CALNETIX POWER SOLUTIONS

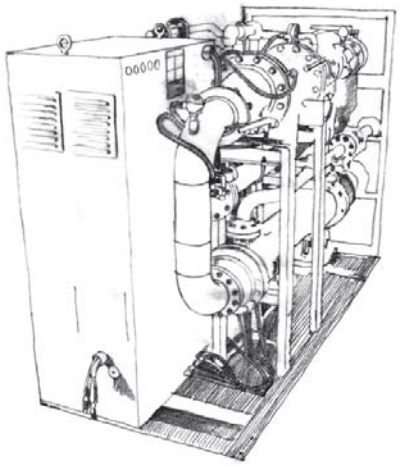
progeco®
Engineering & Solutions

CASE STUDY

Gino Carlon Saw Mill, Italy

Application: Biomass boiler

Integrated by Progeco Ltd.



Thermal energy source	**Saturated Steam @ 135°C**
Installation type	**Indirect heat source / indirect cooling**
Capital cost	**400,000 Euro**
Return on Investment	**45% / 2.2 years**
Average runtime hrs/wk	**160 hrs**
Average Energy Output	**90 kWh net exported to The Grid**
Annual CO2 saving (kg)	**407,347 kg**
Annual NOx saving (kg)	**848 kg**
Annual PM10 saving (kg)	**25 kg**
FiT (Feed in Tariff)	**23 Euro cent / kWh**

No fuel | Zero emissions | Fast payback

"Clean Cycle™ technology lets you build your own power generation plant with minimal investment and fast paybacks. With our installation, we were able to harness wasted energy from the manufacturing process, generating tens of megawatts of electricity to sell back to the grid. Aside from reducing our exposure to increasing energy costs and reliance on the grid, we were able to achieve this with no additional fuel and absolutely zero emissions."

Turning waste heat into electricity.
Calnetix Clean Cycle™.

Alessandro Dorigati
Managing Director,
Progeco, Italy

Clean Cycle™ 125kW.
Waste Heat to Electricity Generator.

The Application:

The Gino Carlon Saw Mill is located near Venice in Italy. This production plant cuts, prepares and finishes timber products for market. During the manufacturing process, biomass fuel is created in the form of waste wood. This is recovered and fed into a 3MWt biomass boiler where it is fired.

The heat from the boiler is used to dry the wood seasoning sheds through a steam radiator circuit. Since the capacity of the boiler was much larger than required for the dryers, and the site produces a large volume of waste wood as a by-product (fig.1.1), it was an ideal application for the CC125.

This project allows megawatts of electricity to be sold back into The Grid, maximizing the companies profits not only by reducing disposal costs of waste, but also by generating revenue from exporting the electricity generated.

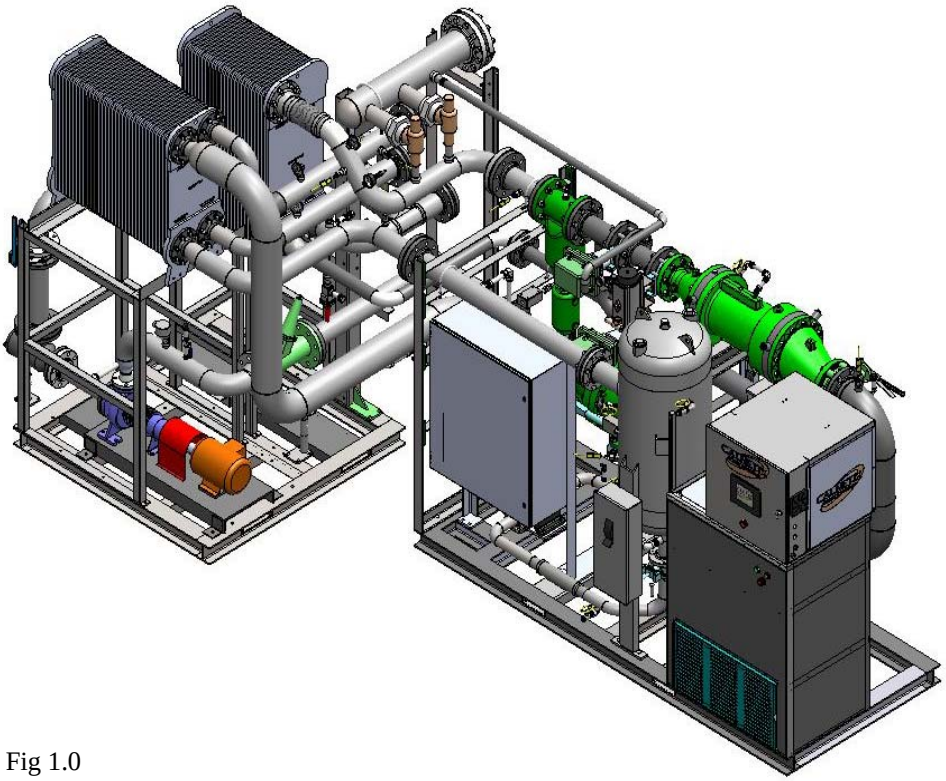


Fig 1.0

Illustration of the close coupled, indirect / indirect CC 125kW installation by Pregeco at Gino Carlon Mill in Venice, Italy.

The illustration above shows the CC125 close-coupled to the evaporating and condensing heat exchangers. There was enough space next to the main building to design a purpose built enclosure for the system to be housed. This can be seen in figure 1.2 below.

Fig 1.1

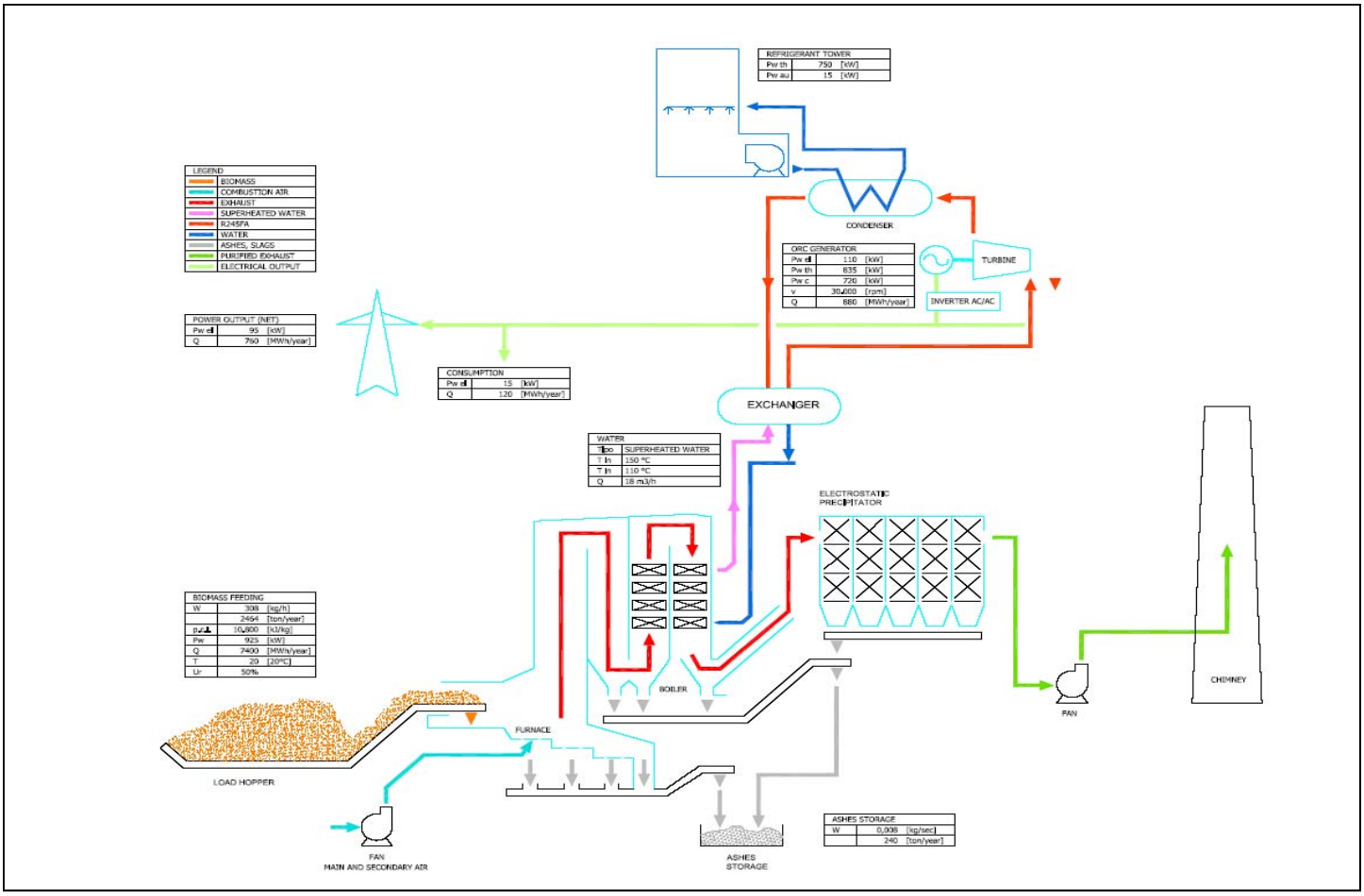
Fig 1.2

The piping and cabling conduit is situated in shallow trenches underneath the skids, making a compact modular installation that will be expanded to three full systems in the future. This will further increase the capacity of the site, generating more electricity and more revenue. In addition to this it will reduce disposal costs for waste removal and cut the emissions associated with this transportation. The modular nature of the CC125 allows projects to be scaled and operated to best suit the site conditions as required.

Clean Cycle™ 125kW.
Waste Heat to Electricity Generator.

The Design:

The CC125 thermal supply and cooling systems at this site are indirect, utilising close coupled evaporating and condensing heat exchangers which allow for a compact design. These are connected to the boiler steam circuit and the external cooling tower water circuit. This is conditioned to reduce lime-scale build-up. The saturated steam from the biomass boiler arrives at a temperature of 135°C, where the working fluid is evaporated. This vapor drives through the turbine. The condenser is used to reject excess heat in the working fluid, condensing it back to a liquid, thus completing the Organic Rankine Cycle. The condenser is cooled using a water circuit and an evaporative cooling tower, as illustrated in the diagram below. Looking at the previous diagram (fig. 1.0), you can see the compact nature of the modular design, allowing for multiple units to be coupled together where there is enough heat availability. Heat otherwise used in the manufacturing process is uninterrupted, as we are only using the excess heat from the boiler. This is simply used by the CC125 system to generate electricity either to be sold into The Grid or to offset the sites base load consumption, which reduces both demand and reliance on the network.



Functional diagram of the CC 125 kW installation, showing piping circuit and major components.

Clean Cycle™ 125kW. Waste Heat to Electricity Generator.

The Installation:

The CC125 skid assembly sits on a concrete pad next to the heat exchanger and ancillary components skid (Ref. Fig 3.0), which contains the indirect heat exchangers and associated pipe work.

The concrete pads include piping and cabling trenches for simplified installation of a further three CC125 systems.

The units are housed in a purpose built, pre-fabricated enclosure (Ref. Fig. 3.2).

Fig 3.1 illustrates the heat exchanger sub-assemblies, which allow good access for any routine instrumentation inspection and calibration.

Fig 3.2 shows the external enclosure housing. This has been built to accommodate a total of three modular skids quickly and with minimum installation cost, as all ground and civil work has been completed in phase one of the project.

Fig. 3.0

The picture above shows the CC 125kW skid installation

The electrical control system and Power Electronics Module are situated in sub-enclosures within the CC125 skid assembly. Part of the control system can be seen in fig 3.3. This is again of a modular design to facilitate the future expansion plans of the site and to simplify integration.

The electrical distribution, control system and grid protection device (G59) is situated within the main pre-fabricated enclosure. The transformer and associated switchgear equipment are installed in sub-enclosures within this housing, and are easily accessible for inspection.

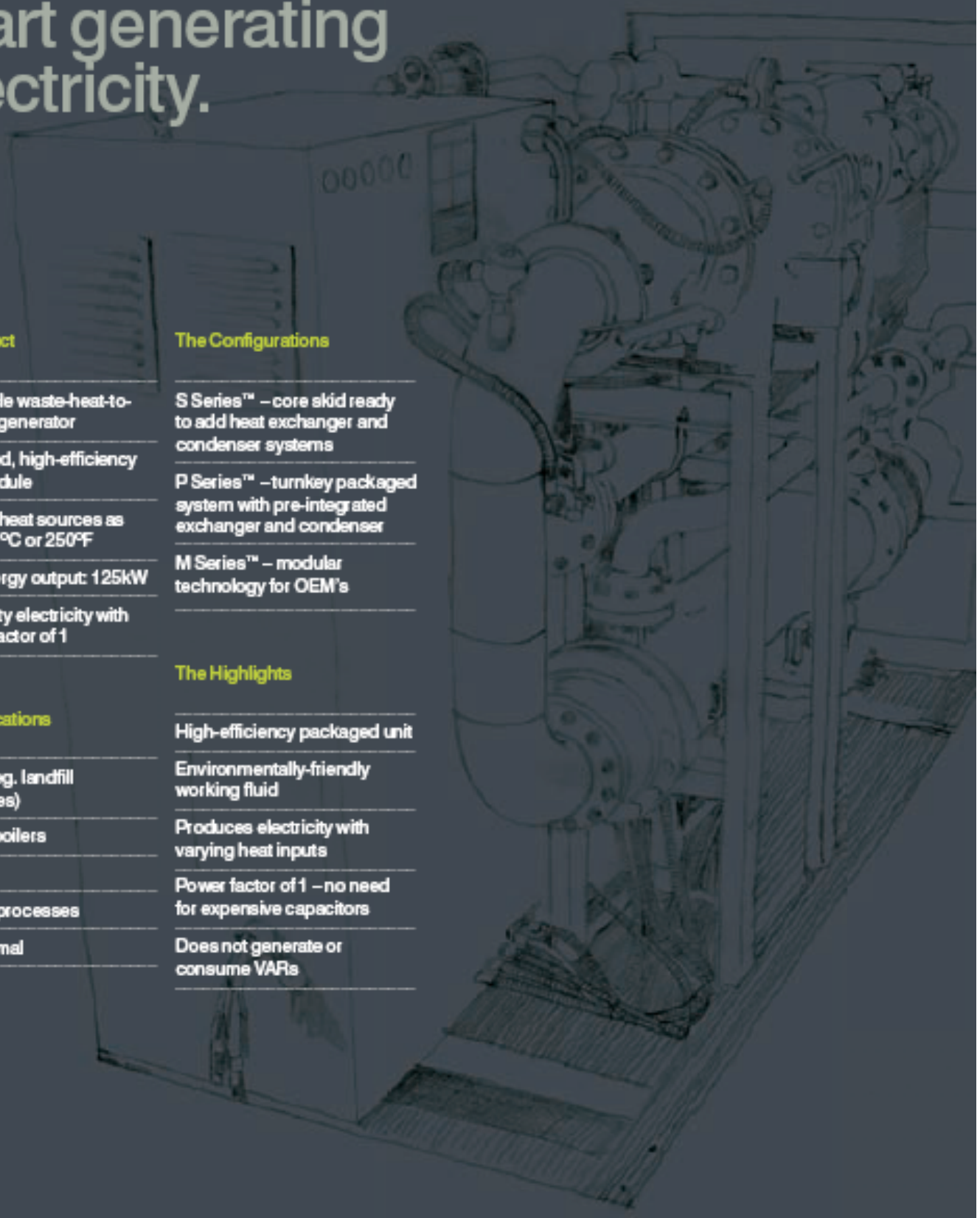
Fig. 3.1

Fig. 3.2

Fig. 3.3

Put the Clean Cycle™ to work.

Stop wasting heat. Start generating electricity.



The Product

- Clean Cycle waste-heat-to-electricity generator
- High-speed, high-efficiency power module
- For waste heat sources as low as 121°C or 250°F
- Gross Energy output: 125kW
- High quality electricity with a Power Factor of 1

The Applications

- Engines (eg. landfill gas engines)
- Biomass boilers
- Turbines
- Industrial processes
- Solar thermal

The Configurations

- S Series™ – core skid ready to add heat exchanger and condenser systems
- P Series™ – turnkey packaged system with pre-integrated exchanger and condenser
- M Series™ – modular technology for OEM's

The Highlights

- High-efficiency packaged unit
- Environmentally-friendly working fluid
- Produces electricity with varying heat inputs
- Power factor of 1 – no need for expensive capacitors
- Does not generate or consume VARs