

The logo for REOSET, featuring the word "REOSET" in a bold, dark grey sans-serif font. The letter "O" is replaced by a green circular icon containing a white stylized leaf or gear shape.

REOSET

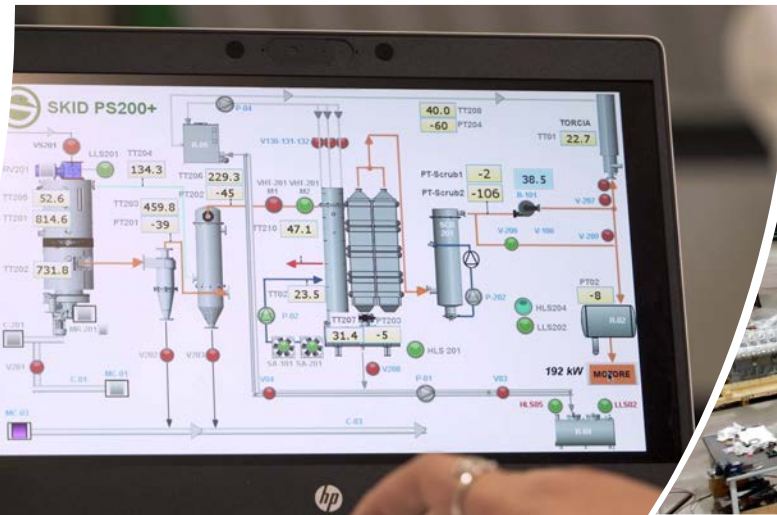
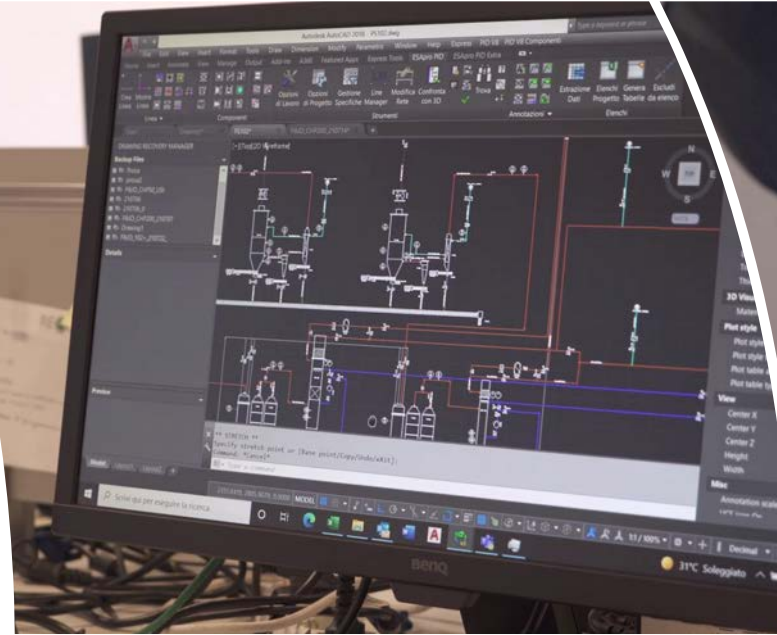
SyngaSmart

BIOMASS GASIFICATION TECHNOLOGY

- *Integrated pyrogasification and cogeneration solutions for biomass-based renewable energy*
- *On-site biomass and organic waste valorization*
- *Carbon-negative process*



- RESET: engineering and manufacturing company founded in 2015
- **Core business:** design and manufacturing of small scale biomass gasification and cogeneration plants
- **Focus:** renewable energy and circular economy
- **Mission:** decentralized solutions for waste biomass valorization, volume reduction and energy generation



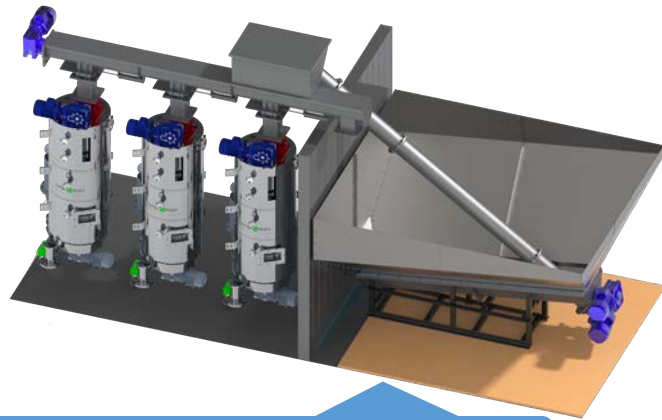
- Small-scale, downdraft biomass **gasification** technology
- BioSyngas generation from residual organic biomass for combined **Heat and Power** generation and **biomass disposal**
- Modular plants [20-200 kWe] for decentralized applications
- **Carbon-negative** process (biochar carbon sequestration)



SyngaSmart units integrate different processes in a single compact system:

- ✓ On board fuel storage with thermal pretreatment;
- ✓ Gaseous fuel generation through downdraft fixed-bed gasification reactors;
- ✓ Bio-Syngas conditioning (dust removal cyclones, heat exchangers, biomass dry filters);
- ✓ Biochar automatic extraction and collection;
- ✓ Genset: syngas-upgraded engines coupled with generators for electric power generation;
- ✓ Thermal power recovery from engine coolant and exhaust;
- ✓ on-site and remote management through IOT control system.

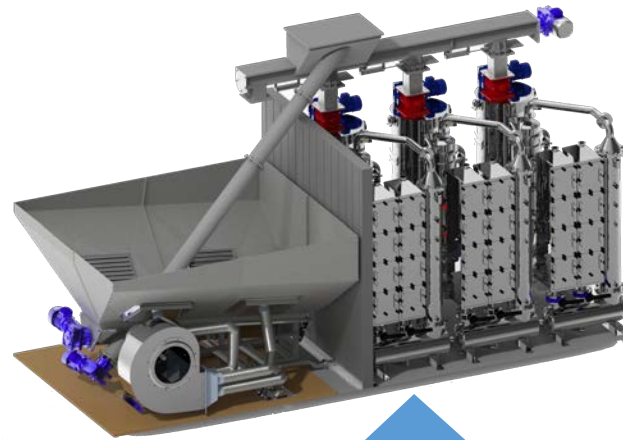
The entire process is controlled and operated through a smart software-automation framework composed of pressure and temperature sensors, valves, probes, gearmotors, conveyor augers, pumps and inverters, aimed at offering the highest level of plant automation and minimum human intervention.



On-board biomass storage and feeding



Gasification reactor



BioSyngas conditioning



Drawer-design biomass filters



SyngaSmart CHP 50

SyngaSmart: the plant

1

Biomass input

- woodchips
- Agricultural residues
- Biofuels from organic waste streams



6

Plant management



Power and automation
electric panel, remote plant
management software
through dedicated interface

2

Gasification

Solid biomass is heated at 900 °C in a closed reactor and transformed into flammable gas and carbonaceous byproduct

3

Biochar

5-7% of the input biomass, it is a natural soil amendment, containing about 70% Carbon, highly porous, large surface area. Biochar is a Carbon sink: 1 kg = 2,5 kg CO₂ eq.



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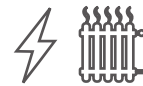
BioSyngas



Synthesys gas made of CO + H₂ + CH₄

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Cogeneration



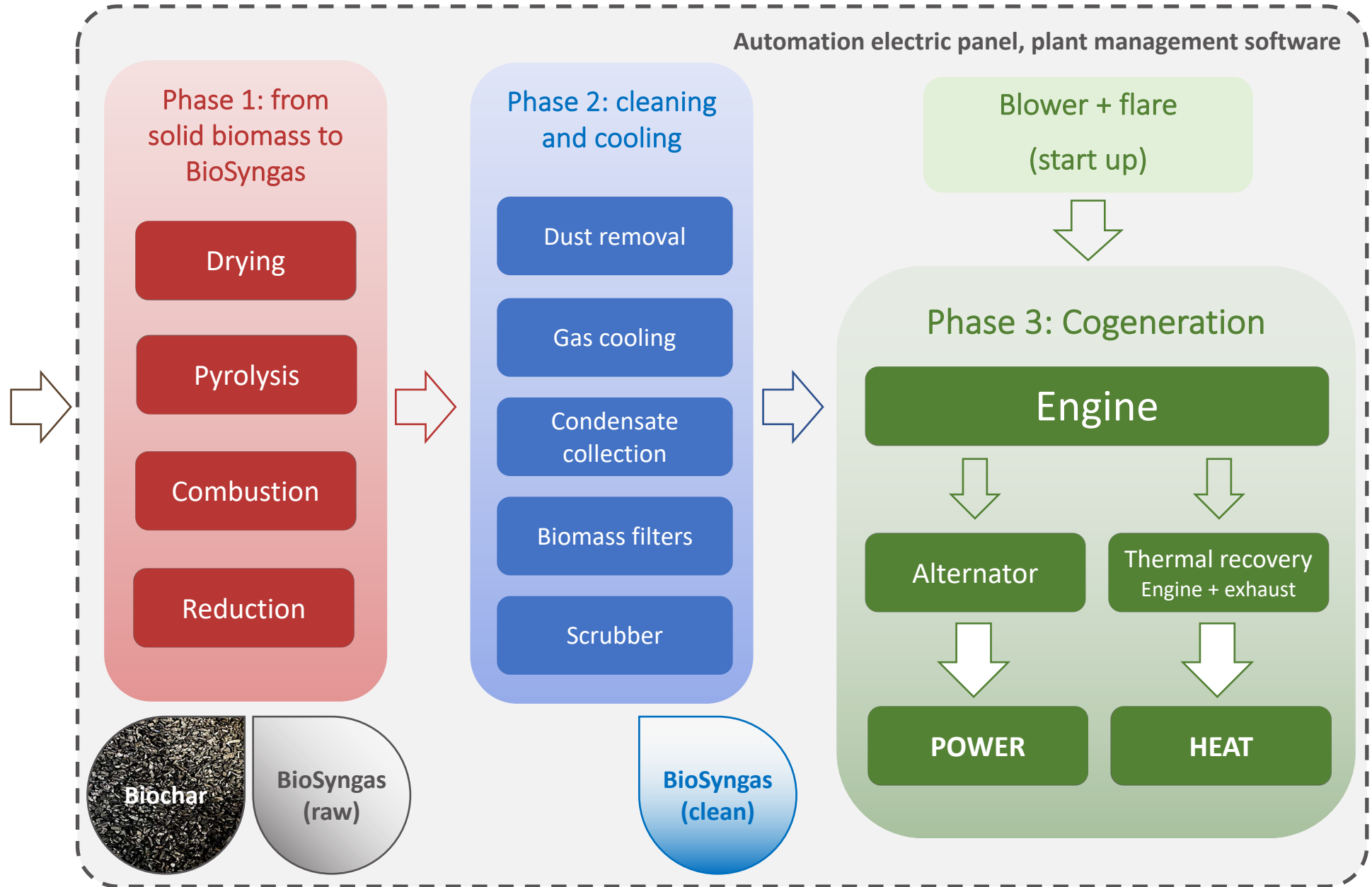
- Engines + alternators
- Engines Heat Exchangers
- Exhaust Heat Exchangers



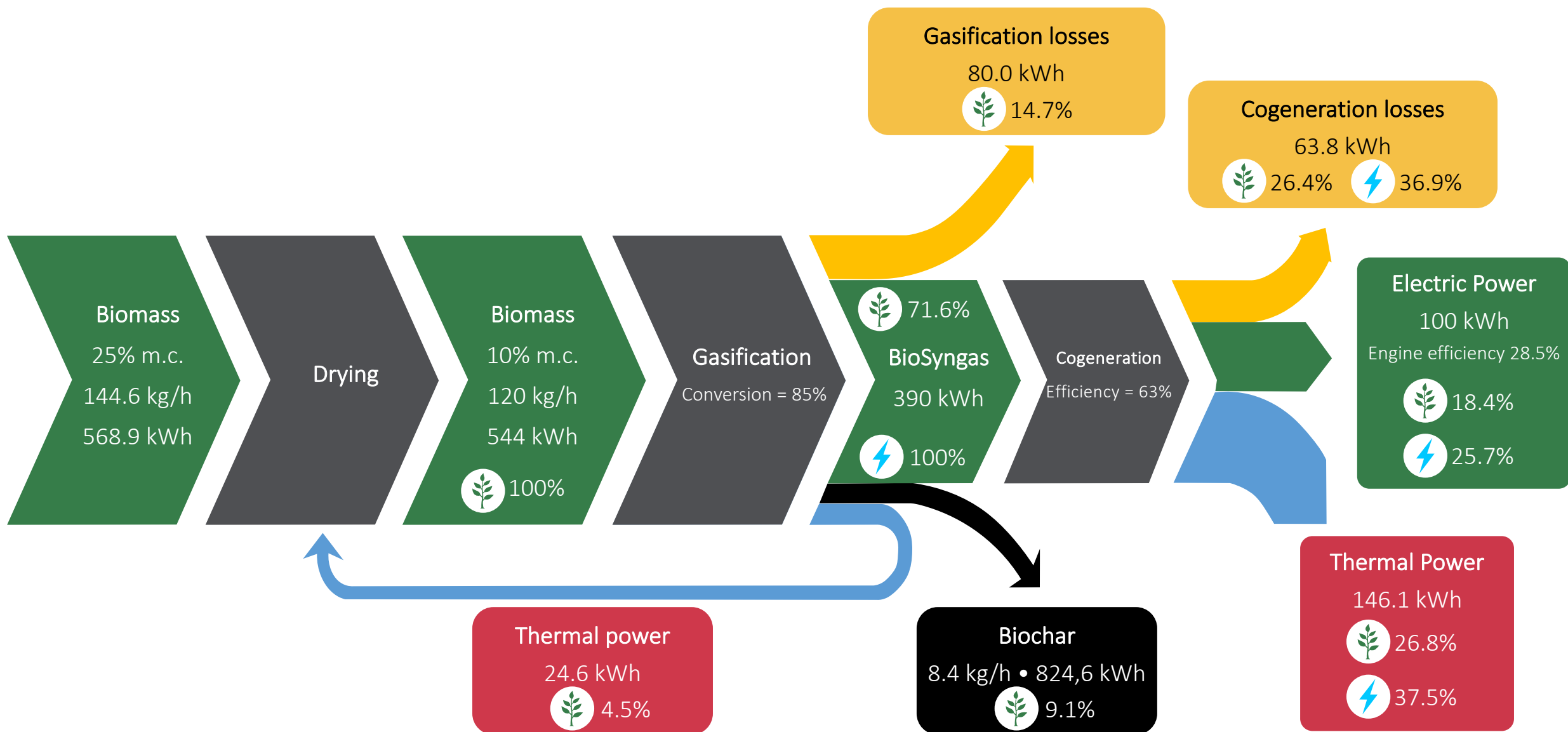
Biomass pretreatment

Depending on biomass quality, includes:

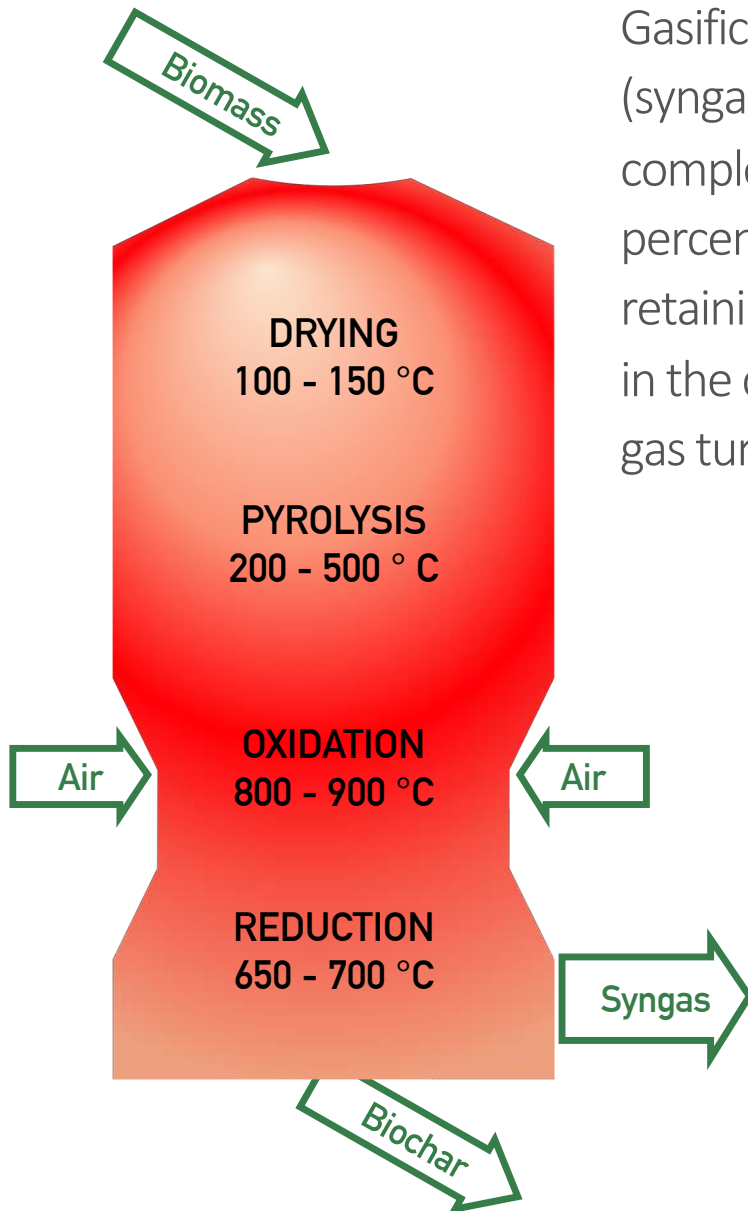
- chipping and screening;
- drying;
- grinding, crushing and mixing;
- compression into briquette or pellet.



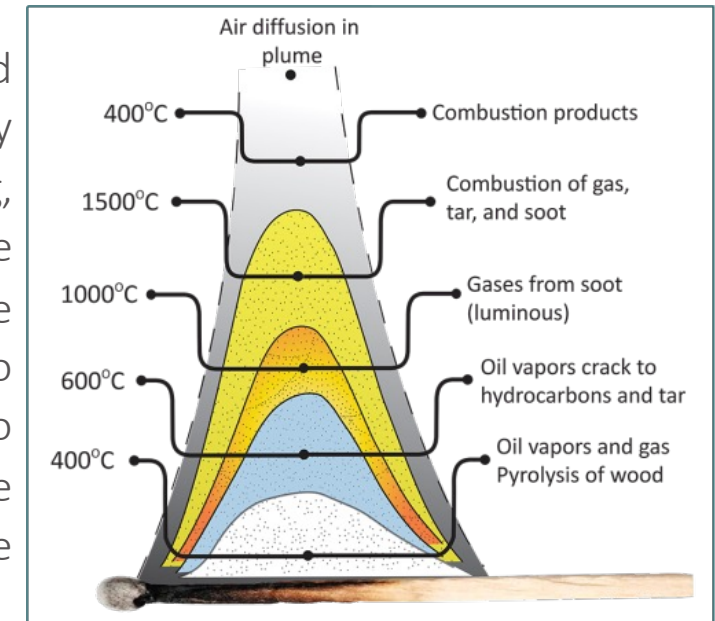
Mass & energy balance: SyngaSmart CHP 100

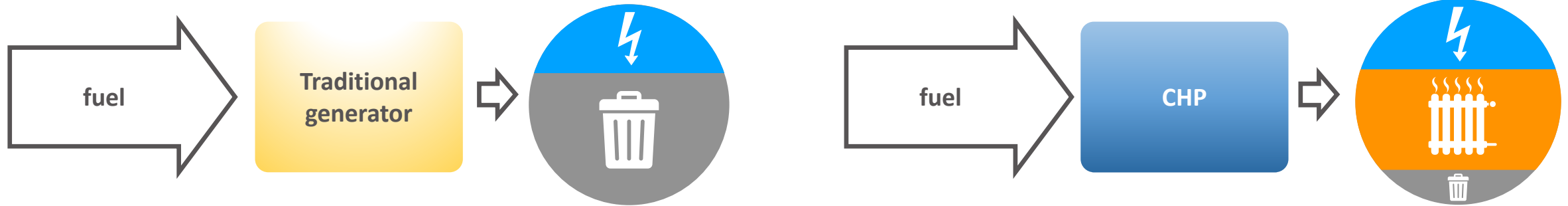


Gasification is a **thermochemical process** which transforms a solid fuel into a **synthesis gas** (syngas). This occurs by supplying the reactor with less oxygen than the amount required for a complete combustion, and for this reason the resulting gaseous mixture still contains a certain percentage of combustible gases such as carbon monoxide, hydrogen and methane, thus retaining the energy content of the original solid fuel. This mixture of combustible gases, which in the case of biomass is called BioSyngas, can be used to produce energy through an engine, a gas turbine, a burner.



The goal of a gasification system is to take control and manage those thermochemical events which are normally almost simultaneous in a combustion process, i.e. drying, pyrolysis, combustion, cracking and reduction. These processes are naturally present, for example, in the flame of a match, even if it is not possible for the human eye to distinguish them. Through gasification it is possible to isolate these processes and interrupt them before the flame, so that combustion can occur elsewhere

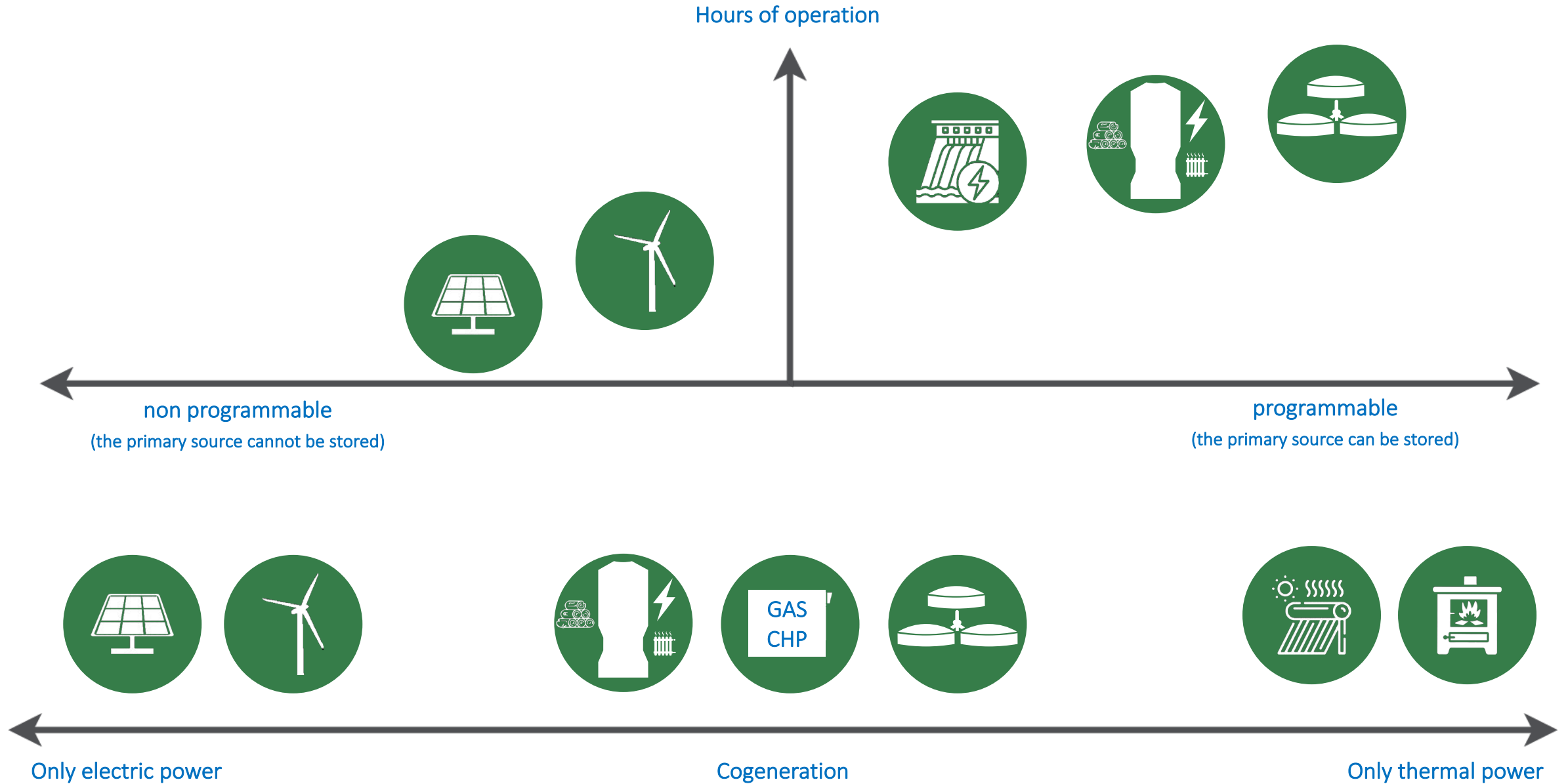




Cogeneration is an efficient energy production method that maximizes the efficiency of thermoelectric power generation, and consists in the simultaneous generation of electricity and heat.

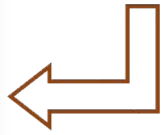
In a traditional plant, such as a diesel generator or a gas-fired power plant, a large part of the energy introduced as fuel, approximately 60%, is dispersed into the environment in the form of heat. The usable energy is therefore reduced to just 30-35% of that used as input.

In cogeneration systems the proportions change radically. By coupling, for example, an engine with an alternator, the chemical energy introduced with the fuel is first transformed into mechanical energy and subsequently into electrical energy. Then, the heat released in the process is recovered from the engine coolant and the exhaust gases through heat exchangers. The resulting energy efficiency can reach 85-90%.

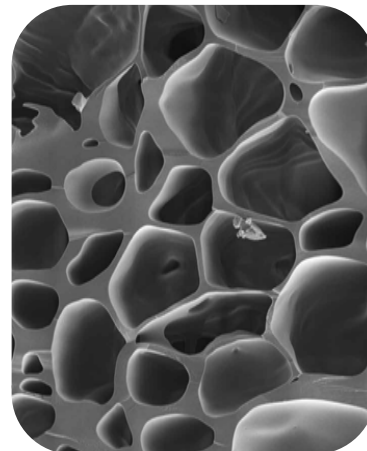




biomass



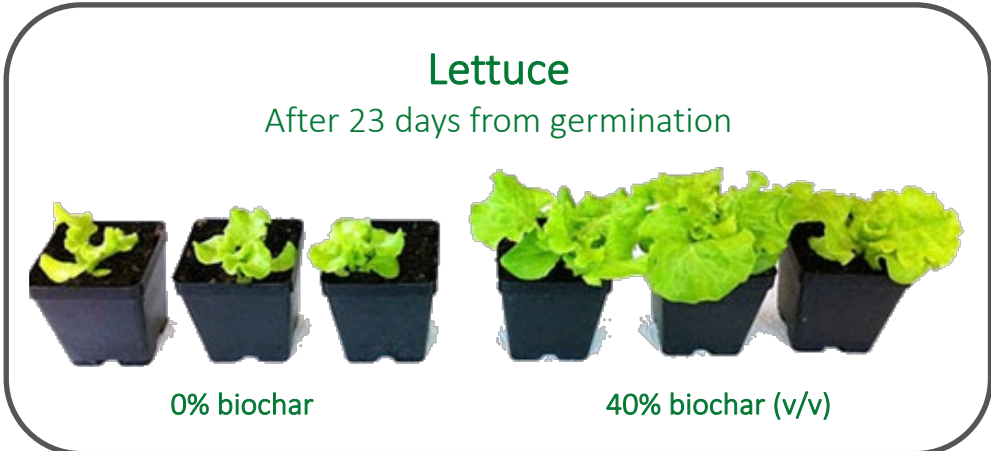
Biochar



Greenchar is the biochar made with SyngaSmart technology, listed in the soil amendment register of the Italian Ministry for forestry and agriculture [n. 0021502/18]

Biochar in agriculture

- Retains plant nutrients
- Reduces water footprint
- Increases microbiological activity and mineral uptake
- Increases crop yields and productivity



24 H RENEWABLE ENERGY

Unlike solar or wind power, SyngaSmart delivers non-intermittent and programmable energy using wide available cheap feedstock

NO PARTICULATE MATTER EMISSIONS

Unlike traditional combustion biomass plants, SyngaSmart has no emission of ashes and fine particles.

CARBON-NEGATIVE ENERGY

Biochar is a Negative Emission Technology, in other words a simple and effective tool for Carbon sequestration, completing the natural CO₂ removal operated through plant photosynthesis. On top of that, biochar shows many useful properties ranging from agriculture (soil amendment), livestock feed additive, filtering media, additive for biogas and composting. The use of biochar is a carbon-negative process.

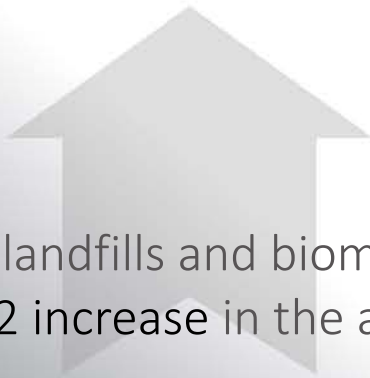
MODULAR AND SCALABLE

With power ranging from 19 to 200 kWe, SyngaSmart design is modular and scalable, and can be easily adapted to meet specific installation requirements. The plug-and-play, skid-mounted or containerized design, allows hassle-free transportation, installation and relocation, with no additional infrastructure requirements and minimum land use and visual impact.

CIRCULAR ECONOMY APPLICATIONS

Not only SyngaSmart delivers renewable energy: it activates new business and job opportunities in local biomass recovery and valorization, such as wood waste and agroindustrial byproducts, but also the organic fraction of MSW, thus allowing environmental footprint reduction from traditional disposal (incineration, landfilling) and revenues from avoided transportation costs.

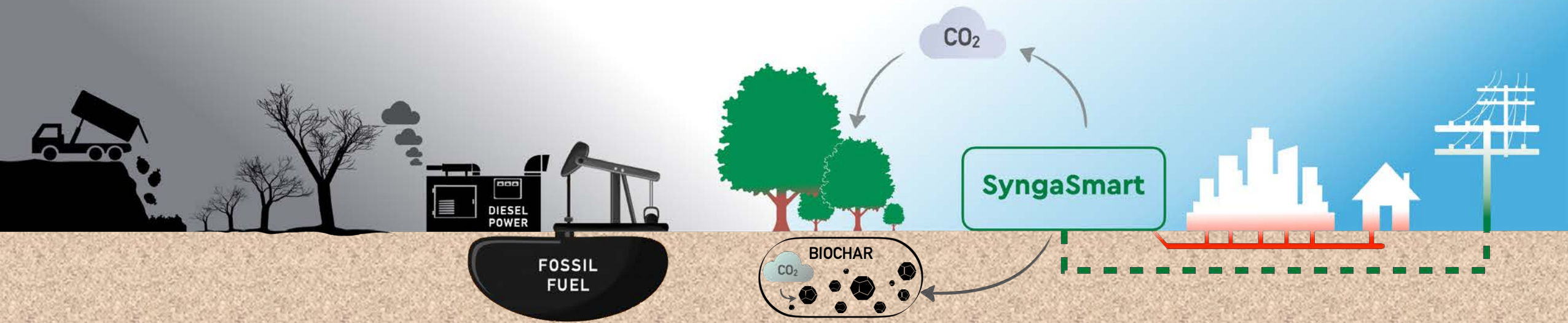
	Patent n.	Title	Filed on	Released on
SyngaSmart	102016000111822	Biomass cogeneration plant for continuous production of thermal and electrical energy.	07/11/2016	10/04/2019
PolySynH2	102017000081333	Highly configurable biomass polygeneration plant for the production of renewable fuels	18/07/2017	15/10/2019



Fossil fuels, landfills and biomass decay cause net CO₂ increase in the atmosphere

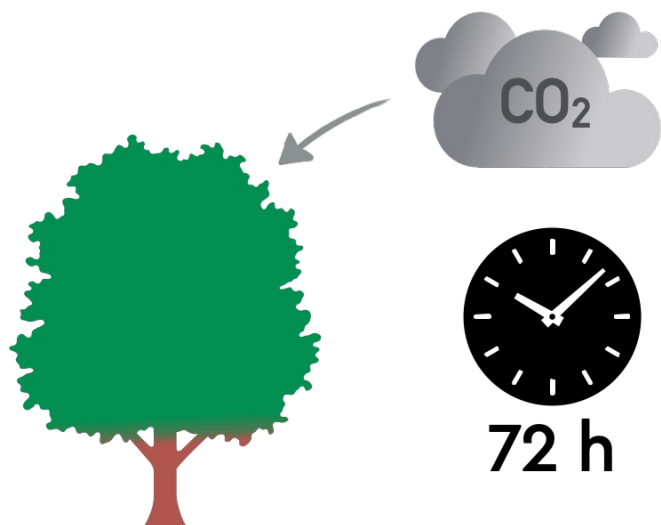
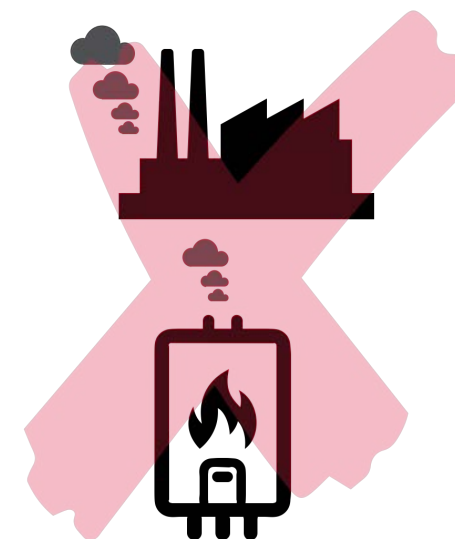
RESET SyngaSmart technology:

- allows to **avoid new CO₂ emission** by replacing fossil fuels- based heat and power generation
- enables **CO₂ sequestration** by incorporating biomass Carbon into the biochar, thus removing CO₂ equivalent from the atmospheric cycle



Generating energy with SyngaSmart allows you to **avoid new CO₂ emission** from fossil fuels combustion...

- 367 g CO₂ per kWh electric (*)
- 231 g CO₂ per kWh thermal (**)



... while at the same time **sequestering Carbon**. In fact, for each kWh generated, about **0.2 kg of CO₂ equivalent** are removed from the atmosphere and stored in the 80 grams of biochar produced along with that kWh. In other words, the **same amount of CO₂ absorbed by a tree in 3 days (***)**

(*) Comparison with natural thermoelectric plant; source: National network for the environmental protection (ISPRA) "Fattori di emissione atmosferica di gas a effetto serra nel settore elettrico nazionale e nei principali paesi Europei • Edizione 2020"

(**) Comparison with natural gas boiler; source: National network for the environmental protection (ISPRA) "Fattori di emissione atmosferica di gas a effetto serra nel settore elettrico nazionale e nei principali paesi Europei • Edizione 2020"

(***) Source: European Environment Agency (<https://www.eea.europa.eu/articles/forests-health-and-climate-change/key-facts/trees-help-tackle-climate-change>), Viessman <https://www.viessmann.co.uk/heating-advice/how-much-co2-does-tree-absorb>

SyngaSmart Carbon-negative process

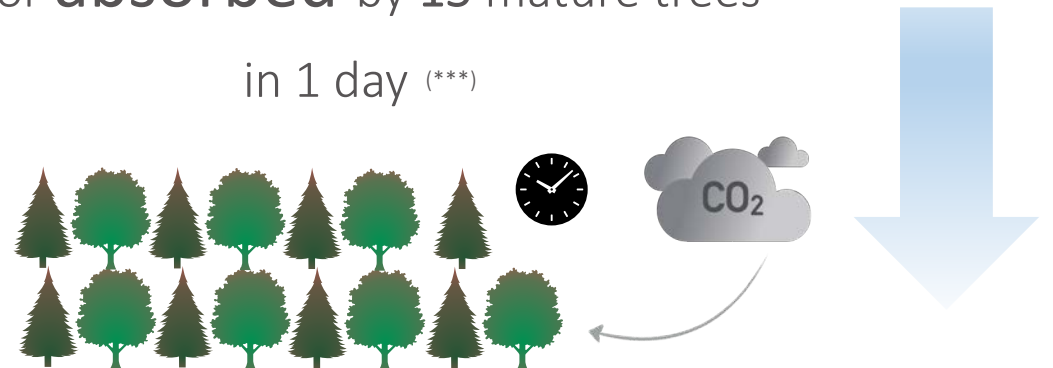


...in other words, the same amount of CO₂

...released by 1 Volkswagen Polo
driven for about **7 km** (**)



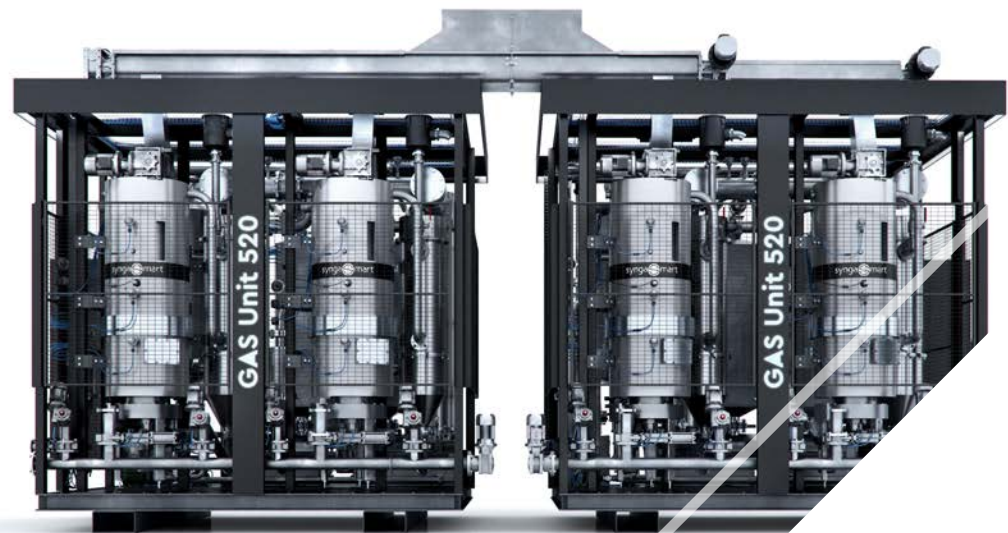
...or absorbed by 15 mature trees
in 1 day (***)



(*) lignocellulosic biomass @ 10% moisture content

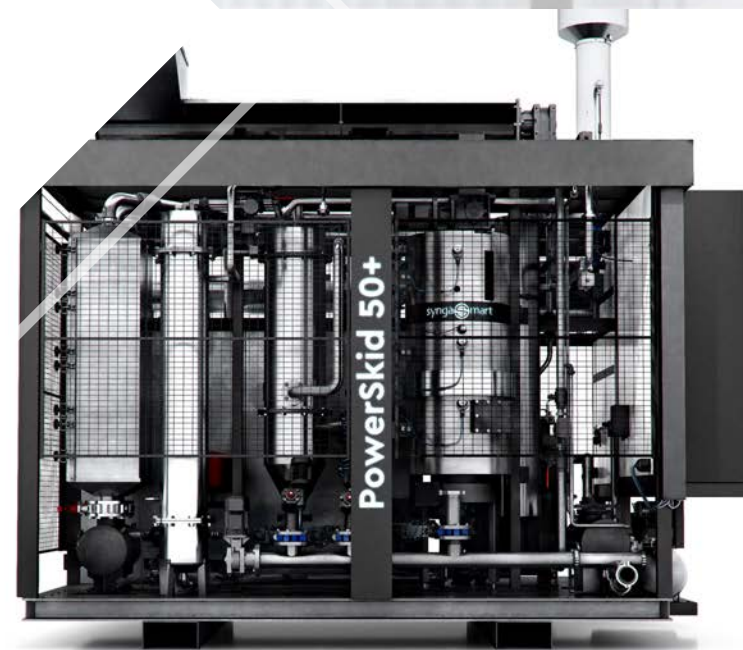
(**) European Environment Agency: VW Polo: fuel petrol, engine capacity 1.0 liter, engine power 95 hp, specific CO₂ emissions (WLTP) 127 g/km

(***) European Environment Agency: Trees help tackle climate change ; Viessman : How much CO₂ can a tree absorb



RE@ET

Product range



SyngaSmart systems are offered as plug-and-play units, easy to transport and install and ready for grid and thermal plant connection. The available models are:

- **PowerSkid:** entry level, skid-mounted model
- **CHP:** containerized version for outdoor applications, equipped with fuel storage tank
- **HEAT:** production of thermal energy only with syngas burner and boiler
- **GAS Unit:** module for the production of renewable gases - including hydrogen - from waste biomass

The commercial offer starts from the definition of a case study tailored to the customer's needs, creating project drawings, documents and business plans, and can include a biomass lab analysis service, plus support for authorizations and permitting.

Modello	Layout	Space required	Electrical Power	Thermal Power	Fuel consumption	Biochar
PowerSkid	Skid	from 10 to 22 sqm	from 19 to 200 kWe	from 28 to 300 kWth	from 23 to 240 kg/h	from 1 to 12 kg/h
CHP	Container (1 or 2)	from 15 to 60 sqm	from 19 to 200 kWe	from 28 to 300 kWth	from 23 to 240 kg/h	from 1 to 12 kg/h
HEAT	Skid or Container	from 10 to 22 sqm	n.a.	150 kWth	60 kg/h	3 kg/h
GAS Unit	Skid or Container	from 10 a 22 sqm	BioSyngas production: from 260 to 520 Scm/h		from 120 to 240 kg/h	From 6 to 12 kg/h

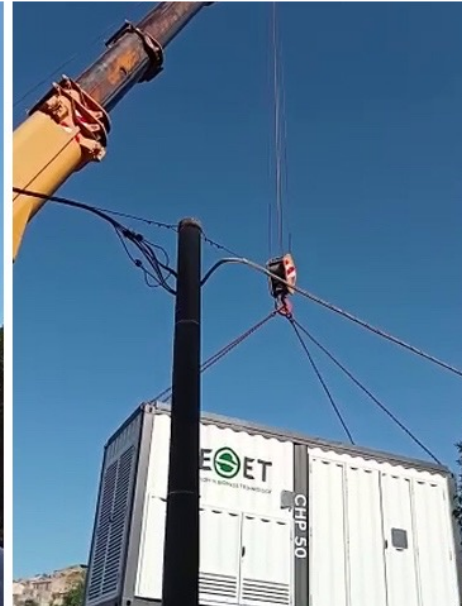
SyngaSmart installation examples

- Location: Viterbo (IT)
- MSW sorting facility
- Installed plant: CHP200 + pretreatment module (drying and briquetting)
- Feedstock: OFMSW



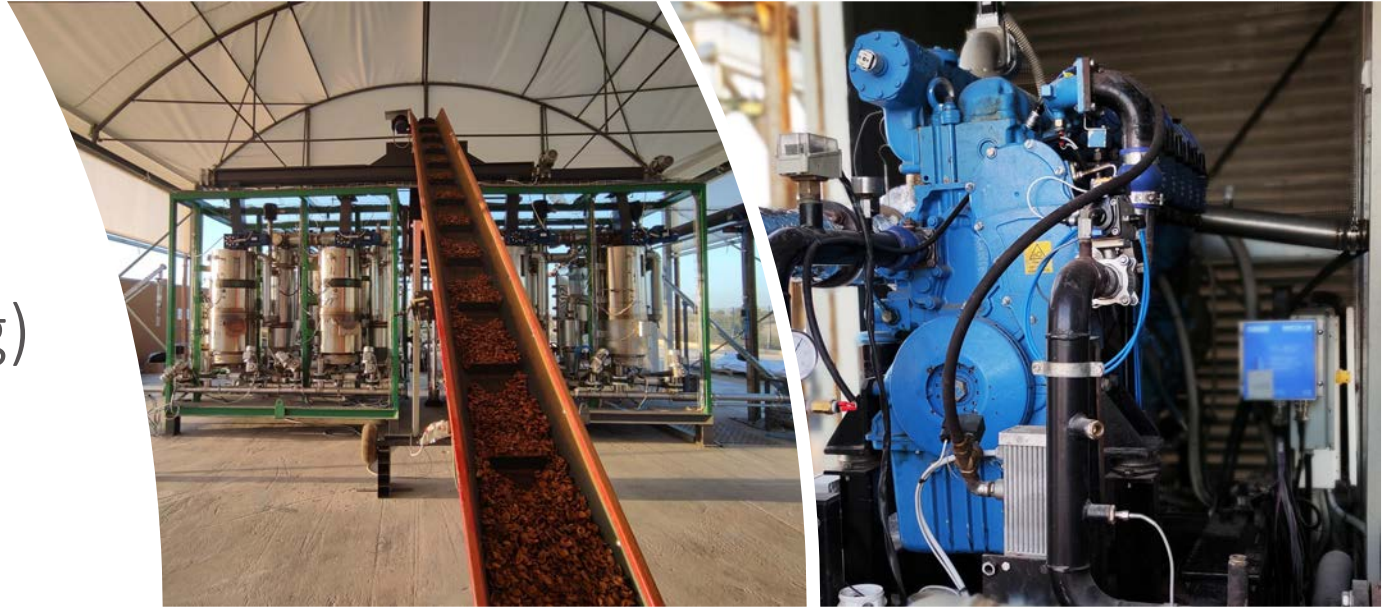
SyngaSmart installation examples

- Location: Sicily (IT)
- Municipality - Energy Community
- Installed plant: CHP50
- Feedstock: woodchips



SyngaSmart installation examples

- Location: Sicily (IT)
- Biomass treatment hub
- Installed plant: GU520 (revamping)
- Feedstock: almond shells





INNOVATION IN BIOMASS TECHNOLOGY

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