

Global Energy Management System Implementation: Case Study

Russian Federation

PJSC Magnitogorsk Iron & Steel Works (PJSC “MMK”)

After EnMS implementation MMK saved more than \$38 million in just three years, which is more than any other factory in Russian Federation



Business Case for Energy Management

Organization Profile

Magnitogorsk iron and steel works (MMK) is one of the world's largest steel producers and a leading Russian metallurgical company.

In 1932 the first pig iron was smelted at the factory, that marked the birth of MMK. During World War II MMK turned into a steel bulwark for the country. Every third shell and every second tank armor were made from Magnitogorsk steel.

Case Study Snapshot

Industry	Metallurgy
Product/Service	Iron & Steel
Location	Magnitogorsk, Russian Federation
Energy Management System	ISO 50001
Energy Performance Improvement Period	3 years
Energy Performance Improvement (%) over improvement period	8,1 %
Total energy cost savings over improvement period	\$ 38 596 000
Cost to implement EnMS	\$ 187 246
Payback period (years) on EnMS implementation	0,0081
Total Energy Savings over improvement period	(GJ) 11 280 682
Total CO₂-e emission reduction over improvement period	698 186

Over the last 10 years, the company has undergone significant modernization. Now the company's operations in Russia include a large steel producing complex encompassing the entire production chain, from preparation of iron ore to downstream processing of rolled steel.

MMK produces a broad range of steel products with a predominant share of high value-added products. In 2017 MMK produced about 12 million tons of crude steel and 10 million tons of commercial steel products.



Figure 1. Mill 5000, MMK

The MMK Group employs more than 60,000 people and complies with all social guarantees.

“The cumulative investment in environmental management is \$625 million until 2025”

— Pavel Shilyaev, Director General

Drivers. Energy efficiency and environmental safety control are the company’s most important strategic goals as well as for the state in whole.

The company conducts its production activities with responsibility for environmental impact and constantly reduces harmful emissions into the atmosphere. Since 2004, MMK is certificated with ISO 14001 and then successfully re-certificated with ISO 14001:2015. Environment management system is constantly improving. In 2016, MMK was the only ferrous metal company that got in top 10 most eco-friendly Russian energy and metallurgy companies. As well as MMK follows its own environmental policy, the company also carefully observes the requirements of the state environment protection programmes. Energy management implementation programme was based on understanding of the top management of the necessity of change. The strategy required development of several plans for efficiency increase and agreement upon the approach towards implementation of changes, projects, and other activities in this direction. In 2009, the federal law on energy-saving was adopted. This also gave an impulse for further development of MMK energy efficiency strategy.

The enterprise is certified by ISO 9001:2008 and OHSAS 18001:2007, so it has an opportunity to superpose the best management systems in the performance.

Energy management program

MMK EnMS aims to improve energy characteristics, including energy efficiency, energy production and use in line with adopted energy policy.

“MMK top management assumes responsibility for resources providing and special conditions creating to implement



energy saving policies and improve energy efficiency.”

— Pavel Shilyaev, Director General

EnMS goals include creation of necessary conditions to reduce financial costs by systematic energy resources management, as well as technological modernization, such as:

- Application of innovative methods and approaches in management to increase energy efficiency;
- Optimization of existing energy supply schemes, production and technology, other affiliated processes;
- Application of energy efficiency criteria in procurement of equipment, resources and technologies;
- Use of energy efficiency criteria in design and implementation of new or modernized objects;
- Energy efficiency increase for systems, and technological and energy equipment;

- Implementation of modern systems of technological energy accounting and measurement of energy parameters.

EnMS includes personnel management, information on energy use, technologies that help to increase energy efficiency.

Business Benefits Achieved

One of the most significant outputs of EnMS was energy expenses decreased without any financial investments and savings were achieved in amount of \$ 20,5 million in 2015. Due to this outstanding result, MMK EnMS was recognized by the **Government of Russian Federation and recommended MMK case as the EnMS best practice for all industries in the country and encouraged its replication.**

The direct benefits of EnMS Implementation:

- Total Energy performance improvements - 4,4% energy savings in 2015; 1,9 % in 2016 and 1,8% in 2017;
- Total compressed air savings – 11,7%;
- Total pure water savings – 7,9%;
- Total CO₂-eq. emissions reduction - 698 186 metric tons;
- Total energy cost savings for 2015-2017 - \$ 38 596 000.

Tools and resources to implement EnMS:

- Chain of business process system from “the birth of idea” to its «implementation in equipment» was established;
- Special «Baby CAPEX» budget line established, which allows to easily finance energy projects with a payback of less than 2 years;
- Foreground complex projects on energy saving were developed for 2015-2018;
- Project to create an EnMS IT platform commenced;
- Staff motivation system developed;
- Operational and low-cost opportunities investigated;

- Training center to improve technical knowledge

EnMS Development and Implementation

MMK EnMS implementation was based on UNIDO methodology, acquired by the EnMS team leader Mr. Danila Tselikanov during UNIDO project on Industrial Energy Efficiency in Russia (2010-2017). In 2014, to prepare for ISO 50001 implementation MMK developed the normative-technical base, consisting of:

- Company standard “Order for EE projects management”;
- Methodology for staff motivation for EE projects submission within Chief Engineer Department;
- Formation and training of a project team to work with ideas on energy saving;
- Restructuring of other subdivisions work to reflect EE goals.

In January 2015, MMK Director General issued the Decree to increase EE by \$ 25 million with a break-down by all MMK divisions and workshops. Progress monitoring was assigned to Economics Department. EnMS implementation team was formed out 3 energy engineers and 1 verification specialist within the Energy Department.

“ISO 50001 is the least expensive and fastest way of cost saving”

— Danila Tselikanov,
EnMS Team leader



In May 2015, UNIDO Expert Mr. Danila Tselikanov was recruited as an EnMS Team leader for implementation and preparation for ISO 50001 certification. He was given a wide mandate with the possibility of reorganizing the structural unit headed by him.

Linkages to other existing ISO standards

EnMS became a logical continuation of the existing ISO 9001 and closely interacts with ISO 14001 by taking part of the functions on itself (e.g. CO2 emission reduction).

Energy review and planning

Company consumes electric power of about 850 MW, out of which 600 MW is produced at its own power generating stations and 250 MW is purchased on the side. In 2015, MMK consumed 1,89 billion kWh and around 3,8 billion m³ of natural gas.

In the basis of effect estimation method – fixation of volume of purchased energy resources against target indicators. The calculation is performed using a multifactorial regression model based on specific consumption norms. Since 2015, MMK uses one of the most advanced in Russia accounting system for material and energy flows; based on its data, UNIDO trained experts developed methodology for baseline verification, depending on assortment and volumes of production output.

Verification of results

To determine the improvement of energy efficiency the methodology of regression analysis is used. For these purposes STADIA (IT product) was applied as a part of the energy management platform. More than 200 parameters and influencing factors are used to analyze energy consumption, e.g.:

- Product orders structure;
- Grades of steel planned for smelting;
- Orders execution technological within chains, calculated in ERP modules;
- Charge materials composition and physical properties of coking coal.

The regression analysis system is supplemented by the processes nonlinear modeling systems in conditions of many influencing factors. This system is considered one of the most complex and progressive, used in metallurgy.

The accuracy is 97.2%.

Implementation of EnMS platform is a part of corporate project on efficiency increase for managing the energy saving processes and increase of production energy efficiency, as well as a part of project on cost optimization for micro cost centers.

Commencing the project to create an EnMS IT platform

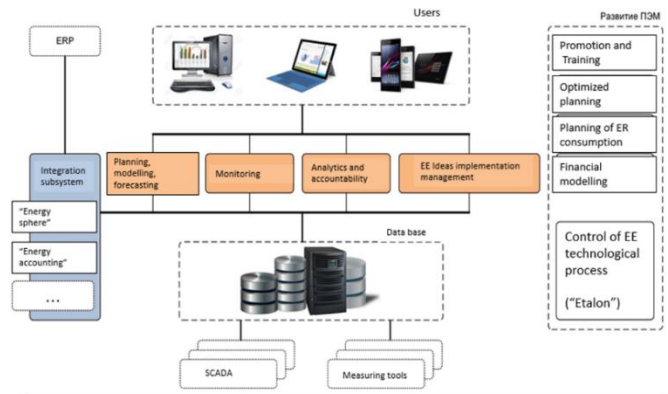


Figure 2. Energy management platform scheme

The platform is designed to automate following management processes:

- Consolidation of information on energy saving activities in one database;
- Standardization of development, negotiation and approval of processes in the field of energy saving;
- Monitoring and analysis of energy saving activities implementation, their impact on energy resource consumption and its costs;
- Formulation of analytical materials on planning and implementation of energy saving activities;
- Accumulation and dissemination of best IEE practices.

In 2016, MMK EnMS Platform became the winner of **ENES-2016** – the **all-Russian EE awards** in the nomination "Effective management system in the field of energy saving and energy efficiency improvement at an industrial enterprise".



Figure 3. MMK EnMS awarded the first prize at All-Russian ENES-Forum

The ENES-Forum was organized by the Ministry of Energy of the Russian Federation and the Government of Moscow.

Cost benefit analysis. In 2014, a specific budget line for energy efficient projects called “Baby CAPEX” was introduced. In 2015, the total investments in EE projects amounted to \$17,5 million, in 2016, - \$21 million and in 2017 - \$21,5 million. The average payback period for all the project is 1,2 years.

But the greatest impact on energy reduction were provided by **non-cost changes in business-process, documents and operational activities** - in 2015 MMK saved more than \$ 20,6 million without any investments.

As an activity portfolio on rational use of secondary gases, MMK increased the degree of their use. Use of furnace gas increased by 65% in 2015, and by 13% in 2016; coke gas – by 84,2% in 2015 and by 48,1% in 2016.

Steps taken to maintain operational control and sustain energy performance improvement

In 2015, MMK adopted a strategic initiative called "The personification of the management of energy resources". In each MMK unit the equipment was divided into groups. Staff workshops were divided into competitive teams measured by energy saved per shift.

“Every worker at his workplace should strive to reduce energy costs.”
 — Pavel Shilyaev, Director General

MMK also modified the system of motivation of the personnel for implementation of energy efficient ideas.

Now, for successful implementation of the project, the team of workers receive 2.5% of the reached effect as a reward. Some employees receive to 10 000 USD for successful implementation of the project.

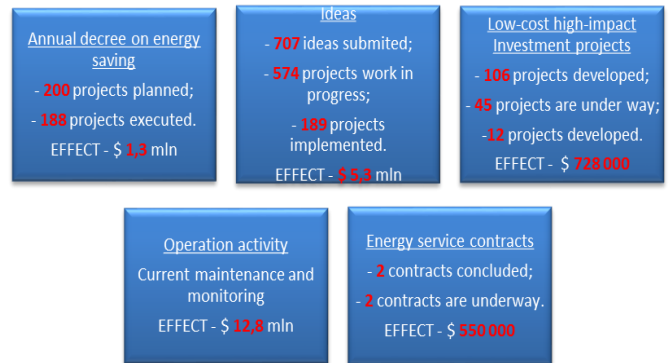


Figure 4. Action groups for energy cost reduction and effects

Than MMK started the implementation of check lists with optimal operating parameters of the equipment. The system of the electrical load peaks dynamic tracking was also adopted.

Lean production project started in parallel within the direction of energy efficiency at MMK.

To increase the EnMS efficiency the conducting internal audits program for 2017 was approved. Also, for better development of professional competencies, knowledge and skills in effective operation of EnMS the trainings of employees were organized with involvement of MMK EnMS team leader Mr. Danila Tselikanov as the lead trainer.

The corporate training center organizes courses on energy efficiency on ongoing basis. Every year more than 500 MMK professionals attend these courses.

Lessons Learned

Implementation of EnMS at MMK faced certain barriers, such as:

- Need to change the established work methods and behaviors. Major resistance towards changes occurs most often among the heads of various departments. This happens due to the differences in priorities.
- EE increase of existing equipment and systems requires high level of technical competence. It requires knowledge on the equipment, as well as possible technological operating modalities.
- There were tendencies for explanatory and rationalizing behaviors when actual energy consumption exceeded the target indicator, which hampered further progress. Changing this behavioral model created opportunities for improvements of monitoring, situational analysis and corrective actions.

Keys to Success

To overcome the barriers, MMK specialists made the following steps:

- Top-management issued an Order that became a guiding document and a starting point for EnMS system implementation. So, most of the barriers were overcome using the strong sides of existing system: issuing the Decrees, directives, administrative pressure with personification of responsibility;
- Improving the motivation system for workshops personnel by introducing changes in current

provisions on rationalizing activities, as well as using the funds of heads of workshops to encourage the staff;

- “Baby-CAPEX” budget line was created to implement highly efficient projects with short payback time;
- Use energy service contracting schemes, through which several large projects were implemented with the costs over \$ 12,3 million with payback period less than 2 years;
- Weekly meetings with workshop representatives;
- Monthly reports with best practices demonstration;
- Introduction of regular internal audits that were conducted by specialists of the Centre for Energy Saving Technologies (MMK department) together with workshop representatives;
- Implementation of EnMS IT platform, which provides opinion exchange system between specialists and experts on different projects in united professional informational field.

The EnMS implementation process consists mainly of organizational and behavioral changes. Key success factors include:

- Readiness for changes and application of new approaches on all organizational levels;
- Top management support and involvement in EnMS development and improvement;
- Necessity to ensure cooperation between the departments. The success cannot be achieved by the means of only technical and energy personnel;
- The process of constant improvement of energy performance of the system.

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.

