

Combined Heat & Power Information & Demonstration Day

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A Sustainable Pathway for CHP in
Commercial & Public Buildings
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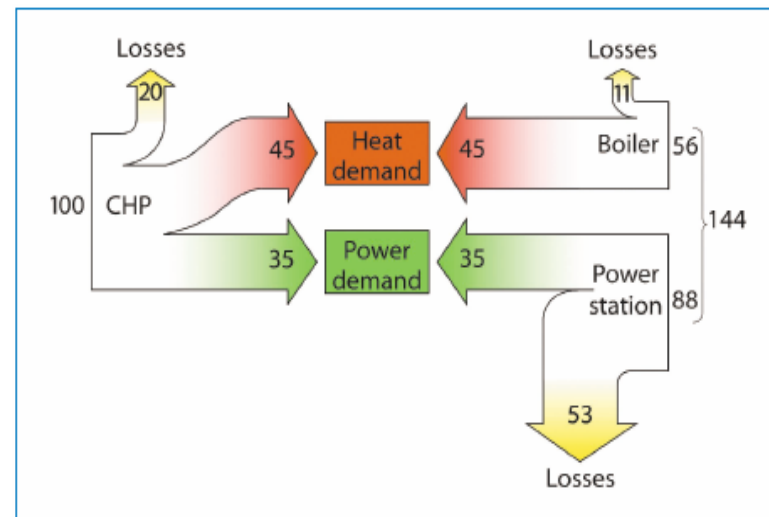
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Introduction

Combined heat and power (CHP) is the combined production of heat and power in a single process. It takes advantage of the heat rejected in the thermo-dynamic conversion process from primary fuel to power and employs that heat for useful purposes. It typically saves around 25% of the energy that would have been required to produce electricity in a conventional power station and heat in separate heat-only boilers.



In the right application, CHP is the single biggest measure for reducing buildings related CO2 emissions and running costs.

Advantages of CHP

- Makes a very significant reduction in the electrical consumption from the ESB.
- Makes a significant reduction in standing charges, maximum demand charges and public service obligation levy.
- Has the most beneficial payback of the plant options considered.
- Protects the client against the risk of increased ESB supply costs.
- CHP is a revenue earning investment and gives an average payback period of 2-4 years (Natural Gas) – 3-5 Years (Propane).
- CHP is environmentally friendly (in comparison to conventional power generation) and gives a reduction on CO₂ levels of 1.2Kg per KWe.
- CHP gives security of electrical supply on site, it can be used as a standby generator, totally independent of the Electrical Utility.
- CHP heat rejection can be utilised within building leading to further energy savings.

Disadvantages of CHP

- During the summer months the heat requirement from the building will be the hot water load, so heat rejection used to dump excess heat when there is no demand within the building.
- This is required to keep the plant operating and avoid overheating.
- This will reduce the efficiency of the plant during the summer months.
- Significant cost associated if the CHP plant is to export power back into the ESB grid. Important to undersize CHP
- More controls / maintenance and lower reliability / availability associated with CHP plant used as a black start generator.

Case Study

Leggetsrath Agri Business Centre – CHP Plant and Biomass Boiler Plant



- **Design Features:**
- Plant to be energy efficient and environmental friendly.
- Proposal to invest in CHP plant as the **lead heat source and electrical supply** for the building.
- Biomass boiler used to supply 'back up' and 'top up' heat when required and electrical utility used when required.
- CHP to give **security of electrical supply** on site and reduced MIC from the ESB.



Factors for use of CHP



The main factors for the use of CHP plant at the Leggetsrath Agri Business Centre are as follows.

- There is a suitable fuel supply for combustion in natural gas
- The estimated CHP operating hours are 5000 hours per annum, which is above the min requirement for grant approval from the SEI of 4000 hours.
- 5000 running hours per annum will result in high utilisation of the plant and a reduced payback period, which makes the CHP plant more economically feasible.
- The building has a simultaneous demand on electricity (pumps, lights, comms , cctv,etc,) and heat (heating, hot water) which will ensure the plant will maintain operation for the maximum number of hours in the day.
- There is suitable plant space and access for CHP Plant.

FUEL SELECTION

Oil, natural gas and LPG are the possible fuels used in building services and the choice of fuel is normally dependent upon the following factors:

- Economy
- Availability
- Combustion cleanliness
- Dependability and reliability
- Operating requirements
- Control requirements

Natural Gas was selected as the fuel source for the CHP Plant and onsite availability, cost and efficiency are some of the deciding factors for its use. Natural Gas also has moderate installation costs compared with other fuels and there is no storage or waste disposal required.

FUEL SELECTION

Woodchip was selected as the fuel source for the back-up boiler to the CHP Plant. The main reasons for its selection were as follows;

- Cost – Very competitive supply costs in comparison to other fuels
- It is deemed carbon neutral and deemed therefore to be environmentally friendly
- It is locally produced and its use puts money back into the local economy.
- It is likely that in the future the price differential between it and fossil fuels will increase.

PREVIOUS TECHNOLOGIES



HEATING

- Boiler Plant utilising natural gas.
- Inflation of Natural Gas fuel costs. Gas Price increase – 34.4% announced in July and implemented from 1st October 2006
- Environmental impact of fuel consumption and CO₂ emissions from plant
- Depleting fossil fuel reserves and uncertainty of supply

ELECTRICITY

- Use of Generator to reduce peak electrical costs has very significant installation costs.
- Standing charges from ESB Networks related to agreed contracted load.
- Wind Power and Photovoltaics technology are very expensive at medium commercial scale.
- Electricity Price increase of up to 20% for Commercial users to be implemented from the 1st January

CURRENT TECHNOLOGIES

HEATING

CHP PLANT:

- CHP becomes the **lead heat source** for the building with the biomass boiler used to supply 'back up' and 'top up' heat when required.
- CHP Plant heat rejection utilised for space heating and hot water heating.
- CHP Plant injects 160kW of heat into return header.
- Heat rejection unit used to dump excess heat when there is no demand within the building.

BIOMASS BOILER PLANT:

- 320 Kw biomass boiler plant to provide **top up heat** for the buildings heating requirements.

CHP Plant heat rejection and biomass boiler capacity selected to ensure high utilisation from both plant.

CURRENT TECHNOLOGIES



ELECTRICITY

- CHP becomes the **lead electrical supply** for the building with the Electrical Utility used as 'top up' when required.
- CHP gives **security of electrical supply** on site, it can be used as a **standby generator**, totally **independent** of the Electrical Utility.
- The CHP Plant installation allows the client to have a reduced MIC (maximum import capacity) from the ESB which means reduced maximum demand charges.

CHP INSTALLATION COSTS



ENER.G 90 CHP UNIT SELECTED

Electrical Output = 90 kWe
Heat Output = 152 kWh

Installation Costs

Prime mover and heat exchanger (CHP Unit)	=	€ 106,600
Pipe and Electrical Works	=	€ 27,517
Civil Works	=	€ 10,000
Total Installation Costs	=	€ 144,117
Less SEI Grant Aid of 30%	=	€ 43,235
Total CHP Installation Costs (Excl VAT)	=	€ 100,882

CHP ENERGY SAVINGS



Cost reduction in standing charges for 100kVA reduction in Max Demand	=	€9,650
Electrical costs savings per annum	=	€36,500
Heating costs savings per annum	=	€11,439
Total Savings	=	€57,589
Total Running Costs of CHP Plant	=	€22,708
Total Savings Per Annum for CHP Plant	=	€34,881
Payback on CHP Plant just under 3 years.		

BIOMASS BOILER INSTALLATION COSTS



Biomass Boiler selected to have an heat output of 320 kW

Installation Costs

Boiler	=	€89,000
Fuel Feed System	=	€9,000
Fuel Storage	=	€22,000
Installation Piping / Connections	=	€35,000
Total Installation Costs	=	€155,000
Less SEI Grant Aid of 30%	=	€46,500
Total Installation Costs (Excl VAT)	=	€108,500

COST / SAVINGS SUMMARY



CHP Plant

Installation Costs	=	€ 144,117
Less SEI Grant Aid of 30%	=	€ 43,235
Total Installation Costs (Excl VAT)	=	€ 100,882
Total Savings Per Annum	=	€ 34,881
Payback on CHP Plant is just under 3 years.		

Woodchip Boiler Plant

Installation Costs	=	€ 155,000
Less SEI Grant Aid of 30%	=	€ 46,500
Total Installation Costs (Excl VAT)	=	€ 108,500
Total Savings Per Annum	=	€ 9,553
Payback on Woodchip Boiler Plant is just under 9 years.		

CONCLUSION

As seen from the figures shown above, the installation of CHP plant and woodchip boilers are economical feasible for both installation on new buildings and existing buildings.

The proposed CHP and Woodchip Boiler Installations can produce large savings over there projected 20 year life cycle.

Care should be taken when selecting the application for CHP and the size of the plant to ensure that it is utilised to its full potential. Excessive oversizing of CHP plant can lead to excessive heat dumping which destroys the economics of the installation.

In the right application, CHP is the single biggest measure for reducing buildings related CO₂ emissions and running costs.

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