



# THE ITALIAN **GREEN** REVOLUTION





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# CMD GROUP

For over 30 years CMD (Costruzioni Motori Diesel SPA) has been involved in design, prototyping and development of engines and **solutions for automotive, marine and aeronautical fields.**

The company was founded in 1971 as “Fratelli Negri Macchine” and it became CMD in 1989.

Today as yesterday the key factor of our company is to design, mixing our experience with the innovation.

Our activity is focused on customers' needs: CMD is not only innovative products, we also offer our know-how to realize your projects.

## CMD, AN EVER-CHANGING COMPANY

We are a cutting edge company in the technical innovation, design and production of internal combustion engines and in innovative solutions for safety and high reliability.

Moreover, we are applying our know-how to develop new important solutions for energy and heat production, precision mechanics, new projects and new products.

Over the years the team has grown and the skills have increased, as the sectors in which we operate.

Today our Business core is composed by 5 departments:

- Avio engines;
- Marine engines;
- Machining components;
- Micro CHP Systems;
- Research & Development.

## Future challenges pass through a culture of innovation.

Only looking the present from a different perspective you can see new developments for the next years.

Over the years CMD has focused its attention on technological revolution, adapting its strategies to markets changes and needs.

But we don't live on technology and skills only.

Customers and partners are an essential part for CMD: **having long term relationship** is one of our goals. We take care of your projects.





A hand is holding a glowing lightbulb over a field of green grass. The lightbulb is illuminated, casting a warm glow. The grass is vibrant green and fills the background. The hand is visible at the bottom left, holding the base of the lightbulb.

## **WHAT WE BELIEVE**

**“ We innovate to improve  
our world:**

**it is the most important  
resource for us and  
our future generations. ”**





# TEAM AND SKILLS

Our **R&D team** is composed by engineers with multi-disciplinary skills, from electronics to mechanics, from software technology to applied chemistry fields.



### **Continuous learning**

We like improve yourself, finding opportunities in difficult things to discover something of new.

We promote continuous learning to use all new tools and software, to be systematically successful in the design of value proposals.

### **Design Thinking skills**

We explore different opportunities before choosing one path. We are in perfect harmony with all kind of process.

### **Empathy with customers**

Customer's opinion is important for us: listening is the first step of any relationship.

### **Experimentation skills**

We systematically research evidences to support our ideas and testing our vision.

We try our projects from the first step of each new process, to understand its operating performances.

### **Experience, but even creativity**

To give always a complete approach to cutting – edge technologies and final products focused on customers'needs.

We support our customers in every phase development process: from technical data gathering to their validation and verification, on specific application.

# OUR PLANTS

CMD owns 4 plants, 3 in Atella (PZ) and 1 in San Nicola La Strada (CE) where our goals and our projects take shape.

Our headquarters is located in San Nicola La Strada (CE).





# IT'S TIME TO ACT!

We have chosen to be a company undertaking tangible actions to improve the world, thanks to the use of green energy.

Climate change is transforming quickly the conditions of life on Earth.

Even now a large part of total energy consumption in the world comes from fossil fuels, generating pollution.

## **Keep global temperature rise low.**

**Since the Paris Agreement, that became law in 2016**, the international community has established to keep the rising of global temperature below 1.5 ° C.

Today over 60% of greenhouse gases emitted in the atmosphere derive from energy production (UN 2020).

This means that we have one great opportunity to create innovation in the production of energy in an alternative way.

Nowadays just less than a third of the world's energy supply comes from sources renewables (IEA 2020)

With this energetic mix, we will not achieve the Paris Agreement purposes.

## **From fossil fuels to renewable fuels.**

Although reached results, we think we must do more to reduce all climate change effects.

We believe a responsible and inclusive energy transition is an important requirement for a sustainable future, and fast decarbonisation is essential for achieving this goal.

## **Sustainability definition:**

An action is socially and environmentally sustainable if it can continue over time without causing it damage to people and the world.

But a sustainable action can even create value, when it get better something for improving people and/or the world.





Our work for environment takes shape with **ECO20x**, a system that can produce green energy for all fields, now and in the future.

Thanks to this technology we allow to people, companies and communities using their resources without worries for the negative environmental impact and opportunities limitation for future generations.





### WHAT IS?

We could define ECO20x as a product belonging to Circular Economy field, because it draws electric energy and heat from biomass, returning nourishment to the environment for new biomass

ECO20x is a microCHP system (Combined Heat & Power System) powered by biomass.

**It can produce electric energy and heat at same time** through a combined process obtained by a thermochemical breakdown of wooden and cellulosic residual (for example textile waste) at high temperature and with low oxygen quantities (**pyrogasification**).

**This process converts biomass into a gas.** After cleaning and cooling process the gas is released to the ECO20x internal combustion engine for engaging the generator and producing electric power.

In this way renewable fuels replace fossil fuels.

### USE

**ECO20x gives value to residual biomasses** from agricultural farms, forest management and maintenance, from pruning and wood manufacturing (processes), because it is used for energy production without direct combustion.





# CERTIFICATIONS

CMD ECO20x achieved the CE European Conformity since it is in compliance to all safety and quality standards required by European law.

ECO20x production process is certified according to the Integrated Quality- Environment- Safety Management System UNI EN ISO 9001/2017 - ISO 14001 - ISO 9100:2009 - ISO/TS 16949:2002.



FIG 1: Micro CHP system ECO20x.



Member of CISQ Federation



Member of CISQ Automotive



Member of CISQ Federation



Member of CISQ Federation





# BIOMASS: WHAT IS?

According to Italian Legislative Decree 29/12/03 n. 387, **biomass for energetic use is** *"...the farming organic waste (including plants and animal products), produced by forestry and related industries, and industrial and urban organic waste."*

For European Union, the wooden biomass for energetic use is **one of most efficient natural fuel to reduce greenhouse gas emissions.**

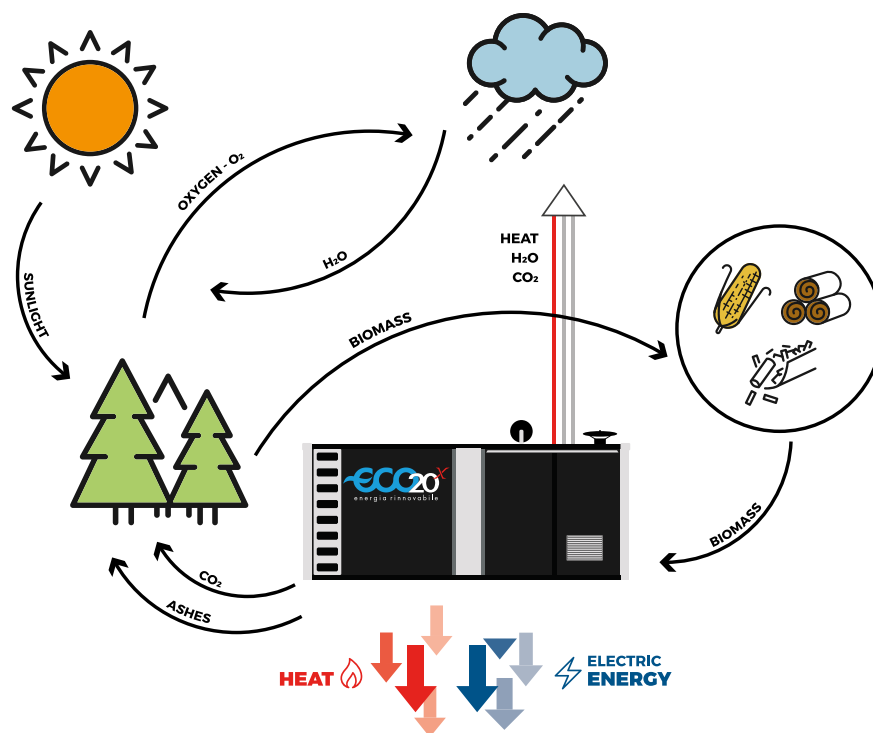
In the last few years, the request of energy efficiency systems for environment protection is strongly increased and the use of biomass into CHP systems has been one of the most innovative solution.

There is no **waste** in the matter.  
There are destinies to be rebuilt.

In a new holistic and circular vision  
**in which everything can be recovered.**



FIG 2: ECO20x virtuous cycle.



## Virtuous cycle

While ECO20x is running, it releases **the same CO<sub>2</sub> quantity another plant got from the atmosphere** during its growth, creating a very "virtuous circle". It does not increase greenhouse percentage in the atmosphere.

Virgin wood ashes are the by product of the energy conversion process and such **ashes** can be used as **soil conditioner for plants growth**, as reported on Legislative Decree n° 220/95 implementing the reg.CEE 2092/91 about "organic agriculture fertilization and soil conditioner products uses".

**Biomasses available for ECO20x** may be chosen in a wide range of products and by products: forestry waste, pruning waste, nut shells, hazelnut shells, coconut shells, almond shells, chestnut shells, almond shells, olive pits, apricot pits, peach pits, tobacco stalks, corn stalks, cane residue.

Different kind of biomasses have been tested in different combinations.

Wood moisture and dimensions are 2 binding features: biomass for ECO20x must have medium size and max 20% of moisture.

ECO20x can convert other specific residual waste such as **textile waste and exhausted sewage sludge** in addition to organic waste.









# WOOD CHIPS: THE BIOMASS ENERGY

Each fuel has a specific energy quantity; after combustion, energy becomes an useful resource for specific purposes (electric energy & heat production). The main available energy quantity is strictly related to heating value of used fuel.

## WOOD HEATING VALUE

This heating value indicates **energy quantity which can be obtained by full combustion of a mass unit**.

Literature studies demonstrate that lower **heating value of wood** ( $PC_L$ ), coming from different wood qualities, varies in a quite limited range [**between 2,5 and 5,5 kWh/kg**].

- In **conifers** it is about 2% higher than broad leaf ones. This difference is especially due to the higher lignin quantity of conifers and also to the higher resin, wax and oil quantities.
- Heating value of **textile waste**, containing **cellulosic fibers**, is higher than wooden waste.
- Heating value of **sewage sludge**, containing high quantity of carbon, if dried at 20% of moisture, is an optimal value.



Wood moisture can modify its heating value reducing it while moisture increases. It happens because a part of released energy during combustion process is used for water evaporation and it is not available for thermal use. Water evaporation needs 678 Wh of energy for each kg of water.

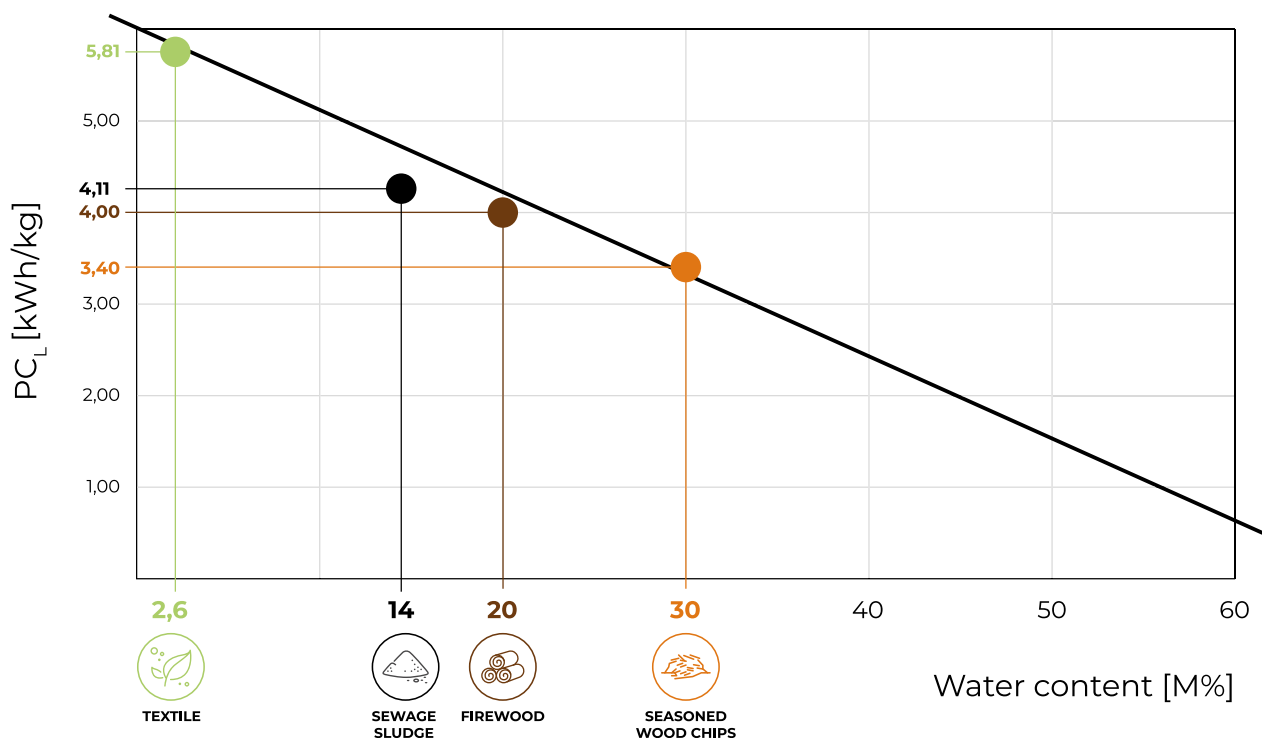
## HEATING VALUE CALCULATION

The formula for wood heating value calculation {MJ/kg} with a specific water quantity [M%] is the following:

$$PC_L = \frac{PC_M \times (100 - M) - 2,44 \times M}{100}$$

**Heating value variation** (with PCM = 5,14 kWh/kg = 18,5 MJ/kg) according to M is shown in the following diagram.

TABLE 2: Wood heating value variation according to specific water quantity



# HEATING VALUE OF MAIN FUELS

An evaluation of wood heating value allows to make energetic comparisons with fossil fuels. Referring to table 1 you can deduce:

FUELS	HEATING VALUE (AVERAGE VALUES)	
	MJ	kWh
<b>1 kg wood (M = 20%)</b>	<b>14,40 MJ/kg</b>	<b>4,00 kWh/kg</b>
Extralight diesel	36,17 MJ/l (42,5 MJ/kg)	10,00 kWh/l (11,80 kWh/kg)
Light diesel	38,60 MJ/l (41,5 MJ/kg)	10,70 kWh/l (11,50 kWh/kg)
Methane*	36,00 MJ/m <sup>3</sup>	10,00 kWh/m <sup>3</sup>
GPL**	24,55 MJ/l (46,3 MJ/kg)	6,82 kWh/l (12,87 kWh/kg)
Carbon	27,60 MJ/kg	7,67 kWh/kg
Coke 40/60	29,50 MJ/kg	8,20 kWh/kg
Lignite (briquettes)	20,20 MJ/kg	5,60 kWh/kg
<b>Textile</b>	<b>20,91 MJ/kg</b>	<b>5,91 kWh/kg</b>
<b>Sewage Sludge</b>	<b>14,8 MJ/kg</b>	<b>4,11 kWh/kg</b>
1 kWh electric	3,60 MJ	1,00 kWh/kg

\*1 kg = 5,8 l (20°C, 216 bar)    \*\* 1 m<sup>3</sup> GPL = 4 l = 2 kg

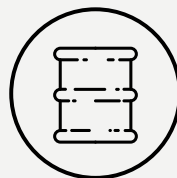


**1 KG  
DIESEL**

=



**3 KG  
WOOD WASTE**



**1 L  
DIESEL**

=



**2,5 KG  
WOOD WASTE**

Textile density before the densification process = 50 kg/m<sup>3</sup>  
Textile density after the densification process = 997,23 kg/m<sup>3</sup>

TABLE 3: Heating value of main fuels





### **NO IMPACT ON ECOSYSTEM**

ECO20x takes part in the natural cycle, environment respecting: its pyrogasification process produces clean energy without emissions for the global warming.



### **BILL COSTS DECREASING**

Producers companies of wooden and organic biomass can decrease energy bill costs generating heat and energy by themselves: recovering wooden scraps and using wooden ashes as soil conditioner.

A great advantage for the environment and consumptions.

# ECO20x MICRO CHP SYSTEM POWERED BY BIOMASS

ECO20x is a highly technological equipment, automatically managed, producing electric energy and heating by combustion of gas coming from biomasses pyro-gasification (a thermo-chemical process developed at high temperature and with a low amount of oxygen).

FIG 4: ECO20x internal details.





# PROCESS PHASES

## PYROGASIFICATION AND FEEDSTOCK FED

**Wooden biomass** is delivered to gas producer taking it from the main **hopper**, integrated into containerized box. The gas is obtained by biomass and other organic materials heating (from 300°C till 900°C), such a fuel is a **gas mixture** (syngas) essentially composed by CO, H<sub>2</sub> and CH<sub>4</sub>.

## SYNGAS

Before air mixing, syngas must be submitted to a cooling, filtering and cleaning process. Only after **cleaning process, fuel/ air mixture is released to the internal combustion engine.**



## FROM SYNGAS TO ENERGY

CHP system's crankshaft is joint to a synchronous alternator; such alternator can **produce  $20\text{kW}_{\text{el}}$**  (peak value). Heating recovery system can produce till  **$40\text{kW}_{\text{th}}$  of heat power** (peak value), using the heating inside cooling engine system and that released by exhaust engine gases.

CHP system is suitable even for **trigenerative purposes** (production of electric energy, heating, thermal and refrigerator), coupled with an absorption chiller.





# ECO20x

## TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATION C€	
<b>Available continuos power</b>	20 kWp @50Hz (value according to biomass)
<b>Available thermal power</b>	40 kWp (cfg standard)
<b>Sound level (Silenced gen set)</b>	60 dB(A) 7m (possibility of soundproofing and dB reduction kit)
<b>Max Continuos Operation</b>	24h
<b>CE - Conformity</b>	Yes
<b>Consumption @100%</b>	1,24 - 1,25 kg/kWh
<b>Start up Time</b>	ca. 15 - 90 min
<b>CHP Combined heat Power - production</b>	Available
<b>Box dimensions</b>	Height = 2,73m / Width = 2,44 m / Lenght = 6,05 m Total Weight = 5.600 kg (box + equipment + biomass storage tank)

TABLE 4: ECO20x technical specification

# ECO20x

## ENERGETIC

## DETAILS

### ENERGETIC DETAILS

7.500	h/year	CHP system working hours
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### BIOMASS CONSUMPTION

Average consumption per hour  
(it strictly depends on quality and humidity  
of biomass)

24 ± 5 kg/h

7.500	h/year	200.000 kg/year
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### ELECTRIC ENERGY PRODUCTION

20	kWh/h	Max electric energy production per hour
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7.500	h/year	150.000 kWh
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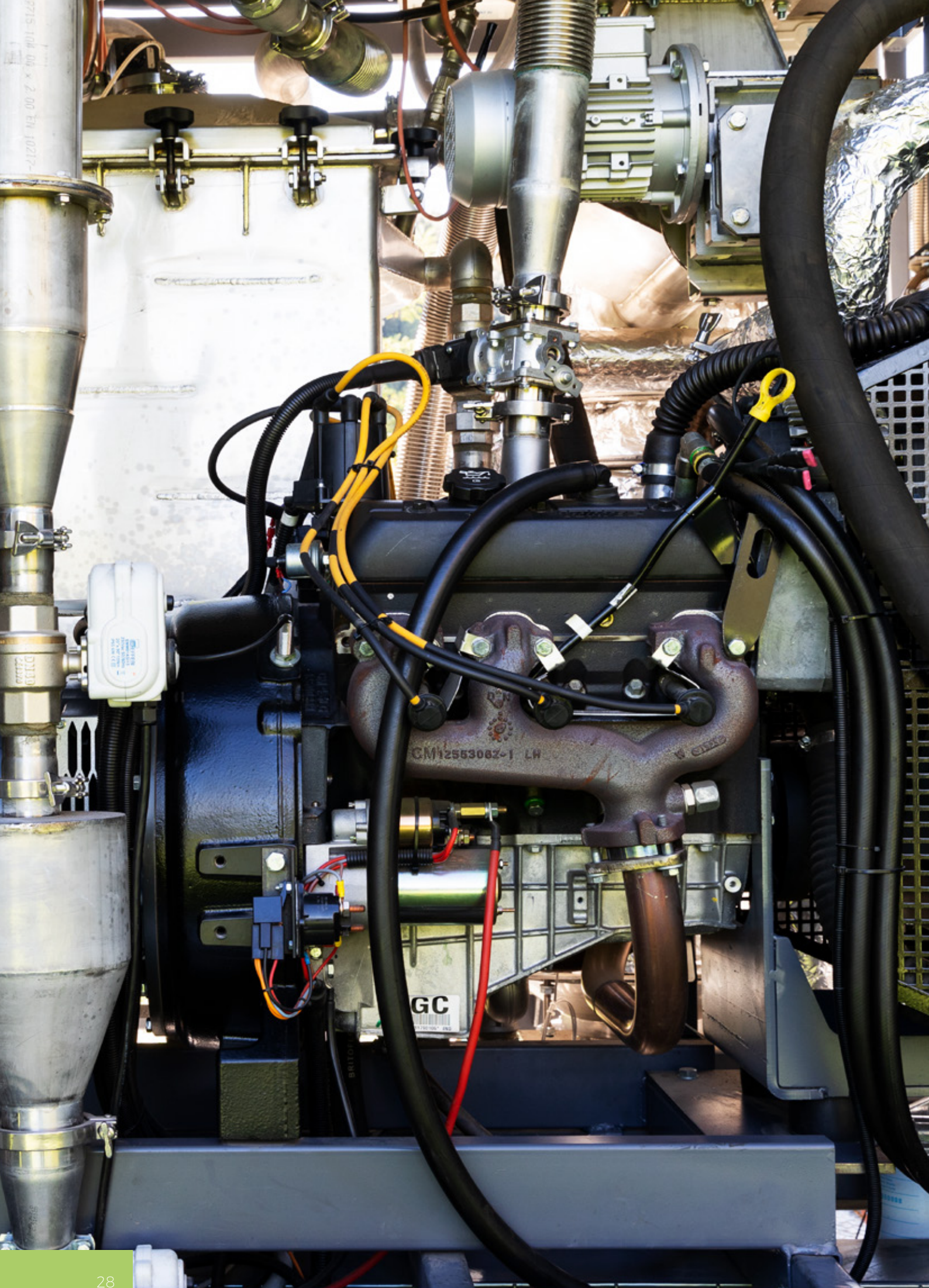
### THERMAL ENERGY PRODUCTION

40	kWh/h (Max thermal energy production per hour)
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300.000	kWh/year (Total thermal energy produced per year)
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TABLE 5: ECO20x CHP system energetic details









# ECO20x MAINTENANCE AND INSURANCE DETAILS

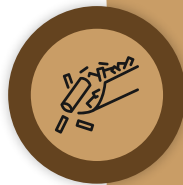
Main information related to **maintenance, insurance, conformity and warranties** are shown in Table 5.

MAINTENANCE AND INSURANCE DETAILS	
<b>Maintenance</b>	Full service ordinary and extraordinary maintenance: - Engine's change each 15,000 hours of production
<b>Insurance</b>	Before signing the contract, a form with evidence of the place of installation and specific parameters must be fulfilled
<b>CE and CEI conformity</b>	Conformity CE Conformity CEI
<b>Warranty</b>	2 years

TABLE 6: ECO20x general details



# ENERGETIC BALANCE



## WOODEN BIOMASS

Input flow rate biomass<sub>wet</sub> = 24[kg/h] = 24[kg/h] x (1/3'600)[h/s] = 0.0066 [kg/s]  
 Water content = 20%  
 Input flow rate biomass<sub>db</sub> = 0.0066 x (1 - 0.20) = 0.0053 [kg/s] x 3600 [s/h] = 19.08 [kg/h]  
 Consumption = 24 [kg/h] x 7'500.00[h/year] = 180'000 [t/year]  
 LHV biomass<sub>wet</sub> = 13'288 [kJ/kg]  
 LHV biomass<sub>db</sub> = 18'045 [kJ/kg]  
 Nominal thermal power<sub>wet</sub> = 0.0066 [kg/s] x 13'288 [kJ/kg] = 87.70 [kW<sub>th</sub>]  
 Nominal thermal power<sub>db</sub> = 0.0053 [kg/s] x 18'045 [kJ/kg] = 95.64 [kW<sub>th</sub>]  
 Primary energy biomass<sub>wet</sub> = 87.70 [kW<sub>th</sub>] x 7'500 [h/year] = 657'750 [kW<sub>th</sub>/year]



## AIR

Input flow rate air = 41.94 [kg/h]

## GAS PRODUCER

Char and ash specific production = 5% wet flow rate biomass

Output flow rate<sub>char and ash</sub> = 24 [kg/h] x 0.05 = 1.2 [kg/h]

Mass balance -> Input flow rate biomass<sub>wet</sub> = Output flow rate syngas + Output flow rate<sub>char and ash</sub>

24 [kg/h]<sub>(biomass)</sub> + 34.16 [kg/h]<sub>(air)</sub> = 64.74 [kg/h]<sub>(syngas)</sub> + 1.2 [kg/h]<sub>(ashes)</sub>

## CHAR AND ASH

## GENERAL DATA SYSTEM

Nominal electrical power = 20 [kW<sub>e</sub>]

Nominal thermal power = 40 [kW<sub>t</sub>]

$$\eta_{el} \text{ ECO20}_{average} = (20[\text{kW}_e] / 87.70[\text{kW}_t]) \times 100 = 22.8\%$$

$$\eta_{th} \text{ ECO20}_{average} = (46.74[\text{kW}_t] / 87.70[\text{kW}_t]) \times 100 = 53.3\%$$

$$\eta_{global} \text{ ECO20}_{average} = \eta_{el} \text{ ECO20}_{average} + \eta_{th} \text{ ECO20}_{average} = 22.8\% + 53.3\% = 76.1\% *$$

\* In evaluation of  $\eta_{global} \text{ ECO20}_{average}$  the contribution of drying thermal power<sub>average</sub> equal to a 3.76[kW<sub>t</sub>] was not considered, because in the CAR calculation, the heat used for fuel preparation is not seen as useful heat (as defined by the *Guidelines on the CAR*, Section 2.3 p. 60).

## EXHAUST GAS

Volumetric flow rate exhaust gas = 142,42 [Nm<sup>3</sup>/h]

NO<sub>x</sub> = 158 [ppm]

PT = 2,9 [ppm]

CO = 1'218 [ppm]

SO<sub>2</sub> = 31 [ppm]

COT = n.r.

NH<sub>3</sub> = n.r.

## SYNGAS

Output flow rate syngas = 64,74 [kg/h]

Volumetric flow rate syngas = 0,01893 [Nm<sup>3</sup>/s] (net TAR)

LHV<sub>syngas</sub> = 4'293 [kJ/Nm<sup>3</sup>/s]

Nominal thermal power syngas = 0,01893 [Nm<sup>3</sup>/s] x 4'293 [kJ/Nm<sup>3</sup>] = 81,30 [kW<sub>th</sub>]

CGE = (81,30/95,64) x 100 = 85%

Syngas productivity = 0,01893 [Nm<sup>3</sup>/s] x 0,0066 [kg/s] = 2,868 [Nm<sup>3</sup>/kg]

## CHP SYSTEM



## ELECTRIC ENERGY

$\eta_{el} MCI_{average} = (20[kW_e]/81,30[kW_t]) \times 100 = 24,6\%$

Gross production<sub>average</sub> = 20[kW<sub>e</sub>] x 7'500 [h/year] = 150'000 [kWh<sub>e</sub>/year]

Auxiliary consumption = up to 15%

Transformation losses = 2%

Net production E<sub>e average</sub> = 150'000 [kWh<sub>e</sub>/year] - (150'000 x 0,17) = 124'500 [kWh<sub>e</sub>/year]



## THERMAL ENERGY

Exhaust gas thermal power recovered<sub>average</sub> = 11,24 [kW<sub>th</sub>]

Engine thermal power primary circuit<sub>average</sub> = 35 [kW<sub>th</sub>]

Drying thermal power<sub>average</sub> = 3,76 [kW<sub>th</sub>]

Global thermal power recovered<sub>average</sub> = 11,24 [kW<sub>th</sub>] + 35 [kW<sub>th</sub>] + 6,74 [kW<sub>th</sub>] = 46,74 [kW<sub>th</sub>]

$\eta_{th} MCI_{average} = (50[kW_{th}]/81,30[kW_{th}]) \times 7'500 [h/year] = 350'550 [kWh_{th}/year]$

## CONSUMPTION MATERIAL AND PRODUCTION WASTE

Lubrication oil = 37 [kg/year]





# WORKING PRINCIPLES

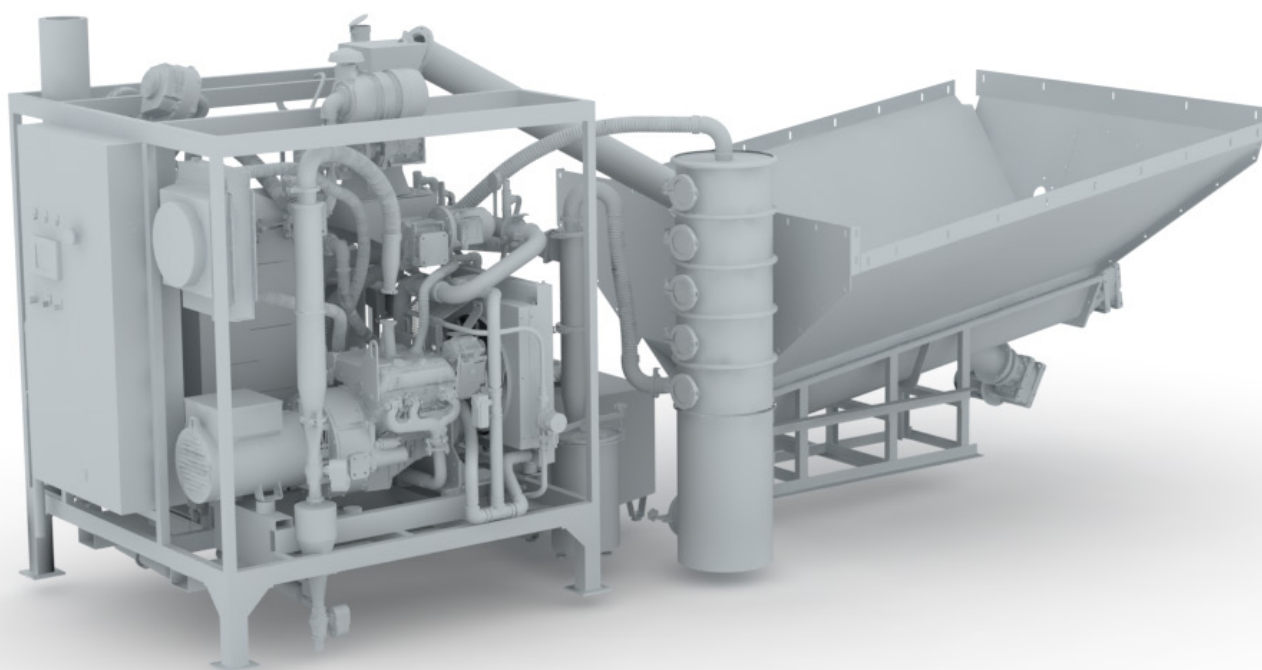
ECO20x pyrogasification and the energy and heating production are highly technological processes but CMD has made them easy with ECO20x microCHP system.

## **ELECTRIC ENERGY PRODUCTION**

ECO20x working principles for electric energy production are shown in fig. 5

The electric motor activates the auger, pushing biomass inside the reactor taking it from the main hopper.

Thermochemical decomposition produces syngas to be cooled and cleaned before the use in internal combustion engine.



For this reason, gas is treated by:



1

a **cyclone reactor** for ultra small ashes removal

---



2

a **cooler** to increase the density and for tars removal, inside the syngas

---



3

a **biological filter** to further remove ultra small ashes and residual tars

---



4

a **cyclone close to the engine**, allowing the mixture with the external air and the final removal of last condensed components.



The produced electric energy is fully released to the electric grid while engine exhaust gas can be used into thermal recovery section.

## THERMAL RECOVERY

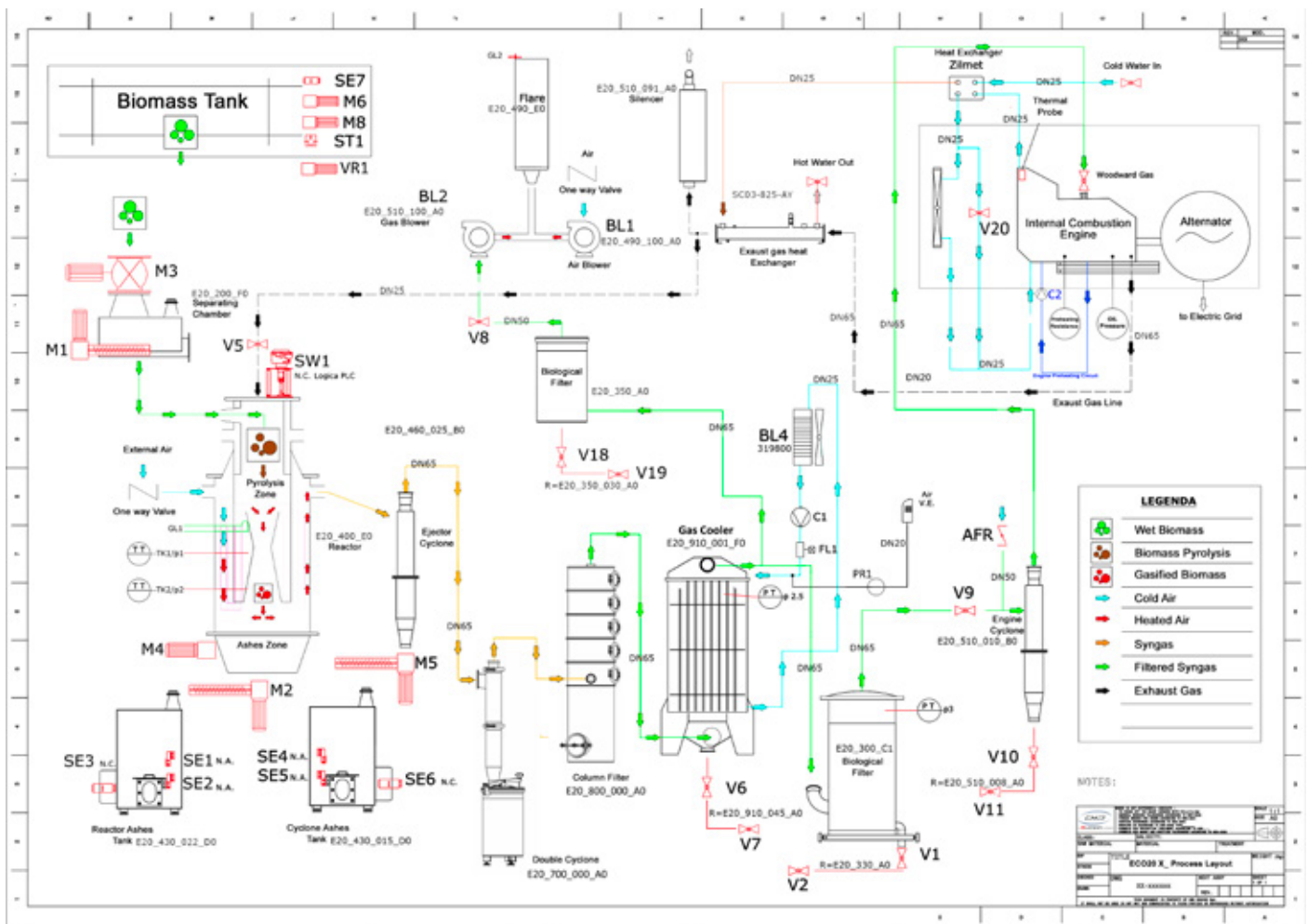
Concerning thermal recovery section, ECO20x can get:

- a **first recovery at low temperature** using engine's cooling water by a plate heat exchanger
- a **further recovery at high temperature** using engine's exhaust gas by a specific heat exchanger, in serie with the first one.

## EXHAUST GAS

After releasing the heat inside the heat exchanger CHP system's exhaust gas are released in the atmosphere, in compliance to the **current regulations on emissions** given by Italian Legislative Decree 152/06.

# WORKING PRINCIPLES' LAYOUT









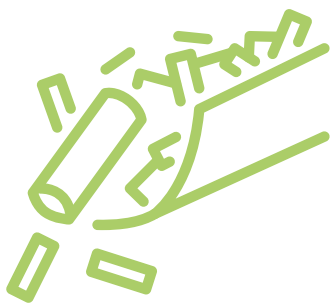


# FINAL APPLICATIONS

The energy box, with its innovative design, includes both hopper and equipment in one single box, making it more efficient and compact to total process management, from biomass to engine operating/CHP system.

Minimal design meets technology: its compactness makes easier and reduces the installation time. It is adaptable and flexible.





### **SME - SMALL MEDIUM ENTERPRISE**

Our ECO20x can be integrated in each kind of small and medium enterprises.

Some examples: logistic platforms for distribution and production of wooden scraps, carpenter's shops, food, paper factories, ceramic industry, glass, chemical, engineering, textile, handcraft industry.

These companies can reach a considerable energetic independence with a positive impact in terms of economic efficiency.



### **AGRICULTURAL AND FOOD CHAIN**

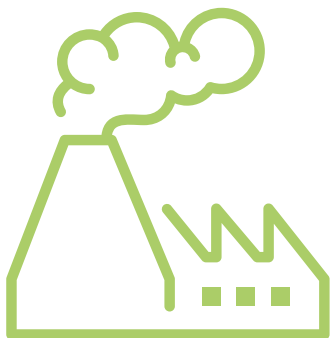
Agricultural farms, greenhouses, cheese factories, livestock, farming products transformation produce large quantities of waste. Wooden waste produced by agriculture is extremely useful for getting natural fuel through pyrogasification: great advantage in terms of reduction of pollution and energy-saving.



### **PUBLIC BODIES**

ECO20x can be the right solution with those PB (Public Bodies) with a high energetic needs, improving the energy management.

Some example: municipalities, districts, care homes, public swimming pools, hospitals, schools.



### **PRODUCTION COMPANIES**

All companies and/or enterprises involved in production processes can find in ECO20x system an efficient option using heating and sanitary hot water.



### **SPA AND WELLNESS**

ECO20x system is the smart choice for powering wellness and SPAS centers: it can directly heat swimming pools, producing at the same time electric energy.





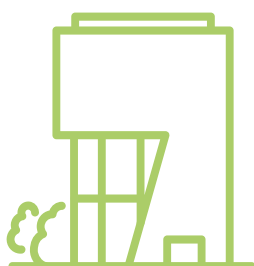
## SPORT FACILITIES

Thanks to high performance technology, ECO20x can help to manage sport facilities and swimming pools, avoiding loss of energy and guaranteeing safety of electric system.



## FORESTRY

ECO20x is suitable for residual biomass management and wood residues in forestry, including mowing and pruning coming from public and private green areas, from forestry and related industries, after a pre-treatment process (drying, sieving, briquetting).



## HO.RE.CA

Hotels, b&b, restaurants, resorts, hospitals, shopping malls are all facilities which can get high profitability from ECO20x installation.



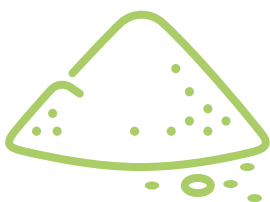
### SMALL HOUSES

CHP systems can be used to heat different residential typologies: small houses, block of flats (both equipped with central heating and independent heating system) and whole districts through a local heating network.



### TEXTILE INDUSTRIES

Textile residuals are important resources to feed ECO20x and to produce heat and electric energy. In this way is possible reducing or eliminating the quantities to be disposed. ECO20x can be useful where textile is processed and handled.



### SEWAGE SLUDGE

The last innovation in the waste field is the sewage sludge treatment.

Facilities and sewage plants will use our ECO20x system for electric energy and heat production with the advantage of disposing a large exhaust sewage sludge, otherwise destined for storage in landfill.







# MANAGEMENT BY REMOTE CONTROL

The cutting-edge design and operating system allow to ECO20x CHP system to offer important benefits to the user, both in terms of technology and in terms of use.

CHP system is managed by a latest generation software recording and checking system' activities, even by **remote** control.

Thanks to **remote control management**, monitoring the equipment's performances and noticing any damages on time will be possible.

The **smart Interface** makes the ECO20x use easier and safe.

## SYMPLIFIED AUTHORIZATION PROCESS


According to Table 7 content, the **nominal electric power** of an ECO20x operating in CHP configuration is **20 kW**.

Authorization's procedure for ECO20x installation is extremely easy and it can be obtained through a **simple communication to the municipality where it will be installed**.

SOURCE	RIF	CONDITION TO BE RESPECTED		Urban / Construction
		Operation mode / Installation	Power	
Biomass, exhaust gas, residual gas from purification process and biogas	12,3	Operating in cogeneration	0-50 kW	Communication
		Installed in existing buildings, unless it modifies volumes and surfaces, modifies the final use and building's structural parts, increases the number of properties and urban parameters	0-200 kW	Communication
	12,4	Working in cogenerative configuration	50-1000 kW or 3000 kW	Pas
		Powered by biomass	0-200 kW	Pas
		Powered by exhaust gas, residual gas from purification process and biogas	0-250 kW	Pas

TABLE 7: ECO20x authorization procedure





# WOODEN SCRAPS FOR CHP SYSTEM REQUIREMENTS

**EN-14961-4 and ISO 17225-4** European regulations provide of precise **quality standards for wooden scraps**, identifying 4 categories according to development of requirements' analysis through analytics techniques.

Wooden scraps for non-industrial use are divided into category A1, A2, B1, B2 (table no. 8).

**Category A1 and A2:** are composed by virgin wooden scraps or wood residues which are not chemically treated, with different quantities of ashes and moisture.

**Category B2:** also includes wooden residues which are chemically treated. Biomass from this category can be used after obtaining specific authorization in accordance to installation place and relative national biomass types, in compliance with local regulations.

**The B1 category is intermediate.**

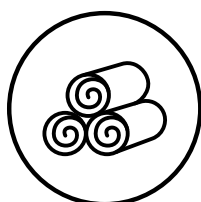
	CATEGORY A1	CATEGORY A2	CATEGORY B1	CATEGORY B2
<b>Source and origin</b>	Whole plants without roots, trunks, not chemically treated wooden scraps, debris from cut	Whole plants without roots, trunks, not chemically treated wooden scraps, debris from cut	Forestry waste, short-cycle crops and other virgin wood, not chemically treated wooden scraps	By-products and residual of wood first production, post consumption wood
<b>Umidity, M</b>	M10 < 10% M25 < 25%	M35 < 35%	To be declared	
<b>Ash, A</b>	A 1,0 < 1% at dry condition	A 1,5 < 1,5% at dry condition	A 3,0 < 3,0% at dry condition	
<b>Bulk Density, BD, kg/m<sup>3</sup></b>	BD 150 ≥ 150 BD 200 ≥ 200	BD 150 ≥ 150 BD 200 ≥ 200	To be declared	

**TABLE 8:** Wooden scraps quality specifications

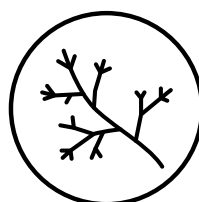
It can be produced by chopping of:



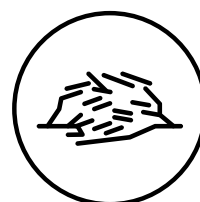
**TRUNKS OF CONIFERS AND BROAD LEAFS**



**BROAD LEAFS TRUNKS WITH BRANCHES AND WITHOUT LEAFS**



**BROAD LEAF DEAD BRANCHES WITHOUT LEAFS OR DRY LEAFS**



**WOODEN SCRAPS FROM FIRST WOOD PRODUCTION GETTING HIGH SCRAPS QUANTITIES.**

## WOODEN SCRAPS COMPATIBILITY

Wooden scraps' quality is extremely important for the right CHP system's operation mode. Wooden scraps powering ECO20x **MUST** be in line with expected requirements of the equipment.

Wooden scraps **compatibility** is based on two main criteria:

1. **Moisture degree;**
2. **A1 quality category** in compliance with EN-14961-4 and ISO 17225-4 European regulations.

Wooden scraps to be used must be produced by mechanical production of virgin wood, as quoted in Legislative Decree 152/2006 "Regulations on Environment".



The chosen wooden biomass **MUST** be without foreign elements like: spikes, wires, bolts and any other metallic items.

## WOODEN SCRAPS QUALITY'S SPECIFICATIONS.

As per the size, you can refer specifications included in **UNI/TS 11264 regulation**.

Wooden scraps shall be included **between categories G10 and G30**, i.e. they shall have size suitable for passing through a 30x30mm mesh but NOT through a 10x10mm mesh.



## STEARIC DENSITY

An essential parameter for storage tank's size should be made according system's consumption rate per hour (26kg/hr), such parameter **is the stearic density (kg/msr) of wooden scraps.**

Stearic density depends on size and strictly **on wood type and moisture degree**, as shown in table no.9.

### LEGENDA

- Lsp:** split wood  
(33cm, stacked)
- Cip:** Wooden chips
- Msr:** Steric cubic meter
- Ms:** Steric mass

HUMIDITY M%	BEECH			OAK			RED FIR			PINE		
	m³	Lps ms	Cip msr	m³	Lps ms	Cip msr	m³	Lps ms	Cip msr	m³	Lps ms	Cip msr

volumetric stearic masses kg\*

0	680	422	280	660	410	272	430	277	177	490	326	202
10	704	437	290	687	427	283	457	295	188	514	332	212
15	716	445	295	702	436	289	472	304	194	527	340	217
20	730	453	300	724	450	298	488	315	201	541	349	223
30	798	495	328	828	514	341	541	349	223	615	397	253
40	930	578	383	966	600	397	631	407	260	718	463	295
50	1117	694	454	1159	720	477	758	489	312	861	556	354

**TABELLA 9:** Wood density variation according to wood types and humidity degree

Summarizing, to support the right ECO20x equipment's operation mode in terms of reliability, efficiency and observance of maintenance rules, the use wooden scraps in compliance with following specifications is required (table 10):

G30 SIZE	1,50 - 3,00 cm
UMIDITY DEGREE	15-20% (A1-P31,5)
DENSITY	>200kg/m <sup>3</sup>

Table 10: wooden scraps specification for ECO20x

Comparing with conventional biomasses, the textile one contains an moisture percentage between 1% and 5%.

Textile briquette density is higher than the wooden sawdust, the value is 875kg/m<sup>3</sup>.







# CMD RANGE OF SERVICE

## OUR SUPPORT TO COMPANIES AND INSTITUTIONS

**CMD** offers a full range of services to help companies and PA installing ECO20x CHP system:

### **INSTALLATION ASSISTANCE**

CMD checks the area where ECO20x shall be installed, for free.

Our company provides engineering services required for ECO20x installation.

### **ACTIVATION ASSISTANCE**

CMD makes compatibility test of biomass to be used for powering ECO20x and provides for any necessary treatment processes. It provides for necessary assistance to obtain administrative authorization required by current regulation and necessary for ECO20x installation.

### **FINANCE ASSISTANCE**

The most important Italian banking institutions are available to financing on ECO20x and it can have access to tax break (government grant, financing).

### **GLOBAL SERVICE**

CMD gives support to potential customer from the Business Plan drafting to the ECO20x installation. CHP system is customizable and adaptable according to customer's needs. It is a full range of services according to "global service" formula and "turnkey system".



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It should be noted that the continuous power performance may be subject to change in relation to the humidity degree of the wooden chips, as well as to the calorific value of the biomass used.  
C.M.D. SpA reserves the right to change these terms and conditions at any time without prior notice.