

Global Energy Management System Implementation: Case Study

Ireland

Abbvie

AbbVie Sligo has delivered an ambitious "Reduce Carbon Footprint" Energy Management program which delivers annual energy efficiency savings of €799,272 and an annual reduction of 2,575 tonnes of CO₂ through sustainable development, teamwork, staff engagement and the application of innovative technologies.



The Abbvie team in Sligo

Figure 1: Abbvie Energy Team

Business Benefits Achieved

Main Benefits: The main benefits **targeted** by the Energy Management program are to reduce the annual energy cost by €900,081 and the annual carbon footprint by 3,590 tonnes of CO₂ emissions. The program has already

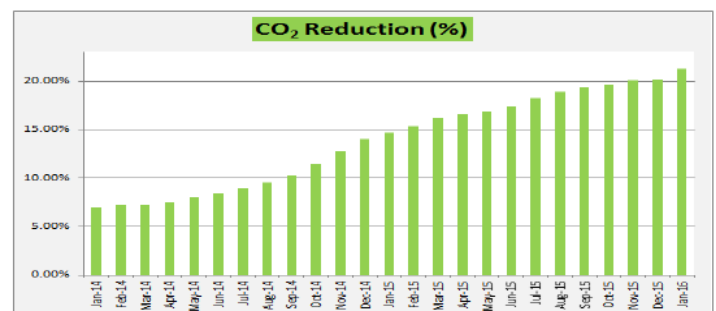
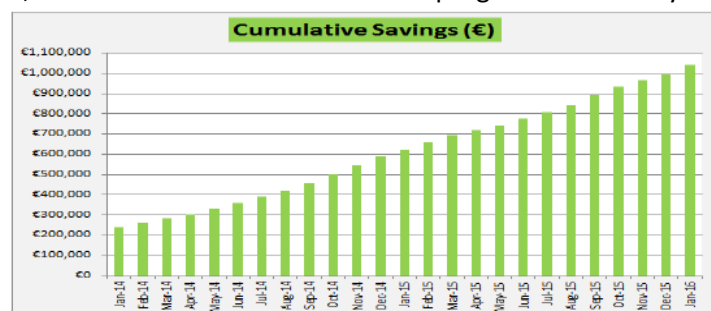


Figure 2: "Energy Management" Energy & CO₂ Savings

delivered €527,287 in annual energy savings (€1,040,294 in cumulative savings) and an annual reduction of 1,844 tonnes in CO₂ emissions to date. In addition, the program has delivered an annual reduction of 5,904 MWh of energy savings (11,389 MWh in cumulative savings) to date.

Case Study Snapshot

Industry	Pharmaceuticals
Location	Sligo, Ireland
Energy Management System	ISO 50001
Product/Service	Pharmaceuticals
Energy Performance Improvement (%)	34
Annual energy cost savings	€799,272
Cost to implement	€7,500 p.a.
Payback period	< 1 year

"The main drivers of the certified EnMS program are to Improve Energy Efficiency, reduce the CO₂ Footprint & the Overall Energy Cost through Sustainable Development with a philosophy of continuous improvement"

Peter Moran, Energy Manager, Abbvie



Abbvie Profile

Established in 2002, AbbVie Ireland in Sligo, is a licensed, state-of-the-art, high containment facility for the manufacture of a wide range of pharmaceuticals. Historically, AbbVie Ireland has demonstrated strong leadership in sustainability and energy management, from being the first in Ireland to achieve ISO 50001 certification through to delivering sustainability and energy efficiency savings such as overall reductions of; 32% in electricity, 25% in fuel, 21% in water and 40% in CO₂ up until end of 2012. In 2013, AbbVie embarked on an ambitious business growth strategy of building capacity for existing products and for introduction of new therapies in their pipeline. This growth strategy recognises the need to grow the business in a sustainable manner. This is primarily being achieved by Peter Moran, Energy Manager and the AbbVie Energy Team through a number of key sustainability initiatives as part of the ambitious “Reduce Carbon Footprint” energy management program. This program commenced in 2013 and has already delivered a number of sustainability initiatives in 2013, 2014 and 2015. The “Reduce Carbon Footprint” program represents a significant capital investment in sustainability with €2.5 million already invested in the overall program.

Business Case for Energy Management

The main drivers of the Energy Management sustainability program are to:

1. Improve Energy Efficiency
2. Reduce the CO₂ Footprint
3. Reduce the Overall Energy Cost
4. Drive Sustainable Development

This program is achieved through team work, by being innovative and through the sustainable use of resources whilst prioritising the needs of the wider environment and society. The AbbVie Energy Team place a particular

focus on staff engagement in identifying new innovations and in ensuring that improvements are sustained. Other key drivers include implementing best-practice solutions that are innovative, replicable and fits in with the programs overall focus on being a leader in environmental and energy management.

Keys to Success

- **Abbvie Energy Team**
Cross-functional - selected based on their diversity, creativity and leadership skills
- **Project Management**
For each project in the “Reduce Carbon Footprint” program, a best-practice Project Management approach is adopted
- **Verification of Energy Savings**
M&V is carried out according to principles of ISO 50015 and where appropriate to IPMVP
- **Handling Issues & Corrective Actions Appropriately**
Any issues or changes that arise are managed through the agreed Project Management Change Control Process. Non conformances are handled through an effective CAPA process.
- **Collaboration**
The overall program is enabled through collaboration with specialized services providers such as Energy Conservation Options (EnCO), EM3, Bord na Mona and SEAI.

Name	Job Title
 Peter Moran	Energy & Utilities Leader
 Michael Gallagher	Site Services Manager
 Lorraine Gillespie	EHS Team Leader
 Jeremy Medlock	Plant Support Engineer
 Paul Dwyer	Drug Product & Synthroid Champion
 Declan McDermott	Facilities Maintenance
 Daire Sheridan	IT Champion
 Garrett Blake	MEP Planner
 Kevin Byrne	Utilities Champion
Michael Lawless/Aisling McCabe	Finance
Stephen McDonnell	Purchasing

Figure 3: AbbVie Sligo Energy Team

EnMS Development and Implementation

Abbvie has used the EnMS evolution – from the Irish energy management standard IS 393 in 2007 through EN 16001 in 2010 to ISO 50001 in 2011 as the first company in Ireland to transition to ISO 50001 - to deliver continuous energy and carbon savings. The system is also used to manage water and nitrogen usage.

Main Business Benefits: The main benefits of the Energy Management program currently targeted are to reduce the annual energy cost by €900,081 and the annual carbon footprint by 3,590 tonnes of CO₂ emissions. The program has already delivered €527,287 in annual energy savings (€1,040,294 in cumulative savings) and an annual reduction of 1,844 tonnes in CO₂ emissions to date. In addition, the program has delivered an annual reduction of 5,904 MWh of energy savings (11,389 MWh in cumulative savings) to date.

The overall “Reduce Carbon Footprint” program has delivered the benefit of an overall increase in capacity of some the site systems:

- The Convert TO to LPG, Convert Space Heating to LPG-Fuelled LPHW, Heat Pump and Thermal Oxidiser Heat Recovery projects have increased the overall steam capacity and heating capacity of the site. These projects also enhance Security of Supply **and reduce** the risk to Business Continuity as the existing kerosene boilers **were** retained to provide process steam and as a back-up to the LPHW system and to the steam system.
- The VSD Compressor and Heated Dryer project increased the compressed air generation capacity by 16%
- The Base-Load HVAC Chiller also can act as an assist to the existing HVAC chillers thus increasing the capacity of the overall HVAC chilling process

Organisational

Skills development and knowledge enhancement of the Energy Team are key benefits and as they develop they unearth the benefits of new innovations. In addition,

some of the intangible benefits of the overall program include maintaining the commitment of the Energy Team, the site staff (and other relevant stakeholders, partners and collaborators) to the overall Energy Management program and providing the motivation to continuously improve and innovate. The program enhances energy awareness and assists the behavioral norms required for continuous improvement and innovation.

Energy Review and Planning

Abbvie has developed a very good understanding of energy use in the organization. SEUs (Significant Energy Users) are monitored on a monthly basis and ongoing analysis is carried out to better understand the relevant variables. Figure 4 shows a breakdown of electrical use which is well understood and various studies have also been carried out over the years to understand the drivers or relevant variables. This information is used to construct more effective EnPIs using CUSUM analysis – for example as already underway for chillers (Fig 4b). The more important SEUs – i.e. those associated with HVAC and chilling have then been the focus for more projects and come under more intense scrutiny during internal audits – i.e. are audited more often etc. In this way ISO 50001 principles are used to direct resources where there will be most benefit. This is also borne out by the project choices described later in this case study.

Currently EnPIs are being reviewed for effectiveness and will be updated for the next energy review in line with Abbvie’s pursuit of continuous improvement.

Electrical SEU 2014 Vs 2015

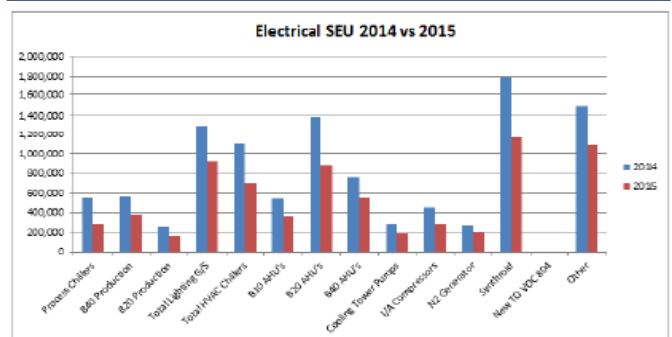


Figure 4a: AbbVie Energy Planning – SEUs

2014 EnPI Review

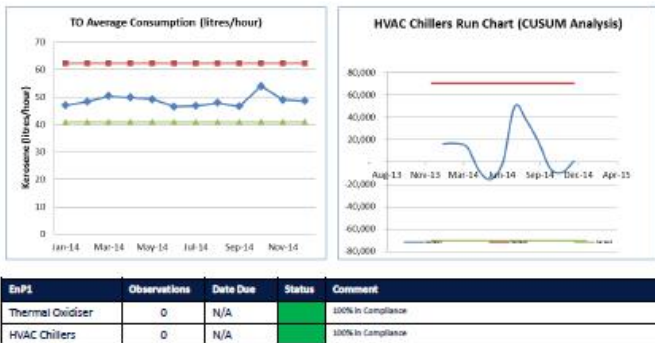


Figure 4b: AbbVie Energy Planning - EnPIs

Financing

Projects are typically financed through internal resources although some have in the past attracted environmental grant aid from the state energy agency SEAI due to the energy efficiency gains associated with them. Projects must be financially feasible and have a payback of under three years. They must compete with other projects for funding and the ISO 50001 system is ideal to provide a strong pipeline of projects.

People and Resources

The **Abbvie Energy Team** is led by the Energy Manager, Peter Moran and is selected based on their diversity, creativity and leadership skills. The team is cross-functional in make-up to cover all the main functions of the site. The Team perform all Energy Management activities in accordance line with IS ISO 50001 for selected energy projects. The function of energy manager has been rotated through a number of personnel since the early days of IS 393 and this has helped to build awareness and expertise in the organisation. In addition, the energy team includes Subject Matter Experts in various disciplines and these SMEs have added energy knowledge to their expertise and actively participate in raising awareness for the rest of the organisation. External training and CPD is used to contribute to performance. Examples include Certified Energy Manager (CEM) training Certified Measurement and Verification Professional (CMVP) as well as membership of bodies such as Engineers Ireland and

Association of Energy Engineers. External resources used include specialist energy management companies with experience of international best practice such as EnCO and EM3. These organisations help Abbvie to focus on performance improvement through optimisation of operational controls and selection and execution of the projects with the best contribution to make.

Project Management: For each project in the **“Reduce Carbon Footprint”** program, a best-practice Project Management approach is adopted. A feasibility study and basis-of design (BOD) is completed prior to execution which reviews the regulatory impacts and the EHS requirements. The BOD focusses on energy-efficient design (EED process assuring latest energy-efficient equipment used) and process load sensitivity. The Financial Analysis reviews the project justification (i.e. Simple Payback, DCFROI and Sensitivity Analysis) and energy efficiency savings. The potential for follow-on innovations are considered a major factor in each Feasibility Study and BOD. By using this best-practice Project Management approach, this determines that the required Scope of Works, the project execution works (Mechanical, Electrical, Civils, Automation, and Testing & Commissioning) and the Energy Savings Verification is all completed on time and within schedule. All the actions are delivered in accordance with ISO 50001.



Figure 5: Key Milestones in Projects

Verification of Energy Efficiency: An M&V Plan for each initiative is created by Peter Moran which is used in conjunction with the onsite Energy Management System (EMS) for capturing and verification of the monthly energy savings in accordance with IPMVP and ISO 50015. Energy Savings are initially reviewed by Peter Moran who is certified a CMVP and CEM and the Energy Team to compare Actual versus Projected consumption and to verify actual savings. The savings are submitted for review and approval by the AbbVie Finance department. Monitoring of performance happens on an ongoing

basis, and verification occurs on a monthly basis for the first 12 months. New Energy KPIs (EnPIs) are created or existing EnPIs are updated and monitoring is performed through the ISO 50001 Energy Management System. Abbvie welcomes the increased focus on gathering evidence of performance improvement by certification bodies in line with ISO 50003 and this has helped us to refocus on improving EnPIs. Aside from individual project M&V, EnPIs as a set are monitored monthly and when they fail to meet targets there is a follow-up through our non-conformance procedure.

Issues & Corrective Actions: Any issues or changes that arose are managed through the agreed Project Management Change Control Process.

Collaboration

The overall program is enabled through collaboration with specialized services providers such as Energy Conservation Options (EnCO) (for energy management and internal audit support), EM3 (for energy projects), Bord na Mona and SEAI.

Operational Controls

As part of the EnMS, operational control tools such as the Green Sheet have been introduced which lists all energy projects completed at Abbvie, the check sheet is monitored on a weekly basis to determine if a project is left in energy saving mode. This method of monitoring and control has proved very beneficial in reaching CO₂ reduction targets. A Weekly Energy Report is generated to analyse the performance of the SEUs and EnPIs. The EMS also has alarm limits set up for some key EnPIs which e-mail SEU owners to notify of performance going outside the Operational Control limits.

A HVAC Operational Control Review was also undertaken identifying savings of using a specialised tool developed by SEAI and findings are integrated into daily operations. Significant savings for HVAC through air change reduction were also identified and will be pursued.

The Energy Team also implement many important improvements as part of their daily duties from

executing PMs, fixing air leaks to running energy awareness events.

WEEKLY ENERGY GREEN SHEET						
Week commencing - Enter date 06th April 2012						
EQUIPMENT						
Area	BUILDING	AS FOUND	AS LEFT			
Emergency Lighting circuit breaker & LED's (10-LP-01 in Plantroom panel)	Red Switch - Three green LEDs	10	On	On		
Emergency Lighting circuit breaker & LED's (11-LP-02 in Plantroom panel)	Red Switch - Three green LEDs	10	On	On		
External emergency lighting (footpath lighting) matching daylight hours TC in CBC panel	Operational Check	10	OK	OK		
10-AHU-01 Supply fan @30Hz, return fan @30Hz from 09:30-10:30 & 12:30-13:30, both at 30Hz during other times. Time clock in automatic mode (TC located in plantroom panel).	Visual Check	10	30Hz	30Hz		
10-AHU-02 - Lso extract fan running at 35 Hz -detail when off from BMS	Visual Check	10	50Hz	50Hz		
Admin Reception light on photo cell operation	Visual Check	10	Yes	Yes		
Lighting on PIR control through out B10	Visual Check	10	Yes	Yes		
B10 card board compactor operating correctly and in use	Operational Check	10	OK	OK		
B10 if room heat recovery unit working - no hot air supply to room	Visual Check	10	OK	OK		
Area						
Area	BUILDING	AS FOUND	AS LEFT			
Emergency Lighting circuit breaker & LED's (20-LP-03 now plantroom panel 12RST)	Red Switch - Three green LEDs	20	On	On		
Emergency Lighting circuit breaker & LED's (20-LP-02 warehouse panel 12 RST)	Red Switch - Three green LEDs	20	On	On		
Emergency Lighting circuit breaker & LED's (20-LP-01 20-MC-room panel 13 RST)	Red Switch - Three green LEDs	20	On	On		
External emergency lighting (footpath) matching daylight hours TC in CBC panel	Operational Check	20	OK	OK		
Warehouse lighting operating on PIR control	Visual Check	20	Yes	Yes		
Lighting on PIR control through out B20	Visual Check	20	Yes	Yes		
B20 sample booth off when not in use - switch off if not in use	Visual Check	20	Yes	Yes		
Area						
Area	BUILDING	AS FOUND	AS LEFT			

Figure 6: Green Sheet

Projects

Convert Space Heating to LPG-Fuelled LPHW: This innovative initiative has been delivering savings since 2013 and delivers the energy efficiency benefits of generation of space heating through LPG-fuelled Low Pressure Hot Water (LPHW) boilers. It replaced the generation of LPHW from steam and delivered an efficiency improvement of 30%. It also delivered significant CO₂ reduction and additional cost savings with LPG being a more economical fuel type than kerosene. One of the additional key benefits of the project is that provides a “sink” for a suite of heat recovery projects.

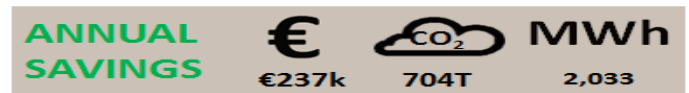


Figure 7: Convert Space Heating to LPG-Fuelled LPHW Energy Savings

Heat Pump & Base-Load HVAC Chiller: The innovative sustainability activity was implemented in 2015 and delivers energy reduction through the recovery of up to 500 kWh “free” waste heat energy in the Cooling Water returned from the water-cooled chillers on site. The Design Team created an overall process designed to act as a “thermal server” which recovers “free” waste heat from the Cooling Water and returns it back to the LPHW “thermal sink”. In addition, the project installed a high efficiency Base-Load Water-Cooled HVAC Chiller and matching Primary Pump set to cater for site chilling loads less than 1,000 kW delivering a COP of between 6.0 and 7.0 over its 20% – 100% operating range. The Base-Load HVAC Chiller project also delivers electrical energy savings.



Figure 8: Heat Pump & Base-Load HVAC Chiller Energy Savings

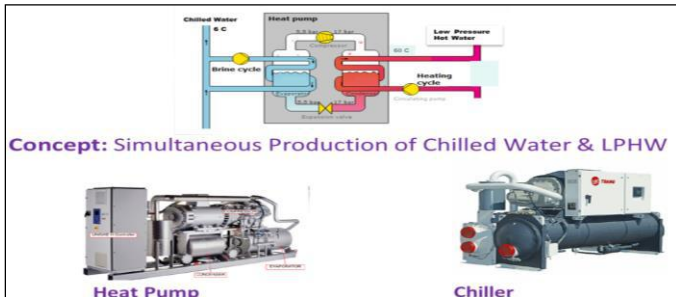


Figure 9: Heat Pump & Base-load HVAC Chiller Sustainability Project

Thermal Oxidiser Heat Recovery: This sustainability initiative was introduced in 2014 and delivers energy reduction through the recovery of “free” waste heat energy emitted from the Thermal Oxidiser Abatement Process. Previously, this waste heat was emitted to atmosphere and through the realisation of this initiative an average of **350 kWh of free energy is recovered**. The AbbVie Design Team have designed an overall process which included the installation of a gas-to-water Heat Recovery Unit that now captures this waste heat and returns it back into the LPHW heating system delivering cost savings, fuel efficiency savings and a CO₂ reduction. This project has excited many on site especially when the LPHW boilers don’t need to run.



Figure 10: Thermal Oxidiser Heat Recovery Energy Savings

De-Humidification, Heat Recovery & Air Change Reduction: This innovative initiative is a suite of HVAC efficiency improvement initiatives including air-change reduction, de-humidification optimisation and heat recovery improvements. These projects will be implemented throughout 2016 and 2017 and are projected to deliver annual cost savings of €267,161 and a reduction of **1,129,427 kilograms** of CO₂.

Convert Thermal Oxidiser to LPG: This initiative was completed in 2015. By successfully performing Energy

Efficiency Design (EED) on a new Thermal Oxidiser (TO), this TO was installed with LPG as its primary fuel and has a “waste heat recovery boiler” that now generates the steam for the site. This project now ensures all site steam is generated using LPG (previously kerosene) and the project is estimated to deliver annual fuel savings of €56,382 and a reduction of **118,143 kilograms** of CO₂.

Boiler Feed Water Pre-Heat: The existing Steam Boilers previously used direct steam injection to pre-heat its feed-water. This activity innovatively offsets the direct steam injection by preheating the feed-water using LPHW generated by the high efficiency LPG fired boilers via a heat exchanger. The project now delivers annual thermal energy savings of **€5,000** and **85 MWh** annually and a reduction of **22,000 kgs** of CO₂.

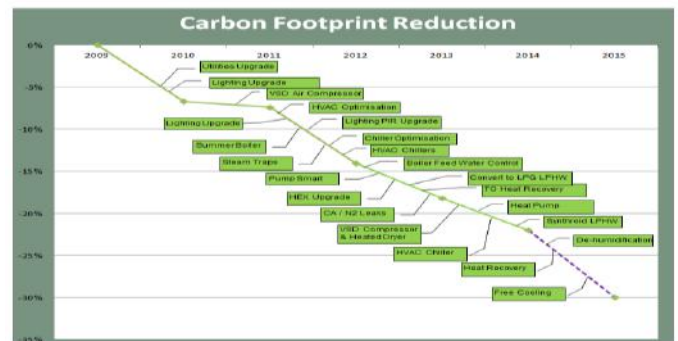


Figure 11: Sample of Energy Initiatives Reducing the Carbon Footprint

Awards & Recognition

Following the success of their efforts, the AbbVie Ireland Energy Management has received a number of recognition awards including:

- Winner of the **2015 AEE Award for Corporate Energy Management in Western Europe**
- Winner of the **2015 SEAI Award in the Large Industry Category**
- Winner of the **2015 Green Award in the Sustainable Energy Management Category**
- Winner of the **2014 Chambers Ireland CSR Award for Heat Recovery Programme**
- Received a **2013 SEAI Energy Management Leadership Commendation Award**

Lessons Learned

- ISO 50001 provides a framework for continuous improvement through both projects and ongoing tight operational control
- The benefits can be shared throughout the organization
- The savings are clearly measurable

“A certified EnMS is now seen as the minimum standard within the AbbVie Manufacturing network. AbbVie Ireland led the way and were the first in the network (and in Ireland) to achieve ISO 50001 certification. All AbbVie plants are now required to achieve certification by 2017.”

Peter Moran, Energy Manager, Abbvie

Through the Energy Management Working Group (EMWG), government officials worldwide share best practices and leverage their collective knowledge and experience to create high-impact national programs that accelerate the use of energy management systems in industry and commercial buildings. The EMWG was launched in 2010 by the Clean Energy Ministerial (CEM) and International Partnership for Energy Efficiency Cooperation (IPEEC).

For more information, please visit www.cleanenergyministerial.org/energymanagement.

