ISO 50001 Energy Management System
Case Study

CANADA

ArcelorMittal Dofasco

The first ISO 50001 certified integrated steel producer in North and South America.

ArcelorMittal Dofasco located in Hamilton, Ont.

Case Study Snapshot	
Industry	Iron Steel and Fabricated Metals
Product/Service	High Quality Flat Carbon Steel
Location	Hamilton, Ontario
Energy management system	ISO 50001
Energy performance improvement period	3 years
Energy Performance Improvement (%) over improvement period	6.16%
Total energy cost savings over improvement period	$15,325,000 USD
Cost to implement EnMS	$250,000 USD
Total Energy Savings over improvement period	1,722,379 GJ
Total CO_2-e emission reduction over improvement period	398,772 Metric tons

Organization Profile & Business Case

Founded in 1912, ArcelorMittal Dofasco is Canada's leading flat rolled steelmaker and a flagship site for the world's largest steel and mining company, ArcelorMittal.

As a key player in North America's advanced manufacturing supply chain, working with the top automotive, energy, packaging and construction brands, ArcelorMittal Dofasco is Hamilton's largest private sector employer with approximately 5,000 employees shipping 4.5 million net tons of high quality flat carbon steel annually.

The vision of ArcelorMittal Dofasco is to transform tomorrow by striving for world class excellence today. Values underpinning this vision are Health and Safety, Recognition, Respect, Transparency, Ownership, Collaboration, Engagement and Innovation. These values are brought to life by generations of employees who have come to work for more than 100 years creating world class products, processes and services.

Inherent in these world class products, processes and services is energy. Energy is a requirement of every part of the steel manufacturing business and is one of ArcelorMittal Dofasco's top three input costs.

"Thermodynamics determines about ~70 per cent of our energy use…We focus on the remaining ~30 per cent and even though some of that isn't accessible, it's still a lot of energy that we can control."

—Ian Shaw, Energy Manager, ArcelorMittal Dofasco

For this reason, ArcelorMittal Dofasco's objective is to reduce energy use to produce steel by taking a holistic, business-wide approach. The foundation of this approach centers around some key elements including our ISO management systems currently in place (9001, 14001, 18001, 50001), our World Class Continuous Improvement pillars and, as an entity within a global business strategy, a corporate sustainable development outcome stating responsible energy use helps create a lower carbon future to achieve maximum value for all stakeholders.

On this basis, ArcelorMittal Dofasco assumed a leadership position in North & South America by becoming the first integrated steel producer to certify to ISO 50001 in October 2018.

Business Benefits

Since 2008 the Canadian steel market has become increasingly competitive, delivery times are shorter and requirements for supply chain management are increasingly demanding. To be the supplier of choice in our chosen target markets, ArcelorMittal Dofasco believes an energy management system together with strong corporate responsibility, where specific focus on making steel sustainable, is vital to achieving the title of top performing flat rolled steel producer in North America and maintaining the principle that the company's prosperity is its best security.

Although ISO 50001 certification was only achieved in October of 2018, the results of implementing ISO 50001 and development of an energy management system worthy of the international standard spans the last 3 years (2016 – 2018). Energy benefits of the system result in energy performance improvement, in GJ per metric ton of prime shipped steel, of 6.16% (1,722,379 GJ). The total energy cost savings over the improvement period are approximately $15 M USD with corresponding $CO_{2\text{-}e}$ emission reduction of approximately ~400,000 metric tons. When you compare the energy cost savings versus the modest investment of ~$250,000 USD to implement ISO 50001, the internal rate of return is undeniable.

To further understand the business benefits, it is important to understand that ArcelorMittal Dofasco's journey toward a mature, energy management system began nearly a decade ago. Since 2010, ArcelorMittal Dofasco has achieved more than 258,000 Mega Watt hours in recurring annual energy savings through a portfolio of projects across the business. Some of these projects were made possible on an enhanced business case created through partnerships and assistance from Ontario's Independent Electricity System Operator (IESO) as well as others such as Enbridge (Union Gas) and Alectra Utilities. With help, we were able to identify projects that have significant impact to energy demand at ArcelorMittal Dofasco and the province of Ontario. ArcelorMittal Dofasco has worked with these governing bodies to achieve some significant energy savings bridging years before and after those associated with ISO 50001 implementation. These projects are exemplified below in our electricity portfolio savings:

Lastly, it is understood that business benefits reach beyond the dollars and cents. ArcelorMittal Dofasco believes energy leadership, demonstrated through implementation of our energy management system and formalization to ISO 50001 certification, differentiates us as a responsible supplier of flat rolled steel, where customers can have confidence and be proud of their supply chain management.

Plan

At ArcelorMittal Dofasco, it is safe to say that top management has always had a long-standing belief in the importance of energy management. In fact, it was ArcelorMittal Dofasco's CEO, Sean Donnelly, who advanced the idea around formalizing ArcelorMittal Dofasco's mature energy management system to the ISO 50001 standard early in 2015. It was at this counsel where ArcelorMittal Dofasco's journey toward a mature energy management system came full-circle in April 2016, with support from NRCAN. ArcelorMittal Dofasco participated with eight other leading organizations (3M, BMW, Cargill, Cummins, Ingersoll Rand, Intertape Polymer Group, New Gold and Titan America) as part of the Commission for Environmental Cooperation's North American Energy Management Pilot Program. Federal Energy Ministries of Canada, Mexico and the United States launched the pilot program to promote implementation of the ISO 50001 international energy management system standard. The pilot program provided a unique opportunity to align the belief and desire of top management to efficiently obtain ISO 50001 certification with assistance from motivated supporting agencies and ultimately increase brand value to stakeholders.

Historically, thorough understanding of the energy-intense nature of manufacturing steel provided the base for system development and early recognition of the need to have dedicated individuals monitor energy performance and strategically structure measurement of energy efficiency, use and consumption within a prescribed framework. With participation and admission to the pilot program confirmed, the next step in the plan to achieve certification was to utilize this resourced team comprised of energy department individuals as well as energy leaders who work across 9 business units within ArcelorMittal Dofasco's Primary and Finishing operations, the Energy Optimization master pillar team, to take relevant operating information and understanding and see its appropriate fit to the international standard. The pillar team of subject matter experts utilized their local business unit data and exceptional understanding of energy consumption and use. Furthermore, the energy leaders act as a conduit for other individuals within the business units to review, analyze and propose where to focus resources and prioritize actions. By using other individuals within the business unit as a constant sounding board to implementation objectives, the implementation was truly a site-wide effort.

Overall, the pillar team became instrumental in the development and implementation of ISO 50001. The team, which was already meeting monthly to review energy performance KPIs and reduction projects, dedicated extra hours over a two-year period to firm up the implementation plan, data gathering and further cultivate ArcelorMittal Dofasco's energy management system.

> ***"[ISO 50001] was another way to cultivate the energy conversation and unlock some opportunities for improvement that we weren't getting from our other systems"***
>
> —Keith Whitely, Manufacturing Technology Senior Specialist Operational Performance, Energy Department

Do, Check, Act

The main support of the implementation plan came from the pilot program. Participating companies including ArcelorMittal Dofasco received training and technical assistance from the Georgia Institute of Technology (Georgia Tech) on their way to certification. Interactive training sessions explored components of the standard and then session learnings were brought back to be incorporated or further our original site energy

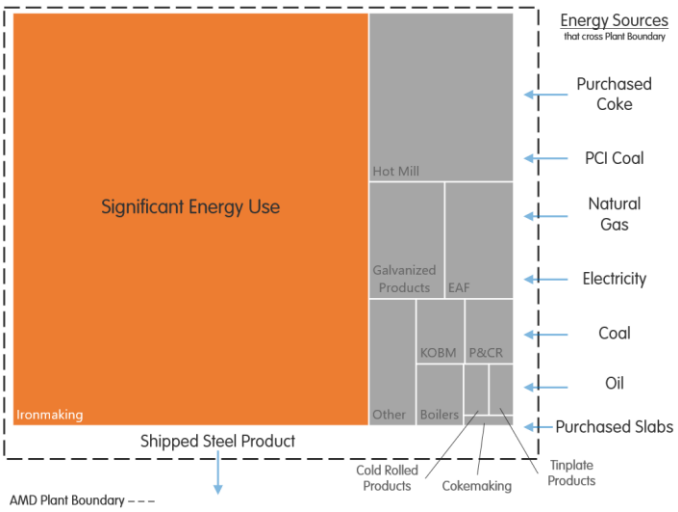
management system. Key activities derived from the pilot program sessions include determination of boundaries and baseline years, creation of a site-specific Energy Policy (which supports the greater Corporate Energy Policy), creation of a site wide Energy Manual, creation of site wide training modules, leveraging our World Class Continuous Improvement systems for continual improvement, leveraging our deviation tracking for potential EnPI root cause analysis, leveraging current operational controls and performance KPIs and leveraging current year and 5-year business planning as one of the many inputs of the Energy Planning process.

One of the final checks for ArcelorMittal Dofasco came in June 2017 when the Georgia Tech consultants visited to assess our readiness for certification and identify gaps that required closing. The final certification audit took place over six full days in September 2018.

ArcelorMittal Dofasco received its certification with no major or minor nonconformances.

Do, Check, Act in more Detail

To understand and analyze ArcelorMittal Dofasco's energy use the energy baseline data was collected from 2013 – 2015. The diagram below demonstrates how the 2015 baseline data was conceptually totaled by business unit and used for boundary and consumption explanation:



Based on the complexity of our steel manufacturing profile, normalization of the energy performance data is required. This is established based on energy use per produced product. For example, energy performance indicators within the blast furnace ironmaking business unit are GJ normalized per metric ton of hot metal produced; however, overall plant performance is measured by GJ per metric ton of shipped steel. This allows each business unit to set monthly and annual targets in the planning process and roll-up business unit performance to the larger whole. Although ArcelorMittal has chosen to use a total energy intensity method at this time, plans to utilize a normalized total energy consumption via regression analysis are being analyzed.

The methodology for determining energy performance improvement begins as part of the Energy Planning process. Annually, the Energy Optimization master pillar team, in collaboration with the business units, review energy performance (see Figure 1) and leverage our World Class Continuous Improvement pillar system to develop new energy project ideas to fill what is termed the 'Value Plan'. These energy action plans are defined by 'Value Plan' project charters.

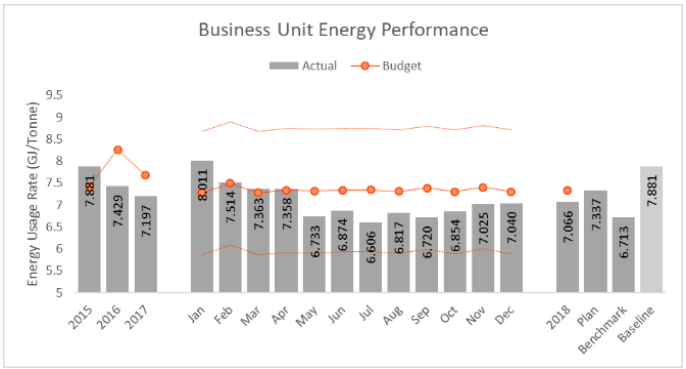


Figure 1 – Energy Performance Indicator (EnPI) Chart

In more detail, each year during September to December, the energy pillar team collects and determines which projects will be completed during the following year based on a high-level business case, capital estimates and resources availability. This means our 'Value Plan', under the Energy Optimization master

pillar, comprises the total sum of energy savings identified in energy projects at each business unit. Therefore, the 'Value Plan' constitutes our annual energy improvement target.

Spanning the past 3 years (2016 – 2018), the achievement of energy improvement of over 45 energy projects have resulted in 1,722,379 GJ in energy savings.

A brief list of key activities identified and implemented to improve energy performance include:

1. Installation of #1 Turbo Generator saving 34,000 MWh/year
2. Installation of #2 Turbo Generator saving 49,000 MWh/year
3. Installation of a new high-efficiency boiler with power generation saving 130,000 MWh/year
4. Installation of High-Turbulence Roll Cooling saving 13,000 MWh/year
5. Various Lighting Projects saving 3,000 MWh/year
6. Construction of #6 Galvanizing Line saving 9,000,000 m^3 of Natural Gas/year

By coupling the international standards need for continual improvement with our 'Value Plan', which is linked to each employee's variable compensation, every employee from operating business units, services, staff departments and top management are encouraged to actively participate and become their own brand of energy manager and look for savings.

Energy projects within the Value Plan are audited by subject matter experts within the business unit and further validated by Financial to ensure actualized results. The energetic benefit expressed in both GJ and dollars is kept for proof. In some cases, projects specific to the IESO's Industrial Accelerator Program, Enbridge/Union Gas and the annual site GHG emissions review undergo an added layer of scrutiny by 3rd party verification.

Lastly, to meet some of the competency, training and awareness requirements of the standard, two separate learning management system modules were created. The learning management system is software used at ArcelorMittal Dofasco where employees must complete a learning module for a given topic and pass a set of test questions to ensure competence on the topic. The learning management system automatically tracks the employees that completed the modules and is considered an official training record.

Transparency

To date, ArcelorMittal Dofasco has publicly announced the organization's ISO 50001 certification through various multimedia including site-wide electronic mail communications, media center advertisement and a local and global corporate magazine.

Lessons Learned

Based on the maturity of our health & safety, quality, and environment management systems and the stringent requirements on high-quality automotive and food-grade steel, which represent nearly 40 – 50% of our product mix, components of the standard like operational control and records management required minimal modification. The main challenges to

implementing ISO 50001 came from the following elements:

- Finding a qualified accreditation body that was able to accommodate the scale and schedule.
- Gathering and eloquently displaying all energy consumption and cost information into one model. Currently, many different platforms are used to collect, record or report data with varying degrees of functionality and compatibility.
- Maintaining appropriate focus with other business drivers (Health & Safety, Environment, Quality & Yield, Throughput, Delivery Performance, Cost).

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Taking another step in our pursuit to be a leader in energy management

ArcelorMittal Dofasco is the first integrated steel mill in North America to earn ISO 50001 energy management certification.

Abigail Cukier
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Using energy efficiently helps organizations save money, conserve resources and tackle climate change. ISO 50001 supports organizations in all sectors to use energy more efficiently and specifies requirements for a world-class energy management system.

The ISO 50001 standard gives an organization a systematic approach to continual improvement of energy efficiency, use and consumption. The standard is based on the Plan – Do – Check – Act (PDCA) continual improvement framework that aligns with ArcelorMittal Dofasco's World Class Continuous Improvement (WCCI) process.

"This certification is a recognition of the integrity of our energy management system," says Ian Shaw (Manager, Energy Department). "We are managing the energy we bring into the system in the most effective way and getting the most value from it. This is another aspect that helps us maintain our competitive position."

Starting in April 2016, ArcelorMittal Dofasco participated with eight other leading organizations as part of the Commission for Environmental Cooperation's North American Energy Management Pilot Program, Federal Energy Ministries of Canada, Mexico and the United States) launched the pilot program to promote implementation of the ISO 50001 international energy management system standard. The other participating companies were BMW, Cargill, Cummins, Ingersoll Rand, Intertape Polymer Group, New Gold and Titan America.

Aerial view of ArcelorMittal Dofasco

As part of the pilot, participating companies received training and technical assistance from the Georgia Institute of Technology (Georgia Tech) on their way to certification. Interactive training sessions explored components of the standard and then session learnings were brought back to Dofasco to be incorporated into our site management system. In June 2017, the Georgia Tech consultants visited to assess our readiness for the certification audit and identify gaps that required closing. The final certification audit took place over six full days this September. Dofasco received its certification with no minor or major non-conformances.

"The auditing organization did not identify a non-conformance, and only three opportunities for improvement. Based on previous certification audit experience, that is an extremely impressive result," said Keith Whitely (Manufacturing Technology). "It is a testament to Dofasco's people and world-class vision. It made me proud to be part of our organization and have employees from business units, services, staff departments and top management participate and demonstrate their expertise. Everyone came through, supported the Energy Department and did an excellent job."

Preparing for certification included many facets of the business spanning the whole organization. Steps taken included managing purchased commodities, such as natural gas, electricity, coal, coke and oil. As Keith explains, many organizations working toward ISO 50001 certification focus only on one or two commodities. Dofasco also elected to incorporate the complex process flows of an integrated steel mill, which has byproduct energy streams recycled back into the mill, such as blast furnace gas and coke oven gas. This added another layer of complexity. Dofasco also had to convey its energy management message to about 5,000 people in all roles, from contractor to CEO.

"In the steel industry, there are imperatives we cannot control. We cannot control energy prices or government policies, but getting certification is one thing we could control," said Keith. "It creates a positive image for us within the community and the industry and makes us more attractive to customers."

The ISO 50001 certification is the latest initiative related to our Energy Optimization World Class Continuous Improvement Pillar, which provides a system and process to identify and eliminate losses associated with all energy consumption across every aspect of our business.

ArcelorMittal Dofasco is in the midst of a significant business-wide energy reduction portfolio to reduce our energy consumption by 260,000 megawatt hours per year by 2019. That's equal to the annual consumption of 26,000 homes from Ontario's power grid, or a town the size of Brantford, Ontario. A significant part of reaching this goal is the $112-million Utilities Boiler and Power Generation project, which will see three boilers replaced with one high pressure boiler and a turbine generator capable of producing 20 megawatts of power on site.

Ian says Dofasco is on track to meet our targets and the Energy Optimization World Class Continuous Improvement Pillar Team is in discussions regarding the next steps needed on the way to meet our energy management goals.

Figure 2 – Letting the public know!

In retrospect, the journey towards ISO 50001 certification was rewarding and insightful. However, the one true wish would be to begin the implementation journey sooner. With certification to ISO 50001 complete, the future of energy performance improvement at ArcelorMittal Dofasco can now take on another interpretation, one where the day will not be judged by the harvest we reap, but by the seeds that we plant.