

# ISO 50001 Energy Management System (EnMS) Case Study

2020

Russian Federation

## PJSC Magnitogorsk Iron & Steel Works (PJSC «MMK»)

*MMK's energy management system have saved more than \$40 million over 4 years.*



### Organization Profile & Business Case

PJSC Magnitogorsk Iron & Steel Works (PJSC «MMK») is Russia's largest supplier of galvanized steel products. The company's assets in Russia represent a large metallurgical complex with a full production cycle, starting with the preparation of iron ore raw materials and ending with deep processing of ferrous metals.

The role of EnMS in MMK's strategy: EnMS is aimed at improving the company's financial performance by directly saving all types of energy resources, reducing costs, and increasing financial transparency. EnMS helps to improve the company's manageability, maintain the company's image and reputation and effectiveness of ecology management.

In order to maintain the image of an "energy-efficient enterprise", the top management set an ambitious goal of developing an energy management system (EnMS) and subsequent certification in accordance with ISO 50001. In order to develop a new culture, operational goals were set within the framework of the strategic goal, as set out in the programs.

### Energy Management Program

According to the program, actions have been developed and implemented to reduce costs in all production and functional divisions of the company.

Main areas of cost reduction:

- implementation of organizational and technical measures;
- implementation of low-budget high-performance investment projects (Baby Capex);
- invention and innovation;
- implementation of energy saving measures.

### Case Study Snapshot

<b>Industry</b>	Metallurgy
<b>Product/Service</b>	Iron & Steel
<b>Location</b>	Magnitogorsk, Russian Federation
<b>Energy management system</b>	ISO 50001
<b>Energy performance improvement period, in years</b>	4 years
<b>Energy Performance Improvement (%) over improvement period</b>	5 %
<b>Total energy cost savings over improvement period</b>	\$40 410 460
<b>Cost to implement EnMS</b>	\$418300
<b>Total Energy Savings over improvement period</b>	(GJ) 8 553606.3
<b>Total CO<sub>2</sub>-e emission reduction over improvement period</b>	1 809 205

### Drivers

MMK is a city-forming enterprise, so monitoring energy efficiency and environmental safety is the most important strategic goal of the company. In 2018, there

was implemented a massive water conservation project reconstruction of a water circulation system worth \$10,5 million. MMK aims to maintain its own environmental policy and the requirements of the state program on environmental protection and the international standard ISO 14001:2015.

*“The cost of environmental protection in 2019 is more than \$3,2 million”*

-Pavel Shilyaev, General Director

*“MMK is systematically working to modernize existing facilities and build new ones”*



-Irina Gladkova, Minister of Ecology of Chelyabinsk Region

Linkages to other existing ISO standards

EnMS has become a logical extension of the existing ISO 9001 standard and works closely with ISO 14001, taking over some of the functions (for example, reducing CO<sub>2</sub> emissions).

Business Benefits & Environmental Responsibility

According to the program, cost reduction measures have been developed and implemented in all production and functional divisions of the company.

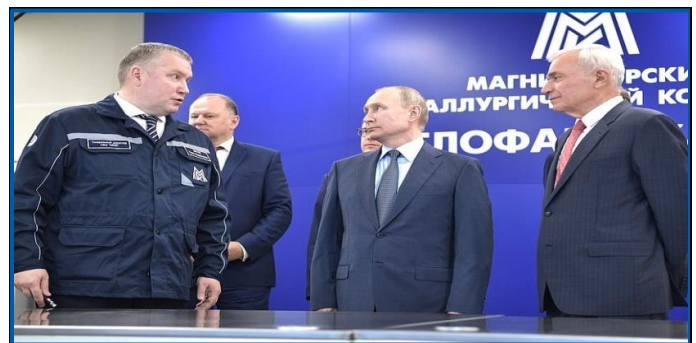
**The direct benefits of EnMS Implementation:**

- implementation of organizational and technical measures aimed at improving energy efficiency allowing us to receive an additional **\$23.215 million for the period from 2016 to 2019;**
- implementation of special low-budget high-performance investment projects (Baby Capex), the

economic effect of which amounted to **\$17.185 million for the period from 2016 to 2019;**

The share of costs for purchased energy resources in the cost of products sold decreased by 1.3%.

The update of the first division has been started: agglomeration, coke-chemical and blast-furnace. A new sinter factory No. 5 was put into operation, and the morally and physically outdated equipment of sinter factory No. 4 was withdrawn.



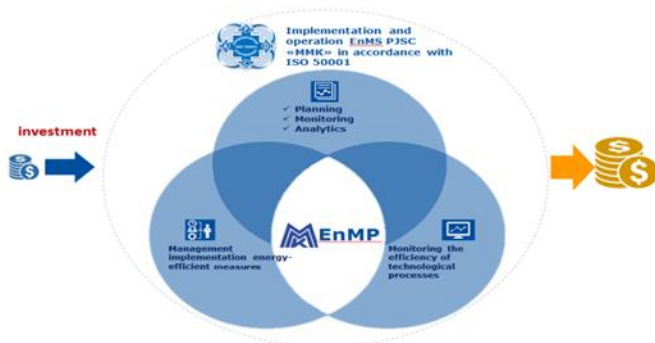
Commissioning of sinter plant No. 5. From left to right: General Director - P. V. Shilyaev, President of the Russian Federation – V. V. Putin, Chairman of the Board of Directors of MMK-V. F. Rashnikov.

**Reduced emissions:**

- dust twice (by 2.1 thousand tons per year);
- sulfur dioxide - four times (3.5 thousand tons per year);
- benzopyrene – 16 times;
- discharges of pollutants into the circulating water supply system have been reduced by 600 tons per year;
- the placement of technological waste from the sinter plant No. 2 in the sludge storage facility has been reduced by 13.75 thousand tons per year.

**Commissioning of a new air separation unit at a cost of \$ 67 million saved about 10 MW of electricity per hour.**

Plan for Implementation of EnMS



To promote energy saving among employees:

- Enterprise Standard «Procedure for managing energy-efficient projects» has been developed and approved by the order of MMK ;
- The method of motivation of the personnel for the design of an energy-efficient project has been developed and approved;
- A project team has been formed and trained to work with ideas in the field of energy saving;
- Implementation of the monitoring and control mechanism for reducing costs and improving energy efficiency of production based on the order of the General Director of MMK has been carried out;
- Regular meetings with the main specialists in the areas and with employees of the shops have been held.

MMK has organized monitoring of energy resources based on the collection of data from an automated system. Areas of significant energy consumption are identified and the largest consumers are defined.

In 2019, MMK successfully recertified the EnMS system and obtained the TÜV Thüringen e.V. (Germany) certificate certifying that the company applies an energy management system that satisfies the requirements of ISO 50001:2011.

The following changes took place during the re-certification process:

1. The certification area to include all production processes has been changed.
2. A special group has been developed and is functioning to coordinate and organize energy

management system activities between the plant's workshops and divisions.

3. A new business process "Energy saving and increasing energy efficiency of production" has been developed.
4. Changes were made to job descriptions and regulations for departments;
5. Programs have been developed and training has been organized for all categories of employees in EnMS, including subsidiaries.
6. A new system for motivating the staff of the main power engineer's workshops has been developed due to the fact that power plants in the structure of energy costs account for more than half of all energy costs.
7. An economic case for EnMS functioning has been demonstrated in order to ensure the commitment of the company's top managers and effective support to the management.
8. The EnMS guide has been analysed and corrected.

The implementation of the EnMS was based on the UNIDO methodology.

### Energy review and planning

The company consumes about 850 MW of electricity, of which 600 MW is generated at its own power plants.

In 2019, MMK consumed 4.72 billion kWh of electricity and 4.27 billion m<sup>3</sup> of natural gas.

The organization of the technological process at all levels - from the management of the enterprise to the management of a separate technological unit - is the main and most significant factor in improving energy efficiency and productivity.

The effectiveness depends on the organization of the production process at the enterprise and shop level, as well as directly on the actions of the operator.

The evaluation method is based on fixing the volume of purchased resources and comparing them with the target indicators.

Calculation of targets is done using a multi-factor regression model.

Verification of results

The methodology of regression analysis of the STADIA software product (IT product) is used to determine ways to improve energy efficiency. The software allows you to analyze several dozen incoming parameters:

- Structure of orders for the products;
- Grade of steel planned for the smelting;
- Execution of process chain orders calculated in ERP modules;
- Composition of the charge materials and physical properties of coking coal;
- Load factor of power plant generators.

The system of regression analysis is supplemented by systems of non-linear modeling of processes under conditions of many influencing factors. This system is one of the most complex and progressive used in metallurgy. Module approximation accuracy is **97-99%**.

Defined dependencies are also useful for forecasting.

The implementation of the energy management platform is part of a corporate project to improve the management of energy saving and energy efficiency processes, as well as part of a project to optimize costs center.

“Do, Check, Act”

EnMS PJSC «MMK» is aimed at improving energy performance, including energy efficiency, production and use of energy, in accordance with the adopted energy policy.



Vladimir Putin at a meeting with MMK employees at the launch of the new sinter plant No. 5 in 2019

The tasks of energy management also include technological re-equipment, such as:

- use of advanced management methods and approaches to improve energy efficiency;
- optimization of existing power supply schemes, production and technological processes and related processes;
- use of the energy efficiency criterion for purchasing equipment, raw materials, technologies and designing and implementing new or modernized facilities;
- development of a new funding item "Baby Capex" and allocation of funds for quick-payback energy efficiency projects with cost up to \$1.6 million. In 2016, were implemented 186 projects, in 2017 – 224 projects, in 2018 – 359 projects, 2019 – 521 project were implemented.
- Improvement of energy operational efficiency in the main power engineer's department by implementing a new system of staff motivation focused on the implementation of economic indicators. The essence of the method is to motivate the use of secondary energy resources.

Utilization of coke oven gas increased by 1% and blast furnace gas by 4.3%, and the consumption of purchased natural gas decreased by 7.7% during this period.

**Overall efficiency for the period from 2016 to 2019 amounted \$23.215 million.**

Implementation of the Energy Management Platform Project

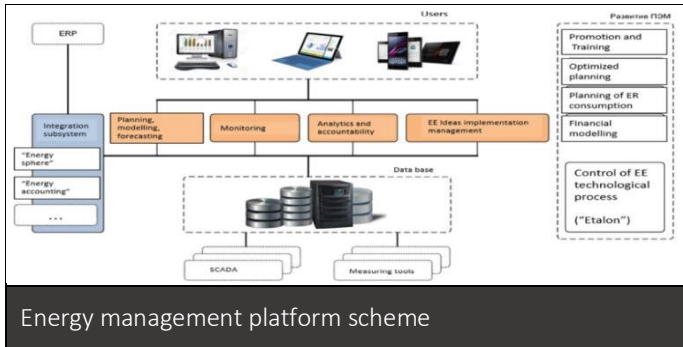
An electronic energy management platform designed for automating energy management processes has been developed. EnMP is designed for:

- Standardization of development, coordination and approval of processes in the field of energy saving;
- Monitoring and analyzing the implementation of energy saving measures and their impact on energy consumption and costs;
- Formation of analytical materials for planning and implementation of measures in the field of energy saving;



- Accumulation and replication of best practices for improving energy efficiency.

EnMP (platform of energy management) has combined several corporate information systems.



Functional subsystems of EnMP:

- Monitoring of energy supply and energy consumption (generation, storage and systematization of primary data) Wonderware Corporate Energy Management;
- Analytics and reporting - Wonderware Intelligence Software;
- Modeling, forecasting, and optimization – based on Wonderware System Platform, Wonderware Corporate Energy Management, Wonderware Intelligence Software, and third-party products of management measures and energy saving projects Wonderware Skelta BPM.

Technology subsystems of EnMP:

- Basic subsystem Wonderware System Platform;
- integration subsystem - Wonderware Enterprise Integrator;
- Administration and support subsystem - Wonderware Development Studio.

The energy management system (EnMS) includes management of personnel and information about energy use and technologies that can improve energy efficiency. Also, in order to improve operational energy efficiency for individual sites and workshops, so-called "Check lists" were developed and existing mode maps were revised. The emphasis was placed on maintaining

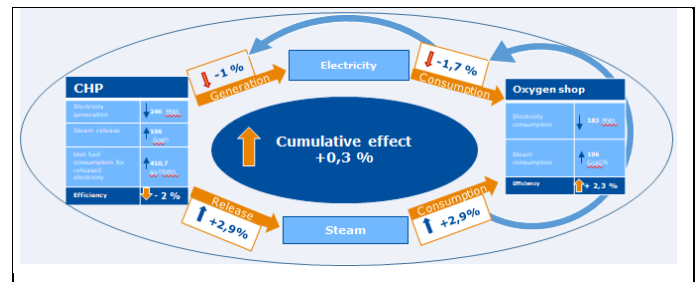
the efficiency of certain technological and technical parameters of the equipment in the specified corridors.

### Transparency

The certificate of compliance of the energy management system with the requirements of the international standard ISO 50001 is posted on the corporate external website of MMK.

### Lessons Learned

1. There are many competent technical specialists and power engineers at the plant, but there are not enough qualified energy managers who can navigate system issues by interacting with technological and energy personnel. It was difficult to understand at once. Therefore, at a minimum, it was necessary to increase the time and expand the training program for specialists.
2. Now, after a while, it can be argued that there is an urgent need to integrate not only commercial accounting systems, but also technical accounting for fuel and energy resources in order to build an effective management system.
3. The greatest resistance to change was most often found among managers of various services. Sometimes this was due to differences in priorities. An end-to-end complex efficiency indicator is being developed for this purpose.
4. Up to a certain point it was not possible to achieve a greater cumulative effect in the allocation of energy flows between departments.



## Steps taken to maintain operational control and sustain energy performance improvement

In 2019, MMK adopted a strategic initiative called "Mobile Energy Management".

MMK also modified the system for motivating staff to implement energy-efficient ideas. Now, for the successful implementation of the project, the team of employees receives 2.5% of the achieved effect as a reward. Software has been developed in EnMP for tracking electrical load peaks.

## Keys to Success

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

- Issued an order top-management that became a guiding document and a starting point for EnMS implementation. So, most of the barriers were overcome using the strong sides of the existing system: issuing the decrees, directives, administrative pressure with personification of responsibility;
- Improving the motivation system for workshops personnel by introducing changes in current documentation provisions on rationalizing activities, as well as using the funds of heads of workshops to encourage the staff;
- Creating "Baby-CAPEX" budget line to implement highly efficient projects with short payback time;
- Using 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;
- Organising weekly meetings with workshop representatives;

- Demonstrating monthly reports with best practices;
- Introducing regular internal audits that were conducted by specialists of the Centre for Energy Saving Technologies (MMK department) together with workshop representatives;
- Implementing 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 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](http://www.cleanenergyministerial.org/energymanagement).

