

PROJECT CASE STUDY:

Twin Energy Chiller-Hot Water Generator
 Meat Processing Plant Delivering -12C Water Glycol
 and 65C + Hot Water

Project

A recent project has demonstrated the performance and practical efficiency of utilising natural refrigerant CO2 Water/Glycol Chiller - Hot Water Generators within a production cooling application.

Application

A GTE Twin Energy CO2 Chiller-Hot Water Generator system is providing critical cooling at a leading UK producer of high quality meat products.

The installed Twin Energy CO2 Chiller-Hot Water Generator system provided by Green Thermal Energy (GTE) operates with a -12C leaving water/glycol temperature with each chiller able to provide a 55kW cooling output along with a simultaneous 80kW high grade 65C recycled waste heat output (at -12C Flow).

The 80kW of recycled high-grade waste heat that can be delivered by these efficient twin output Chiller-Hot Water Generators reflects a cost saving opportunity to the site as their hot water/steam demand is consistent over a 52-week period meaning that the hot water output from the CO2 Chiller-Hot Water Generator can be reliably utilised on site to deliver energy cost savings.

The natural refrigerant CO2 system that was provided for this project delivers cooling to a state of the art beef ageing facility. This new installation has been designed to deliver the highest quality product to the UK's premium food retailers.

A state of the art automated process control and handling system ensures that each cut of meat receives the required airflow at the temperature and humidity conditions necessary in order to provide the best premium quality dry aged beef.

Hence the temperature and relative humidity conditions of the circulated air are of the utmost importance in terms of meeting the process requirements of this cutting edge project.

In line with the automated dry ageing system the design and specification of the cooling and humidity control plant was also required to be of the latest class leading technology delivering high levels of both sustainability and efficiency.

For these reasons the project team selected a GTE CO2 Cooling and Hot Water production system in order to meet the requirements of this cutting edge project in terms of both sustainability and efficiency. However alongside efficiency and sustainability an equally important selection criteria was a requirement to future proof

the project throughout its lifetime.

Achieving the maximum levels of longevity with respect to all of the installed mechanical systems within the high specification development was an important consideration.

Therefore a natural refrigerant CO2 Twin Energy Chiller System was selected for this application rather than a conventional HFC F Gas based cooling system, which would have provided a potential maintenance cost risk over the next ten to fifteen years due to the F Gas refrigerant phase out legislation.

The selection of a CO2 Twin Energy chiller system that produces high-grade heat as a 'by product' of cooling means that the maximum levels of overall system efficiency can be achieved.



Twin Energy Applications:

- Hospitals
- Hotels/hospitality
- Food & drink processing
- Pharmaceutical production
- Chemical manufacturing
- Process cooling
- HVAC
- Blast chilling
- Cold storage
- Hot water production

In terms of cooling technology this is where GTE Twin Energy CO2 Chiller-Hot Water Generator provides real benefits over conventional F Gas cooling equipment due to the fact that 125% to 150% of the cooling output can be delivered as simultaneous free and zero carbon 65C high grade heat, whereas a conventional F Gas chiller is only able to deliver circa 10% to 15% of its cooling output as high temperature recovered heat.

Where efficiency is concerned these CO2 Twin Energy Chillers provide both cooling and heating from the equivalent input power of a cooling only system. Producing a Total Coefficient of Performance/TCOP of over 4 or an efficiency level of 400% + when the system is operating at a full load condition with a -12C outlet temperature.

On higher temperature cooling projects where -12C flow temperatures are not required the efficiency level of the GTE Twin Energy unit will increase.

For example a Total COP of 7 or an efficiency of 700% is achieved when the cooling output temperature is 5C (the system operates with a -12C water/glycol output flow temperature on the this featured project at 400% efficiency).

In terms of heating/hot water integration the Twin Energy system on this project has been designed to heat incoming mains water, which is fed to the sites hot water and steam boilers via an accumulation and delivery heat exchanger system.

The system provided comprises of the Twin Energy CO2 Chiller-Hot Water Generator System operating with a 2,000 litre chilled water glycol integration/buffer tank and a 4,000 litre heating/hot water accumulation and delivery tank system.

As such this CO2 Production Cooling installation represents an excellent example of a leading food manufacturer adopting established CO2 refrigeration technology to satisfy the specific demands of their new high volume dry ageing facility.

In summary these Green Thermal Energy Twin Energy CO2 Chillers provide the highest levels of sustainability and performance by delivering both cooling and high temperature heating/hot water from the same modular units.

'Site were eager to utilise a system that satisfies the demands of the plant from sustainability and efficiency perspectives', commented Garry Broadbent, continuing, ' utilising not only the cooling but also now the high value waste heat is straightforward with this system and the fact that there will be no refrigerant availability or F Gas cost implications from the natural refrigerant CO2 plant over the next ten to fifteen years also provides security from a whole of life project cost perspective'.



Equipment & Services

- 2 x Nominal 100kW CO2 Chiller-Hot Water Generators
- 12 x Modulating Circulation Pumps
- 1 x 250kW Dry Air Cooler
- 1 x Hot Water Heat Exchanger Pack
- 1 x 2,000 Litre Water/Glycol Buffer-Integration Vessel
- 1 x 4,000 Litre Stratified Thermal Battery System
- 4 x Heat and Coolth meters
- 1 x Remote Monitoring System
- Plus a complete technical support package comprising of Design and Commissioning services from the initial stages through to completion.

Project Summary

The system design within this application reflects the requirements of the majority of manufacturing and processing/production sites across the UK where cooling and heating/hot water is required on the same site. However the valuable waste heat from cooling or refrigeration systems is normally released as waste to atmosphere.

'This CO2 Twin Energy system enabled site to utilise the latest CO2 Chillers in order to match their own production demands', continued Garry Broadbent, explaining further, 'the production requirements within the facility, and also across the site as a whole, call for both hot water and cooling and the Twin Energy system delivers on both counts.'

When a site operator considers their overall energy costs, for both cooling and hot water production, it is normally very clear that delivering high temperature/high grade heat from cooling and refrigeration systems via a Twin Energy system is a practical next step method of reducing energy costs.

The ability to utilise high-grade waste heat from CO2 Twin Energy systems provides a genuine sustainable energy saving opportunity for most manufacturing sites or indeed anywhere where cooling and hot water are needed at the same time.

Hence the use of CO2 cooling equipment in the form of GTE Twin Energy Chiller-Hot Water Generators, enables sustainability and energy cost saving to be delivered within one practical system either on a new installation or retrofit basis providing both cooling and high temperature/high grade waste heat.

Garry Broadbent also noted, ***'Our standard design on a Twin Energy project includes a monitoring and metering system which means that the dual outputs of both cooling and heating can be assessed,'*** continuing, ***' where the efficiency benefits of equipment focused around delivering energy cost and carbon reductions are considered this installation provides a practical demonstration of the Twin Energy CO2 System benefits.'***

Refrigeration and cooling provided by the natural refrigerant CO2 is definitely not new, in fact the earliest recorded cooling systems from the 1800's utilised CO2 as the refrigerant.

However the application of natural refrigerant based cooling systems is now becoming much more relevant due to the increasing demands for organisations to achieve both energy cost and carbon savings alongside meeting the F Gas phase out compliance demands.

In summary this application demonstrates a cooling system that meets 2019 requirements with historically well-established natural refrigerant technology.

By delivering a natural refrigerant based CO2 package of low temperature cooling and high grade 65C + heat output, from a GTE CO2 Twin Energy system, this installation shows a practical but innovative system design with an equipment configuration that is matched to meet the demands of this critical production cooling demand.

Annual Projected Energy Cost Savings	£30,000+
Annual Projected Carbon Savings	160 Tonnes CO2
Payback on Twin Energy Investment	3.5 Years