



ENVIRONMENT &
RENEWABLE ENERGY

About CNIM

Founded in 1856, CNIM is a French equipment manufacturer and industrial contractor operating on a worldwide basis.

The Group supplies products and services to major public and private sector organizations, local authorities and national governments in the Environment, Energy, Defense and High technology markets. Technological innovation is at the core of the equipment and services designed and manufactured by the Group. They contribute to the production of cleaner and more competitive energy, to limiting the environmental impacts of industrial activities, to making sensitive facilities and infrastructures safer and protecting individuals and nation states.

CNIM is listed on the Euronext exchange in Paris. It relies on a stable family-based majority shareholding structure committed to its development. The Group employs approximately 2,500 staff with strong technological expertise, including 1,500 multidisciplinary engineers. More than half of CNIM revenue is from export and is achieved by the Environment & Energy sector.

For Environment and Renewable Energy activities, CNIM has an exclusive integrated global business offering including all necessary skills all along its value chain: project development, financing, in-house technologies supply, turnkey design and build, commissioning, operation and maintenance, upgrading services, etc.

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CNIM

<http://www.cnim.com/en>

 @CNIM_Group

HEADQUARTERS

35, rue de Bassano
75008 Paris - France
contact@cnim.com
+33 (0)1 44 31 11 00

CNIM

Waste-to-Energy

A tonne of municipal waste provides as much energy as a tonne of wood without consuming any natural resources



➔ Half of the energy recovered from municipal waste is recognized as **renewable**

The waste treatment hierarchy defined by European directives is asking firstly to promote material and biological recycling and then to recover energy from the waste left after this first step. This residual waste generally represents more than 50% of the initial tonnage of municipal waste. **Waste-to-Energy is the only way to close the Circular Economy loop**, by recovering energy and materials from this residual waste and so avoiding the landfill waste disposal polluting the environment.

For these reasons, CNIM continues its successful development of Waste-to-Energy environmental technology, with **more than 55 years of experience**.

This experience extends to more than 285 units throughout Europe and draws on CNIM's combustion technology based on Martin GmbH grates. The Martin company, a CNIM partner since 1961, is a world leader in the thermal treatment of waste, **treating more than 110 million tonnes per year, i.e. the waste produced by more than 400 million inhabitants around the world**.



In France, Waste-to-Energy plants already produce the energy equivalent to 1.2 million tonnes of oil and could easily produce the energy equivalent to 5 million tonnes from merely half of the non-hazardous industrial waste whose heat is not yet recovered.

The volume of waste materials is reduced by 90% during combustion. Bottom ash can be recycled to form an aggregate. Ferrous and non-ferrous metals are recovered after combustion. In practice, waste combustion is the largest source of recycled ferrous metals from municipal waste.

Biological pollutants such as viruses and bacteria are destroyed during combustion.

Any chemical pollutants present in the waste are controlled during combustion and then removed and treated to avoid any dispersion in the environment and impact upon human health.

The greenhouse effect of the CO₂ produced during combustion is much lower than that of the methane generated by the anaerobic digestion of untreated waste in landfills. Another benefit for greenhouse gas effect : Waste-to-Energy plants are also avoiding fossil fuels consumption generally required for energy production.

Environmentally sound

CNIM implements an integrated environmental management approach in order to achieve a high level of protection across the complete environmental spectrum



All these processes comply with the emission limit values of the European Directive for Industrial Emissions and can easily be adapted to meet even more stringent limits as they are all recognised as **Best Available Techniques**. National public administrations have studied the health impact assessment and come to the conclusion that the extremely low emission levels have no significant impacts upon public health.

➔ More than **450 lines** built by LAB - CNIM Group since 1953 help to completely and efficiently clean the waste combustion flue gases of 150 million people all over the world.

CNIM minimizes its airborne, water-borne and land emissions as well as reducing water consumption and the production of residues, electricity, raw materials, noise, etc.

Considering that one of the most sensitive aspects is flue gas cleaning, CNIM has built up considerable in-house knowledge, **with proprietary technologies** offered by its 100% subsidiary LAB S.A.

LAB is a world leader in this sector and offers a remarkably wide range of different processes that are continuously improved in order to reduce reagent consumption and the production of residues, etc.

- ▲ For dust, heavy metals and acid gases, LAB offers dry, semi-dry or wet processes as well as their variants and combinations.
- ▲ For NO_x, dioxins and furans, LAB proposes de-NO_x/de-diox systems such as selective catalytic or non-catalytic reactors (SCR or SNCR) and wet catalyst or activated carbon processes.

Lab



How waste is...

...turned into energy and materials

The entire transformation process is automatically controlled and supervised from the main control room and at the equipment itself



/ Waste is tipped into the storage pit ① by refuse collection vehicles.



/ Waste is transported by overhead cranes ② to feed hoppers ③. It then passes down the chute to the feeder ④.



/ Waste is transferred onto the surface of the CNIM-MARTIN grate ⑤ (reverse acting grate) at a rate controlled by the hydraulic feeder.



/ The CNIM-MARTIN grate deals with all types of municipal waste without the need for pre-sorting. This grate is capable of directly handling municipal waste (without any pre-treatment), but also handles residual waste or refuse derived fuel (RDF) with a very large range of calorific values (from 5 to 20MJ/kg). The hourly capacity, ranging from 3 to 50 t/h, can be achieved without any grate water cooling, even at very high combustion temperatures.



/ In the combustion chamber ⑥, the energy available in waste is released as hot flue gases.

This heat is converted into superheated steam in the integral boiler ⑦. Using a multi-pass boiler ensures that maximum energy is captured. CNIM boilers are carefully designed to operate for long periods without any manual boiler cleaning.

The boiler design is realised by CNIM's experienced experts, and is adapted on a case-by-case basis to the specific local conditions. The general configuration (horizontal/vertical), the number of passes and the layout of the heat exchangers are optimised for each project.



/ The superheated steam leaving the boiler is fed directly to a turbo-generator ⑧, which turns its energy into **electricity**. A very small fraction of the electricity generated is used to run the facility itself while the major part is exported to the Grid.



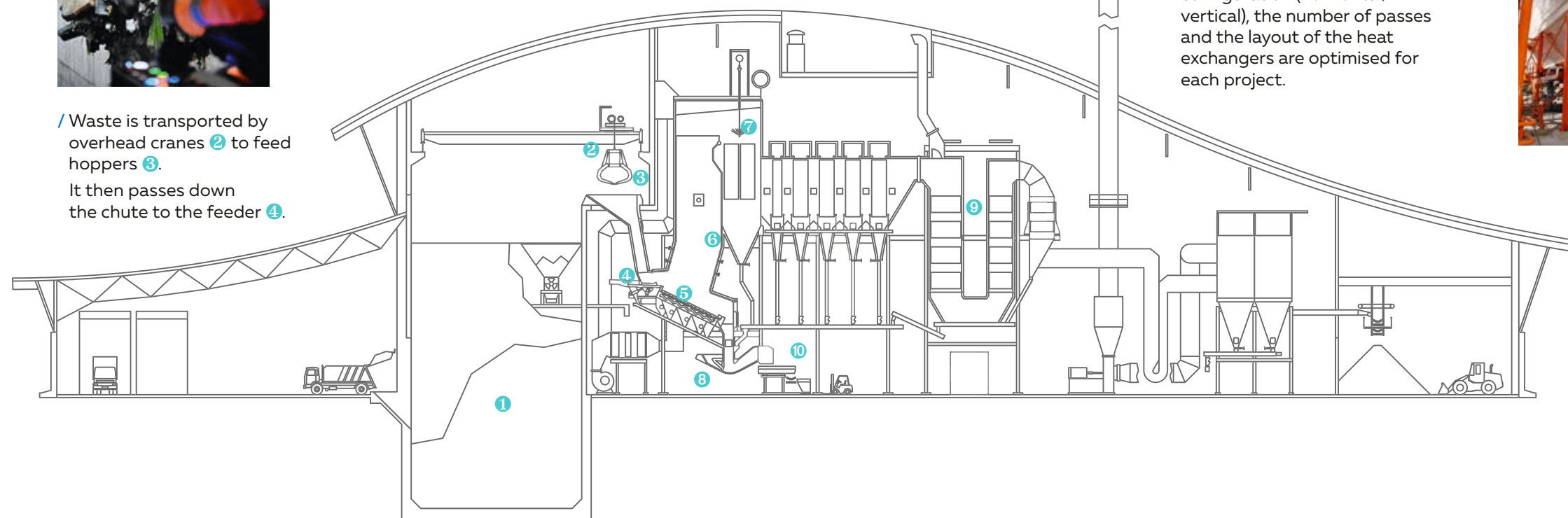
The presence of a District Heating Network or of industrial consumers in the surrounding area means that part of the recovered energy can be exported as **heat** (steam or hot water), offering the greater efficiency of Combined Heat and Power.



/ The high temperatures obtained in the combustion chamber destroy any odours and bio-pollutants. Flue gases are completely cleaned ⑨ before the stack in order to remove all micro-pollutants (dust and chemicals) coming from the waste.

Bottom ashes are conveyed ⑩ to a storage area where it is processed before being **recycled** as a foundation material for road building.

Ferrous and non-ferrous metals, which are sanitized by their stay in the furnace, are separated from the ash and **recycled**.



Biomass

Biomass is a source of 100% green energy

It is renewable and its combustion gas (CO₂) is considered as not contributing to climate change.

If the same amount of carbon was left to be digested in order to produce methane (CH₄), it would make a very significant negative impact as greenhouse gas.



Biomass is available everywhere. The types of biomass materials that are regularly used to produce energy include:

- ▲ bagasse,
- ▲ bagasse pith,
- ▲ bark,
- ▲ sawdust and wood waste,
- ▲ palm waste,
- ▲ peanut and cotton husks,
- ▲ sunflower husks,
- ▲ coffee grounds,
- ▲ nutshells,
- ▲ olive pits/stones,
- ▲ rice husks,
- ▲ grape waste, etc.

➔ References all over the world

CNIM has built more than **288 biomass boilers** with or without burning additional fuel and using a range of different combustion technologies.

CNIM* is the world's largest manufacturer of large bagasse/coal-fired boilers for thermal power plants.

* Under its BABCOCK trademark



Services

The CNIM Group's specialized Service Division provides refurbishment and after-sales services in the environment and energy fields (Waste- and Biomass-to-Energy plants as well as industrial boilers)

Its know-how covers:

- ▲ technical appraisals and diagnosis,
- ▲ maintenance,
- ▲ overhauls and refurbishment,
- ▲ design and manufacturing of thermal equipment,
- ▲ performance improvements (efficiency, emissions...),

- ▲ upgrades to new standards,
- ▲ pressure part manufacturing and installation,
- ▲ instrumentation and controls,
- ▲ installation of boiler houses,
- ▲ technical assistance,
- ▲ spare parts.

