Feasibility Studies with the Aim of Developing a Bilateral Offset Credit Mechanism FY2011

Studies for Project Exploration and Planning

CO₂ Emission Reduction by Modernizing the Plant Operation System in Indonesia

New Energy and Industrial Technology Development Organization (NEDO)
Yokogawa Electric Corporation
Bilateral Offset Scheme Feasibility Study  Country : Indonesia  Category : Energy Efficiency

CO₂ Emission Reduction by Modernizing the Plant Operation System in Indonesia
Proposer: Yokogawa Electric Corporation

FS Scope

Investigate CO₂ emission and Energy saving potential by modernizing the automation system and implementing the latest operational technologies at large scale production sites

Study Items

1. Target Site Survey
2. Operation and Control Analysis
3. CO₂/ Energy saving potential study
4. Business ROI study

Project Concept

Baseline Analysis

Conventional Plant

1: Update Operation System
Diagnose Saving Potential
Advanced Control Technology
Advanced Operation Technology
2: Implement Latest Technology
Control and Measurement Systems

Modern Plant

Equipments and Pipe lines

MRV of Saving Effect

Target & Technology selection
Estimate Saving Potential
Define MRV methodology
Business ROI study

Local Partner Company

Indonesia : Oil producer

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Oil refining plants operate many huge equipments to heat, distillate, crack sulfur/nitrogen or reforming crude oil. These equipments consume enormous amount of energy so that only a little energy saving by eliminating heat/pressure/quality variation enables huge CO$_2$ emission reduction.
Project Boundary

Purchase fuel
- Coal
- Heavy oil
- Natural gas

Purchase energy
- Steam
- Electricity

Raw materials
- Crude oil

Oil Refinery
- Equipment group
  - CDU
  - HDU
  - CCU
  - Furnace
  - Pump
  - Compressor
  - Boiler
  - Private power generation

Equipment
- Fuel
- Steam
- Elect
- Fuel

Products
- LP gas
- Naphtha
- Gasoline
- Kerosene
- Light oil
- Light oil
- Heavy oil
- Asphalt
- Sulfur (By-product)
- Flare

Self consumption
- By-product gas consumption
  (Self consumption)

By-product gas consumption
- Fuel gas

Selling energy
- Steam
- Electricity

Release into atmosphere of energy
- Steam
- Electricity

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Step1. Project Boundary
- Overall refinery

Step2. Baseline energy (reference) calculation
- Solomon EII ® can be applied in this project

Step3. Energy reduction of a project year

- Energy consumption
  \[ FC_y = \sum_i \left( FC_{i,y} \times \frac{NCV_{i,y}}{NCV_{fueloil,y}} \right) \]
  
  FC: Fuel Consumption of each fuel, NCV: True Fuel Heat Value

- Energy reduction
  \[ FR_y = \left( \frac{EII_{ref}}{EII_y} - 1 \right) \times FC_y \]
  
  FR: Fuel Reduction, EII: Energy Intensity Index

Step4. CO₂ emission reduction

- CO₂ emission rate
  \[ EF_y = \text{MIN} \left[ \sum_x \frac{\sum_i FC_{i,x} \times NCV_{i,x} \times EF_{i,x}}{\sum_i FC_{i,x} \times NCV_i}, \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{i,y}}{\sum_i FC_{i,y} \times NCV_{i,y}} \right] \]

- CO₂ reduction volume
  \[ ER_y = FR_y \times NCV_y \times EF_y \]
  
  ER: Emission Reduction, EF: Emission Factor

Note: co-work with Mitsubishi UFJ Morgan Stanley Securities CO., Ltd.
<table>
<thead>
<tr>
<th>Area</th>
<th>Technology</th>
<th>Energy Saving (FOE-kL/Year)</th>
<th>CO₂ Reduction (ton-CO₂/Year)</th>
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</thead>
<tbody>
<tr>
<td>Management</td>
<td>PDCA cycle management for energy consumption monitoring and energy saving activity through Energy management committee</td>
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<tr>
<td>KPI Monitoring</td>
<td>Production management</td>
<td>1,900</td>
<td>4,560</td>
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<td>Automatic EMS</td>
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<td>Operation monitoring</td>
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<td>Real-time monitoring and</td>
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<td>Operational Improvement</td>
<td>Furnace and boiler O₂ control</td>
<td>22,900</td>
<td>54,960</td>
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<td></td>
<td>Operation and Control System</td>
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<td>Advanced Process Control (APC)</td>
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<td>Operation and Control System (DCS)</td>
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<tr>
<td>Total Energy Saving Potential</td>
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<td>24,800</td>
<td>59,520</td>
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