SICUREZZA & INNOVAZIONE INDUSTRIALE

SUSTAINABLE ENERGY PRODUCTION

FROM WOODY BIOMASS WASTE

All known life needs energy and, of course we need many forms of energy but, in particular, thermal and electric energy.

The goal of replacing fossil energy sources with renewable and clean energy sources is the most important goal that humanity has given itself. This goal goes hand in hand with the goal of reducing all forms of environmental pollution by promoting and encouraging the recycling of materials to keep our world cleaner.

Clean electricity will play a predominant role in achieving these goals and its need will increase for the next decades.

Therefore, all clean or green electricity technologies, such as hydropower, geothermal, wind, solar, and biomass, and their related markets, are having and will increasingly have significant growth, and they will all contribute together to give us a better world

GOALS

- **RENEWABLE, SUSTAINABLE, GREEN ENERGY SOURCE**
- **WASTE MATERIALS RECYCLING AND VALORIZATION**

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System of cogeneration through the pyrogasification of woody biomass waste

SII Ltd is a micro company operating in the field of business services, and it is able to provide technical project support, in the field of innovation to production in the renewable energy sector.

SII Ltd. has launched the BYE (Biomass Your Energy) project and PICO (Small Cogenerator) project making use of the experience and technology, patented by Antonio Nenna and Daniele Lazzari, for the production of electrical and thermal energy by means of a **system of cogeneration through the pyrogasification of woody biomass waste**.

….IT IS WOODY BIOMASS WASTE!

NEGATIVE ENVIRONMENTAL IMPACT

LOT OF STORAGE SPACE

DISPOSAL COSTS!

Worldwide, billions of tons of woody biomass waste is produced by food industries, agricultural industries, wood industries and more!

WOODY BIOMASS WASTE GENERATE DISPOSAL COSTS, NEED A LOT OF STORAGE SPACE, AND ITS DISPOSAL CURRENTLY GENERATE A NEGATIVE ENVIRONMENTAL IMPACT!

FOOD WASTE

Nutshells

Peanut shells

Agave bagasse

INDUSTRIAL WASTE

Pallet

Wood sawdust

AGRICOLTURAL WASTE

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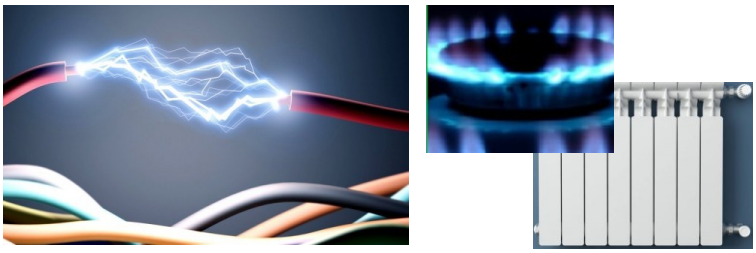
Biomass, Your Energy!



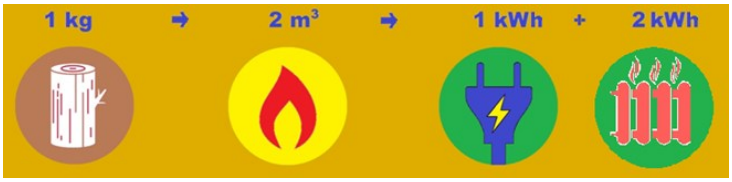
So, what about a system that allows us to use woody biomass waste for electricity and heat production?

A system capable of producing a clean fuel gas in a controlled and efficient way and then turn it into energy?

A "Carbon Neutral" system that helps us keep our environment clean that does not produce unburnt carbon waste?

Well, this can be achieved through BYE and PICO gasification technology for transforming woody biomass waste into sustainable energy.

MASS → ENERGY



1 ton => 2k m^3 => 1 MWh + 2 MWh

The mass - energy equation shows important benefits in terms of electricity and heat production, and in terms of reduction of CO_2 emissions.

1 kg of woody biomass can produce 1 kWh of electricity and 2 kWh of heat, and **can save 1.5 kg of fossil fuel CO_2.**

1000 tons => 2M m^3 => 1 GWh + 2 GWh

1500 tons of fossil fuel CO_2 saved !

So with 1000 tons of woody biomass waste it is possible to save 1·500 tons of fossil fuel CO_2.

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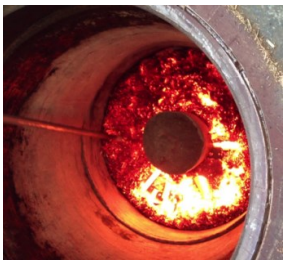
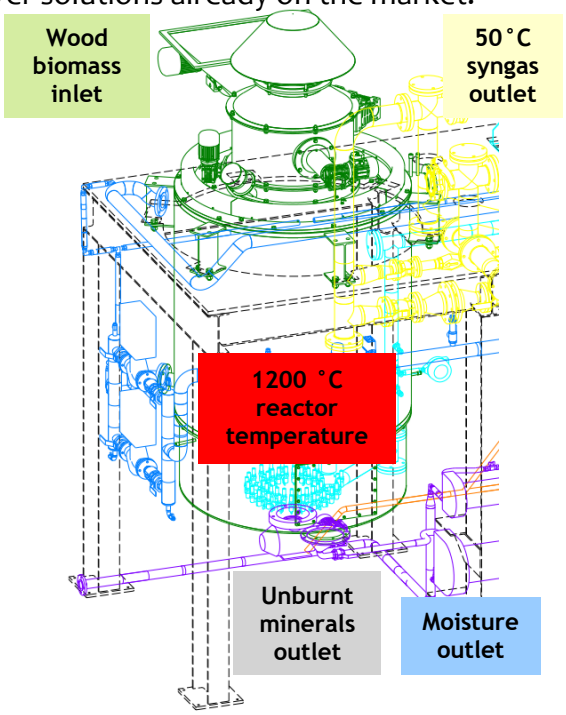
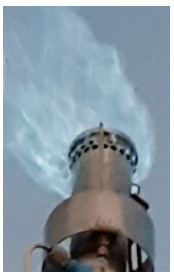
BYE GASIFICATION REACTOR

The innovative patented technology behind the BYE ad PICO gasification machine offers numerous advantages over solutions already on the market.







- The gasification process is Self-sustained, with final combustion of the total exhausted woody biomass (CHAR).
- Only minerals pass over, everything else is dissociated, CHAR also. Reactor temperature is over 1200 °C.
- The refining and cooling system of Syngas is inside the reactor. Syngas outlet temperature is about 50 °C.
- "NO EMISSIONS" into the atmosphere because BYE has closed chamber under equal-pressure conditions. There are no openings to the outside during regular operation.
- The innovative refining process of the syngas, with ceramic catalyst, inside the dissociator, allows the production of a TAR free syngas.
- Forced and controlled air inlet and syngas extraction is performed. Syngas production is not affected by the cogenerator conditions.
- Biomass with a moisture content of up to 40% can be injected, thanks to the internal reactor configuration.
- Biomass of various qualities, types and sizes can be fed, also mixed, so BYE has lower costs related to the supply, preparation, treatment and drying of wood biomass.

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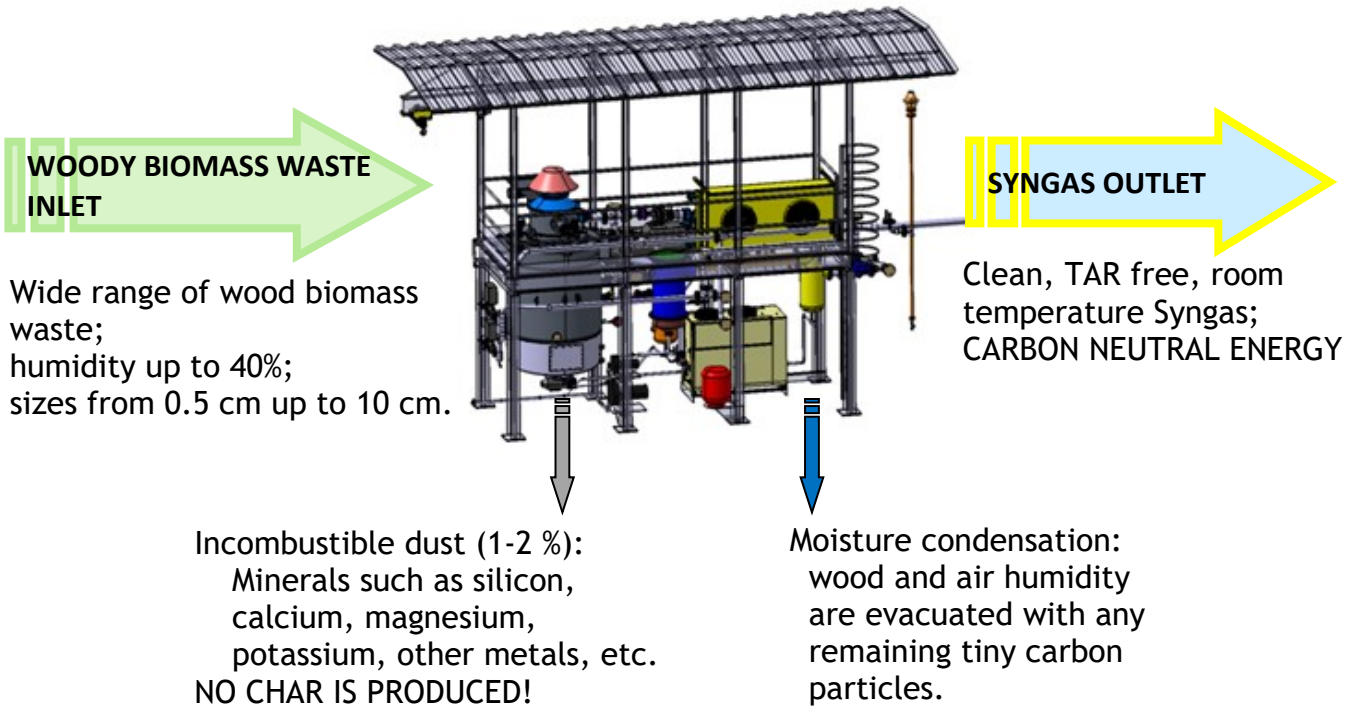
BYE GASIFICATION MACHINE



Thanks to our BYE technology, a wide range of woody biomass waste, also mixed, with humidity up to 40% and with sizes from 0.5 cm up to 10 cm, can be used.

Only minerals such as silicon, calcium, magnesium, potassium, other metals, etc. are produced, not CHAR! They can be used as soil conditioner or can be useful for chemical industry!

Woody and air humidity are evacuated with any remaining tiny particles. These tiny carbon particles and other volatiles can be useful for chemical industry.

So, thanks to BYE technology, clean, TAR free, room temperature Syngas is produced; ready to be used, for cogeneration or for combustion, saving tons of CO_2 from oil, natural gas and coal!

COMPARISON

	Wood Biomass Types	Wood Biomass Moisture	Wood Biomass Sizes	Outlet Syngas Temperature (Reactor)	Wood Biomass Consumption Per Electric Kw	One Reactor Energy Density	Adjustable Syngas Production (Flow Rate)	Scalable, Modular, Compact
BYE	**Any, Also mixed**	**Up to 35-40 %**	**0.5-10cm, Also mixed**	**About 50 °C**	**< 1 kg**	**Up to 400 kW**	**yes**	**yes**
Other Technologies	Wood Chips, Pellets	< 13-15 %	Regular 2-3 cm.	About 700-850 °C	> 1 kg	Up to 180 kW	no	yes

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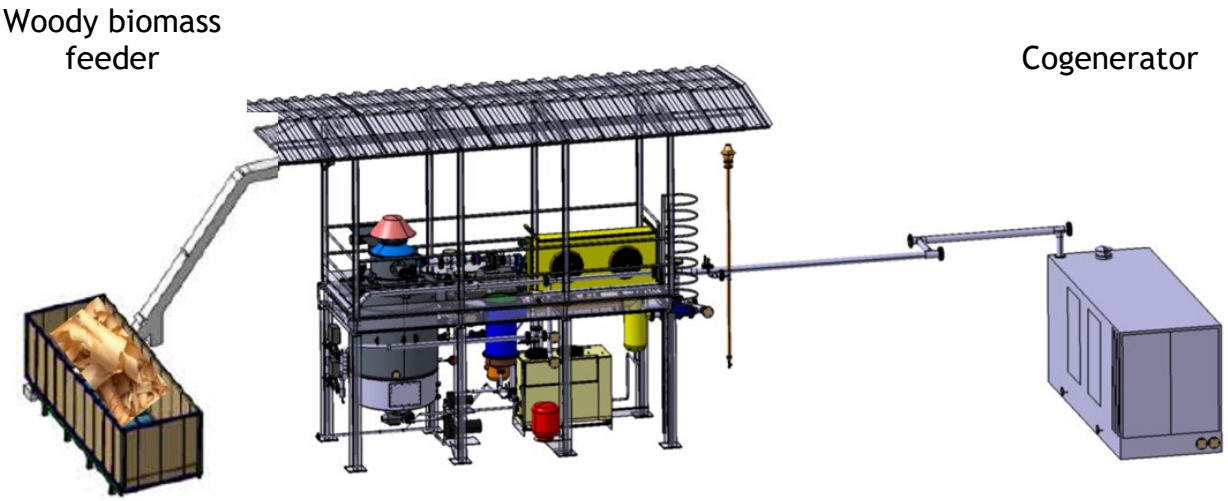
BYE GASIFICATION PLANT



The BYE basic gasification plant has the main following components:

- Woody biomass feeder; It is a standard component.
- BYE gasification machine; It is the Process unit (the gasification reactor) for transforming woody biomass waste to clean syngas.
- Cogenerator (gas engine generator for electricity and heat); It is a standard component.

The BYE machine main characteristics are:

- **"Carbon neutral" renewable energy production,** because the natural carbon cycle is respected.
- Use of Wide variety of **woody biomass,** to do the **best use of the** local woody biomass waste.
- **Scalable, modular** and **compact** solutions, so it is possible to produce energy where it is needed.

Save CO2 from fossil fuels by **recycling waste**

Produce and use sustainable energy at the source!

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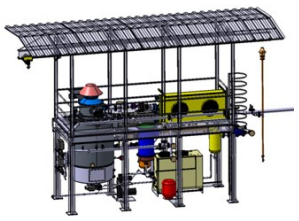
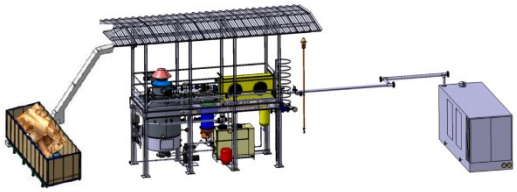
BYE SIZES AND SHAPES

BYE gasification machine
Same footprint as std container 20'



Suitable space for the BYE plant
FROM 10 m x 20 m to 20 m x 20 m



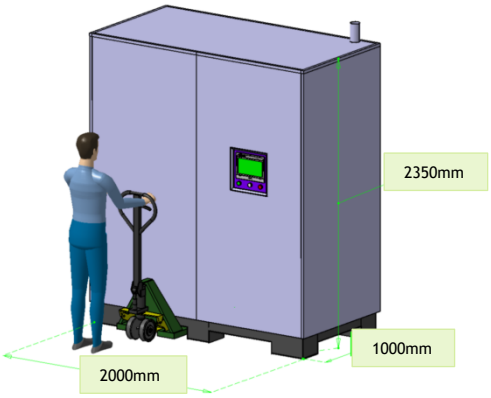
BYE - SIZES					
Type	Electric Power	Annual electric Power production	Annual hours of operation	Annual consumption of dry biomass	Annual thermal power availability
BYE 50	50 kW	375 MWh	7500	375 t	750 MWh
BYE 100	100 kW	750 MWh	7500	750 t	1500 MWh
BYE 200	200 kW	1500 MWh	7500	1500 t	3000 MWh
BYE 400	400 kW	3000 MWh	7500	3000 t	6000 MWh

Installations for the BYE plant can be arranged in dimensions of 10 m x 20 m up to 20 m x 20 m, because the gasification machine has the same footprint of a 20' standard container (6 x 2.5 m).

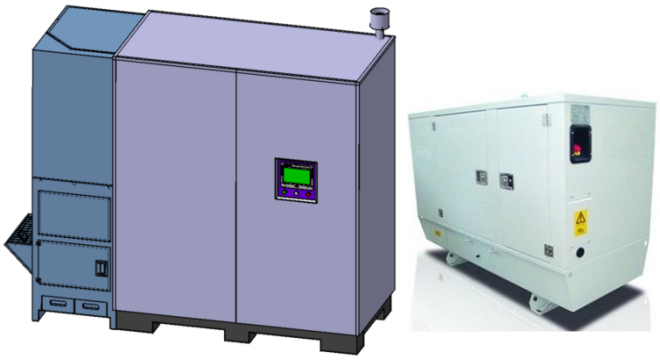
Sizes are available for electric power from 50kW to 400kW and thermal power from 100kW to 800kW.

PICO SIZES AND SHAPES

PICO gasification machine
2 m x 1 m footprint



Suitable space for the PICO plant
6 m x 2 m footprint



PICO - SIZES					
Type	Electric Power	Annual electric Power production	Annual hours of operation	Annual consumption of dry biomass	Annual thermal power availability
PICO 10	10 kW	75 MWh	7500	75 t	150 MWh
PICO 20	20 kW	150 MWh	7500	150 t	300 MWh
PICO 30	30 kW	225 MWh	7500	225 t	450 MWh

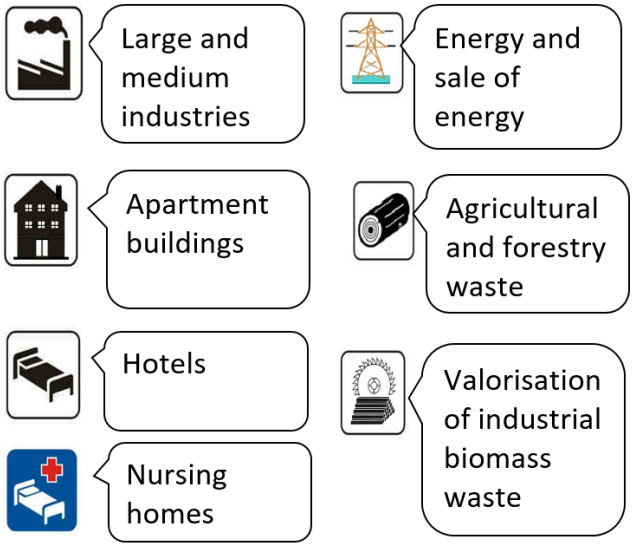
Installations for PICO plant can be arranged in dimensions of 2 m x 6 m, because the gasification machine has rectangular footprint of 2 m x 1 m.

Sizes are available for electric power from 10kW to 30kW and thermal power from 20kW to 60kW.

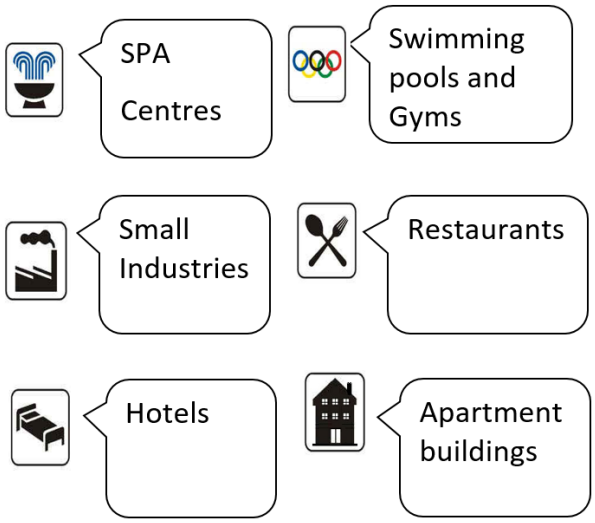
All these features allow us to say that, thanks to BYE and PICO, it is possible to produce energy at the source and use it as needed!

MARKET

BYE 50 - 400 kWe



PICO 10 - 30 kWe



So the market can be the whole world

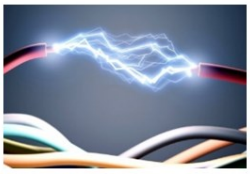
- Food and agricultural industry
- Woody transformation industry
- Forestry and urban pruning waste
- Industrial biomass waste
- ….and so on

Where there is woody biomass waste, there BYE and PICO can produce cheap and eco-friendly energy!

OUR PLANS FOR THE NEAR FUTURE

URBAN SOLID WASTE

GREEN ENERGY



The patented technology of BYE is ready to be implemented in prototypes for the valorization of differentiated urban solid waste.

Urban solid waste, because of its basic constituents, can have the same calorific value as woody biomass of medium calorific value.

Testing and researching will enable the "gasifier of the future" to be built, to make the most of solid urban waste in a cost-effective and environmentally sustainable way.

SICUREZZA & INNOVAZIONE INDUSTRIALE

Say good BYE to old fossil energy sources!

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ATTACHMENTS

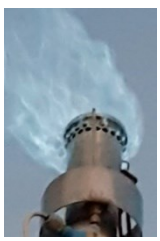
PROTOTYPES



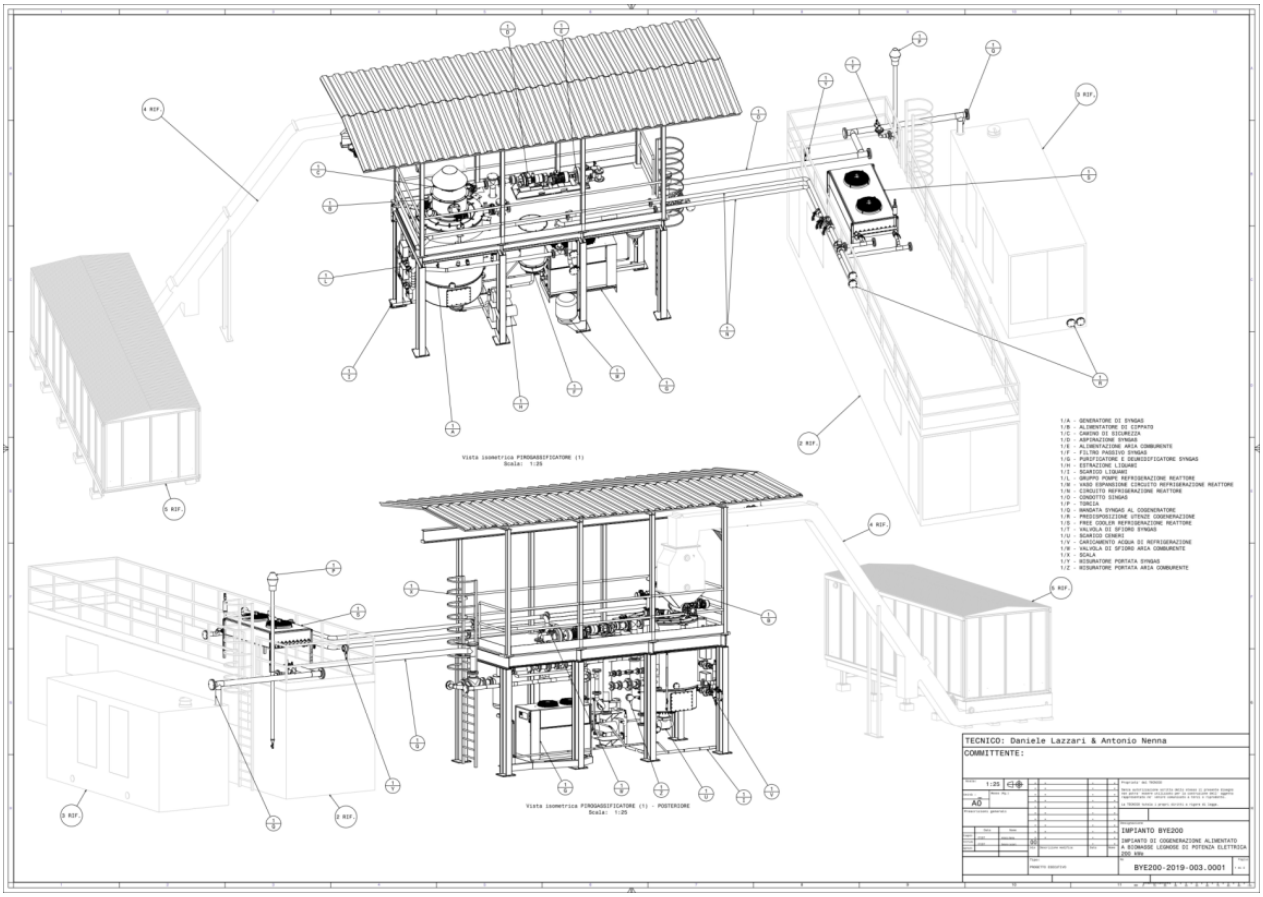


FULL SCALE PROTOTYPES




FULL SCALE BYE PLANT



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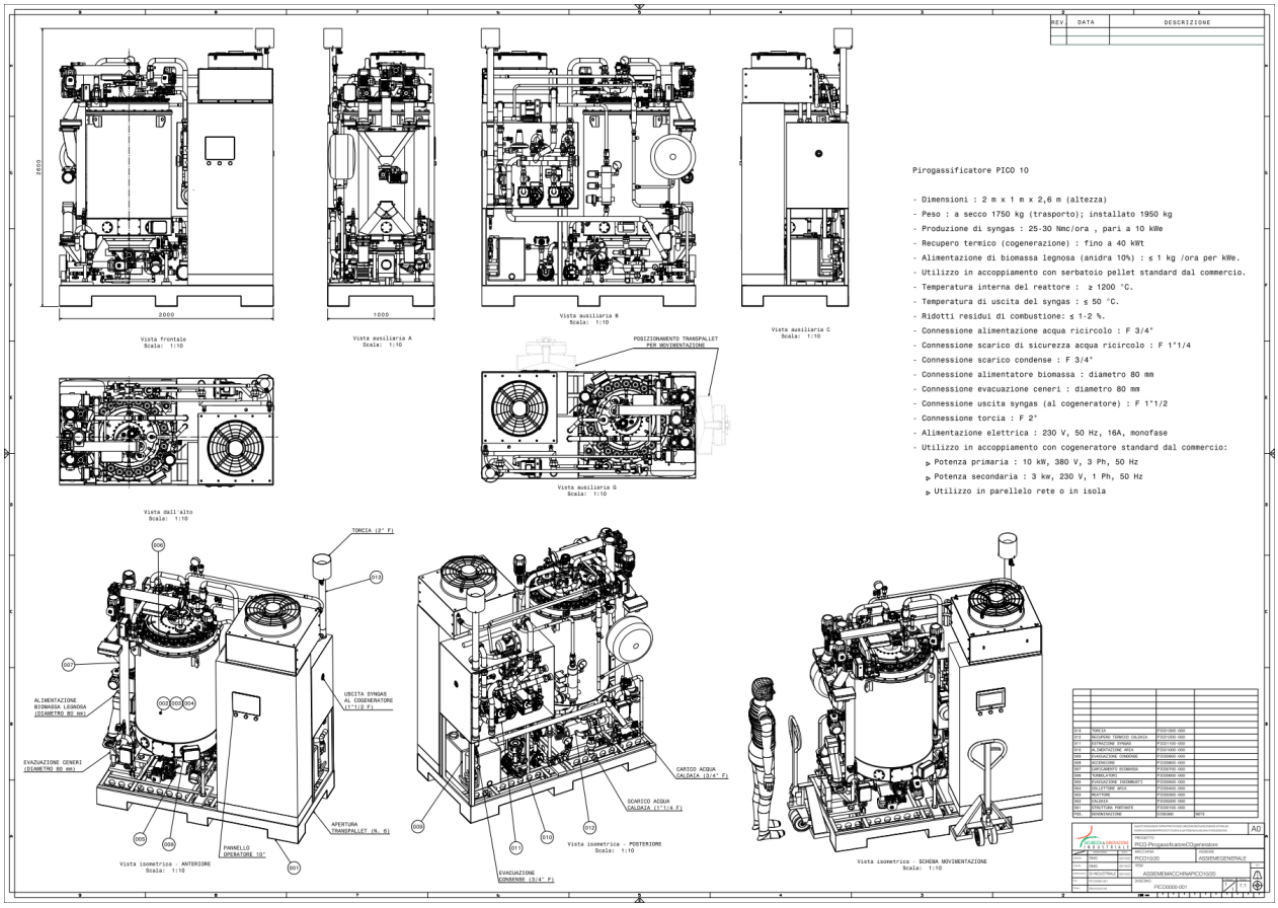
PICO FULL SCALE PROTOTYPE



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