Welcome to our April Newsletter. In this issue we have included a brief overview of Combined Heat and Power (CHP) and the implications of power loss along with an article on HVAC Optimization in Pharmaceutical Facilities. For more information on our current projects and to sign up to our email newsletter, please go onto our website www.bpe.ie or contact us directly on info@biopharma.ie. We do hope you enjoy this newsletter and thank you for your continued support. Any feedback or comments you may have would be highly appreciated.

COMBINED HEAT & POWER (CHP) OVERVIEW

Combined Heat and Power (CHP), also known as cogeneration, involves the simultaneous production of heat and electrical power from the same source of fuel, usually natural gas. The CHP consists of a gas-fuelled reciprocating engine, a generator / alternator, and a heat recovery system capturing exhaust gas and engine heat.

A CHP uses the by-product heat that is normally discharged to the atmosphere resulting in a higher thermal efficiency. This leads to reduced energy costs and as a result, CHP engines have a lower rate of carbon dioxide (CO_2) emissions per Mega Watt (MW) of useful energy produced. The heat harnessed from the machine is available as low pressure hot water and steam.

A CHP unit also offers greatest benefits where the heat load is large and constant throughout the year and makes excellent economic sense when the ratio of grid electricity prices to gas prices per kWh are high.

A brief explanation of all key elements to consider are detailed bellow:

The 'Spark Gap'

This is the ratio between the cost of a unit of electricity versus a unit of gas. A 'unit' is a kilowatt-hour, which is one kilowatt of power for 1 hour. So, this measure of energy is the same whether for gas or electricity. For CHP to be viable, the cost of a unit of electricity, divided by the cost of a unit of gas, generally need to be 2.5 or greater. The higher this gap, the greater the benefit of the CHP plant and the shorter the payback period.

Thermal (Heat Load) Profile

A CHP unit needs to be able to effectively dissipate the heat generated as a by-product of combustion. This heat is harnessed from the various engine circuits (engine coolant, lube oil coolers, turbocharger intercoolers etc) by a series of heat exchangers and is available in the form of hot water and steam and can be used directly in the plant rather than using hot water and steam boilers. When sizing a CHP unit, the thermal load must be monitored to ensure that the heat-load is present to 'sink' the CHP heat, and therefore benefit the customer. Uses of steam and hot water can vary from humidity control, space heating, jacket heating, washing & cleaning skids and sterilisation.

Electrical & Thermal Efficiencies

The electrical efficiency is extremely important in CHP selection as it tells you what percentage of the input fuel energy goes to generating electrical power. As electrical power is expensive to buy from the grid, the cheaper a CHP can generate a kWh of electricity, the bigger the payback for the customer. Modern CHP units can have electrical efficiencies of up to 45.7%. The thermal efficiency is a measure of the usable heat generated per kWh of input fuel.

Availability (Uptime) Guarantees

A CHP vendor will offer an availability guarantee, which will guarantee the customer that the machine, when properly maintained as per manufacturer's guidelines, will run for a minimum number of hours in the year. This figure is usually expressed as a percentage. So given that there are 8760 hours in a year, a typical up-time guarantee would be given as 92%, which equates to 8059 hours.

Penalty clauses should be in place so that the vendor is penalised if the guarantee is not met. The availability guarantee is a measure of the vendor's confidence in their equipment and design, as well as in their ability to maintain the equipment satisfactorily. A vendor will insist upon being able to remotely monitor the machine as it operates, so that any alarms can be highlighted early and dealt with to minimise down-time. This remote monitoring is usually configured using a broadband enabled telephone line (internet connection).

Operations & Maintenance Costs

Modern CHP units are highly efficient machines that need regular scheduled maintenance in order to guarantee their reliability over their lifetime. The cost of maintaining a multi-cylinder CHP machine can be expensive and needs to be factored into the overall payback calculation figure to determine viability. The vendor will usually quote for this cost in a €/hour run format. It can also be quoted as a cost per electrical kilowatt hour (kWhe) produced. As well as routine maintenance, these machines will require scheduled minor, intermediate and major overhauls. Maintenance quotations can be structured to include (or exclude) these larger services and overhauls depending on available finance.

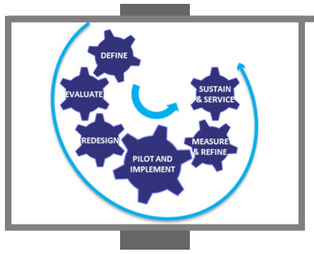
Installation & Integration Costs

Installing and integrating a large scale CHP into an existing plant can be expensive and invasive. Such an installation needs to be professionally assessed and designed to ensure optimum design and operating efficiencies. There are tie-ins required to a gas supply, a LPHW loop, a steam loop, the site electrical ring main system and plant BMS. These design and installation costs need to be included in the overall payback calculation to determine CHP viability.

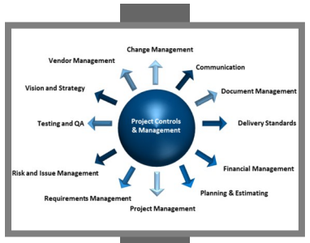
In Biopharma Engineering, our team have extensive CHP experience with design, installation and commissioning of CHP systems and combined cycle power plants in Pharma, Medical Devices & Educational facilities. We can assess CHP viability and payback times, initial requirements and project scope development, as well as project manage and deliver turnkey CHP solutions.

For more information on this article or CHP please contact Fergus Cawley on fcawley@biopharma.ie.

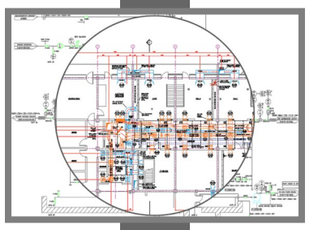
BPE AREAS OF EXPERTISE



PROCESS



PROJECT CONTROL & MANAGEMENT



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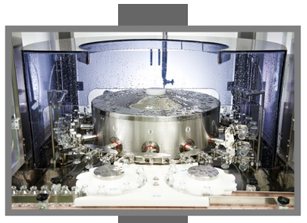

AUTOMATION

BUILDING SERVICES

3D MECHANICAL

DESIGN MANAGE DELIVER

HVAC OPTIMISATION IN PHARMACEUTICAL FACILITIES

HVAC systems represent one of the major energy consumers in a pharmaceutical facility, particularly for secondary sites and fill-finish facilities. The HVAC systems for these types of facility have been conventionally designed to provide a very conservative solution to the requirements for environmental control. With operating costs and energy consumption considered a low priority in the design process, many HVAC systems are designed for excess air change rates, overly tight temperature and humidity setpoints and excess fresh air demand.

With the increasing demand within the Pharma industry to reduce both operating costs and environmental impacts, there is a growing recognition of the need to improve the design and operation of the HVAC systems to maximise their operational efficiency. While the focus of energy savings initiatives is often on the generation side – upgrading or replacing boilers & chillers, installing Co-generation plants or switching to renewable energy sources, there is a great deal of scope to achieve significant improvements on the demand side with far lower capital investment and this should be the starting point.

In line with the current ISPE Good Practice Guide for HVAC, the starting point for optimising the HVAC for any pharmaceutical facility is a thorough assessment of the required environmental conditions. This risk-based assessment should concentrate on the fundamental requirements – what does the process require in terms of air cleanliness, temperature, humidity, recovery rate? Setting arbitrary limits such as minimum air change rates should be avoided as this will tend to constrain the system design. The fundamental requirements should be identified and the air change rates set to offset the gains in heat, moisture and viable particulate.

Once the room requirements have been established, the operation of HVAC systems can then be optimised to maintain the required conditions while minimising the energy demand. A detailed survey of the HVAC setup – airflows, room pressure profiles, duct pressure profiles, control strategy, room conditions and activities, etc, should be analysed and an action plan developed to optimise the system operation, ranking the improvement measures based on potential energy savings, impact on operations and capital cost.

Typical low cost measures will include reducing air change rates, rationalising pressure profiles to reduce fresh air loads, optimising temperature & humidity limits, improving control sequences to utilise floating setpoints and deadband control.

More radical changes involve strategies such as changing three-port, constant volume chilled water and LPHW to two-port variable volume systems, adding air flow meters and air volume control to allow night setback of airflows and use of free cooling while maintaining pressure profiles, adding fresh air pre-treatment and heat recovery systems.

In Biopharma Engineering, our HVAC and automation engineers have both site and design office experience of a wide range of HVAC retrofit and optimisation projects across a wide range of bulk API, secondary fill-finish and biotech facilities. We can facilitate the initial requirements and risk assessments and project scope development of what needs to be completed as well as deliver the capital equipment changes.

For more information on this article, please contact Dermot O'Driscoll on dodriscoll@biopharma.ie.

WE WOULD LIKE TO WELCOME OUR NEW TEAM MEMBER TO BIOPHARMA ENGINEERING

Ger O'Brien– E&I Engineer

Ger is an experienced Electrical & Instrumentation Engineer with over five years of industrial experience. Ger qualified as an Electrical Engineering (Hons) from Cork Institute of Technology and spent a number of years as E&I Engineer working for clients such as Novartis and Irish Distillers. Ger is highly skilled in instrumentation specification and design and his experience covers all aspects of project delivery from estimation, design and construction through to commissioning on site. Ger's experience and attention to detail will further enhance and strengthen our E&I Team.

Our Capabilities

We design, manage & deliver projects for a broad spectrum of clients in the following Industries

PHARMACEUTICAL

BIOTECHNOLOGY

MEDICAL DEVICES

To find out how we can tailor our service to meet your business goals give us a call or visit our website.

- Combined Heat & Power(CHP) Overview
- HVAC Optimisation in Pharmaceutical Facilities
- New BPE Team Members

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