Installation Co-generation system 7.8 MW for increasing energy usage efficiency of manufacturing

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Facility Manager
Siam Denso Manufacturing Co., Ltd
Agenda

1. Company profile
2. Company environment management
3. Company energy management
4. JCM Project background
5. Introduction of Co-generation 7.8 MW system
6. Environment report study for work permit
7. Existing electric system upgrade for work permit
8. Co-generation operation result
9. Q/A
1. Company profile

SIAM DENSO MANUFACTURING CO., LTD (SDM)

Company Name: Siam DENSO Manufacturing Co., Ltd
Establishment: February 8, 2002
Employee: 3,943 people (as of Mar 2019)
Address: Amata City I.E.Chonburi, Thailand
700/618 M.4 T. Bankao A. Panthong
Chonburi 20160

DIESEL ENGINE TECHNOLOGY
COMMON RAIL SYSTEM: CRS

Diesel Products
HP3
HP5

Gasoline Products

Siam DENSO produce high pressure injector each diesel and gasoline which are Eco friendly.
2. Company environment management

The Environment Goals: To reduce environment impact, achieve highly efficient mobility and thereby help create an Eco-friendly and sustainable society

- Prevention of global warming
- Prevention of air pollution
- Effective utilization of resources
- Conservation of water resources

**Eco Vision 2025**

What we can do to preserve the planet.
2. Company environment management [Eco-Vision 2025]

ACTION 10

ENERGY 1/2

01 Ultimate fuel efficiency

02 Minimum CO₂ 'Monozukuri'

CLEAN × 2

04 Eco materials & low emissions

05 Minimum impact production

GREEN × 2

07 New green technologies

08 Nature rich workplace

09 Environmental volunteer action

10 Environmental value efficient management

Products

Production

Associates

Management
## 3. Company energy management

### Energy management tool

- ECO VISION 2025
- System Certification: SGS

### Long term energy target

- t-CO₂ / Sale (MB)
- CO₂ reduction 50% within 2025

<table>
<thead>
<tr>
<th>CO₂ reduction concept</th>
<th>FY’2016</th>
<th>FY’2017</th>
<th>FY’2018 - Present</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Reduce energy usage loss &amp; over demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply side</td>
<td>Not over supply</td>
<td>Supply by request</td>
<td></td>
</tr>
<tr>
<td>Demand side</td>
<td>No over use</td>
<td>No energy leak</td>
<td>No stand by loss</td>
</tr>
<tr>
<td>“JIT supply concept”</td>
<td></td>
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</tbody>
</table>

| **Step 2** | Apply energy technology & innovation | | |
| (1) Energy visualize | SCADA system | | |
| (2) Energy innovation | LED | LED | Inverter |
| (3) High efficiency machine | Air compressor Variable speed | Electric booster | |

| **Step 3** | Increasing renewable energy & high energy source efficiency | | |
| (1) Co-generation system | | | |
| (2) Solar energy | | “Request investment support from government” | |
4. JCM Project background

**Project approach**

**DENSO Co-generation system**

**Japan co-generation plant**
- Installed year: 1997-2016
- Installed plant Total: 13 plant
- Installed capacity Total: 112 MW

**Thailand (SDM plant)**

**Euro co-generation plant**
- Installed year: 2013-2014
- Installed plant Total: 2 plant
- Installed capacity Total: 4 MW

**Asia co-generation plant**
- Thailand (Capacity 7.8 MW), 2018 Year
- Indonesia (Capacity 2 MW), 2019 Year

We have success of CO$_2$ reduction from Japan plant and extend result to oversea plant

**Cooperation activity**

- Government: Ministry of Environment
- DENSO: DENSO Corporation
- Engineering contract: Toshiba plant systems & services corporation
- Ministry of Natural Resource and Environment
- Siam DENSO Manufacturing
- Tosplant Engineering
5. Introduction Co-generation 7.8 MW system

Gas Engine 7.8 MW
- Efficiency = 48.5%
- Low NOx < 57 ppm.

Absorption Chiller
- Efficiency (COP) = 1.39

Gas
- Up gas pressure from 1.5 bar to 4.5 bar

Electric control room

SCR

Stack 30m.

HRSG
- Efficiency = 13%

Pump

Cooling tower

JCM investment support 40%, Start operation Jul’2018
5. Introduction Co-generation 7.8 MW system

- Natural gas company
- NG station
- Gas compressor
- Gas engine 7.8 MW
- Electric company
- Electric 6.7 MW
- Electric 7.3 MW
- EXCHANGER
- Hot water
- Steam 2.6 ton/h
- Steam 0.5 ton/h
- Cool water 700 RT 7-8 °C
- Stack
- CEMS
- IEAT
- Absorption chiller
- NOx on-line
- DENSO
- Co-generation Plant Diagram

- Exhaust gas 331 °C
- 1.5 Bar
- 4.5 Bar
- Electric 6.7 MW
- Electric 7.3 MW
- 14 MW
### 6. Environment report study for work permit

<table>
<thead>
<tr>
<th>Items</th>
<th>Government concern</th>
<th>Request</th>
<th>Activity support</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Industrial Estate Authority of Thailand (IEAT)</td>
<td>NOx &lt; 0.171 kg/Rai/day (at stack high 30 m.)&lt;br&gt;NOx control &lt; 18 ppm.</td>
<td>1. Select high efficiency gas engine type&lt;br&gt;*Kawasaki model KG-18&lt;br&gt;*NOx &lt; 57 ppm.&lt;br&gt;2. Design Selective Catalytic Reduction (SCR) to reduce NOx &lt;15 ppm.</td>
<td>Mar’17-Apr’17 (2 month)</td>
</tr>
<tr>
<td>2</td>
<td>Industrial Estate Authority of Thailand</td>
<td>Initial Environment Examination Report (IEE) for Co-generation system (All equipment system)</td>
<td>Siam DENSO explain details of project to public</td>
<td>May’17-Aug’17 (4 month)</td>
</tr>
</tbody>
</table>

#### Evaluate and Preparation Plan during

**1. Preparation construction period**
- Design base on law
- Public relation meeting

**2. During construction period**
- Transportation control
- Air pollution, sound control
- Waste management
- Public health and safety control

**3. During operation period**
- Social and public relation
- Public health and safety control
- Maintenance control
- 1/6 Month IEE follow up report
### 7. Existing Electric System Upgrade for Work Permit

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</thead>
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<tr>
<td>3</td>
<td>Provincial Electricity Authority (PEA)</td>
<td>Install inter-trip protection system of 115 kV electric system</td>
<td>Siam Denso Co-gen 115/22 kV substation</td>
<td>Nov’17-Feb’18 (4 month)</td>
</tr>
</tbody>
</table>

**PEA:** Amata Nakorn

**PEA:** Amata Bgrim #3 Substation

**PEA:** Panthong Substation

**EGAT:** Panthong

**Amata Bgrim# 1-2 Substation**

**Siam Denso Co-gen**

Fiber optic

Inter trip installation point

SDM inter-trip installation all 115 kV substation in Amata City Industrial Estate

Siam Denso inter-trip installed

115/22 kV Substation
8. Co-generation operation result

Company energy usage and CO2 reduction

Company energy usage

- Electric buy from PEA
- Electric from Co-gen
- Solar roof top

Company energy usage over FY'15 to FY'19:

- Before
- Jul'18
- Aug'18
- Sep'18
- Oct'18
- Nov'18
- Dec'18
- Jan'19
- Feb'19
- Mar'19
- Apr'19
- May'19
- Jun'19
- Jul'19

Company energy reduction

- CO2 reduction by Co-generation

Company energy reduction performance

- t-CO2/MB
- Result (t-CO2/MB)
- Target (t-CO2/MB)

Company energy reduction:

- Before FY'17: 50,218 t-CO2
- Estimate: 44,314 t-CO2
- Result FY'18: 43,906 t-CO2

- FY'15: 3.21 t-CO2/MB
- FY'16: 3.08 t-CO2/MB
- FY'17: 2.85 t-CO2/MB
- FY'18: 2.55 t-CO2/MB
- FY'19: 2.29 t-CO2/MB
- FY'20: 2.00 t-CO2/MB
- FY'21: 1.71 t-CO2/MB
- FY'22: 1.49 t-CO2/MB

- 50% CO2 reduction by Co-generation
- 0.5% Solar roof
- 49.5% Electric buy from PEA
- 50% Electric from Co-gen