



HENNLICH



Cogeneration: how it works and what are the advantages of cogeneration plants

For cogeneration or co-generation we mean the **combined production of electricity and heat**. These two forms of energy are produced in cascade, in a single plant.

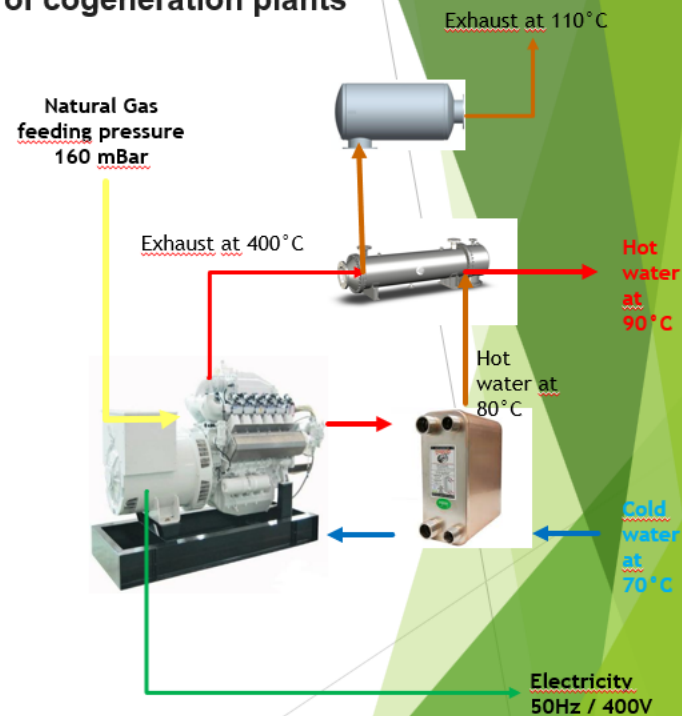
Cogeneration systems are also called **CHP**, from the English acronym Combined Heat and Power.

Traditionally electric and thermal energy are **produced separately**.

In fact, to produce electricity, usually **thermoelectric power stations** are used that disperse low temperature thermal energy into the environment, while to produce the only thermal energy the **boilers** are used that convert the primary energy represented by the fuel, with a high thermodynamic value, in thermal energy of reduced thermodynamic value.

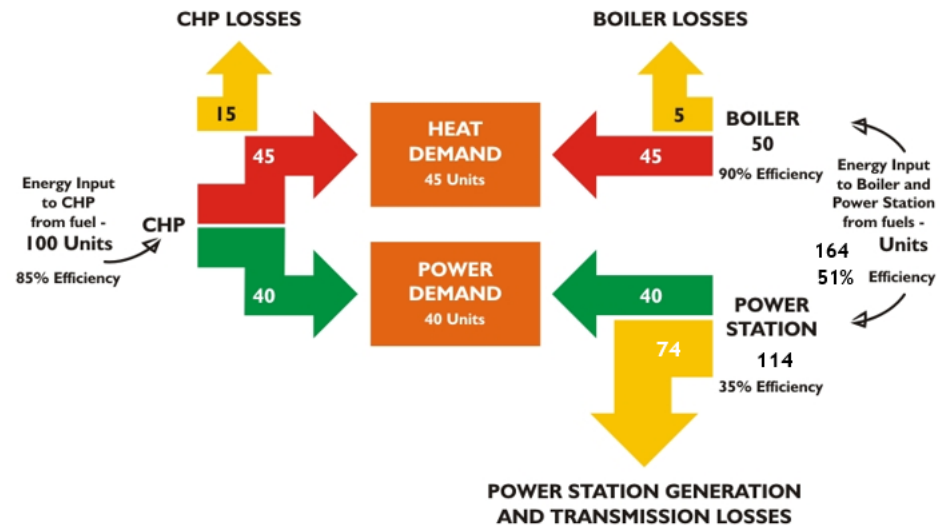
If a user requires at the same time electricity and thermal energy, instead of installing a boiler and buying electricity from the grid, one can think of creating a system, **the cogeneration plant**, which **produces both electricity and thermal energy**.

It is intuitive how this system can produce an energy saving determined by lower fuel consumption.



The cogeneration system permits:

- Saving more than 35% of the primary energy from fuel
- Reducing the emissions of pollutants caused by the production of thermoelectric energy, thus reducing the environmental impact
- Producing energy in the vicinity of the thermal user, a factor that reduces transmission losses for the distribution and transport of energy
- Having an economic advantage deriving from the lower consumption of primary energy



The energy efficiency of CHP



Industrial

- ❖ Agro-food industries
- ❖ Dairy
- ❖ Pasta industries
- ❖ Tanneries
- ❖ Pet food
- ❖ Chemical Industries
- ❖ Pharmaceutical industries
- ❖ Plastic industries
- ❖ Paper mills
- ❖ Manufacture of textiles
- ❖ Wineries / distilleries
- ❖ Industrial laundries
- ❖ Data centers



Tertiary

- ✓ Swimming pools
- ✓ Sport & fitness centres
- ✓ Clinics
- ✓ Hospitals
- ✓ Retirement home
- ✓ Colleges
- ✓ Communities
- ✓ Supermarkets
- ✓ Malls
- ✓ Hotels
- ✓ Wellness
- ✓ Beauty centers
- ✓ District heating



Environment

- Waste water treatment plants
- Alpine pastures and mountain huts
- Greenhouse crops
- Breeding farms
- Waste treatment
- Manufacturers of biodigesters for biogas production
- Constructors gasifiers for the production of gas from plant biomass

Typical applications

Cold water	Hot water	Hot water with steam / diathermic oil / overheated water	Hot water and cold water	Hot water, steam, cold water	Steam and cold water
<ul style="list-style-type: none"> • Data Center • Food <u>packging</u> • Industrial <u>packging</u> • Plastic <u>materials</u> • Plastic automotive 	<ul style="list-style-type: none"> • <u>Dairies</u> (small) • <u>Galvanic</u> • <u>Hotels</u> • <u>Retirement homes</u> • <u>Sport centers</u> • <u>Swimmng</u> pools 	<ul style="list-style-type: none"> • <u>Dairies</u> (big) • <u>Paper mills</u> • <u>Pet food</u> • <u>Pharmaceuti cal industries</u> • <u>Tanneries</u> 	<ul style="list-style-type: none"> • Business center • Hospitals • Hotels • <u>Retirement homes</u> • <u>Shopping malls</u> • <u>Sport centers</u> 	<ul style="list-style-type: none"> • Chemical Industries 	<ul style="list-style-type: none"> • <u>Beverage</u> • <u>Bottled water industries</u> • <u>Chemical industries</u> • <u>Detergent industries</u> • <u>Food</u> • <u>Ham factory</u>
<ul style="list-style-type: none"> • Media & big size 	<ul style="list-style-type: none"> • Micro & Media size 	<ul style="list-style-type: none"> • Micro, Media & Big size 	<ul style="list-style-type: none"> • Micro, Media & Big size 	<ul style="list-style-type: none"> • Big size 	<ul style="list-style-type: none"> • Media & Big size

Physical proximity of the thermal user, i.e. the user who needs heating must be close to the cogeneration plant

Physical proximity of natural gas pipe line

Request for thermal and electrical energy must be simultaneous

Electric power consumption not less than 100.000 kW/year

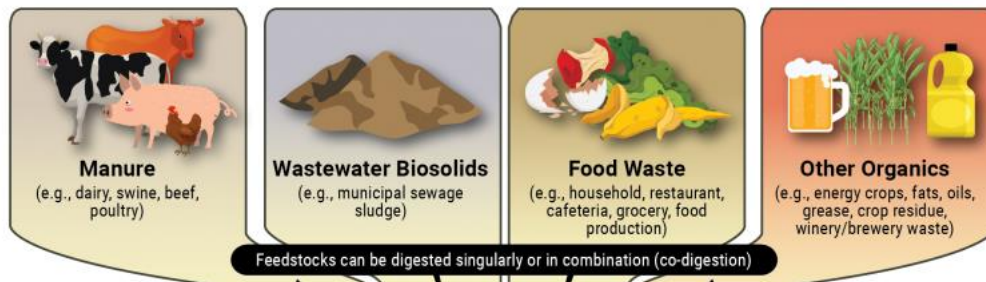
Thermal compatibility: hydronic heating and cooling system with use hot water at 90°C

Cogeneration module must be able to operate for at least 3,000/4,000 hours per year

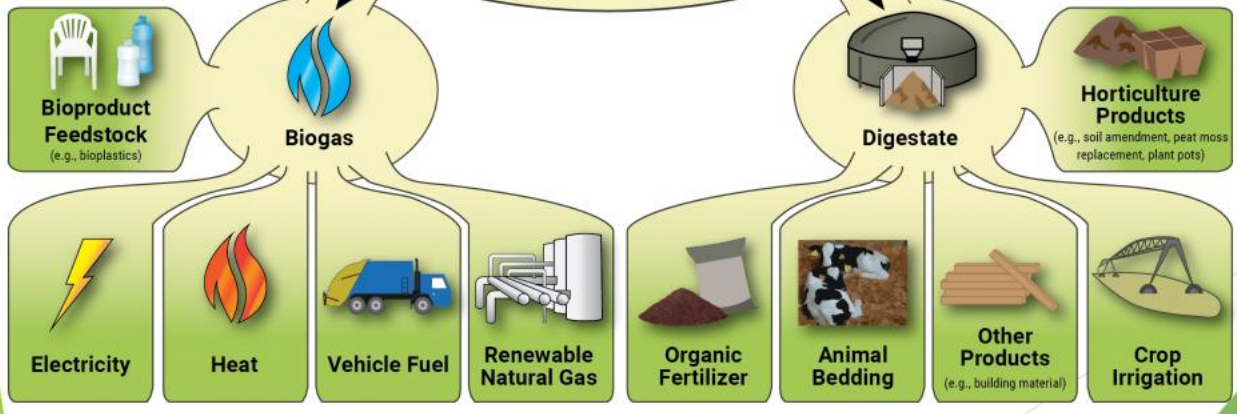
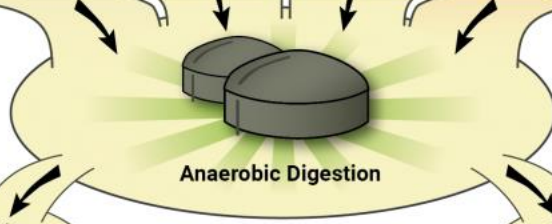
Possibility to connect the CHP in parallel with the grid (avoid the solution in "island mode")

When to co-generate?



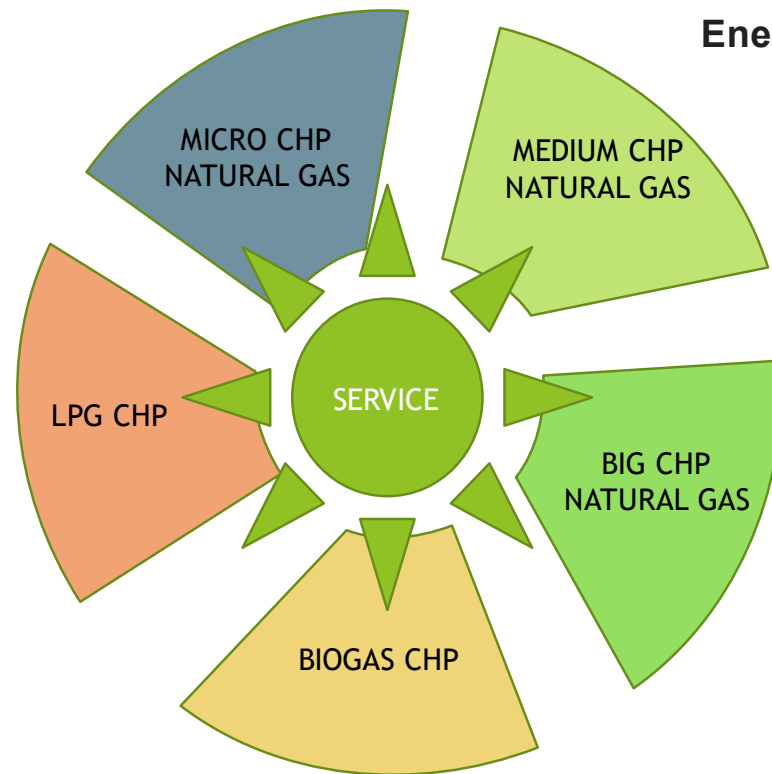


Feedstocks can be digested singularly or in combination (co-digestion)



Enerblu PLUSES: Services

- Energy Audits
- Feasibility studies to size the correct CHP and give an indication about the return of investment
- Customized Financial Service
- Accurate design, in compliance with the most up-to-date regulations on product, environment and safety
- Customized production of units and systems
- Service
- Customized maintenance contracts
- Spare parts
- Remote supervision 7/24



Enerblu products

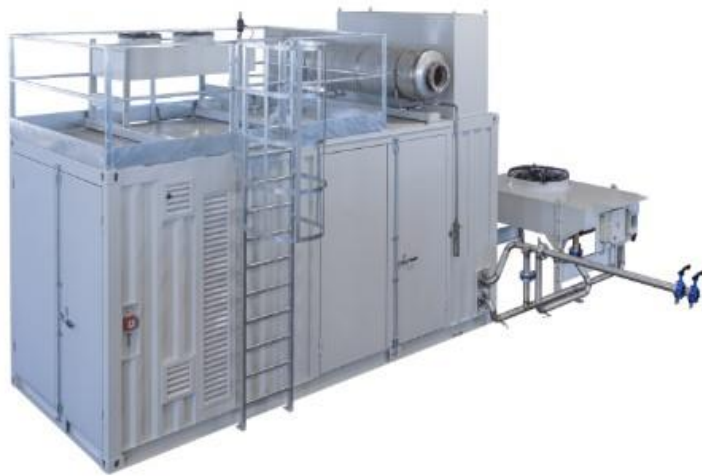




MICRO CHP

Small size high efficiency cogeneration with power range from 6 to 100 kWe. Unit available in open version, in canopy for indoor and outdoor use or in container. The units can produce electricity and thermal energy at the same time both for the use of hot water and cold water for air conditioning through the supply of an absorber and evaporative tower. The units have a soundproofing of 65dBA at 10 meters and can be supplied with catalysts for reducing emissions (CO-NOx). Various accessories are also available to meet the various needs of customers.

Type	Engine	kWe	kWt	Eff. %
REC_06G TYT	Toyota	6	14	93
REC_09G TYT	Toyota	9	20	93
REC_15G TYT	Toyota	15	34	97
REC_20G TYT	Toyota	20	42	95
REC_20G TYT	Toyota	20	39	95
REC_30G PSI	PSI	30	60	93
REC_40G PSI	PSI	43	84	89
REC_50G MAN	MAN	50	75	84
REC_65G DSN	Doosan	65	104	82
REC_70G MAN	MAN	70	104	85
REC_80G TDM	Tedom	80	121	80
REC_100G DSN	Doosan	105	168	85
REC_100G TDM	Tedom	103	165	83



MEDIUM CHP

Medium size high efficiency cogeneration with power range from 140 to 500 kWe. Units available in open version, in canopy for indoor and outdoor use or in container. The units can produce electricity and thermal energy simultaneously for both the use of hot water and cold water for air conditioning through the supply of absorber and evaporative tower. The units have a soundproofing of 65dBA at 10 meters and can be supplied with catalysts for reducing emissions (CO-NOx). Various accessories are also available to meet the various needs of customers such as steam generators, SCR,....

Type	Engine	kWe	kWt	Eff. %
REC 140G MAN	MAN	140	199	87
REC 200G MAN	MAN	200	245	80
REC 200G DSN	Doosan	200	317	96
REC 260G MAN	MAN	260	351	88
REC 300G DSN	Doosan	309	517	94
REC 350G MAN	MAN	340	407	84
REC 370G MAN	MAN	372	475	85
REC 420G MAN	MAN	425	511	86
REC 480G MAN	MAN	480	563	85
REC 500G MAN	MAN	520	585	84



BIG CHP

Medium size high efficiency cogeneration with power range from 500 to 2700 kWe. Units available in open version, in canopy for indoor and outdoor use or in container. The units can produce electricity and thermal energy simultaneously for both the use of hot water and cold water for air conditioning through the supply of absorber and evaporative tower. The units have a soundproofing of 65dBA at 10 meters and can be supplied with catalysts for reducing emissions (CO-NOx). Various accessories are also available to meet the various needs of customers such as steam generators, SCR,....

Type	Engine	kWe	kWt	Eff. %
REC 600G JES	Jenbacher	635	730	86
REC 600G MWM	MWM	600	652	88
REC 800G MTU	MTU	856	936	89
REC 800G MWM	MWM	800	860	88
REC 1000G JES	Jenbacher	1063	1249	87
REC 1000G MTU	MTU	1013	1084	84
REC 1000G LBR	Liebherr	1000	1053	85
REC 1200 MWM	MWM	1200	1245	87
REC 1300G MTU	MTU	1287	1357	90
REC 1500G MWM	MWM	1560	1650	87
REC 1500G MTU	MTU	1521	1566	90
REC 1700G MTU	MTU	1716	1858	90
REC 2000G MTU	MTU	2028	2147	90
REC 2000G JES	Jenbacher	2000	1997	86
REC 2000G MWM	MWM	2000	2066	87
REC 2100G MTU	MTU	2147	2329	90
REC 2300G MWM	MWM	2300	2186	87
REC 2500G MTU	MTU	2538	2684	90
REC 2700G JES	Jenbacher	2679	2499	86



BIOGAS

The biogas cogeneration range covers the range from 50 to 1000 kWe. On request we can supply higher powers with a single motorization or with several modules in parallel, in relation to the system requirements. The biogas that feeds these units can have a different nature: biogas from wastewater and zootechnical waste, biogas from waste water purification, biogas from landfills with different percentages of CH₄. Units available in open version, in canopy for indoor and outdoor use or in container. These units comply with the emission limits set by current national legislation. Various accessories are also available to meet the various needs of customers, such as dehumidification, blower and torch.

Type	Engine	kWe	kWt	Eff. %
REC_50B_MAN	MAN	50	68	91
REC_60B_MAN	MAN	60	80	78
REC_80B_TDM	Tedom	80	117	83
REC_100B_TDM	Tedom	100	127	78
REC_100B_	SR			
REC_200B_	SR			
REC_250B_MAN	MAN	250	280	82
REC_250B_DSN	Doosan	250	346	85
REC_300B_MAN	MAN	300	320	80
REC_350B_MAN	MAN	350	396	81
REC_400B_MAN	MAN	420	514	85
REC_500B_MAN	MAN	500	533	78
REC_600G_	SR			
REC_800G_	SR			
REC_1000G_	SR			



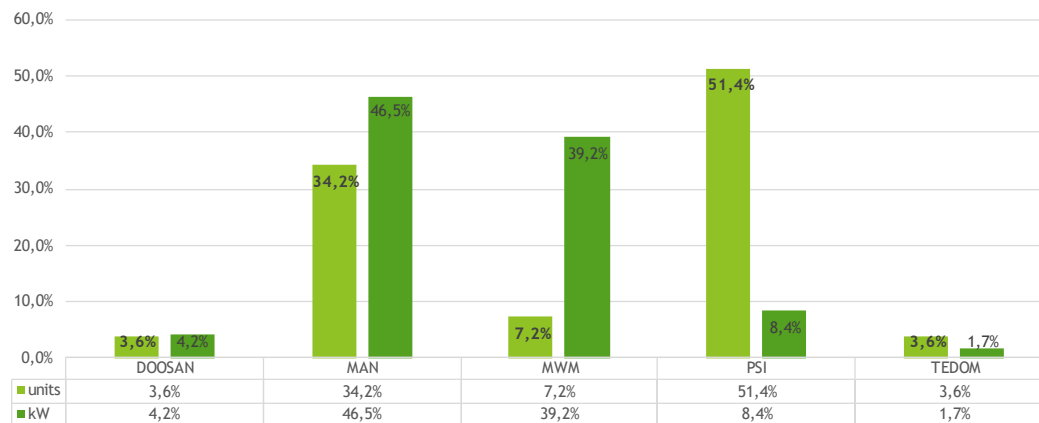
CHP & LPG

Where there is no natural gas distribution, it is still possible to enjoy the advantages of cogeneration by using endothermic engines running on LPG (Liquefied Petroleum Gas) fully compliant with regulations and with proven reliability.

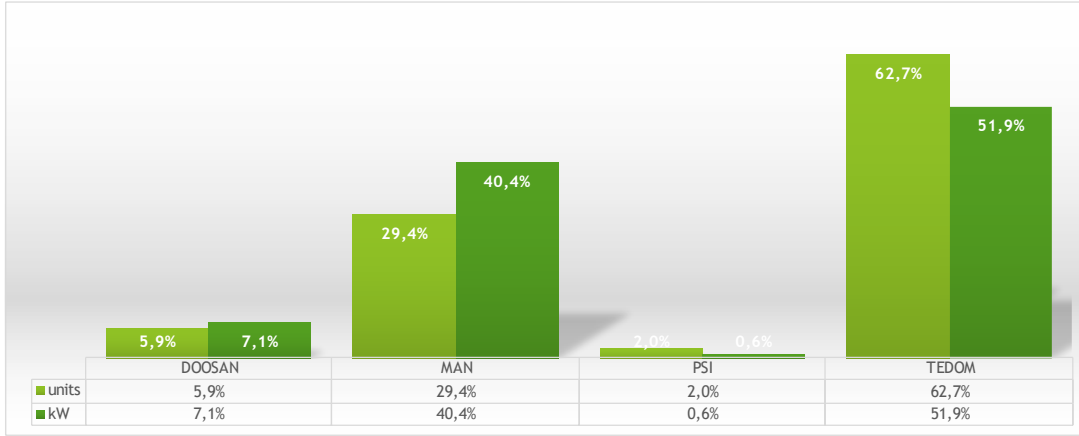
LPG allows you to compress the gaseous mixture so that it can be used in small containers. In addition, thanks to a low sulfur content and complete combustion, with modest amounts of residues, it helps to reduce the environmental impact, promoting better air quality and a reduction in greenhouse gas emissions.

Also on LPG there is a tax relief on the consumption tax (excise duty), granted directly by the distributor at the time of supply.

Modello	Motore	kWe	kWt	Eff. %
REC_65L_	DSN	65	118	78
REC_100L_	DSN	103	167	77
REC_200L_	DSN	201	282	90



Natural Gas CHP Units / Tot. Electric power



Biogas CHP Units / Tot. Electric power

Swimming pools, Sport & fitness centers, ecc...

Cogeneration in swimming pools, sports centers, wellness centers, sports clubs, rehabilitation centers with swimming pools is particularly efficient because the pool itself is an excellent thermal flywheel with an important energy demand. At the same time there is the self-production of electricity to meet the needs of the structure.



Example: (plant in operation in Italy)
Power 40 kW_e
Investment 94,000 €
Operation 5,500 h/year
Savings 28,500 €/year
Pay-Back 3.3 years

HOTEL

Example (plant in operation hot water)
Power 65 kW_e
Investment 121,000 €
Operation 6,000 h/year
Savings 35,500 €/year
Pay-Back 3.4 years

Example (plant in operation in trigeneration)
Power 100 kW_e
Investment 231,000 €
Operation 5,100 h/year
Savings 42,721 €/year
Pay-Back 5.4 years

Example (plant in operation in trigeneration)
Power 40 kW_e
Investment 140,000 €
Operation 6,447 h/year
Savings 43,380 €/year
Pay-Back 3.2 years



Hospital / Clinics / Retirement homes

Hospitals, nursing homes, nursing homes, rehabilitation centers are structures that use methane cogeneration for the production of electricity with recovery of thermal energy.

The thermal energy produced by the machine, in fact, is used to integrate the necessary heat to the hospital's heating system.

The cogeneration plant is a real thermoelectric plant, with a higher energy yield than the traditional system (boiler). Very often the trigeneration for summer conditioning is also integrated.

Both electricity and thermal energy will be produced at costs that are much lower than market ones, and this will allow the return of the initial investment normally in less than 4 years (Italy data).

The cogeneration plant also reduces carbon dioxide emissions by 50% compared to the often very old boilers found on this type of customer.



* Reference of the construction and installation at a hospital in Italy of our cogenerator designed, built ad hoc and assembled on site.

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COGENERATION

HAM FACTORY

Our REC2_800G produces 800 kWe and 869 kWt in the form of hot water at 90 ° used by the customer for keeping the warehouses at a controlled temperature during the winter and for washing in the production process.

Type	Hot Water
Power	800 kWe
Investment	820.000 €
Working hrs/year	6.500 h/ year
Saving	320.000 €/ year
Pay-back	2.6 years



Dairy factories

Cogeneration in dairy establishments:

Thermal energy is used in the form of hot water or steam for the production process (for example, pasteurisation of milk or storage at controlled temperatures of warehouses or even simply for partial use for washing), while electricity is needed for lighting and technological equipment.

An important item to propose energy efficiency is the replacement as far as possible of the use of steam with hot water at 90 °.

Very often in fact the steam is used at 120 ° to heat the water and use it for washing.

As an alternative to steam, a smaller micro-cogeneration machine can be provided but preheating the water before entering the steam boiler.



Example (plant in operation in Italy)

Power	400 kW _e
Investment	450,000 €
Operation	4,000 h/year
Savings	150,000 €/year
Pay-Back	3.0 years

Tannery

In the typical production process of a tannery industry, thermal energy plays a fundamental role, in fact a continuous supply of hot water is necessary to heat large volumes of hot water that is used daily

Moreover, even the implementation is simpler than techniques such as inkjet printing and laser treatment with cold plasma involves large consumption of electricity.

The company's cogeneration plant has significant energy benefits and economic savings in the management of wet and chemical phases and processes in the tanning process.

Example (plant in operation in Italy in a tannery industry REC2 200 G – hot water production)

Power 200 kW_e

Investment 280,000 €

Operation 4,000 h/year

Savings 75,500 €/year

Pay-Back 3.7 years



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COGENERATION

Plastic Industry

An important manufacturer of plastic pipes for aqueducts, gas pipelines, sewers and irrigation has chosen the cogeneration solution proposed by Enerblu. We installed our REC3_500G system in trigeneration mode for the simultaneous production of 500 kW and 460 kW refrigerators for production needs.

Type	Hot/cold water
Power	500 kW
Investment	640.000 €
Working hrs/year	6.000 h/ year
Saving	280.000 €/ year
Pay-back	2.3 years



Chemical Industry

Famous Italian chemical company, owned by a German multinational, which produces intermediates containing fluorine mainly for the agrochemical and pharmaceutical industry.

We installed a 2 MWe plant combined with a steam generator for the production of saturated steam thanks to the emission of exhaust fumes from the cogenerator directly into a steam boiler located in an adjacent thermal power plant.

The water from the engine is used in a phase of processing and heating of the offices.

Type	Hot water/steam
Power	2000 kWe
Investment	1.500.000 €
Working hrs/year	7.000 h/year
Saving	700.000 €/year
Payback	2.1 years





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