

Global Energy Management System Implementation: Case Study

Republic of Korea

LG Innotek 1 plant

LG Innotek Gumi 1 plant has achieved a 4.8% performance in 2016 (three years) compared to 2013 as a result of quantitative energy savings evaluation at a factory that produces camera modules.



LG Innotek is a global material & component company with 6 business such as Mobile, Automotive, LED, Display, Semiconductor and IoT that has led the technological advancement of cutting-edge material & parts company leading customer value.

Business Case for Energy Management

Since its establishment in 1970, LG Innotek has been a global leader in materials and components, leading the way in customer value. LG Innotek is leading the development of the front and back industry in a wide range of fields ranging from materials & devices to components and modules, and is growing with customers.

It has secured a network for global markets by establishing major domestic and overseas base and is focused on developing innovative technologies and market-leading products through CTO operations.

As a result, we achieved a rapid annual growth rate of over 8% from 2011 to 2015.

“Prevention of business-related risks due to climate change through environmental conservation activities such as energy-saving activity.”

Case Study Snapshot

Industry	LG Innotek
Product/Service	Application component business such as camera modules and etc.
Location	Gumi-si, Gyeongbuk
Energy Management System	ISO 50001
Energy Performance Improvement Period	3years
Energy Performance Improvement (%) over improvement period	4.8%
Total energy cost savings over improvement period	1.15billion
Cost to implement EnMS	556million
Payback period (years) on EnMS implementation	0.48year
Total Energy Savings over improvement period	64,477 (GJ)
Total CO₂-e emission reduction over improvement period	3,236

LG Innotek is strengthening its EESH system, expanding investment in greenhouse gas and energy savings, improving process activities, etc., as new regulations are introduced and the demand for information disclosure

on climate change response is expanded as the importance of the environment is emphasized globally. We are pursuing diverse activities in order to make the crisis of introducing regulations an opportunity to preempt the eco-friendly industry.

As part of these activities, we recognize that EESH (Energy, Environment, Safety, and Health) is the foundation of sustainable management and are making continuous improvements. Green Management, Green Company, Green Product, and Green Communication are set to reduce greenhouse gas emissions by 20% under the slogan of "Value Plus, Carbon Minus" in order to cope with climate change. We are setting up a major direction and pursuing the goal.

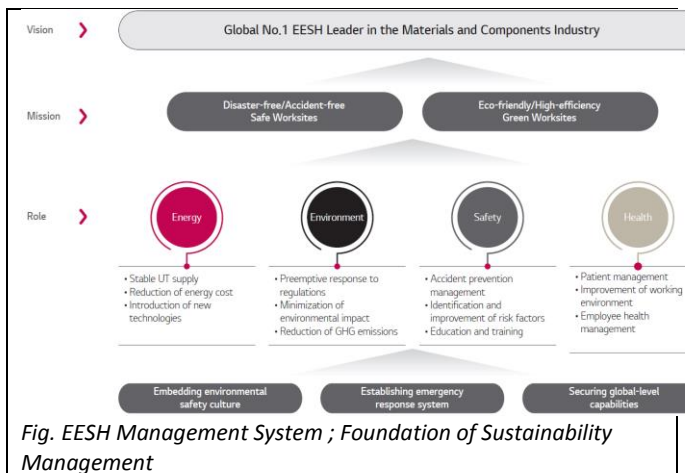


Fig. EESH Management System ; Foundation of Sustainability Management

We are strengthening management of all processes from energy supply to use by operating energy use goals and planning, implementation, verification and improvement according to PDCA (Plan, Do, Check, Act). When new equipment arrives, it conducts energy pre-check and registers and manages the facilities in the energy planning document and facility management system. Each year we report to management the results of energy cost unit goal setting, implementing plan establishment and action, confirmation of compliance with legal regulations through internal audit once a year, operation and management, and deducing and

implementing improvement tasks to our management in order to participate in energy saving activities.

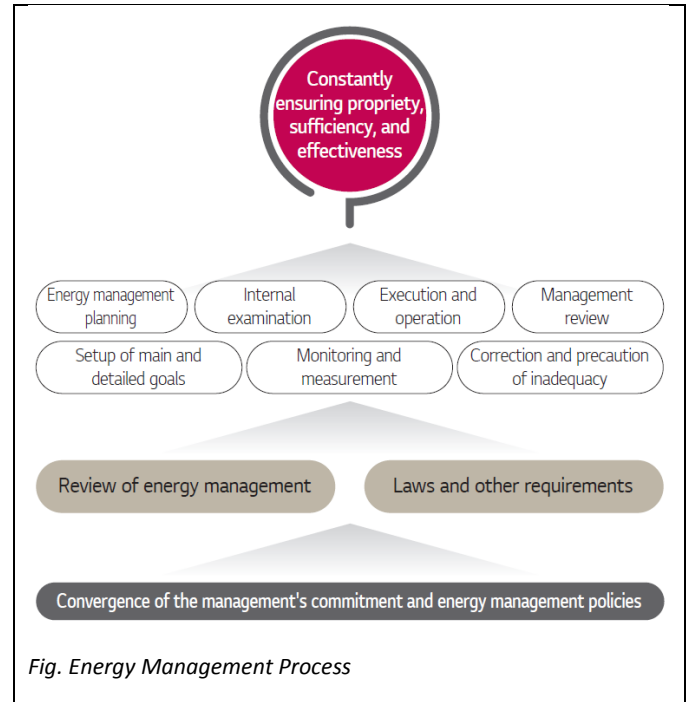


Fig. Energy Management Process

Business Benefits Achieved

LG Innotek selects key issues through prioritization by analyzing of importance among various sustainability management issues identified from internal and external stakeholders.

Issues related to corporate growth (securing product competitiveness and finding growth engines) and employee-related issues (human resources development, establishment of a safe workplace) and effective use of energy has been selected as a major issue this year after last year, and it is very interested in energy efficiency.

It has been recognized as an excellent energy saving company by being awarded as the prize of energy reducing award recipient and an excellent power saving Management Company by fulfilling demand reduction activities in accordance with the government energy policy.

In order to objectively evaluate these energy saving activities, we participated in the energy management system performance evaluation project promoted by the Korea Energy Agency and these achievements can be viewed under following for 3 years.

- Baseline period : 2013
- Project period : 2016
- Energy result (Electricity) : 4.0 % (48,430 GJ)
- Energy result (Thermal Energy) : 12.0 % (16,047 GJ)
- Energy result (total) : 4.8 % (64,477 GJ)
- Energy reducing cost : 1.15billion/year

In LG Innotek Gumi 1 plant, energy efficiency was managed based on energy consumption compared to final production. However, LG Innotek Gumi 1 plant participated in the energy performance evaluation carried out by the Korea Energy Agency, and introduced energy management methods using more advanced statistics besides energy. Using these derived models, we improved the energy performance evaluation and internal energy management model.

EnMS Development and Implementation

LG Innotek has introduced and operated the Energy Management System (ISO 50001) for more systematic savings.

Organization

Energy management organization of LG Innotek is organized throughout the company and the headquarters safety and environmental team who is under energy management agent manages the company's energy planning, review of domestic and foreign laws and regulations, and supports workplaces, and encourages energy savings by allocating energy targets for each workplace.

In the case of LG Innotek's Gumi 1 plant's safety and environmental team, it is investing in energy savings to improve the efficiency of common facilities and

manufacturing facilities, including energy management, instrument management, and UT facilities.

In addition, the manufacturing team at LG Innotek's Gumi 1 plant contributes to enterprise-wide energy management and reduction by conducting activities to reduce manufacturing facilities and on-site energy.

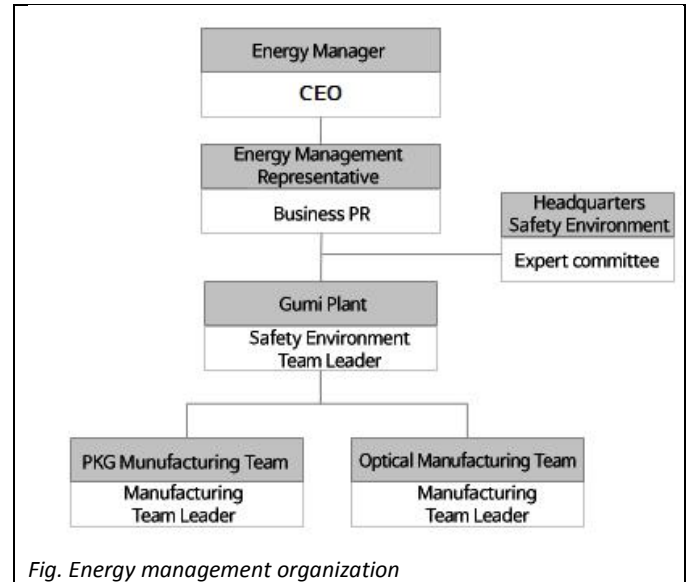


Fig. Energy management organization

Energy review and planning

Understanding of the current situation

By participating in the Korea Energy Agency's performance evaluation, Fence Diagram was created to enable the LG Innotek Gumi 1 Plant's energy to be identified.

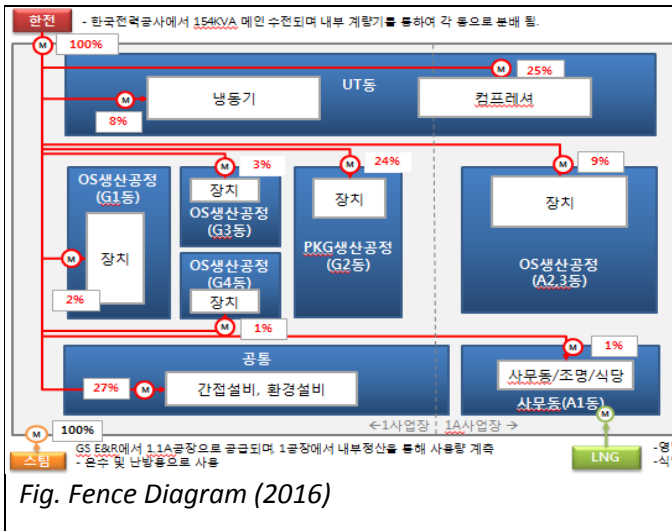


Fig. Fence Diagram (2016)

LG Innotek is a company that produces electric and electronic materials and most of the energy used in common facilities such as refrigerator and compressor because there are manufacturing processes for producing PKG, OS, and clean room.

Significant Energy Use (SEU) Drawing

Since LG Innotek's Gumi 1 plant has a clean room, it is very important to control the refrigerator and air conditioning facilities that have high energy consumption and the PKG and OS production process which is direct manufacturing process.

Accordingly, we designate production process facilities such as the refrigerator, air conditioning facilities and the PKG and OS production process which is direct manufacturing process as important energy use, develop continuous facility maintenance activities, and discover opportunities for energy improvement through operational efficiency management.

“Improving energy efficiency through one-person saving investment.”

Finding opportunities for improvement

LG Innotek's Gumi 1 plant has been steadily promoting one-person saving investment, non-operating

equipment / peak management and applying it to lighting for small wind power generation. LG Innotek's Gumi 1 plant also finds and applies such as the electricity demand trading system.

We conduct the internal audit once a year to check on energy saving activities and draw up improvements. We also carry out activities such as optimal usage management, non-operating facility management, and facility efficiency improvement linked to facility operation.

In addition, EESH Global conferences share the excellent cases of energy saving conservation throughout the company and the award is given to excellent energy saving departments and individuals to encourage active energy saving participation.

To more actively reduce energy costs, we are continuously promoting energy saving ideas and field improvement activities that all employees and employees participate in.



Fig. LG Innotek's Global EESH conferences

Energy Performance Check

Identifying of Influential factors

We predicted and analyzed the factors affecting each energy usage and derived the factors affecting energy consumption of LG Innotek.

Table. Deriving of influence factors

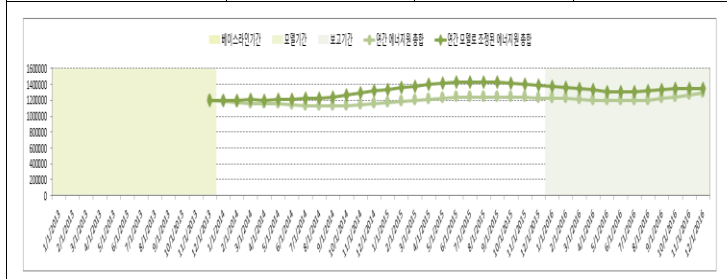
Energy source	Independent Variable (P-Value)			F-Test	Adj. R ²
	Total production	CDD(22)	HDD(22)		
Electricity (GJ)	1.12	1.12	-	0.00	80.51%
Thermal Energy (GJ)	Not applicable because of one influence factor derived			0.00	89.82%

Energy performance drawing

The energy performance of 2016 was 4.77% compared to 2013 using the derived influence factors.

Table. Energy Performance drawing

Division	Year	Electricity(GJ)	Thermal Energy(GJ)	Total(GJ)
Baseline Period	2013	1,219,101	133,666	1,352,768
Reporting Period	2016	1,170,671	117,620	1,288,291
Performance (GJ)		48,430	16,046	64,476
Performance (%)		3.97%	12.00%	4.77%



Cost Benefit

Energy saving activities was implemented through various activities such as optimization of conditioning facilities in the clean room, LED replacement, and recovery of waste heat from discharged water during the performance period (3 years).

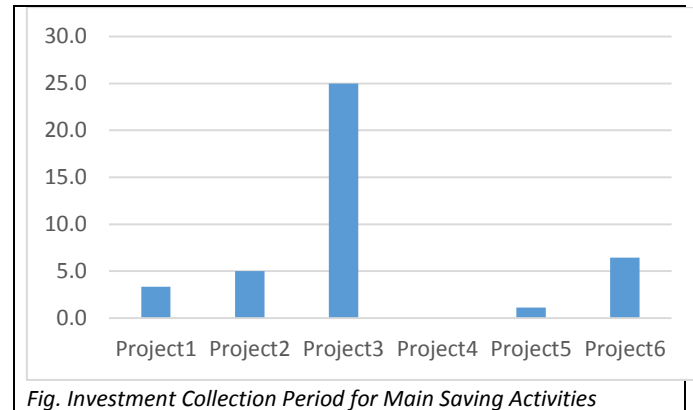


Fig. Investment Collection Period for Main Saving Activities

We confirmed the energy cost savings of about KRW 1.21 billion during the performance period (2016) by implementing the energy efficiency improvement activities.

The payback period for the savings activities exclusive of the internal labor cost and EnMS Certification and related investment costs is about 0.5 years, and the energy management system was able to confirm significant energy savings.

Communication, Education and Tool

The headquarters is at the center, introducing and operating the energy management system (ISO 50001), and all the business sites are carrying out activities for energy management.

We have exchanged various opinions through the consultative group, shared energy saving and process improvement linked to waste elimination activities, and are continuously investing to save energy at all work sites.

We are continuously promoting the energy saving investment and process improvement linked with waste elimination activities and select employees in charge of each workplace and manufacturing department and conduct energy education once a year.

Energy-related information such as energy management system construction, energy saving performance, etc. is

disclosed to the outside through homepage and corporate sustainability management report.

We controlled energy saving with unit. However, after consulting EnPI tools through the projects supported by the Korea Energy Agency, we plan to manage energy performance not only through LG Innotek's Gumi 1 plant, but also through company-wide expansion.

Lessons Learned

From the introduction of the energy management system at the head office, there are various activities for continuous energy management and reduction such as the operation of conferences and the attendance of seminars.

In this way, it is necessary to expand the measurement range of quantitative energy consumption to maintain the competitiveness of the business through cost reduction and maintenance of the effect of continuous energy greenhouse gas reduction and improvement activities.

However, the collection, analysis, alerting, and improvement of energy consumption should be structured and substantive, but it is urgent to introduce Factory Energy Monitoring System (FEMS) throughout the company, not limited to some facilities

In addition, in order to introduce FEMS business and to reduce Green House Gas emissions and improve energy consumption structure due to environmental and regulatory changes, it is necessary to continuously carry out strengthening of individual capacity through participation in internal and external education. As

energy costs increase, it is necessary to promote energy saving investment such as renewable energy.

LG Innotek will continue to manage the entire process from energy supply to use by operating energy use goals, planning, implementation, verification and improvement according to the PDCA (Plan, Do, Check, Act).

In addition, we will report to management the results of annual energy cost target setting, execution plan implementation and execution, confirmation of compliance with regulations through annual internal audit, operation and management so that all employees will continue to participate in energy saving activities.

Keys to Success

- Company-wide energy management commitment
- Developing Energy-saving activity and investing for its item.
- Establishing communication channels to share energy

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.

