

Global Energy Management System Implementation: Case Study

Republic of Korea

SUNGSHIN CEMENT Co., Ltd. Danyang Plant

The quantitative evaluation found that SUNGSHIN CEMENT Co., Ltd.-Danyang Plant improves Energy Performance 2.2% due to Energy Management System in 2016 (for 3years) from 2013.

성신양회 단양공장 전경



SUNGSHIN Cement Co., Ltd.-Danyang Plant has manufactured cement using limestone quarried in the mine, the overall production is 7.74 million tonnes for 2016.

Business Case for Energy Management

SUNGSHIN CEMENT Co., Ltd.-Danyang Plant established in 1968 is the most representative of Korea, has been continuing its cement production business so far and has fulfilled its role as the leader who building the national infrastructure for Republic of Korea.

SUNGSHIN CEMENT Co., Ltd.-Danyang Plant implementing the greenhouse gas energy target management system in accordance with the 「Guidelines for Greenhouse Gas and Energy Target Management and Operation」 in 2010, and was awarded as leading company in the reduction of greenhouse gas emissions by Ministry of Trade, Industry and Energy in October, 2013.

In addition, it is the first domestic cement company to be certified by ISO 50001.

Also, SUNGSHIN CEMENT Co., Ltd. has developed a green management policy to realize sustainable and environmentally friendly company activities by considering the benefits of nature beyond the area of creating company value in Korea.

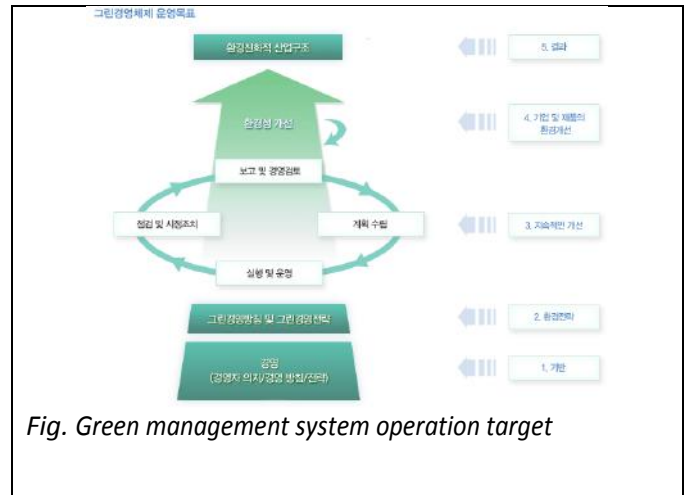


Fig. Green management system operation target

SUNGSHIN CEMENT Co., Ltd.-Danyang Plant based on this Green management system has operated the Energy management system for more systematic and enterprise-wide improvement of energy performance.



Fig. Green Management Organization

“Obtained the first energy management system certification in the industry and Taking the lead in energy management.”

Case Study Snapshot	
Industry	SUNGSHIN CEMENT Co., Ltd.-Danyang Plant
Product/Service	Portland Cement
Location	Danyang
Energy Management System	ISO 50001
Energy Performance Improvement Period	3year
Energy Performance Improvement (%) over improvement period	2.2%
Total energy cost savings over improvement period	7,656,220 USD
Cost to implement EnMS (just for capital investment)	10,527,303 USD
Payback period (years) on EnMS implementation	1.3 years
Total Energy Savings over improvement period	627,726 (GJ)
Total CO₂-e emission reduction over improvement period	59,245

Business Benefits Achieved

SUNGSHIN CEMENT Co., Ltd.-Danyang Plant has established the total energy target of Danyang Plant at the beginning of the year based on the energy consumption level of the previous year.

In the case of the cement industry, it is difficult to find the reduction technology except for replacing old parts or new equipment as a device industry. So, reducing energy by increasing clinker production efficiency and reducing the amount of clinker used to produce cement are the most energy saving forms.

As part of energy management, SUNGSHIN CEMENT Co., Ltd.-Danyang Plant conducted a performance evaluation on energy saving through third party verification conducted by the Korea Energy Agency to estimate more accurate savings while managing the energy intensity before implementation of the energy management system internally.

As a result, the calculation of the savings of the energy management system performance evaluation and the calculation of the savings through the unit cost have similar characteristics. However, the reflection in the difference according to the base unit was different and we applied the linear regression analysis using statistical techniques rather than the energy intensity as an energy saving index as a KPI indicator for Danyang Plant and SUNGSHIN CEMENT Co., Ltd.

Using the same method, we can confirm the following a year's achievements in participating in the energy management system performance evaluation project promoted by Korea Energy Agency.

- Baseline period : in 2013
- Project period : in 2016
- Energy performance (electricity) : 4.9% (392,797 GJ)
- Energy performance (fuel energy) : 1.1% (234,929 GJ)
- Energy performance (total) : 2.2 % (33,137 GJ)
- Energy reduction costs : 7,656,220 USD /year

As a result of participating in the energy performance evaluation carried out by Korea Energy Agency, it was found that there was a high correlation with clinker energy usage and it was also found that it is a more accurate model to evaluate the energy usage of the energy management system in order to evaluate the energy saving technology.

EnMS Development and Implementation

SUNGSHIN CEMENT Co., Ltd.-Danyang Plant established the energy management system and was certified ISO5001 in October 2013 for the first time among domestic cement industry.



Fig. ISO 50001 certificate

Organization

The organizational structure of the SUNGSHIN CEMENT Co., Ltd.-Danyang Plant consists of a sub-manager who is an administrative agent under the plant manager, who is the CEO, and each team carries out its roles and activities. The production planning team is responsible for the overall task of establishing factory energy usage plans and managing energy and the QA team carries out activities to reduce energy consumption through quality control of production products.

Production 1 and 2 teams, resource management and business development teams conduct energy saving activities through finding points that can be saved and self-improvement activities by real-time energy usage monitoring. The facility management team, the management team and the environment team are responsible for equipment maintenance and also for high-efficiency equipment exchange and maintenance.

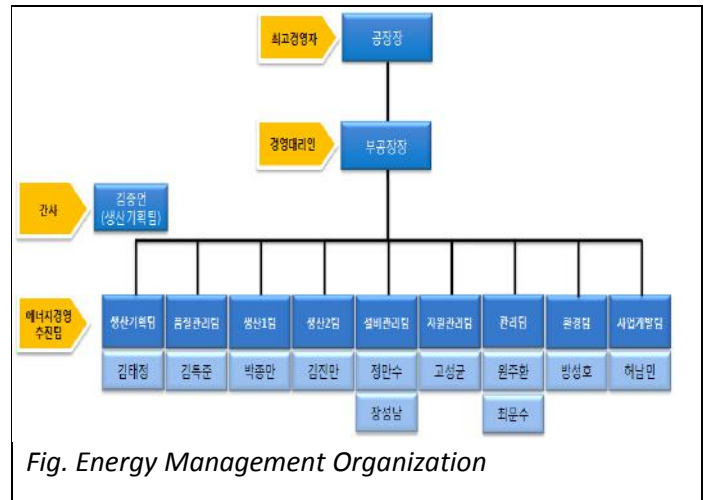


Fig. Energy Management Organization

Energy review and planning

Understanding of the current situation

Various fuels and electricity are being used as Fence Diagram of SUNGSHIN CEMENT Co., Ltd.-Danyang Plant.

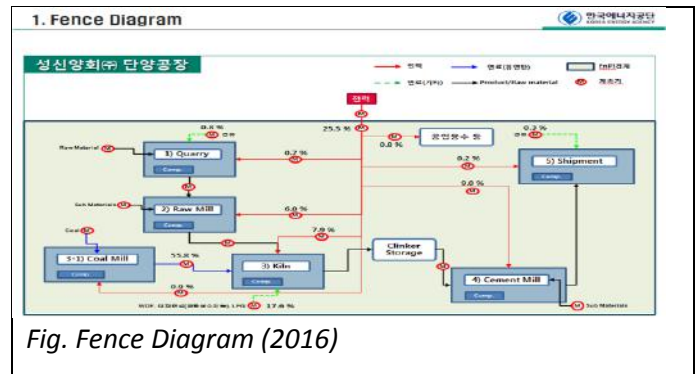


Fig. Fence Diagram (2016)

Most of the energy consumption of SUNGSHIN CEMENT Co., Ltd.-Danyang Plant is used in firing furnace, and it is mostly fuel. In the case of electric, most of them are used in the crushing process (raw material & cement) and the firing furnace.

Significant Energy Use (SEU) Drawing

Reducing kiln energy consumption by reducing the use of clinker (the intermediate product of cement) as a result of sintering is an important energy saving

measure because almost energy is used in sintering process in SUNGSHIN CEMENT Co., Ltd.-Danyang Plant.

Therefore, we designate firing furnace as important energy use and find opportunity to improve efficiency through operation management and facility maintenance activities.

“Energy Savings Through Replacement of Clinker in Cement Manufacturing.”

Finding opportunities for improvement

SUNGSHIN CEMENT Co., Ltd.-Danyang Plant manages the use of important energy in accordance with the operation management guidelines of the energy management system and the government personnel, management responsibility method and plan for the facilities concerned.

Because the energy consumption of each facility is considerable, the FEMS for energy management is being built and operated, and the fuel and raw materials of each facility are controlled by the pre-established process management system, and the quantitative feeder(W/F) is controlled according to the setting value of the operation panel at SUNGSHIN CEMENT Co., Ltd.-Danyang Plant.

Actual measured values measured by the quantitative feeder are transferred to the operation panel and stored. In addition, the RTDB value is stored in the TOPS production management system on a daily basis, and it is possible to grasp the production efficiency index against energy usage in real time.

In addition, a solar power generation facility is installed on the rooftop of the office building in order to save the power of the workplace a little.

SUNGSHIN CEMENT Co., Ltd.-Danyang Plant is making efforts to keep optimal system by putting budget in time to replace old equipment as well as equipped with factory energy management system itself and is doing its utmost to use energy efficiently.



Fig. Solar power generation of SUNGSHIN CEMENT Co., Ltd.-Danyang Plant

Energy Performance Check

Identifying of Influential factors

Factors affecting the energy consumption of SUNGSHIN CEMENT Co., Ltd.-Danyang Plant were estimated and analyzed.

The cement industry maintains an appropriate amount of clinker inventory by season in order to organically match demand and supply, and the demand for cement is adjusted by inventory (first-in and first-out) and production volume for the current month. Fuel used for clinker production accounts for more than 80% of the total energy use of the plant. The energy usage of the clinker inventory used in this process was calibrated to the production month.

And, the final impact factor was selected as cement production, which is the final product.

Table. Impact factor drawing

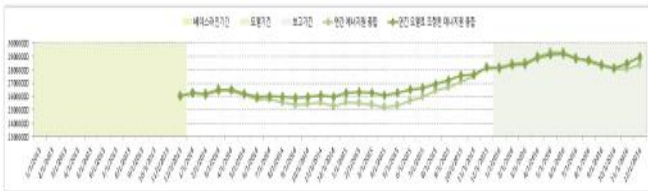
Energy source	Independent Variable (P-Value)	F-Test	R ²
	Cement production amount		
Electricity (GJ)	0.00	0.00	89.42%
Fuel (GJ)	0.00	0.00	98.54%

Energy performance drawing

Using the derived influence factors, the energy performance of the three years of 2016 compared to 2013 was confirmed. As a result, the electricity 4.89%, fuel 1.12% and the whole plant 2.17% were achieved.

Table. Energy performance drawing

Division	Year	Electricity(GJ)	Thermal E(GJ)	Total(GJ)
Baseline period	2013	7,636,263	20,709,015	28,345,278
Reporting period	2016	8,029,060	20,943,944	28,973,004
Performance (GJ)		392,797	234,929	627,726
Performance (%)		4.89	1.12	2.17



Cost Benefit

The cement industry is not a device industry and does not replace the entire plant. Most of the energy conservation activities are carried out by maintenance, but the amount of energy savings is insignificant compared to the amount used.

Most electricity-saving technologies replace industrial clinker to produce cement, which is the final product, to produce cement by injecting industrial by-products generated outside the plant. Of course, cement quality has remained the same or improved.

This energy saving is achieved by reducing the amount of clinker produced in the firing process that consumes most of the energy.

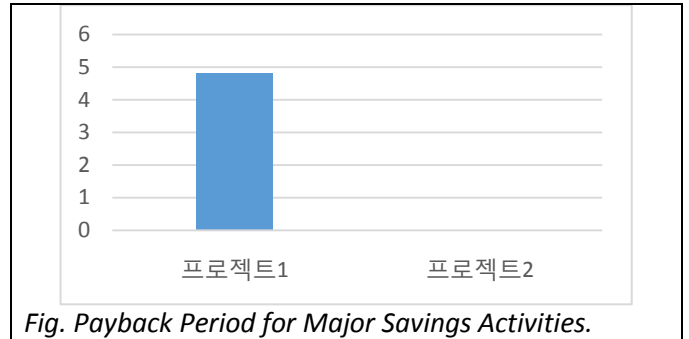


Fig. Payback Period for Major Savings Activities.

We confirmed the energy cost savings of about 7,656,220 USD during the performance period (2016) by implementing energy efficiency improvement activities.

The investment payback period for the savings activities excluding the internal manpower costs and the EnMS certification and related investment costs is about 1.3years, and the energy management system was able to confirm significant energy saving performance.

Communication, Education and Tool

In accordance with the energy management organization, every quarter, we are communication and gathering opinions through factory workshops on energy management and reduction activities and also hold workshops for energy, environment and safety and health in terms of environmental management.

In terms of energy management, internal training on energy management, law and regulations is being carried out, and management is actively encouraging the attendance of outside education and seminar attendance required for such personnel.

TPM activities internalized by tool of factory management and suggestions for energy saving of the members of the organization can be introduced at any time through internal meetings with each team leader, and the proposed contents are judged whether they are commercialized through energy review at weekly meetings.

In addition, issued and publicity about energy management of SUNGSHIN CEMENT Co., Ltd.-Danyang Plant are disclosed to the outside through homepage or media reports.

Lessons Learned

All of our employees are conducting energy management activities in accordance with standardized guidelines so that energy management can be continuously achieved through the P-D-C-A cycle for energy management at factories.

Management sets energy policies for energy saving and greenhouse gas reduction through energy management, encourages all employees to reduce energy consumption and greenhouse gas emissions, and emphasizes constant updating of related laws and regulations.

Accordingly, the energy management department collects and analyzes the energy and related data collected at the factory in accordance with the energy policy, and pursues sustainable energy saving by deriving priorities when problems or improvements occur.

As the first company in the domestic industry to acquire the energy management system certification, employees are proud of the energy management system and intend to conduct internal audit, follow-up service, re-certification audit and certification audit for energy management continuously.

Keys to Success

- **Active feedback (ideas, suggestions, etc.)**
- **Energy savings are not a duty but right**
- **C.E.O's energy philosophy**

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.

