INDUSTRIAL BEST PRACTICE INITIATIVE

Wyeth Medica

EED'S THE RIGHT MEDICINE FOR NEW WYETH PLANT

WYETH is a world leader in prescription pharmaceuticals, healthcare products, and pharmaceuticals for animal health. With net revenues of $24.4 billion in 2007, it has 47,000 employees in manufacturing facilities and offices in over 100 countries on four continents.

Wyeth has had a manufacturing presence in Ireland for over 30 years. It currently operates four manufacturing facilities in the country. One such facility is Wyeth Newbridge, Co Kildare.

The Wyeth Newbridge facility was established in 1992 and currently employs around 1,300 people. Measuring 1,000,000 sq ft, it is a centre of excellence for the supply of existing products, while the development and manufacture of new solid-dose, small-molecule therapies is in the pipeline.

In 2007, Wyeth Newbridge began the detailed design of a new Pharmaceutical Development Centre (PDC). Essentially, this centre is intended to optimise the development of solid, small-molecule drugs by integrating pharmaceutical development into the existing commercial manufacturing facility. The centre consists of a number of process rooms dedicated to technology platforms widely used in the secondary pharmaceutical industry. The PDC will offer Wyeth Newbridge the dual benefits of:

- Optimising the robustness and development of pipeline products
- Supporting existing product manufacturing operations

This will lead to more efficient manufacturing processes and thus more efficient energy usage. With this in mind, a key consideration in the design, construction, and operation of the facility was the need to achieve a significant reduction in energy costs and an associated reduction in CO_2 emissions. These objectives were met in full:

- 51% reduction in operational costs
- 85% reduction in both indirect and direct CO_2 emissions
- 5% reduction in freshwater use

This project was part-funded under Sustainable Energy Ireland's Industrial Best Practice Initiative. Based on the energy savings outlined above, Wyeth Newbridge has a payback timeframe of less than five years for the changes identified in the initiative.

Overhead photograph of Wyeth Newbridge

KEY ENABLER

The PDC is considered to be a key enabler in providing Wyeth with greater product and process knowledge, ultimately leading to a more efficient manufacturing process. It was important, therefore, that Wyeth examine how to design and operate the PDC with energy efficiency in mind.

Wyeth Newbridge has an established framework for energy management and is certified to IS393. It had recently executed a number of other capital projects and the experience gained was inputted into the design process for the PDC. The PDC project was exposed to Energy Efficient Design (EED) through a best-practice workshop organised by Sustainable Energy Ireland (SEI), which arranged for the energy-efficiency consultants to provide an overview presentation of some EED projects conducted in the pharma/healthcare sector.

The initial design, while it did follow some energy-efficiency guidelines, was not in itself an EED. But during the workshop the project management and engineering team were fully exposed to the advantages of following the EED methodology in the design and in the final operation of the PDC.

At this point the detailed design phase of the project was approximately 50% complete and it would have been both inefficient and uneconomical to pursue all suggestions identified. It was not too late however to make an impact. The identification of significant energy savings opportunities, even at a late stage in the design process, illustrates the advantage of using EED for such a project.

The breakdown of the Wyeth Newbridge EED team is as follows:

Table 1: Breakdown of EED team

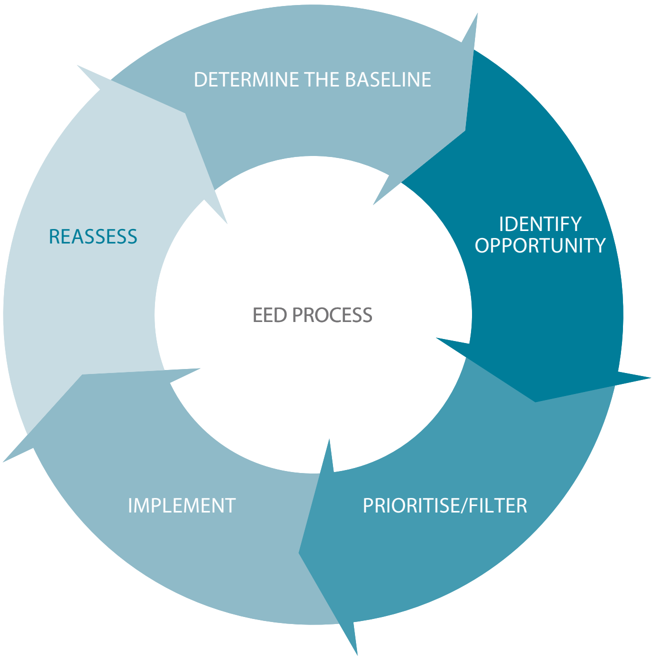
Name	Role in EED
Cathal Kiely	Wyeth Newbridge Lead Utilities (EED Lead)
Martin Wallace	Wyeth Newbridge Project Manager
Lars Mønkler	External Energy Management Expert
John O'Sullivan	SEI

THE EED PHASES

EED methodology uses the following three phases (see *Figure 1* below):

- Project baseline & analysis
- Identification of opportunities
- Assessment of the opportunities
- Implementation

Figure 1: The main steps in the EED process



A number of saving initiatives were identified and implemented by Wyeth before the EED methodology process commenced. These initiatives, evaluated as part of the EED, were:

HVAC (heating, ventilating, and air-conditioning)

Baseline 1. Heat-recovery system in HVAC.

Baseline 2. A heat-recovery system is designed to recover energy from the exhaust air from the ventilation system and transfer the energy to the inlet air. This initiative will reduce the demand for heating in winter. The assessment revealed that the cooling recovery was negligible compared to the value of heat recovery.

Baseline 3. VSDs (variable-speed drives) and toothed belts on all motors.

VSDs have been integrated for the control of the fan speed in the air-handling units. This initiative will enable the fans to vary output to match actual demand and will save energy corresponding to variable pressure losses in filters.

Baseline 4. Split circuits for GMP AHUs (air-handling units).

The GMP area of the PDC is serviced by two AHUs. Rooms with high internal loads will be served by one AHU while a second AHU (operating at steady operating conditions) will be used in rooms with lower internal loads.

Baseline 5. Free cooling on non-GMP unit.

When external temperature matches the cooling temperature required, ambient external temperature air will be used for cooling. Compared to the baseline, two alternative operation strategies of the AHU for the technical spaces were designed in order to maximise the use of appropriate outside conditions and thus reduce the cooling and heating demand for HVAC. Variable outside air intake 20-100% depending on outside temperature. Fixed outside air intake of 25%.

Utilities

Baseline 6. High-efficiency equipment.

All electrical equipment has been specified to be 'high-efficiency'.

During the EED process, carried out in conjunction with EED consultants, a number of saving proposals were identified for analysis:

Process

EED 1. Review of air-supply requirements.

This review concentrated on air supply for coating processing equipment. The coater has a dedicated AHU which supplies high volumes of hot dry air to the equipment. By ensuring that only air of the sufficient temperature and humidity is supplied to the coater, energy use will be optimised. (Not within EED scope.)

EED 2. Review of AHU requirements for processing equipment.

This review concentrated on processing equipment, for example, granulation, fluid bed. This equipment has a dedicated AHU, which supplies high volumes of hot dry air to the equipment. (Not within EED scope.)

EED 3. Review of dust aggregates.

This review concentrated on the central dust collection system and processing equipment. (Not within EED scope.)

EED 4. Introduction of standby mode for UDF/down-flow booth.

When the down-flow blow booths are not in operation, the equipment will be set in standby mode. This results in a reduction in air velocity of 85% and reduced internal load from lighting, fans, etc. Three down-flow booths will have this functionality.

EED 5. Review of EFF1 electric motors.

In the tender specification, EFF1 motors were stipulated throughout the project. This initiative will evaluate the benefits of using these EFF1 motors.

EED 6. Insulation of processing equipment.

This initiative applies specifically to the coater equipment. The coater operates with low humidity requirements and high air temperatures (80°C) in the coater chamber. This initiative evaluates the benefits accruing from insulating the processing equipment.

HVAC

EED 7. Review of temperature requirements for mechanical spaces.

In the original design, the acceptable temperature tolerance for the technical spaces in the PDC was defined as 24°C ±3°C. The latest design proposes a summer setpoint of 24°C ±3°C and a winter setpoint of 20°C ±3°C. As a consequence, the overall acceptable range for temperature throughout the year (that is, not just for summer and winter) will be 17°C – 27°C, resulting in significant savings.

EED 8. Reduced air conditioning for rooms with no activity.

The cleanroom design incorporates 100% fresh air for all GMP areas. This creates an energy demand for conditioning large volumes of outside air. Parts of the GMP areas will not be used for certain periods (up to months); thus air-change rates can be reduced for these areas when they are not in use.

EED 9. HVAC humidification based on waste heat instead of MTHW (medium-temperature hot water).

Humidification in the two GMP air-handling units is carried out by injecting hot water aerosols into the inlet air. This hot water is heated by MTHW, which would be replaced by LPHW (low-pressure hot water) in this initiative. The energy demand for humidification is not affected by this initiative, but the unit cost and the environmental impact in using LPHW is lower than those of MTHW.

EED 10. Heating for HVAC based on waste heat and not MTHW.

The energy demand for heating in the HVAC systems is based on MTHW, which has a high temperature (137°C) and relatively high CO_2 emissions per kWh. The MTHW feeds an LTHW (60°C) circuit, which supplies the coils in the HVAC systems.

By supplying the LTWH circuit with waste heat (for example, from CHP, chillers, and air compressors), this energy could be saved. The direct and indirect advantages of such a system are:

- Energy for heating in HVAC systems at no cost
- Reduced steam demand for the site (MTHW is based on steam)
- Reduced cost and load for the site cooling towers

The availability of waste-heat sources far exceeds the peak demand from the PDC. It is estimated that 100% of the heating demand for technical spaces and GMP areas could be supplied by a heat-recovery system, for example, with a supply temperature of 70°C.

Utilities

EED 1. Waste-heat supply.

This initiative proposes to harness waste heat from site utilities (for example, CHP, chillers, and air compressors).

EED 2. Change water usage regime.

This initiative proposes to use a PW hot loop based on waste heat and/or to use MTHW as an alternative to steam.

EED 3. Replace pneumatic doors with electric doors.

It is proposed to redesign the existing pneumatically operated doors to make use of electric drives. Compressed air is far more expensive and less efficient than electricity for such equipment. (Not within EED scope)

EED 4. Lighting systems review.

This initiative proposes to improve the efficiency of the lighting system so that a 500 lux area can be lit with an average of $15W/m^2$, rather than the $27W/m^2$ in the PDC. This is a reduction of 44%.

Table 2: Breakdown of initiatives implemented and savings achieved

Category			Operational savings (€/year)	Value EUA (€/year)	GHG savings (tonnes CO_2 eqv/year	Water (m^3/year)
Process	1.3a	Floating set points T	22780	3740	163	7
	1.3b	Floating set points RH	9066	929	64	362
	1.7	UDF standby mode	4949	0	34	105
	1.8	Review, Energy efficient motors	TBD	TBD	TBD	TBD
	2.1	Energy efficient motors specification	TBD	TBD	TBD	TBD
	2.2	Energy efficient processing equipment	N/A	N/A	N/A	N/A
HVAC	1.15	Modulated operation of HVAC	23237	2447	164	71
	1.17	HVAC humidification	9082	1258	65	0
	1.18	Waste heat supply for HVAC	59633	8259	614	0
	2.3	Heat recovery system in HVAC	25241	4156	181	0
	2.4	VSD and toothed belts on fans	14257	0	98	0
	2.5	Split HVAC circuits	7163	1179	51	0
	2.6b	Free cooling on non-GMP areas	47875	6883	341	641
Utilities	1.19	Waste heat supply for LPHW	This initiative corresponds to the aggregated savings of 1.17, 1.18 and 1.20			
Total			**223283**	**28850**	**1774**	**1186**

THE POTENTIAL SAVINGS

The table above outlines the savings to be made by carrying out the most significant initiatives outlined in Wyeth's baseline designs (outlined on previous page).

THE LESSONS LEARNED

Standard industrial design tends to focus on time and investment but does not always address long-term operating costs. Decisions on technology for design are taken without considering the impact of ongoing energy use on the production site. These shortcomings are addressed when EED principles are applied from the initial design phase.

While this project applied EED principles late in the design phase, the fact that significant savings (>50%) could still be realised demonstrates the robust and flexible nature of the EED process. It is clear that it is never too late to adopt the EED methodology.

The EED for this PDC facility is easily replicated. The project will deliver a fundamental piece of infrastructure that will drive further innovations and initiatives at the Newbridge site. While several of the initiatives identified will not be carried out, due to time constraints, prior purchases, and Wyeth's requirement of a two to three-year return on investment, it was a worthwhile exercise to identify and investigate these initiatives for both future reference and for replication.

The following lessons were learned during the EED process:

- Significant advantages are gained by concentrating on energy efficiency early in the design process.
- The EED process did not have any adverse impact on the execution of the overall project plan.
- It is important to have EED advisors working closely with the engineers on the ground.
- While carrying out initiatives, it is important to constantly refer to and challenge the design, without restricting its original purpose.
- The benefits and weaknesses of strict corporate guidelines must be constantly assessed and challenged.
- EED is a continuous process while in operation and greater understandings of the business's needs are understood.

When starting to design the new PDC, Wyeth assessed some initiatives that reduced energy use. However, the EED process with Viegand & Maagøe identified, even at a late stage in the design process, significant energy-savings opportunities – a 5% reduction in freshwater use, a 51% cut in operational costs, and an 85% reduction in CO_2 emissions.

"Energy efficiency isn't about equipment and buildings. It is about the way scarce resources are used during operation. The big hits are not achieved by changing or modifying equipment but by considering the way the equipment is used."

Martin Wallace, PDC Project Manager, Wyeth Medica

Sustainable Energy Ireland

Glasnevin, Dublin 9, Ireland
Glas Naíon, Baile Átha Cliath 9, Éireann

T. +353 1 8369080
F. +353 1 8372848

info@sei.ie
www.sei.ie

NDP
National Development Plan 2007 - 2013

Sustainable Energy Ireland is funded by the Irish Government under the National Development Plan with programmes part financed by the European Union.