Energy Management Practices of LG Chem

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Sunghee Won

LG Chem
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II. Paradigm Shift of Energy Saving
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LG Group Structure

LG streamlines its business fields into 3 domains as follows.

I. Introduction of LG Chem

- **Chemicals**
  - LG Chem
  - LG Hausys
  - LG Life Sciences
  - LG Household & Healthcare
  - LG MMA
  - etc.
  - **14**

- **Electronics**
  - LG Electronics
  - LG Display
  - LG Innotek
  - LG Siltron
  - Lusem
  - etc.
  - **9**

- **Telecommunications & Services**
  - LG U*
  - LG CNS
  - LG International
  - LG Solar Energy
  - SERVEONE
  - etc.
  - **34**

* Figure refers to the number of affiliates
About LG Chem

Known as the largest chemical company in Korea, LG Chem extends its chemical expertise into IT & electronic materials industries, such as rechargeable batteries.

- Brief History
  - 1947: Founded Lucky Chemical Industrial Corp.
  - 1960~1990s: Entered into
    - Industrial Materials business in 1960s
    - Petrochemicals business in 1970s
    - Information & Electronic Materials in 1990s
  - 2001: Corporate Spin-Off
    (LG Chem, LG Life Science and LG Household & Healthcare)
  - 2006: Acquired LG Daesan Petrochemicals Ltd.
  - 2009: Demerged Industrial Materials business (LG Hausys)
  - 2010: Acquired Dow Polycarbonate

- 2010 Sales: KRW 19.5 Trillion (based on IFRS)
- Workforce: 16,000 employees (as of Dec. 2010)
Global Network

27 Subsidiaries around the world

Manufacturing Subsidiaries (13) : China (9), Vietnam, India, Poland, USA
Marketing Subsidiaries (6) : China (2), USA, Brazil, Europe, India
Representative Offices (8) : Moscow, Istanbul(2), Ho Chi Minh City, Bangkok, Jakarta, Singapore, Tokyo
Main products of LG Chem are ‘Petrochemicals’ and ‘IT & Electronic materials’
Energy Efficiency in Korean Petrochemical Industry

I. Introduction of LG Chem

Statistics

4th largest manufacturing industry of Korea

- Production: 92 trillion KRW
- 10.8% of manufacturing industry

2nd Largest exporting products (2008)

- Exports: $45.9 billion

8th largest job market (manufacturing sector)

- Employees: 137,000
- 4.7% of manufacturing industry

World’s 6th largest production

- Shipment: $116.1 billion
- Global market share: 3.6%

Energy Efficiency

- World’s best level of energy efficiency
- Low GHG reduction potential
- High marginal cost for additional reduction

Energy Efficiency of Petrochemical Industries

Korean Policies for GHG/Energy Management

Corporate GHG reduction and energy saving targets are set along with the national target.

GHG/Energy Regulatory Progress

- **Nov. 2009**
  - National GHG reduction target setting
    - Announcement to reduce 30% of BAU level by 2020
    - Selection of the highest target from IPCC's recommended range (15 – 30%)
    - Reduction Methods: Renewable E, energy efficient products, green cars, CCS

- **Apr. 2010**
  - Effectuation of Framework Act on Low Carbon, Green Growth
    - GHG/energy target management
    - Emission trading
    - Carbon tax

- **Nov. 2010**
  - Announcement of Emission Trading legislative bill
    - System comes into effect from 2015

- **Mar. 2011**
  - Enforcement of GHG/Energy Target Management
    - Managing 70% of the national emissions
    - Completed 2012 target setting (Sep. 2011)

Korean National Target

(2005 - 594) Increment due to growth 813 (BAU) 2020 (Target) 569

- 30% - 4%

Corporate GHG reduction and energy saving targets are set along with the national target.
## Transition of Energy Saving Trend

<table>
<thead>
<tr>
<th>As - Is</th>
<th>To - be</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Setting</strong></td>
<td><strong>Negotiation with the government</strong></td>
</tr>
<tr>
<td>▪ Voluntary target</td>
<td></td>
</tr>
<tr>
<td><strong>Project Development (Saving Potential Analysis)</strong></td>
<td><strong>NPV ≥ 0</strong> (Even the project with NPV &lt; 0 due to carbon price)</td>
</tr>
<tr>
<td>▪ Relatively short Pay-Back Period: within 1 ~ 2 years</td>
<td></td>
</tr>
<tr>
<td><strong>Data Monitoring</strong></td>
<td><strong>Strict National Guideline</strong></td>
</tr>
<tr>
<td>▪ Internal Guideline</td>
<td></td>
</tr>
<tr>
<td><strong>Verification</strong></td>
<td><strong>Verification by 3rd parties</strong></td>
</tr>
<tr>
<td>▪ No verification</td>
<td></td>
</tr>
<tr>
<td><strong>Penalty for not reaching the target</strong></td>
<td><strong>Penalty and damage on corporate reputation</strong></td>
</tr>
<tr>
<td>▪ No penalty</td>
<td></td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td><strong>Energy projects will be vitalized with ‘National Emission Trading Scheme’</strong></td>
</tr>
</tbody>
</table>

II. Paradigm shift of energy saving
Corporate Strategy and Energy

III. Energy Management of LG Chem

Competitive Advantage

Cost Leadership
- Energy Management
- Energy Technologies

Differentiation
- Business
  - Polysilicon for Photovoltaic Business
  - EV Batteries
- Customer
  - Energy Audit
  - Carbon Footprint

Cost Leadership

Differentiation
Energy Management Vision

Green Manufacturing Process

Cost Saving

Minimizing Pollution Load

Head Office
- Channel for exchanging energy information
  1) Energy strategy development
  2) Energy data management
  3) Corporate-wide performance management

Plants
- Develop / apply energy efficient technology
  1) Energy reduction planning
  2) Energy efficient technology development
  3) Performance analysis / improvement

Goals

Role

Action Plans

Management of Energy Efficiency Indicator

Gov. Program

Energy Data Management

Technology Development

Maximization of Energy Efficiency

Transition to low energy consuming structure

Enhancement of energy management technology

III. Energy Management of LG Chem
Energy Campaign

III. Energy Management of LG Chem

Implementation Strategy

EIF (Energy Impact Free) ‘PRO’ Campaign with participation of all departments

P

Process Innovation

- Production process innovation
- Energy saving task forces
- Energy efficient atmosphere

R

Restructuring Companies & Divisions

- Enhancement of product added values
- Investment in new energy-efficient facilities
- Transition to low-energy consuming products

O

Optimization Management Staff Departments

- Development of mid-long term energy plans
- Technical support for energy saving
- Support conversion of energy & GHG into credit

Efficient Supports

EIF ‘PRO’ Campaign
Energy Campaign

‘PRO’ Process

- **Market Aiming**
  - Simplification & centralization
  - Acceleration of execution
  - Achievements

**P**
- **Process Innovation**
  - **Plants**
    - Energy saving T.F.T
    - Energy saving campaign
  - **Companies /Divisions**
    - Reduction of absolute amount of uses
    - Activities on productivity improvement

**R**
- **Restructuring**
  - **Staff Departments**
    - Enhancement of energy management efficiency
    - Training energy experts

**O**
- **Optimization Management**
  - **Companies /Divisions**
    - Improvement of energy intensive processes
    - Process destruction
    - Innovations in manufacturing methods
    - With no product defects

- **Staff Departments**
  - Improvement of transparency in reduction performances (government verification)
  - Computerization of energy management
  - Converting GHG into credits
  - Customized train on technology

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Achievement of mid-long term reduction plan

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III. Energy Management of LG Chem
Project Management Process

Energy Project Management Schedule

**CONTENTS**
- Selection of subject process lines
- Registration
- Basic activities analysis
- Reconfirming concepts of themes

**OUTPUT**
- Scheduling
- Result projection
- Analysis on factors to be supported

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Registration of 1st &amp; 2nd themes</td>
<td>Project Process Monitoring (Jun, Nov)</td>
<td>Presentation / Assessment (Dec)</td>
<td>F/U management</td>
</tr>
<tr>
<td>- Monitoring changes</td>
<td>- Monitoring changes</td>
<td>- Assessment on practices</td>
<td>- F/U management</td>
</tr>
<tr>
<td>- Check on progress</td>
<td>- Effectiveness identification</td>
<td>- Executed facts confirmation</td>
<td>- Developing next projects</td>
</tr>
<tr>
<td>- Consulting on direction of project [study beforehand/advice]</td>
<td>- Spreading method</td>
<td>- Effectiveness analysis</td>
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**III. Energy Management of LG Chem**
National EnMS Trend

Korean government is in process of introducing EnMS (Energy Management System) to reduce energy importing costs and GHG emissions through effective energy management.

✅ Needs of standardization and systematic approach of energy savings
- Provision of standard methods for energy reduction through energy efficiency improvement.
- Corporate wide management system construction
- Establishment of national foundation for climate change

✅ Government policies on energy savings for industry
- Green Growth 5-Year Plan (2009 ~ 2013) : introduction of NA, EnMS
- The 1st National Energy Master Plan (2008 ~ 2030) : introduction of NA, expansion of EnMS
- The 4th Energy Usage Rationalization Master Plan (2008 ~ 2012) : mandatory EnMS implementation for NA subjects
- Introduction of Energy Target Management / Energy Management System (MKE)

✅ Foundation of Energy Target Management
- Analysis in energy aspect – Energy target setting – Improvement projects – Performance management process
- Identification of energy reduction factors by corporate wide efficiency control & designing / purchase / internal & external diagnosis
- Securing reliability of energy data
- Building Infrastructure through managing MRV, documents, records, internal verification, and performance
## EnMS Concept

<table>
<thead>
<tr>
<th>Paradigm Shift of Corporate Energy Management</th>
<th>International Standard</th>
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<tbody>
<tr>
<td>Energy team-level management</td>
<td>Energy Policy</td>
</tr>
<tr>
<td>Short-term improvements</td>
<td>Energy Planning</td>
</tr>
<tr>
<td>Focused on energy supply</td>
<td>Management review</td>
</tr>
<tr>
<td>Bottom-up target setting</td>
<td>Implementation and operation</td>
</tr>
<tr>
<td></td>
<td>Checking and correction</td>
</tr>
<tr>
<td></td>
<td>Internal Evaluation</td>
</tr>
<tr>
<td></td>
<td>Corrective and preventive action</td>
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### Energy Team-Level Management
- Focused on energy supply
- Bottom-up target setting

### Corporate-Wide Management
- Mid to long-term and continual improvements
- Purchasing/planning teams and end-users included
- Top-down target setting

### International Standard
- Continual improvement
- Monitoring, measurement and analysis
Coping with Climate Change through Energy Saving

- Energy using installation → GHG emitting source
- Energy saving project → GHG reduction project
- Investment effect of energy saving facilities → GHG marginal abatement cost
- Energy saving potential → GHG reduction potential

Energy Improvement through Simulation

Simulation

- Load Calculation
  - Used to identify volumes and capacities of various facilities
- Energy Analysis
  - Energy forecast
  - Provision of optimizing application condition

Energy Saving & Climate Change

Pre-Analysis

- Process checkups
- Process analysis for each plant
- System checkups by simulation

Applicability & effectiveness analysis

- Energy saving items
- Draw items
- GHG reduction items
- Applicability analysis & consultation with plants
- Simulation efficiency test
- Applicability test

Cost & effectiveness analysis

- Energy saving effectiveness analysis
- GHG reduction effectiveness analysis
- Investment analysis
- Investment analysis

Strategy

- Link with inventory
- Confirmation of implementing items
- Implementation plan for EnMS
- Strategy to cope with FCCC
- Report
EnMS Organization (Ochang Plant)

IV. EnMS Practices

[CEO]

[Executive officer for Energy Management]

[Head of Energy Department]

Director of Environment and Safety Department

Environment / Energy Team

Battery Production

EV Production

Optical Materials Production

Staff

Production Team

Equipment Engineering Team

Production Team

Equipment Engineering Team

Production Team

Equipment Engineering Team

Staff

EnMS Organization (Ochang Plant)
Project Development Process

**Energy Facilities & Measuring Status Identification**
- Identification of status on energy using facilities by developing relevant inquiry forms.
- Identification of status on plants’ energy meters.

**Energy Balance**
- Identification of monitoring points and energy current by drawing energy maps.
- Identification of amount of energy input by each process, facility and plant.

**Data Gathering & Analysis from Energy Aspect**
- Development and management of energy aspect analysis form.
- Management of segmented data: energy cost, power, fuel, and energy intensity.

**Analysis Results**
- Power utilities: compressor, freezer, large pumps
- Heat generating utilities: steam boiler, thermal fluid boiler, RTO

**Improvement Method**
- Deriving energy saving items through energy aspect analysis
- Setting targets for technology development & specific energy cost reduction
## Application of EnMS with National Energy Policies

<table>
<thead>
<tr>
<th>Categories</th>
<th>EnMS</th>
<th>National GHG/Energy Mgmt.</th>
<th>Energy Audit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>GHG reduction &amp; energy saving</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subjects</strong></td>
<td>Organization &amp; system oriented</td>
<td>Plant oriented</td>
<td>Installation oriented</td>
</tr>
<tr>
<td><strong>Basis</strong></td>
<td>ISO 50001 / KSA 4000</td>
<td>Green Growth Act</td>
<td>Energy Usage Rationalization Act</td>
</tr>
<tr>
<td><strong>Characteristics</strong></td>
<td>Improvement activities through systemic approach</td>
<td>Data based target setting &amp; implementation</td>
<td>Identification of improvement factors and implementation through facility diagnosis</td>
</tr>
<tr>
<td><strong>Basic activities</strong></td>
<td>• Analysis on energy related works throughout the whole organizational activities  • Analysis on Specific energy inventory, effectiveness</td>
<td>• Investigating plants’ energy usages and target setting  • Rational target setting considering the BAU (Business as usual)</td>
<td>• Audit and improvement activities by processes or installations  • Consultation from auditing experts</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>• Eco-product purchase  • Considering energy when adding facilities  • Managing real time energy data  • Statistical analysis</td>
<td>Regulations &amp; incentives</td>
<td>Auditing organizations &amp; equipments</td>
</tr>
</tbody>
</table>
Future Plans

IV. EnMS Practices

Target Management

• Roles & acts of executives
• Resource support (human, financial, technology)
• Provide authorities & responsibilities
• Eco–product purchase
• Performance assessment
• Incentives

Energy Data

Energy Forecast

EnMS

Regular Reporting

Improvement Target

Green Growth Act

Implementation

Energy Audit

Organization

Technology

Facility

• Energy map
• Inventory & efficiency analysis
• Energy management guideline
• Eco–product design
• Eco–product process
• Energy efficient projects
• Meters & monitoring methods

• Facility audit
• Process re–engineering
• Installation of meters
• Energy efficient facilities
Thank You!!