

ISO 50001 Energy Management System Case Study

2020

Ireland

Tipperary Co-Operative Creamery Limited

Implementation of an Energy Management System aligned to the ISO 50001 standard.



Company logo.

Organization Profile & Business Case

Tipperary Co-Operative Creamery Limited [TCCL] is a farmer/shareholder owned company that has been supporting the dairy enterprises of farmers in Ireland since 1908. The company lives by the motto 'Better Farming – Better Business – Better Living'. TCCL's milk intake is approximately two hundred million litres annually. Various products are made from the incoming milk such as: cheese, butter, milk powders and other dairy products for export and home markets.

TCCL made the decision to become certified to the International Energy Management System Standard ISO 50001 in 2018. The scope of the management system encompasses the main manufacturing site in Tipperary Town, however the learnings from system implementation have added benefits to both secondary manufacturing sites such as Fairgreen, and inside the farm gate through supplier engagement initiatives. More than 112 GWh of energy were consumed onsite in 2019. One of the reasons an EnMS was implemented is the need for a method of monitoring of the Significant Energy Users (SEU) and developing them to make them as efficient as they can possibly be. This can further result in CO₂ savings as well as financial savings in the long run.

Case Study Snapshot

Industry	Dairy Industry
Product/Service	Cheese, butter, milk powders and other dairy products.
Location	Ireland
Energy management system	ISO 50001
Energy performance improvement period, in years	2 Years
Energy Performance Improvement (%) over improvement period	5.8%
Total energy cost savings over improvement period	\$562,342
Cost to implement EnMS	\$129,200
Total Energy Savings over improvement period	44,100 GJ
Total CO ₂ -e emission reduction over improvement period	2,918 tonnes

The implementation of ISO50001 is the first step in our sustainability journey in TCCL. The following phase includes the implementation of the environmental management system which is certified to ISO 14001. This will set us on our path to having a carbon neutral plant by 2030. The EnMS will help with achieving that, by identifying any opportunities for improvement and consequently avoiding any unnecessary emissions.

The journey of TCCL reaching the ISO 50001 standard was aided through Enterprise Ireland's GreenPlus grant programme. The GreenPlus Programme provided funding to assist with the application of environmental best practices in order to achieve the ISO 50001 standard. It helped with having greater resource

efficiency and increasing the company’s environmental sustainability. The implementation of ISO50001 is also a viable root to compliance with the Energy Efficiency Directive through SI426 in Ireland. This directive requires member states to carry out an in-depth energy audit every four years or become certified to ISO 50001. The most logical approach for TCCL was to implement a structured management system which adds value to the organisation. In addition, we are members of the Sustainable Energy Authority Irelands [SEAI’s] Large Industry Energy Network [LIEN]. Through the LIEN, the SEAI provide support to large energy using organisations in order to implement structured management systems and effective action plans to also assist the process. More details are available on what LIEN is later on in this study.

“Implementation of the ISO 50001 in Tipperary Co-Op has greatly altered the way energy is managed on site. It has also helped identify many opportunities for improvement.”— JP Bourke, EHS & Energy Manager.

Business Benefits

The implementation of ISO 50001 commenced informally in 2017 through the identification of SEU’s and a focus on energy as a manageable business expense. From 2017 to 2019, this focused approach allowed us to form a suitable and logical way to organise data in order to determine the operational performance of SEU’s. The following points illustrate the key benefits which have been gained through the implementation of the management system:

- 12.3GWh of energy savings over two years with a cost saving of \$562,342. This is equivalent to the cost of 1.6million litres of milk.

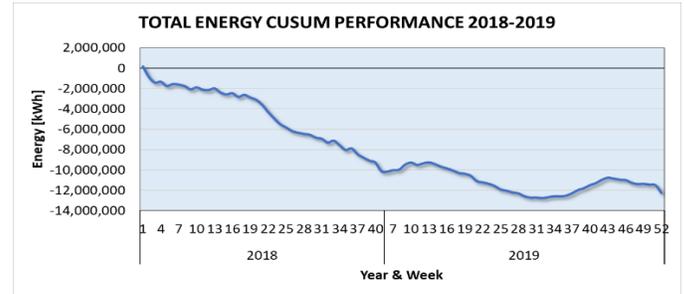


Figure 1: CUSUM graph for total energy on site over 2018 and 2019.

- The overall implementation cost was low in comparison to the savings achieved. At a cost of \$129,200, the implementation of the system paid for itself in less than a year.
- System implementation has helped us to focus more on standard working practices and the monitoring of operational criteria. This has allowed us to root cause deviations in performance faster.
- We have been able to develop more effective energy budgets through the use of regression analysis. This builds confidence in the process with our Board of Directors.
- Through our commitment to energy management, we have gained further grant assistance to carry out a thermal system review across the whole site. Given that 87% of the energy consumption of TCCL is aimed towards the generation and use of steam, a full thermal map was developed in order to determine opportunities across the site. This review has been incorporated into a 3-year energy upgrade strategy. See thermal Sankey diagram which was developed in Figure 2:

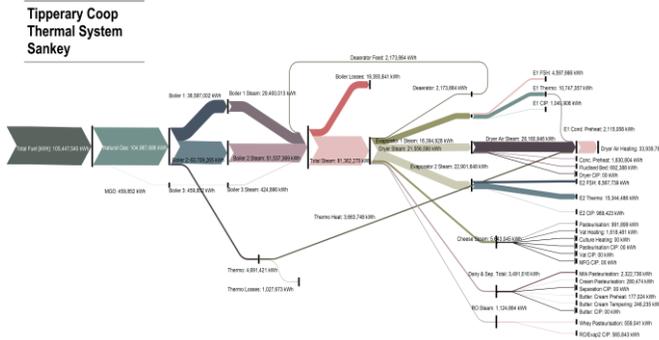


Figure 2: Thermal Review Sankey

- Our staff have been upskilled as a result of the process through energy awareness, root cause, internal auditing and utilities training.
- The design element of the standard along with the energy efficient design standard IS399 have yielded significant improvements during the design and construction of our new spray dryer and effluent treatment plant.
- There has also been engagement with farmer stakeholders to champion better energy usage at a farm level by installing an energy management software on farms. This aims to look at the supply chain as a whole from an energy point of view.

Plan

Management in TCCL have always been committed to good energy management practices, however a structured system had never been put in place. Due to increasing pressures on the agricultural industry in Ireland regarding CO₂ emissions and other requirements in line with the Energy Efficiency Directive and the Origin Green programme, ISO 50001 was the most logical next step in our energy journey. In the process of implementing ISO 50001, we gained assistance from the Enterprise Ireland and SEAI. As the implementation of the system progressed, and the potential savings that could be achieved were realised, this further fortified management’s commitment to this programme. There less than half a years’ worth of staff time put into the process of implementing ISO 50001. The implementation

process was much lighter on resource than expected. We would recommend implementing this standard to any large energy using organisation as the gains far outweigh any input required.

There are many ways in which Tipperary Co-Op has planned and developed the EnMS:

➤ **Energy Policy**

The management team illustrate commitment to energy management both internally and externally as required through the organisation’s energy policy. The policy was generated in order to ensure alignment to the ISO 50001 standard as well as the company’s strategy and objectives. It is displayed in the main reception area. This ensures that all personnel working on behalf of the business are aware of its contents. This policy is put into action through the sites strategic energy plan. We have established three-year upgrade objectives which are structured to ensure that consumption is minimised prior to specifying any plant or equipment upgrades.

➤ **Scope of the EnMS**

To help understand energy consumption and use on site, a comprehensive review of energy sources had to be carried out. This also helped with determining the appropriate approach for implementing the EnMS. Through this review it was determined that the sources within the scope of the EnMS include:

- Electricity
- Natural Gas
- Diesel
- Liquefied Petroleum Gas (LPG)

➤ **Performance Evaluation and Improvement**

Energy data is obtained from the organisation’s M&T system and inputted to an EnPI tracker. In addition, energy variable data as outlined in the data collection plan is inputted to this file. Regression analysis is used to determine the most relevant energy drivers at a site level and for each SEU. Each graph in the EnPI report is then updated, sent to the relevant personnel across the site and reviewed in order to determine if there are any deviations. Any deviations in performance are discussed

with the relevant SEU owners and an investigation is performed if necessary.

Process operators and supervisors review the total cost of production on a daily and weekly basis. Through the implementation of the management system, energy has now been incorporated into these metrics and is therefore continuously on the minds of those that can most effect consumption.

At the beginning of the new financial year an annual management review is performed of the effectiveness of the previous year's Energy Management Programs (EnMP's) in achieving the objectives and targets as set out in this management system. The relevant file on the system records these objective and targets, which are stored in a tabular form. This table is reviewed and a decision is determined on whether the targets of the relevant year have been achieved. The decision is supported by data collected throughout the year. These targets also have to be in alignment with the Origin Green programme in order to support the sustainability of the organisation. Energy is the third largest annual expense for the company therefore gaining commitment to incorporate planning into the overall business strategy has not been an issue.

“The implementation of ISO 50001 has brought a structured approach to the management of energy on-site. This structured approach has translated to better identification of energy related projects which will reduce the carbon footprint of the manufacturing business and has resulted in 10% reduction in energy usage for 2018. The Tipperary Co-Operative strategy has also expanded the scope of the sustainability program beyond of the site and have engaged with the local community to create an enhanced awareness at farm and school levels of the importance of better energy management, both from a business and society perspective” — JP Bourke, EHS & Energy Manager

Do, Check, Act

Leadership in the form of communications from our CEO has specified how crucial energy management is, causing all levels of the organisation to prioritise energy

management. In addition, the energy management team have branched out to several operational and maintenance teams to support the identification of potential projects. This have been materialised through energy hubs whereby operations, maintenance and quality personnel are assigned to a specific process/SEU. This energy hub is tasked with root causing any issues which affect production or performance [See Table 1: 2020-2022 Project Plan].

➤ **Strategic Planning**

Energy planning has now been incorporated into our strategic plans. We are currently on a journey to becoming a carbon neutral site with the hope of achieving a circular economy within our thermal system. This includes the generation of biomethane from slurry from our supplier's farms.

➤ **Action Plans**

We have set an overall site objective to become carbon neutral by 2030 and a further year on year target to improve energy performance by 3%. Some of the projects which have been carried out which have helped us to achieve this target include:

- Evaporator optimisation project.
- Compressed air leak survey and leak fixing.
- Compressed air heatless dryer replacement with heated system.
- Thermal systems review which is being incorporated into our medium term plan
- Energy efficient design of a new spray dryer ensuring best practice technologies are being installed.
- Energy efficient design of our new effluent treatment plant which has resulted in a mostly gravity fed system therefore reducing pumping significantly.

A three year energy efficiency plan has also been developed based largely on the output from the thermal systems review. The table below illustrates the project details:

Year	Action Plans	Mechanism	Electricity Savings (kWh)	Gas Savings (kWh)	Water Savings (m3)	Total CO ₂ Savings	Total kWh Savings	Total Cost Savings
2020	Water systems review	Green Plus	0	0	0	0	-	€ -
2020	Repair all steam malfunctioning steam traps and implement a steam trap maintenance programme. Including pasteuriser 2 & dryer condensate recovery solutions	BEC/EXEED	-	4,936,356	5,018	911	4,936,356	€ 149,596.08
2020	Cheese refrigeration plate heat exchanger	BEC/EXEED	97,353	-	-	40	97,353	€ 8,997.36
2020	Valve & Pipework insulation	BEC/EXEED	-	764,170	-	141	764,170	€ 22,925.10
2020	Implement a utilities request/scheduling system	Site	-	1,049,877	-	194	1,049,877	€ 31,496.31
2020	Carry out roof cause on the boiler TDS & Output	Site/EXEED	-	864,002	2,791	159	864,002	€ 26,757.36
2020	Boiler 3 controls upgrade	BEC	-	-	-	-	-	-
2020	Recover steam condensate from the cheese Vats	BEC/EXEED	-	400,521	3,678	74	400,521	€ 13,119.03
2021	Refrigeration system upgrade	EXEED	412,664	-	-	191	412,664	€ 42,504.39
2021	Hot water replacement	EXEED	162,201	731,253	-	208,980	893,754	€ 38,075.19
2021	Cream pasteuriser obsolescence optimisation	EXEED	23,431	84,550	-	26,387.93	107,781	€ 4,943.89
2021	Slim cooler modulating valve	EXEED	71,301	-	-	32,854.61	71,301	€ 7,344.00
2021	Cream cooling tower	EXEED	231,514	-	-	107,003.6	231,514	€ 23,845.94
2021	Indirect fired dryer air heater	EXEED	-	6,177,562	-	1129,449	6,177,562	€ 185,329.56
2021	Dryer heat recovery	EXEED	-	8,176,685	-	1508.19	8,176,685	€ 245,300.55
2021	Boiler 1 economiser	EXEED	-	1,077,393	-	198,725.1	1,077,393	€ 32,321.79
2022	Evaporation RO plant including water scrubbing	EXEED/EI	-	1,977,485	13,465,714	1569,786	11,488,249	€ 200,292.53

Table 1: 2020-2022 Project Plan

➤ **Enhanced EnPI's**

We use regression and multivariate regression analysis in order to determine baselines for our site and SEU energy. The regression models are then used to determine expected consumption for the coming period on a weekly basis. The most appropriate energy drivers are determined through the use of regression analysis. Agreement is gained from the overall team as to the most appropriate drivers. Performance dials and CUSUM graphs are issued for each SEU and site energy. An example for site electricity can be seen below and the site level energy, CO₂ and Water can be seen in **Figure 4**.



Figure 3: Performance dial and CUSUM graph for site electricity.

Only deviations in energy performance are reacted to. A deviation is defined as any three consecutive increases in the CUSUM graph.

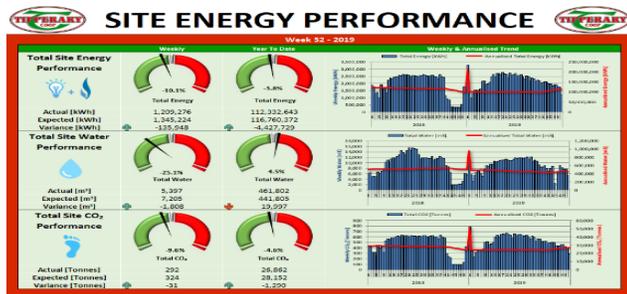


Figure 4: Example of dials and annualized charts used for total energy, site CO₂ and water analysis.

These metrics are reviewed at the end of the year in order to determine if objectives and targets have been met. The dials in **Figure 4** illustrate the year to date

saving. These dials are established through the regression baseline i.e. expected energy is calculated for the year based on production outputs. This expected energy consumption is then compared against actual consumption. The energy variables which are determined for the site are Total Powder, Total Cheese, Total Butter and Total Skim Concentrate Produced. It is not appropriate to review performance against one single driver given the diversity of products and seasonality of the business.

➤ **Independent M&V**

All energy savings are independently measured and verified by a Certified Measurement and Verification Professional. Through the Energy Efficiency Obligation Scheme, TCCL can sell the energy credits which are gained in a given year to an Obligated Party [Energy Provider]. The funding from energy credits sold are then put back into further energy initiatives. An enhanced energy monitoring system is being implemented in 2020 using funds from the sale of 2019 energy credits.

➤ **Energy Efficiency Design & Procurement**

Energy efficient design and procurement are pivotal to the success of our energy programme. We now design and procure processes, systems and facilities which can affect our SEU's ensuring that long term emissions are taken into consideration. We have a goal of not designing opportunities for improvement into our processes.

Transparency

Tipperary Co-Op are a member of the Sustainable Energy Authority of Ireland's (SEAI) Large Industry Energy Network (LIEN). LIEN is a group of companies with significant energy use that adds up to €1 Million in energy bills or more. With the aid of SEAI, companies within this network can improve their energy performance and consequently inspire others.

Tipperary Co-Op submits annually a LIEN report, which includes information about the ISO 50001 certification. Any information regarding the ISO 50001 would have been transferred with complete transparency to the SEAI

via the aforementioned reports. In addition, Tipperary Co-Op is required to submit a compliance assessment which details compliance to the Energy Efficiency Directive through SI426. This requires submission of details of ISO 50001 certification.

Lessons Learned

There were a wide number of learning during the implementation of the standard including:

- We should have implemented ISO50001 at an earlier stage. This would have yielded much greater operational savings for the organization and would have accelerated our goal to becoming carbon neutral. We advise that all large energy using organizations take the leap and implement a management system which is certified to ISO50001.
- Communicating with the staff for any feedback they might have on how to implement the EnMS ensures a steady stream of information between management and operational personnel. If starting again, we would engage with operations staff much earlier. The information we received from our energy awareness event was invaluable. During the system implementation we initially carried much of the work out within a small team. We have realized that personnel within all factions of the business should be included from the get-go.
- We have learned that you will never have the perfect system. Initially we got caught up in trying to have the perfect data set, or perfect documentation. This at times slowed progress. We learned through the certification process that this is a journey of continuous improvement and to move on, get things done and improve what you can, when you can.
- Management commitment at all levels is key. We would engage with our CEO at an earlier stage to outline the responsibilities of our senior team. This would improve engagement at an earlier stage.
- We would “sell the sizzle” to our senior management team in a better way. While we as energy professionals are motivated by improvements in energy performance, our colleagues are not always engaged through the same metrics. We have learned that operations are motivated by cost per tonne, maintenance by the potential for new equipment, health & safety by the lower risk of incidents as a result of less exposed hot pipework and so on.

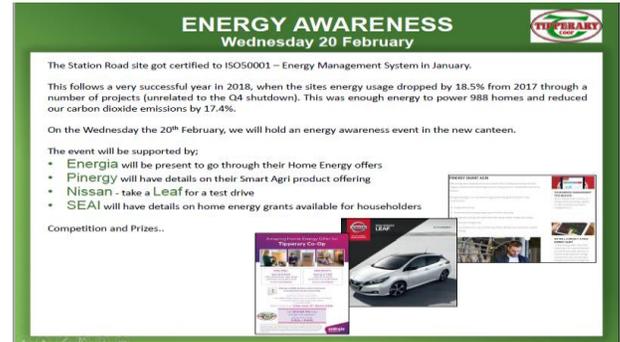


Figure 5: Energy awareness event flyer.

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.