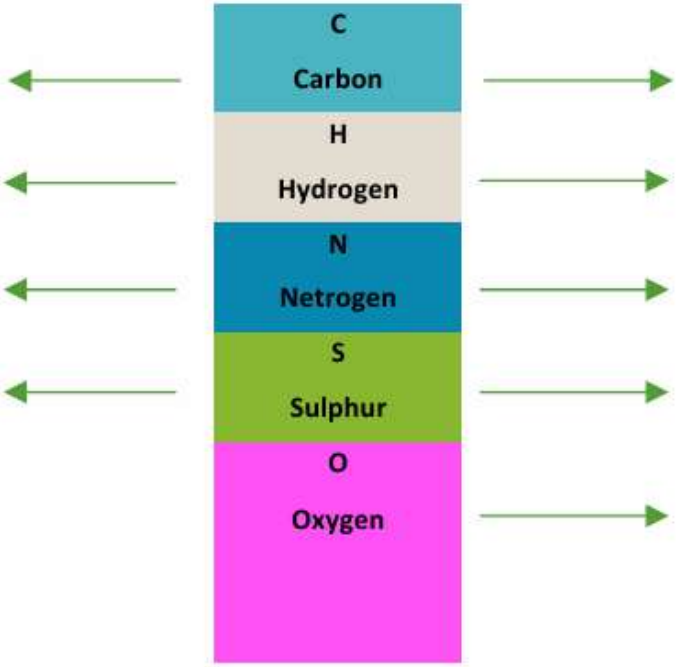
THERMAL OXIDATION

800ºC/1200ºC

Lack of oxygen

Regime of depression

Creation of syngas



INCINIRETOR

600ºC/800ºC

Oxygen demand

Atmospheric pressure

smoke

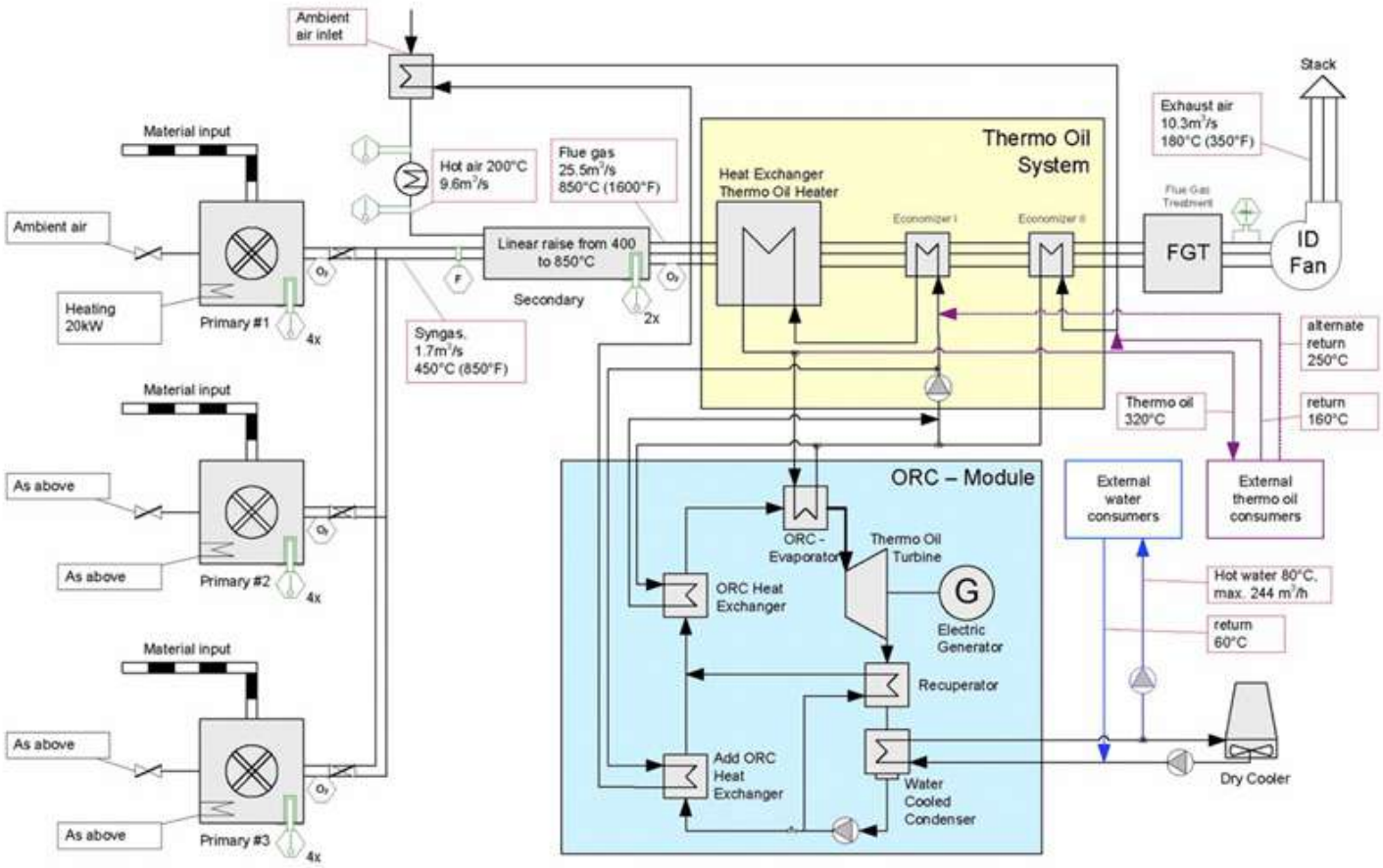
Emission in air

	Unit	European Air Quality Limits	Limits by Legislative Decree 152/2006 and subsequent	TWO System Emissions	% TWO reduction compared to the limits imposed by Legislative Decree 152/2006 and subsequent amendments
Total Particulate Matter	mg/Nm3	10	10	1	-90%
Hydrogen Chloride (HCl)	mg/Nm3	10	10	2,8	-72%
Sulphur Dioxide (SO2)	mg/Nm3	50	50	15	-70%
Nitric Oxide (NOx)	mg/Nm3	200	200	21,64	-89%
Carbon Monoxide (CO)	mg/Nm3	50	50	14,12	-72%
Total Organic Compounds (TOC)	mg/Nm3	10	10	2,8	-72%
ammonia (NH3)	mg/Nm3		30	0	-100%
Dioxins and Furans (PCDD + PCDF)	mg/Nm3	0.1	0,1	0,017	-83%
Heavy metals	mg/Nm3	0.5	0,5	0 - 0,15	-70%
Mercury (Hg)	mg/Nm3	0.05	0,05	0 - 0,020	-60%
hydrofluoric acid (HF)	mg/Nm3	1	1	0 - 0,25	-75%
Cadmium (Cd)	mg/Nm3	0.05	0,05	0.018	-64%

Thermal Waste Oxidation

The Thermal Waste Oxidation Plant (TWO) is a two-stage waste combustion process that converts combustible organic matter from its existing solid, sludge or liquid state into a gas under an oxygen depleted environment (also known as 'oxidation"). The resulting gas product is then well mixed with ambient air before being burnt off (flared) in a secondary gas-processing unit.

Flow chart


Ambient air inlet
Material input
Ambient air
Heating 20kW
Primary #1
4x
Hot air 200°C 9.6m³/s
Flue gas 25.5m³/s 850°C (1600°F)
Linear raise from 400 to 850°C
Secondary
2x
Syngas, 1.7m³/s 450°C (850°F)
Heat Exchanger Thermo Oil Heater
Thermo Oil System
Economizer I
Economizer II
Exhaust air 10.3m³/s 180°C (350°F)
Stack
Flue Gas Treatment
FGT
ID Fan
alternate return 250°C
Thermo oil 320°C
return 160°C
Material input
As above
As above
Primary #2
4x
Material input
As above
As above
Primary #3
4x
ORC – Module
ORC - Evaporator
Thermo Oil Turbine
ORC Heat Exchanger
G
Electric Generator
Recuperator
Add ORC Heat Exchanger
Water Cooled Condenser
Dry Cooler
External water consumers
External thermo oil consumers
Hot water 80°C, max. 244 m³/h
return 60°C

The TWO is composed of three basic components

Primary Cell

Internal pressure: - 0,5 bar;
Temperature range: 350°C – 480°C – depending on the material treated;
Ashes: 3% - 5% - depending on the material treated;
Oxidation time: 8h – 12h;

The TWO is comprised of three basic components

Secondary Cell

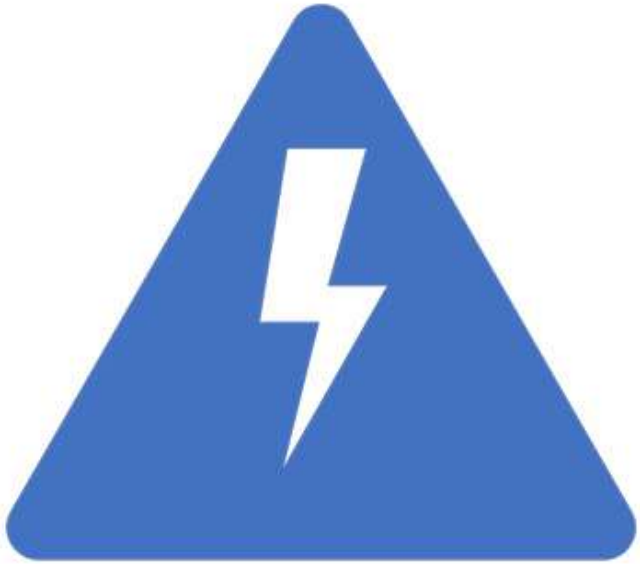
Internal pressure: positive;
Temperature range: 800ºC – 1300ºC – depending on the material treated;
Permanence time: 2,5” – 3,5”;

The TWO is comprised of three basic components

Turbine

The syngas from the secondary cell is sent to a heat exchanger/boiler for the production of vapor that will feed the turbine

Technical advantages of the system



- Very low emission (guaranteed by the system manufacturer);
- High efficency in power and thermal energy production;
- Low impact on the landscape compared to other systems for energy recovery from biomass and / or waste;
- Recovery of non-organic materials - post differentiation;
- Low ash production - which, however, is inerted;
- Requires little routine maintenance.

Benefits of the system

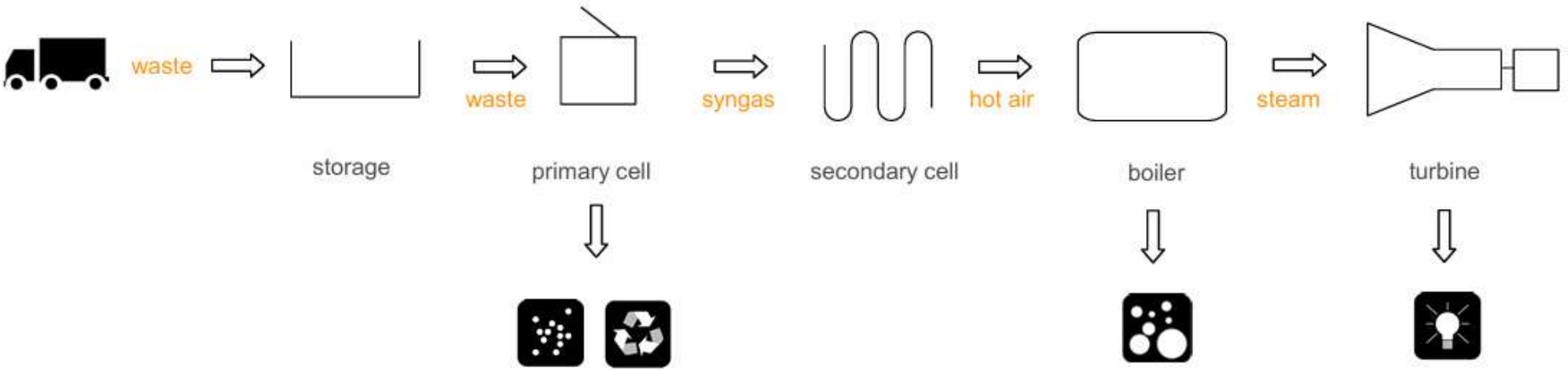
The key points in terms of environmental and production efficiency are the following:	Drastic reduction of environmental pollution;	High technical / productive efficiency of the process;	Creation of local employment and specialization (in terms of know-how);	Elimination of sludge (pollution of aquifers and farmland);
Elimination of dust emissions;	Elimination of harmful substances emissions;	Reduction of process waste;	Reducing costs, economic benefits;	Recycling of reusable materials;
	Energy production and energy saving;	Architectural sustainability for construction even in urban areas;	Reduction of transport.	

Social benefits

- Employment impact positive;
- Technological specialization;
- Use of thermal energy (possible applications):
  - Thermal energy for the industrial district;
  - Power supply public buildings;
  - heating greenhouses;

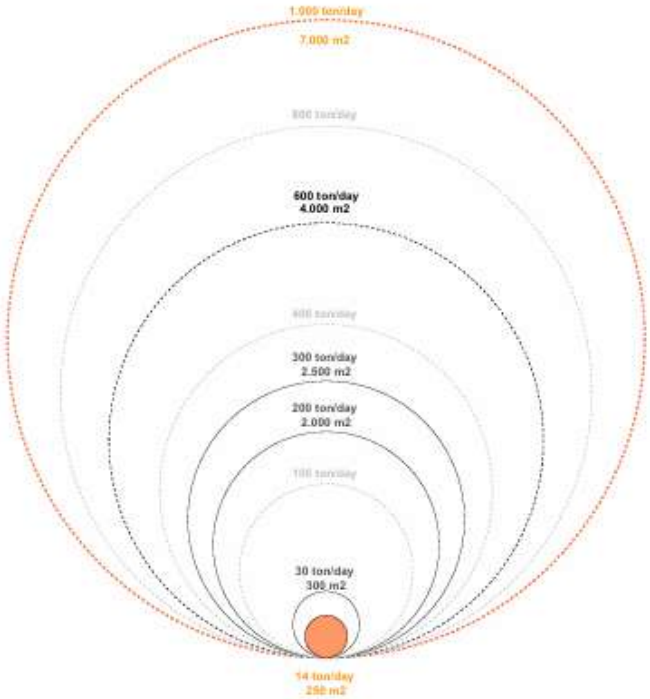
Ability to carry out energy recovery directly into the storage site - elimination of management issues related to the viability of the means of transport carrying out such operations in sites other than the primary storage.

TWO process
synthetic process scheme



The dimension

14 ton /day > 30 ton/day
demountable (transportable) gasificator



30 ton /day > 1.000 ton/day
fixed gasificator

the system can have various dimensions

30 ton /day > 1.000 ton/day fixed gasificator

in order to adapt to the most diverse requirements the maximum dimension with a capacity of 365.000 ton/year is determined exclusively by logistical/ managerial criteria and not by any other kind of limitation.

Ashes use

system produces between 3% to 5% of inert ashes these wastes can be reused in various compounds as inert/binding

asphalts

self - blockings

CLS road

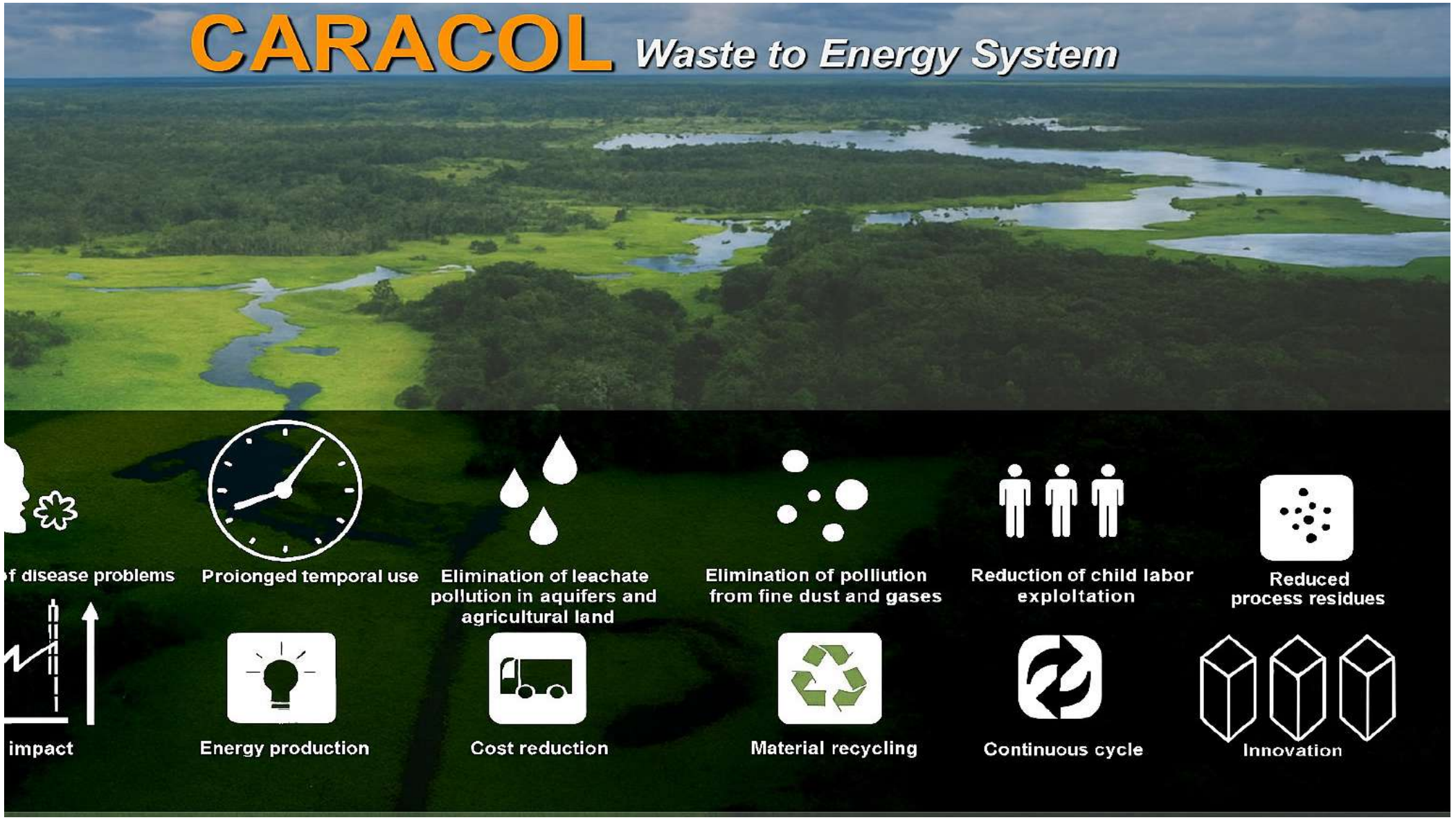
Use of non-gasified materials

the metals and glass are deposited at the bottom of the cell's and can be recuperated

metals

cans

glass


CARACOL
Waste to Energy System
f disease problems
Proionged temporal use
Elimination of leachate pollution in aquifers and agricultural land
Elimination of polliution from fine dust and gases
Reduction of child labor exploitation
Reduced process residues
impact
Energy production
Cost reduction
Material recycling
Continuous cycle
Innovation