# A Prescription for Energy

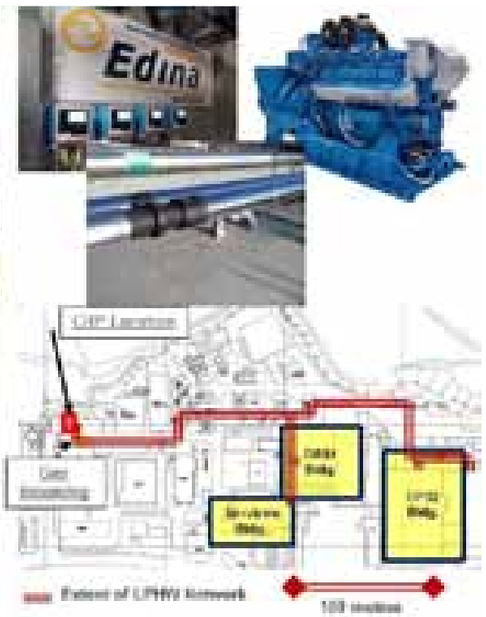
**by Mark O'Connor, MSD Brinny Site Energy Lead**

As energy prices continue to rise, pharmaceutical utility plant managers are taking a proactive approach to energy management, exploring diverse energy supply options, from demand response to on-site energy generation. One such opportunity is Combined Heat and Power (CHP) technology, which is experiencing a revival in pharmaceutical manufacturing facilities revival thanks to its ability to generate electricity as well as heat.

Merck & Co., Inc. (Merck) is a global, research-based pharmaceutical and healthcare company with a longstanding presence in Ireland, employing over 2,000 people across eight sites in Carlow, Cork, Dublin, Tipperary and Wicklow. This May has seen the CHP Project coming on-stream and now feeding power into the electrical distribution system at Merck Sharp Dohme (MSD) Brinny site in Co. Cork.

Mark O'Connor, MSD Brinny Site Energy Lead, successfully initiated and gathered the support of key stakeholders across the business for this significant strategic energy investment which entailed the delivery of a 1.5MWe Combined Heat & Power (CHP) plant onsite. This investment now provides significant energy spend reductions for the site as well as meeting environmental and security of supply issues over its expected 15 year lifetime.

CHP (or Cogeneration) is defined as the generation of heat and electricity from a single fuel input such as gas. In contrast to traditional national grid power generation stations, where the heat produced during production is typically wasted to atmosphere, Combined Heat and Power generation captures this heat and diverts it to useful sources such as hot water & steam.




Picture Above: SLT along with key Project Stakeholders at recent CHP GEMBA tour showcasing the new CHP Facility at Brinny. Also in attendance is EMEA Energy Manager Philippe Legile accompanied by Mark O'Connor Site Energy Lead and Jimmy Conlon (MSD Rathdrum Energy Lead)

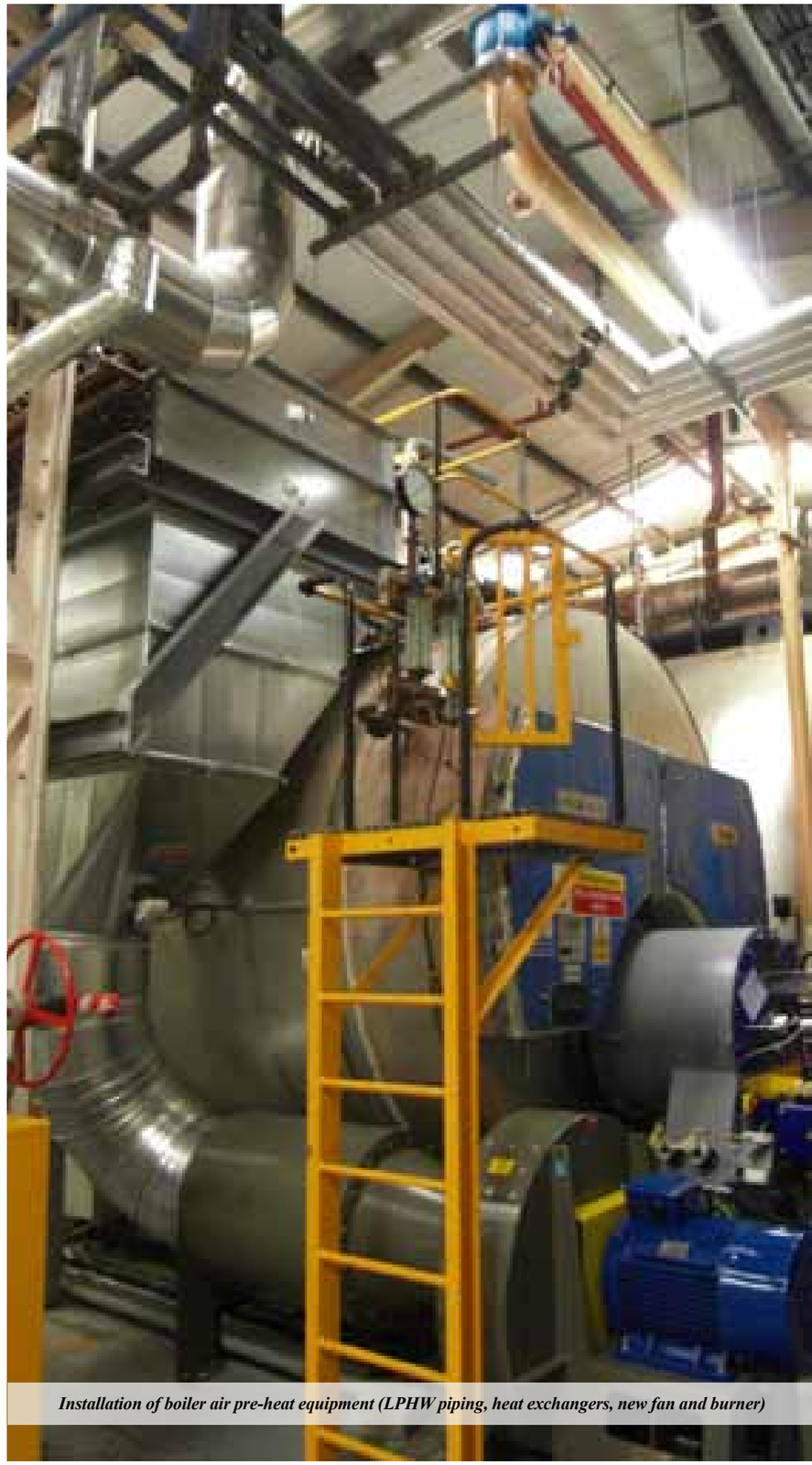


All images in this article courtesy of Merck Sharp Dohme (MSD)

CHP plants can reach efficiencies up to 75-80% versus conventional power stations (typically 40%) as the excess heat generated can be used that would otherwise be wasted in conventional power plant as delivered from the grid.

Brinny is the first MSD site in Ireland to install CHP on their premises. That said, there are over 125MW of CHP plant installed across the entire Merck network to date. The project has been funded by Merck with financial support from IDA. The project duration, from initial concept through to final commissioning and realization, has been successfully completed in approximately 30 months. This project is likely to deliver >10% energy cost savings to the site typical annual energy spend, significantly helping the site in its journey towards meeting its targets as aligned to Merck's global cost reduction initiative, Target 15.

Brinny's activities onsite lends itself to an annual energy consumption that is equivalent to approximately 3,000 typical dwellings representing an average sized town. To this end, MSD Brinny's Energy Reduction Programme has set itself very challenging targets annually over the past number of years aligned with Merck's Target 15 expectations. The programme encompasses a combination of technical, organisational and behavioural changes in order to reduce the energy usage onsite and is aligned to ISO50001 principles. The site has invested in a range of technical capital solutions since the beginning of the energy programme including, process & HVAC chillers distribution optimisation, cooling towers optimisation, compressed air system optimisation, process water reduction, lighting upgrades, and notably the CHP Project to name but some.



*Installation of boiler air pre-heat equipment (LPHW piping, heat exchangers, new fan and burner)*


*CHP LPHW pump skids skid*

Energy demand reduction through the active development and implementation of energy efficiency opportunities, with a particular focus on reducing electrical, thermal and water consumption has been the focus of optimization projects to date. An active onsite Energy Team has played it's role in communicating and influencing the key energy users onsite (Sterile, API & Quality Integrated Process Teams (IPTs)) in terms of ensuring operational vigilance regarding shutting down equipment in times of little or no demand. A culture of awareness entailing that energy conservation is everyone's business ensures the site as a whole shares the task of reducing energy wastage. An important but parallel focus on energy pricing on the supply side has led to the development of the combined heat and power project which is now operational since May 14.

**Why need for CHP?**

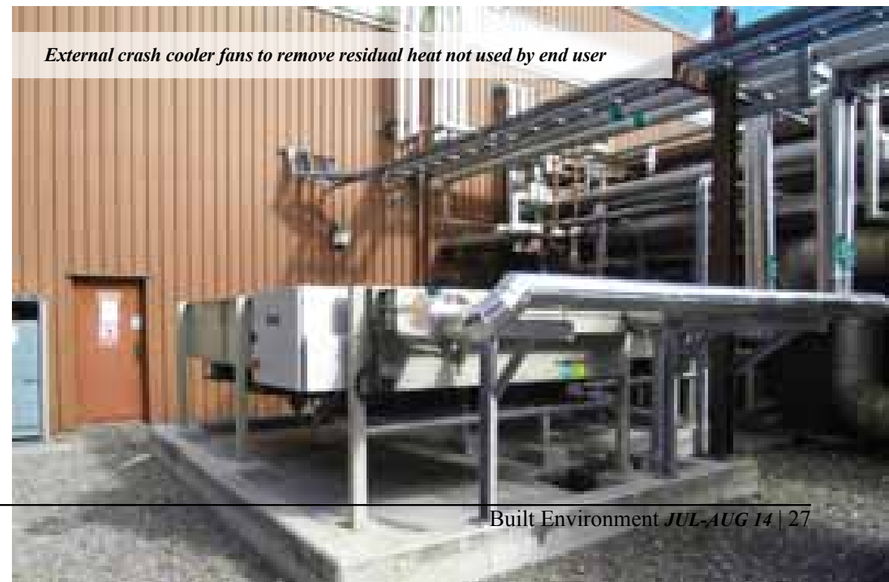
Energy costs represent a significant portion of the standard operating cost of the site. By reducing the energy spend, this project will significantly help the site become more cost-competitive leading to more sustainable future for the site.This strategic project has been developed to realise annual net cost energy savings for Brinny representing in the region of savings equivalent to > 10% of annual energy costs over the next 15-year period.

**What savings will it make from an environment perspective?**

Environmental benefits of the CHP installation relate to the annual saving of approx. 3,100t $CO_2$ equivalent to displacing the annual emissions of more than 633 cars and light trucks from our roads.

*CHP Plant room internal view with engine located within acoustic enclosure*

*Associated high grade/low grade heat exchangers/pump skids*



*External crash cooler fans to remove residual heat not used by end user*

**CHP Project Approach:**

A stage-gate risk-based approach to delivery of the CHP project from initial concept through to completion was taken. Such elements of this approach can be summarized as follows:

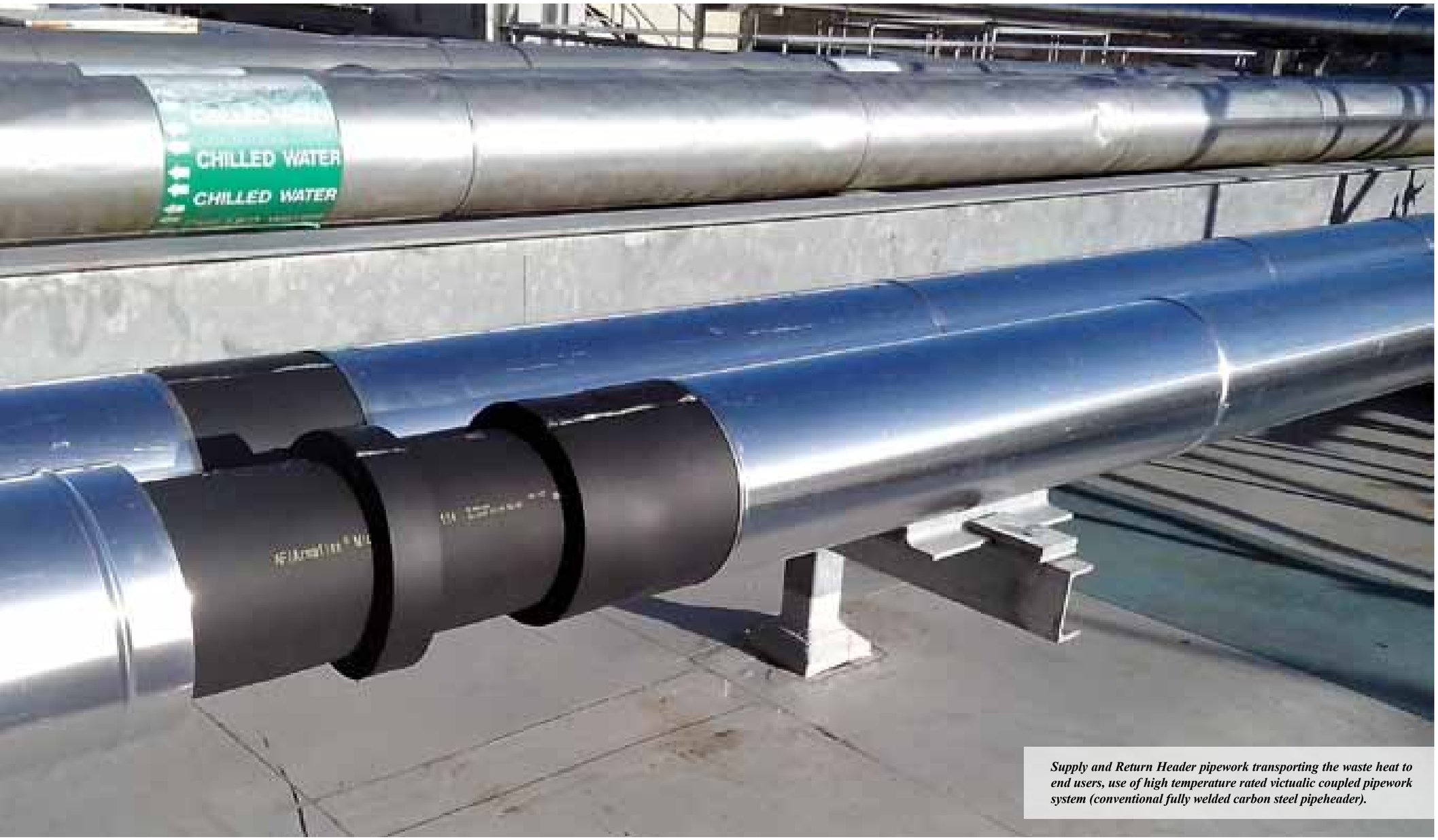
- Initial Technology Review/Vendor engagement
- Business Case Development
- Site funded Technical and Financial Feasibility Study – load measurement, location, contract options such as: – Energy Supply Company (ESCO) model – Build, Own, Operate, Maintain (BOOM); Design, Build, Operate, Maintain (DBOM)
- Approval of funding to support Basis Of Design (BOD)
- Engagement with IDA Ireland for business support that enabled an acceptable business case
- Full funding approval followed by Detailed Design/Construction/Commissioning phases

**Key Technical Considerations in this project included:**

- Key elements of this project was ensuring on an appropriately sized facility that matches the site heat demands, was aligned to the business and was supported by key stakeholders. Some specific technical considerations include, but not limited to;
- Detailed site heat load monitoring and sizing – engine should be matched to the existing Low Pressure Hot Water (LPHW), Steam & Electrical Demands
- CHP requires a high usage (85% +) level of both thermal and electrical energy to make it attractive
- Fuel source considerations – high pressure gas availability, other alternative sources such as biogas from suitable waste streams if viable
- Layout considerations – CHP LPHW Header, optimum location of engine review, electrical ti- ins
- Engineering Design considerations – CHP Technology Options - engine v turbine, integration into existing boilers if feasible
- Heat recovery options: into existing LPHW network, use of engine flue gas exhaust generating steam in dedicated waste heat section of existing boiler, pre-heating of boiler feed air using 40/90Deg C CHP LPHW heat sources, load shedding control priority matrix of end users of heat
- EHS considerations – planning if required, impact to IPPC licensing requirements with regard to sound levels & emission, process safety considerations
- Key Performance Indictor development & implementation to verify savings being achieved with system in operation

**Project Challenges:**

- Extent of physical installation – equipment encompasses LPHW header to end users, CHP engine and associated skids, transformers, control infrastructure all into existing brownfield locations
- Cost of extensive pipework header: solution – use of high temperature rated victualic coupled pipework system (v conventional fully welded carbon steel pipeheader)
- Commissioning/toubleshooting challenges regarding energy measurement at end user locations
- Aggressive Project timelines
- ESCO Maintenance Contract implementation




***Supply and Return Header pipework transporting the waste heat to end users, use of high temperature rated victualic coupled pipework system (conventional fully welded carbon steel pipeheader).***

"The investment by the site into an appropriately sized CHP facility is a strategic decision that entails an efficient energy technology that is expected to deliver a more cost-competitive energy supply to the site into the future, whilst allowing for continued improvements in energy demand reduction initiatives" says Mark. The successful realisation of savings can be attributed to the approach taken in terms of commitment shown by Brinny Senior Leadership Team, the governance and delivery from Merck Global Engineering Services (GES) and the design and implementation experience delivered by PM Group.

In conclusion, over the past 3 years, the energy demand reduction achieved at Brinny is estimated in the region of 15% and including the onset of CHP, the site is on track to have implemented energy cost savings in region of 30% by end 2015. These savings are attributable to an effective energy management programme onsite that is actively supported by its people and resources.