

WOODCO

Creating Energy



Biomass
Combined Heat & Power (CHP)
Solutions

Together in Electric Dreams...

Generate Heat and Power with Wood Fuel

WOODCO is a European specialist in biomass CHP systems. It has over 15 patents on its CHP systems using ORC (Organic Rankine Cycle) or Steam as a medium. WOODCO CHP systems have many advantages:



- High Return on Investment
- High efficiency electrical generator producing up to circa 16% electrical output
- Safe environmentally friendly working fluid (patented)
- Simple operating procedure
- Automatic and continuous operation
- Simple maintenance procedure
- No operator attendance required
- Long Plant Life (20 years+)
- Operates using wood pellet 15kW to 215kW standard WOODCO boilers, wood chip plus other biomass fuels with steam boilers
- WOODCO provides the complete solution, standard, steam low pressure and steam high pressure boilers
- WOODCO operates a European installation service via its premium partners

Heating costs may have come down in recent years, but many still experience excessive electricity costs

Biomass heating has grown in popularity in recent years throughout the UK as businesses save money v's fossils fuels and earn money through RHI (Renewable Heat Incentive).

Until recently, most biomass systems have only produced heat.

WOODCO's CHP systems, not only produce heat, but also generate electricity using the same wood fuel.

The biomass fuel is in abundance and wood pellets are a worldwide commodity.

WOODCO commercial boilers are used in agri-business, leisure, hotels and factories throughout the UK. Now our biomass CHP is also rapidly gaining traction. WOODCO already has several CHP systems in operation throughout Europe.

Generate Heat you would normally already use, but receive FREE Electricity and government financial incentives!

It's a Win Win

With Carbon taxes already in place, businesses are rushing to take advantage of the incentives at their peak to maximise their returns, and avoid paying even more significant carbon tax bills in the future.



Types of CHP

There are two main medium-scale Biomass CHP options offered by WOODCO.

- Organic Rankine Cycle (ORC)
- Steam CHP



These can be further subdivided as:

ORC

- Hot Water boiler with ORC up to 10kWe (Scroll expander)
- Hot Water boiler with ORC 10kWe up to 1MW (Screw Expander)

Steam

- Steam Boiler with Screw Expander up to 1MW
- Steam Boiler with Steam Turbine 1MW+

WOODCO's commercial offering is ORC or Steam Screw Expander depending on their choice of boiler and hot water temperature requirements.

Low Temperature CHP

Organic Rankine Cycle

ORC CHP - How it works

The Boiler heats the water to 110°C (Standard HTHW Boiler)

The hot fluid is drawn to and from the ORC module in closed circuit. In the ORC it evaporates the organic working fluid of the ORC in a suitable heat exchanger system (pre-heater and evaporator);

Organic vapour expands in the Volumetric Screw Expander (turbine), producing mechanical energy, further transformed into electric energy through a generator;

The vapour is then cooled by a fluid in a closed circuit and condensed. The water is then used for different applications requiring heat;

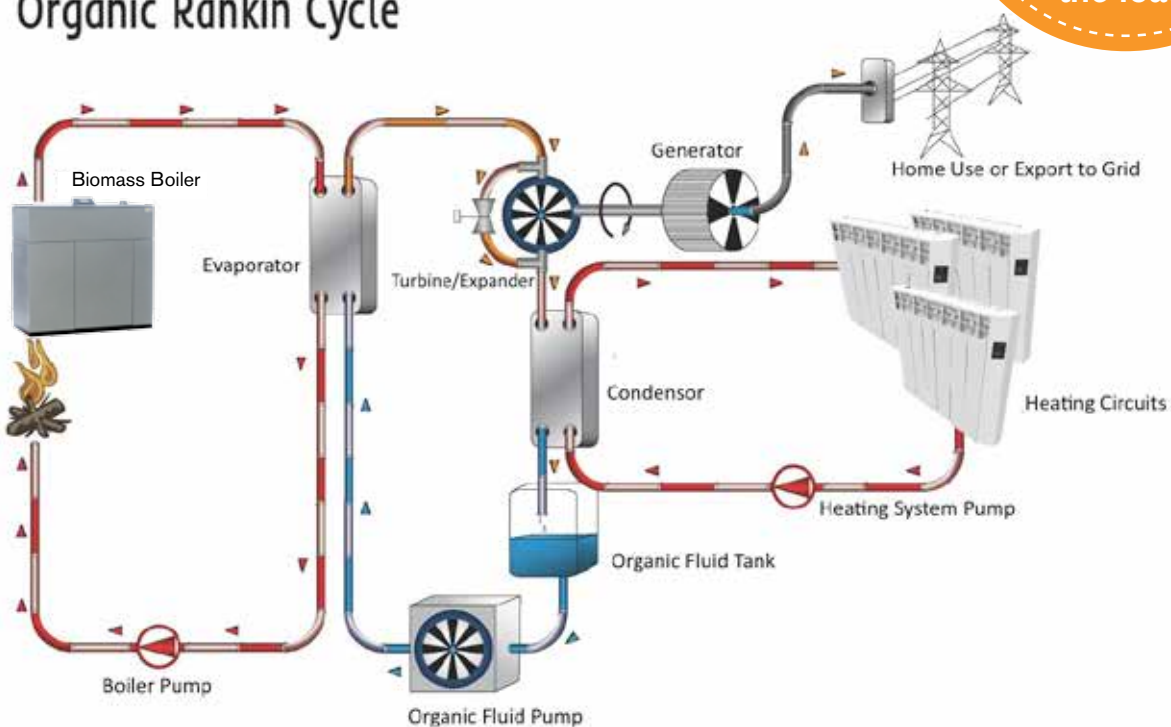
The condensed organic fluid is pumped back into the regenerator to close the circuit and restart the cycle.

Critical to good efficiency on ORC is low return water temperature i.e ΔT must be wide as possible

REMEMBER:
45°C-55°C is lost across the CHP system, giving 55°C-65°C to the load.

cogetherm[®]

Organic Rankin Cycle

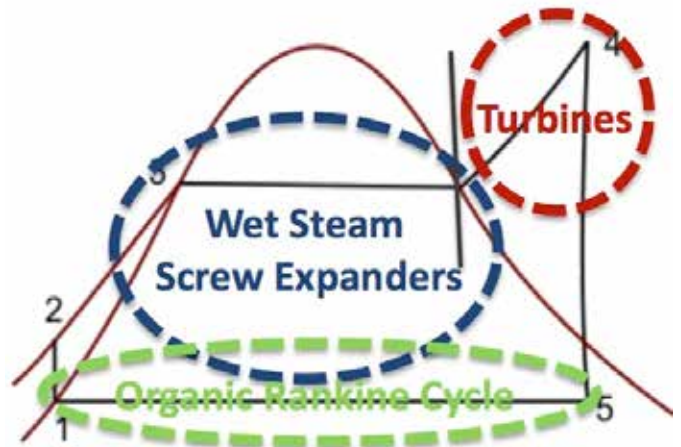


Biomass Steam CHP

How it Works

The simple Combined Heat and Power solution for biomass boilers

When integrated with WOODCO's steam biomass boiler, the CHP system will generate electricity in addition to the heat generated by your boiler, helping you achieve a significantly shorter payback period on your project via RHI (CHP) tariff and ROC's.



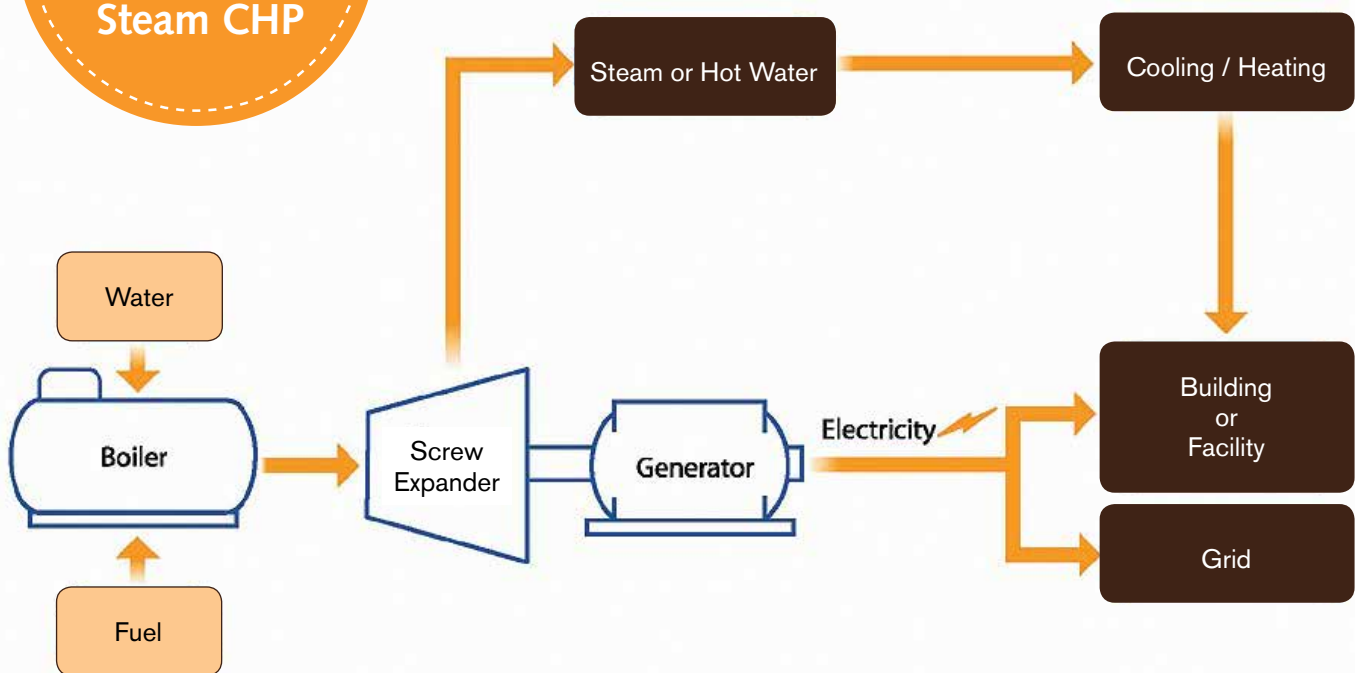
Drop the pressure

The CHP system (screw expander or steam turbine) is installed after the biomass boiler where it drops the steam pressure and extracts energy from the steam to generate

electricity, for use on site or to be sold back to the grid.

After the CHP System the steam can be used for a process such as drying or cooling, or domestic hot water, space or district heating.

A Wide ΔP gives greatest efficiency on Steam CHP



Biomass Steam CHP

(10kW to 1MW)

The wet steam conundrum

Harnessing the energy from steam to generate power is nothing new.

The key innovation in WOODCO's design is that it can operate with 'wet steam' – steam that is at a low pressure and temperature and often contains water droplets that would destroy traditional machines.

Versatility

WOODCO's screw (volumetric) expander therefore can generate power from a broad range of thermal sources such as superheated steam, saturated steam, hot water as well as the aforementioned wet steam.

Thanks to WOODCO's patented design, Steam Expander Systems can generate power from medium temperature heat sources of between 150C° – 300C°, exploiting all the energy contained within it, which might otherwise be wasted.



Steam turbines that have impellers cannot use saturated steam and are confined to use in high temperature, high thermal power applications.

Compatible with fluctuating Flows

A key feature of WOODCO's Screw Expander CHP System is that it works well with fluctuating steam flows, adapting and continuing to generate electricity even when the heat demand is low, for example during the summer months.

How do we do it?

The Steam Expander System is unique rotary device mounted on a skid that converts expansion energy from steam into useable clean electricity via a simple wet steam cycle.

A wet steam cycle is the thermodynamic cycle of a heat engine that converts heat into mechanical work. The heat is supplied externally to a closed loop, which usually uses water, or in our case steam, as the working fluid.

Our systems operate at 4,500rpm, driving a 3,000rpm asynchronous generator.

Steam expanders operate on Pressure Difference (ΔP) whereas ORC operates on Latent Heat of Vaporisation (ΔT) to generate power

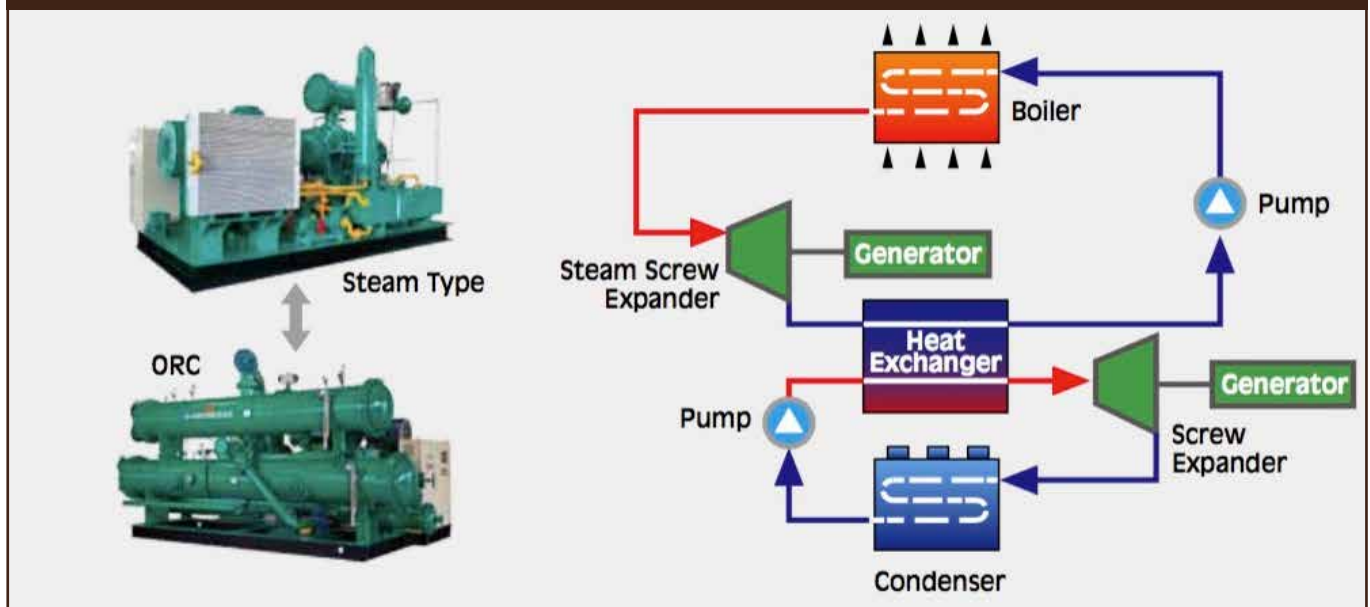
Biomass Steam CHP

Steam Screw Expanders

Steam Expanders can work in series. After the steam has gone through the expander and generated electricity the low pressure steam can be REUSED

- In the manufacturing process e.g steam drying, steam cleaning etc.
- In a second low pressure screw expander to generate further electricity
- In an ORC screw expander to generate further electricity

Second stage design to achieve additional higher efficiency



Steam Screw Expanders

The core technology in our systems is the volumetric rotary screw expanders. While being quite compact our screw expanders are packed with our patented technology. Advantages of using rotary screw expanders to generate power are:

- Reduced cost and size of the machine
- Minimal wear and tear
- Robust and low maintenance
- No need for timing gears or other costly components
- Able to take in wet steam without any erosion (unlike Steam turbine which have impellers)

All WOODCO steam screw expanders work with Low pressure (<10 bar) biomass Steam Boilers

Biomass Steam CHP

Steam Turbines (1MW+)

(These steam turbines work with high temperature and high pressure steam biomass boilers. The steam boilers produce superheated steam.

Each WOODCO Steam Turbine is custom made and for specific information you should contact our engineering team for further information on these.



Summary

CHP Systems

Electrical Output Capacities

Boiler Type/Heat Source	CHP Type	1kW	10kW	1MW	5W
HTHW/Thermal Oil	ORC (Scroll Expander)				
HTHW/Thermal Oil	ORC (Screw Volumetric Expander)				
Low Pressure/High Pressure Steam	Steam (Screw Volumetric Expander)				
High Pressure Steam	Steam Turbine (Impellar)				

Some important points to know...

Steam
CHP offers
better
efficiency

One needs
to consider what
is the temperature
required on the
secondary
i.e. the load

WOODCO
has over 15
patents on
Expanders and
Organic
Fluid

Useful steam
(low pressure)
is still available
after the Screw
Expander

WOOD
GASIFICATION
CHP system are
not offered by
WOODCO

ORC is used widely in waste heat recovery scenarios

Wood Gasification is very expensive, high maintenance and complex albeit they can achieve efficiencies circa 30%

Steam CHP is cheaper/Kw to purchase than ORC

Biomass CHP should always be sized based on the properties Thermal Load.

ORC are extremely low maintenance (once every 5 years)

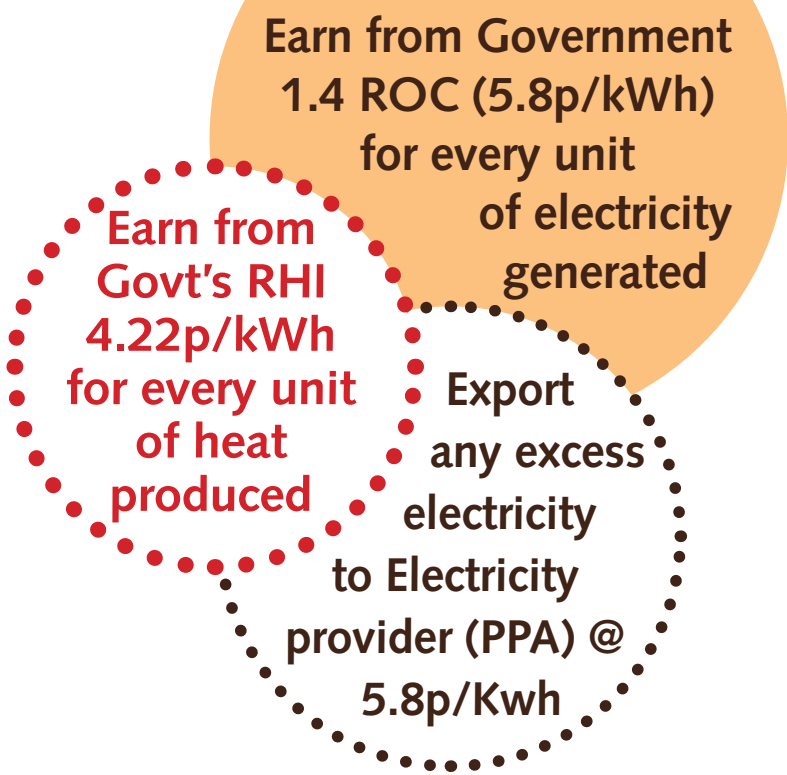
Incentives

- Earnings through the renewable heat incentive Renewable Heat Incentive (RHI)
- Earnings through the generation of your own electricity through the Renewable Obligation Scheme (ROCS)
- Savings through displacement of fossil fuels and electricity bills
- Export excess electricity to the grid (Power Purchase Agreements)
- Reduce carbon taxes
- Boost your business environmental credentials. Being green is good for business.

Running Hours

With adequate on site experience and the right operation and maintenance package in place, WOODCO CHP units are capable of running for up to 8,000 hours. However you should have a thermal heat demand of this size to enable the boiler to run for this duration.

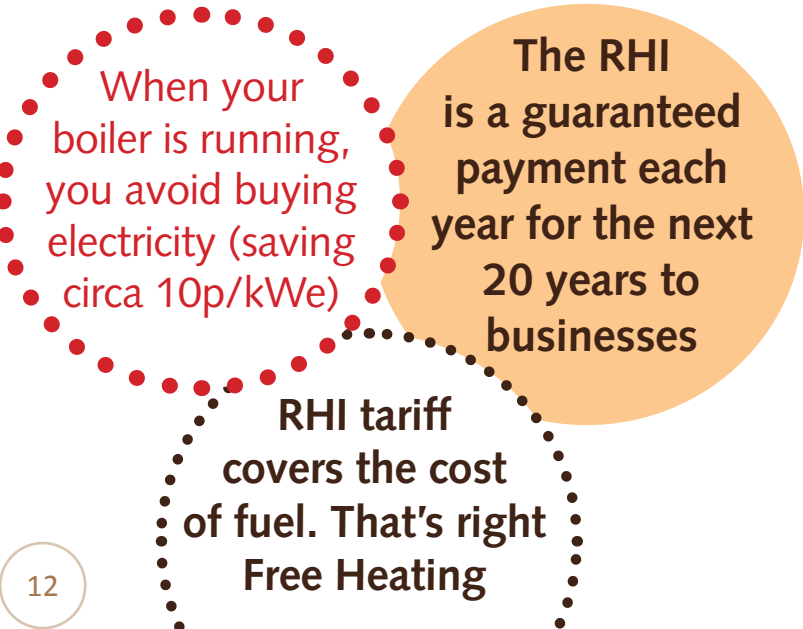
Businesses are being paid to generate heat and electricity.
Show me the Money!



Servicing, Maintenance & Warranty CHP Units

A full list of maintenance requirements available upon request from your installation partner. ORC and Steam CHP systems are very low maintenance and require checks annually and full service every 5 years.

The biomass boilers themselves require their usually service and given that Biomass boilers matched with CHP systems tend to operate for much longer hours (so clients can maximize financial incentives), one should budget for more frequent boiler service intervals.



CASE STUDY Derbyshire Farm

Farm and Holiday cottages powered by WOODCO CHP

This Derbyshire Farm after 12 months will derive the following financial benefits. The farm consists of holiday lets, a swimming pool as well as a

working horse farm. A 500kW Steam biomass boiler and 40kW Cogetherm on a mini district heating scheme will earn RHI CHP tariffs for 20 years.



Potential Thermal Output

(@ 7,200 hours):

Biomass Steam Boiler

500kw @ 7,200 hours

85% efficiency = 3,060 MWh (th)



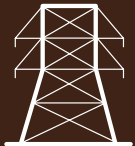
Potential Electrical Output

(@ 7,200 hours):

Steam Expander

40kw @ 7,200 hours

= 288 MW (el)



- BOILER: 500 kW WOODCO Steam Multi-Fuel Boiler
- CHP: 40kW Steam Cogetherm in CogeCabin by WOODCO

Investment	£515,356
Boiler Running time	7,200
IRR	32.92%
Year 1 Income	£186,047
20 year Nett Benefit after Income & Savings @ 2.5%	£3,511,618



Together in Electric Dreams...

Biomass CHP installed in Cheshire

Milton Brook Farm and Holiday Lodges is set in the idyllic Cheshire countryside and caters for visitors wishing to explore historic Chester and into the Wales.

Recently renewable energy installers and business owners have been visiting Milton Brook to see its CogeCabin, a Combined Heat and Power (CHP) system powered by biomass. The owner Mr Mark Chesworth installed 2no 215kW WOODCO E-COMPACT biomass boilers in 2015 and when he learned of WOODCO'S Cogetherm system he jumped at the chance to install the unit.

The site is home to 4 industrial units but also has a heated swimming pool and games room as well as 7 holiday lodges and a private dwelling. The CogeCabin which houses a 20kWe Cogetherm provides electricity for all the farms needs while the boiler is running and any excess electricity is sold to the grid.

An added bonus is the owner can earn both RHI and ROCs from the system, making it a real winner in terms of reducing energy costs and using one of the most complete renewable energy systems in the world.

Holiday Lodges at Milton Brook Farm





20kWe Cogetherm CHP Unit



20kWe Cogetherm in CogeCabin

Cogetherm is available as a standalone unit or can be supplied in a CogeCabin, a plug and play plant room, which is delivered on site. The Cogetherm (which uses Organic Rankin Cycle) provides outstanding value for money, low maintenance and simplicity compared to other biomass CHP systems. The manufacturer can also provide finance packages in terms of lease/Hire Purchase

and free to fit/funded solutions. To make an appointment to visit a Cogetherm or to learn more call 0161 261 7497

www.woodco-energy.com



Swimming Pool at Milton Brook heated by 430kW WOODCO E-COMPACT Boilers

CASE STUDY **Bedfordshire Business Park**

Bedfordshire Business Park powered with WOODCO CogeCabin

Study the table below to see what this Business Park in Bedfordshire will earn by installing WOODCO's 150kW Biomass (HTHW) Boiler and 15kW Cogetherm ORC.

The Business Park's total heating and electricity is provided by the biomass boiler when there is a demand for heat. Excess electricity is sold back to the grid.

- **BOILER: 150kW WOODCO E-COMPACT Pellet Boiler**
- **CHP: 15kW ORC Cogetherm in CogeCabin by WOODCO**

Investment	£146,072
Boiler Running time	3,000
IRR	23.23%
Year 1 Income	£46,227
20 year Nett Benefit after Income & Savings @ 2.5%	£647,228

Local Expertise
GLOBAL REACH



Our Offices

Head Quarters
Porrentruy, Switzerland

Manufacturing
Tipperary, Ireland

European Distribution & Training Centre
Lyon, France



Our Agents



Our Distributors



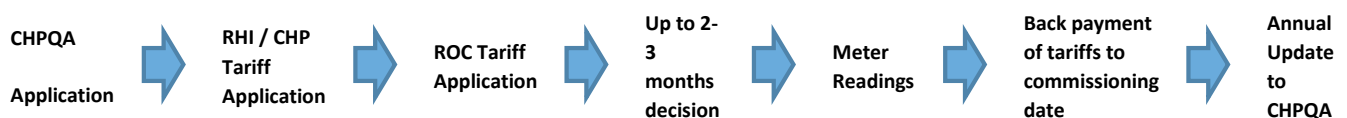
Sales Process

We have proposed a CHP system that will deliver the most cost effective solution for your business in generating heat and power, whilst delivering an income stream for the next 20 years. Below are the steps to be taken to proceed and to register your system for its financial benefits.

WOODCO Process of Sale



Your installation will meet a "GOOD QUALITY CHP" rating which is then submitted via yourself or a CHP advisor so you may receive your financial rewards.



Generation Earnings

For every kWh of heat generated you receive a CHP tariff via the Government RHI Scheme (after qualification from the CHPQA scheme) – Combined Heat and Power Quality Assurance, currently 4.22 pence per kWh for every kWh of electricity generated minus the actual running kWh usage for the system to operate you receive 1.4 ROCS which equates to approx. 5.89 pence per kWh.

Saving or Export Earnings

Heating – You will save money on the fuel cost difference from your current cost pence per kWh minus the kWh cost of Biomass Pellets and in addition improved efficiency.

Electric – You will save the kWh cost from the electricity produced against your current costs. If you do not use the electricity, then this will be exported back to the grid for which you will receive 4.85 pence per kWh from your energy supplier on a quarterly basis.

We recommend you use a CHP specialist to sell your Export Energy and ROCS, this can be done on a fixed contract (our numbers relate to a fixed contract) or at auction to enhance your earnings. We have included in our price the cost of this for the first year, which also includes the registration of the system on the CHPQA, RHI/CHP Tariff ROC and first year meter readings.



WOODCO Manufacturing Site, Tipperary, Ireland



WOODCO Training Centre, Tipperary, Ireland



WOODCO Head Office, Switzerland



WOODCO Component Production

WOODCO
A European
manufacturer



CHP Leadsheet

Customer Details		Proposal Date <input style="width: 100px;" type="text"/>	
Company	<input style="width: 90%;" type="text"/>	Electricity Usage	
Company Reg. No.	<input style="width: 90%;" type="text"/>		
Contact	<input style="width: 90%;" type="text"/>		
Tel	<input style="width: 90%;" type="text"/>		
Email	<input style="width: 90%;" type="text"/>		
Address	<input style="width: 90%;" type="text"/>		
Street	<input style="width: 90%;" type="text"/>		
Town	<input style="width: 90%;" type="text"/>		
County	<input style="width: 90%;" type="text"/>		
Post Code	<input style="width: 90%;" type="text"/>		
Site Details		Heating Usage	
Contact	<input style="width: 90%;" type="text"/>	Fuel Type	
Tel	<input style="width: 90%;" type="text"/>	Cost per KWh	
Email	<input style="width: 90%;" type="text"/>	Existing Boiler Size KW	
Address	<input style="width: 90%;" type="text"/>	Total Annual Bill	
Street	<input style="width: 90%;" type="text"/>	Existing Annual Maintenance	
Town	<input style="width: 90%;" type="text"/>	Total Annual KWh	
County	<input style="width: 90%;" type="text"/>	NEW Proposed Boiler Size KW	
Post Code	<input style="width: 90%;" type="text"/>	Running Hours per Year	
Lead Generator		Equipment in containers?	
		Steam or Standard Boilers?	
		Hot Water Temperature Required	
Tel Email		Return temperature to boiler	
		Pressure (BAR) required (steam only)	
		Existing Waste Steam supply temp	
Tel Email		Existing Waste Steam Pressure BAR	
		Sales Person	
		Tel	
		Email	

Installers Only if you have indicative installation costs please insert them below

Installation Details	
CHP Installation Charge	£0.00
Biomass Complete System Installation Charge	£0.00
Annual Maintenance to be charged	£0.00

If you wish to include additional products / Services in the price for the job enter them below

Item	Description	Qty	Price	Total
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
				£0.00
Grand Total				£0.00

WOODCO

Heat and Power

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MANUFACTURERS OF RENEWABLE HEATING PRODUCTS