Case Study

Daesan plant of LG Chem

Daesan plant of LG Chem reduces energy consumption by 4.88% after having established EnMS and delivered various energy saving activities.



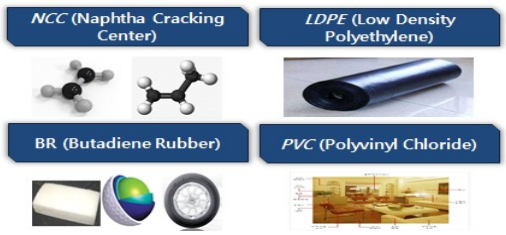
Daesan plant of LG Chem producing various products ranged from basic hydrocarbons to petrochemical basic materials.

Business Case for Energy Management

Company Profile/Business Case

LG Chem, which has shown a steady growth since 1947 when first established, is now the leading chemical company in Korea contributing to growing the national economy and increasing people's quality of life through continuous technology development, creation of new products, and increasing product quality.

Daesan plant of LG Chem consists of 4 departments (NCC, PO, Butadiene rubber, PVC), and produces basic products, synthetic resine and synthetic rubber, etc .



<Typical products of each department>

"It is remarkable for a large plant such as Daesan plant achieved a substantial level of energy saving in efforts of all staff and the Management"

—Dongon Kim, Complex Leader

Case Study Snapshot	
Industry	Manufacturing of petrochemical basic products
Product/Service	Basic products, other products
Location	54, 1-ro, Dok-got Daesan-eup, Seosan-si, Chungcheong namdo, Korea
Energy Management System	ISO 50001
Energy Performance Improvement Period	2015 (Baseline 2014)
Energy Performance Improvement (%) over improvement period	$\frac{42,660,920\,GJ - 40,581,014}{42,660,920\,GJ}$ =4.88%
Total energy cost savings over improvement period	44.23 Bil KRW
Total Energy Savings over improvement period	2,079,906 (GJ)
Total CO2-e emission reduction over improvement period	112,100 (tCO2)

Energy management program: Having introduced GHG emissions trading system, energy saving has emerged more significantly in 2016 as part of environmental management and corporate social responsibility by identifying various energy saving activities including. Deasan plant of LG Chem, large energy consumer using 40,581,014GJ (in 2015) of energy annually, introduced EnMS to manage energy consumption more systematically. Deasan plant will contribute to energy cost saving, increasing productivity, increasing social philanthropies , by identifying and delivering various energy saving activities.

Having introduced EnMS, each department sets up their energy performance target and systematically plans activities to achieve the goal. We identify various energy saving activities in the process , review the project feasibility and implement projects.

Business Benefits Achieved

Business Benefits (Summary)

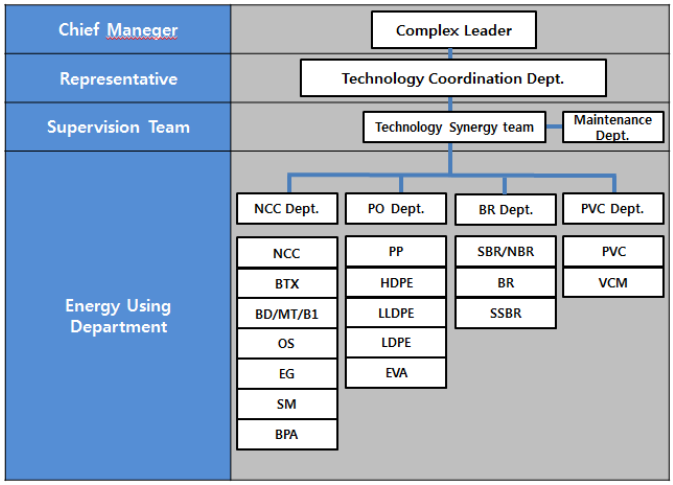
Having introduced ISO 50001, we identified and delivered more than 50 energy saving activities including waste heat recovery, steam use optimization, and production optimization at corporate level. As the result, we saved energy consumption by 4.88% in 2015 compared to the level in 2014. This is equivalent to 44.23 billion KRW in cost saving and 112,100 tCO_2 in GHG reduction, which is the result of great level of our staff's efforts.

Confident in our performance, we participated in the Superior plant certification program and were certified by Korea Energy Agency as superior plant. Result of the certification was similar to the one that we analyzed and reported internally, which provides further credibility on our EnMS performance evaluation process.

EnMS Development and Implementation

Organizational

We achieved ISO 50001 certification under the support from the company management member. We designated technology synergy team as energy management team and managed energy performance by each department, which enabled technical exchanges between departments and initiated departmental competitions in energy saving.



<EnMS organizational structure>

Roles and responsibilities

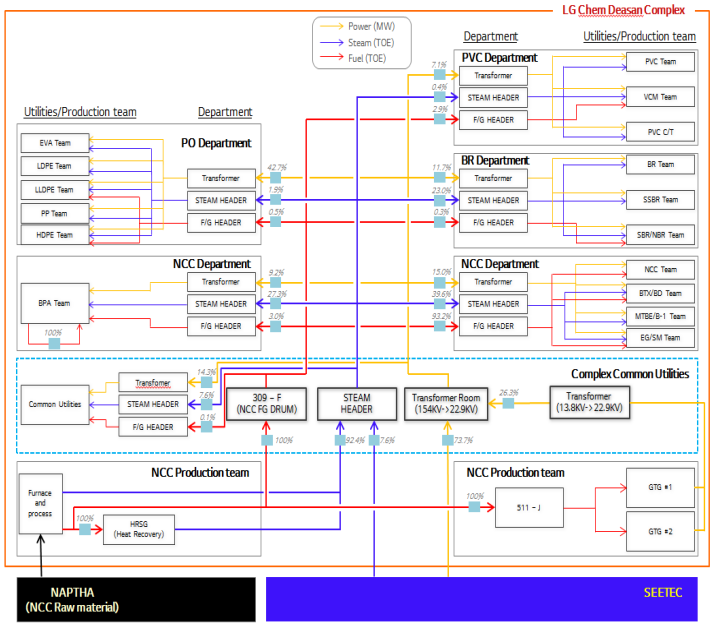
Dept.	Roles and responsibilities
Tech. Synergy team	Total energy consumption, utility management, energy saving activities applied to all sites
Process Tech team	Total energy consumption, utility management, energy saving activities applied to all business departments
Each prod. team	Energy consumption by plant, utility management, energy saving activities by each plant

Energy consumption review and business planning

There are various plants in Daesan site of LG Chem, including NCC and downstream plants producing various final products based on basic products sourced from NCC plant.

We have very complicated energy flows, as energy produced from NCC can be used for Downstream plants, and energy from Downstream plants can be either used on site or sold.

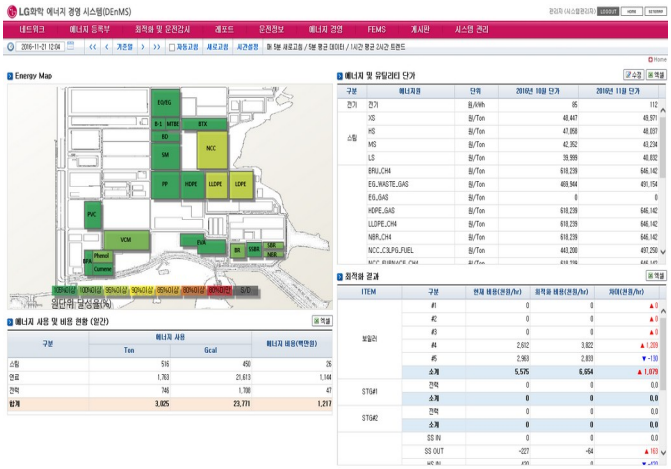
In order to define energy flows, we drew Fence Diagram and reviewed the energy flows on Daesan site.



< Fence diagram of Daesan site>

We upgraded the monitoring system in 2014 in order to define performance indicators by each department and received the certification of EnMS establishment from KEA, 1 Sep 2016.

* Certification *in EnMS establishment in managing, controlling and monitoring energy consumption on site following the defined standards*



<Screenshot of the monitoring system>

We establish action plan after identifying energy saving activities and energy saving potentials using the energy monitoring system. The plans are implemented after business feasibility reviews in detail. We monitor the performance of implemented activities through the monitoring system and identify problems to improve.

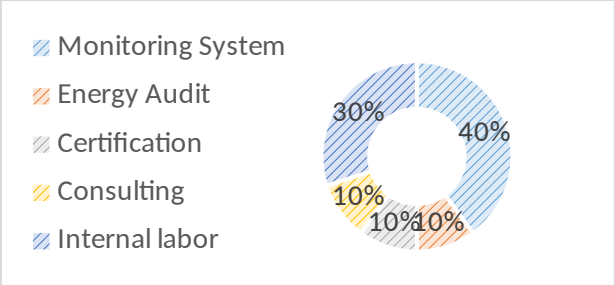
Following this process of planning and implementation, we achieved ISO 50001 certification on 24th Nov, 2014.

"All our staff contributes to energy saving in a systematical manner after the introduction of EnMS"

—Dongon Kim, Complex Leader

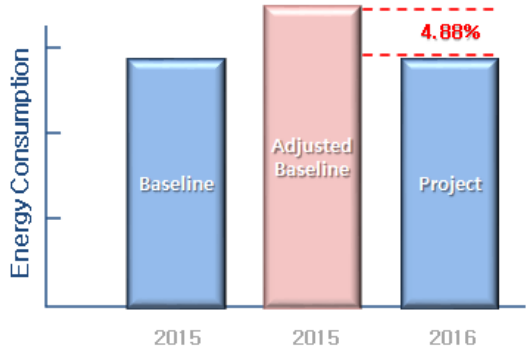
Cost-benefit analysis

We designed EnMS, improved the monitoring system, and delivered audit to introduce EnMS . The biggest share of the cost was spent on improving monitoring system, but the cost level is still very limited compared to the effects.



<EnMS establishment cost>

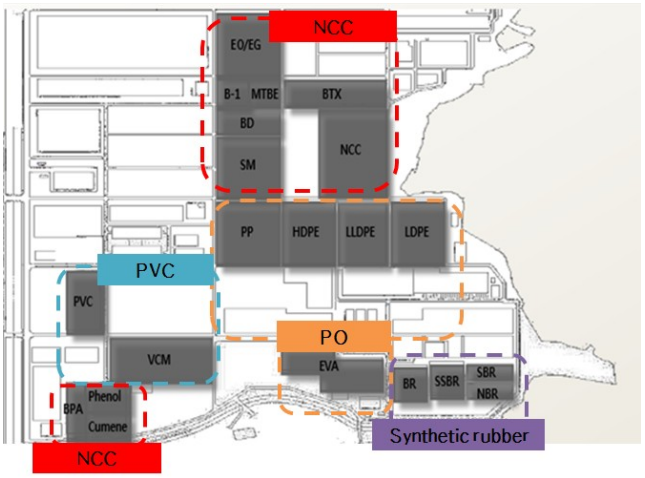
Beside the costs shown above, most of other costs were spent on energy saving activities such as facility investment. The total cost of EnMS establishment is 44.23 billion KRW.



<Effects of EnMS>

Approach used to determine whether energy performance improved

In order to check the energy performance, we set the four business departments of Daesan site of LG Chem (NCC, PVC, PO, Synthetic rubber) as the performance evaluation boundary.



<Boundaries of each department>

Having set the baseline period for 2014 and reporting period for 2015, we evaluated the performance in 2015 against the one in 2014.

We analyzed the influence factors based on 2014 data in order to measure the performance through regression analysis.

	Energy	Influence factors
NCC	Heating value	NCC production (ton), BP production(ton), HDD
PO	Power	LDPE+EVA production (ton), Production (ton) excluding LDPE+EVA, CDD
	Fuel	Production of EOR+EBR(ton)
Synthetic rubber	Power	SSBR+NBR production (ton), Total production (ton), excluding SSBR+NBR, CDD
	Steam	BR#1 production (ton), BR#2 production (ton), SSBR production (ton),
PVC	Power	Total PVC production (ton), Total VCM production (ton), CDD

Approach used to validate results

Following internal review process, we checked the entire process from target establishment to measuring the performance, identified problems, and checked measures to solve the problems.

Performance check was based on the data measured on meters and reliability of the measured data and the maintenance levels are also reflected in the evaluation.

We also compare the measured performance against the expected level of activity performance in order to increase reliability of the performance results.

	Expected value (toe)	Measured value (toe)
NCC	47,363	44,812
PO	2,440	1,803
Synthetic rubber	1,887	1,692
PVC	1,405	1,372
Total	53,095	49,678

Steps taken to maintain operational control and sustain energy performance improvement

Following PCDA cycle of ISO 50001, we deliver energy management and develop solutions to identified problems. We make our EnMS sustainable by re-implementing the solutions and analyzing the results.

All technical teams from each business department meet regularly and share best practices and energy saving ideas together, contributing to EnMS operation more productively.

We award best performers with a chance to participate in overseas benchmarking program and provide incentives of energy saving to staff.

Development and use of professional expertise, training, and communications

We established a system for all staff to propose energy saving activities and reward best ideas.

For external communication, we participate in EPS (Energy Saving through Partnership) program, share energy saving practices of the sector and discuss our problems together.



<Presentation on best practice by Daesan site of LG Chem>

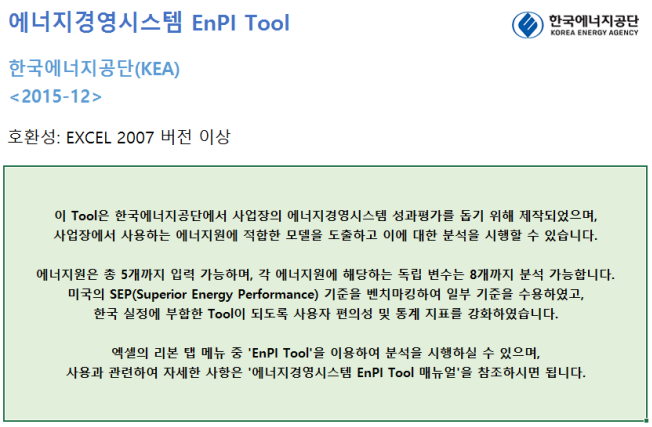
We also provide our staff with chances to participate in various paid and free trainings and seminars, to help them increase their technical capacity



<Training for EnPI>

Tools & resources

We use tools provided by KEA and other statistical programs (Minitab, SPSS) for performance evaluation.



<EnPI Tool provided by KEA>

Keys to Success

- A strong willingness and support of the CEO in energy management
- Communication at corporate level and motivation creation to staff

Quote

All companies manage energy consumption but it needs a substantial level of efforts to do it a systematically.

Lessons Learned

Lessons Learned

Daesan site has a complex configuration consisting of four different business plants (20 production teams). We analyzed and standardized the process of EnMS. The most difficult task was establishing a performance evaluation methodology acceptable by various productions teams different in product characteristics. We built experimental knowledge of the major influence factors by each department identified by using regression methods and draw the performance results understandable to all members of the site.

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.

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