Energy Saving for Air-Conditioning at Shopping Mall with High Efficiency Centrifugal Chiller
About Pakuwon Jati & Tunjungan Plaza

**Pakuwon Jati & Tunjungan Plaza**

- The most famous and symbolic shopping mall
- Opened in 1985 as the first large-scale mega complex in Surabaya
- Total area 165,000m2 + α (Still expanding)

**Superblock Gandaria City**

Located on a 7.5 hectare site, Superblock Gandaria City is the largest integrated mixed-use development in South Jakarta, with a total gross floor area of 564,784 square meters and over 4,000 car park lots. Positioned as a "one-stop lifestyle hub" Superblock Gandaria City consists of a retail mall (Gandaria City), two towers of executive condominium (Gandaria Heights), a Green Mark office tower (Gandaria Ria 8) and a five-star hotel.

Strategically located in the prime residential neighborhood and emerging commercial hub of South Jakarta, Superblock Gandaria City is situated on the main thoroughfare that connects northwest and south Jakarta and is 5 kilometres away from the outer ring road.

**Superblock Tunjungan City**

Superblock Tunjungan City is a landmark and lifestyle destination of East Jakarta. Located on a 7.4-hectare site in the heart of Surabaya's City Center, Tunjungan City is the first Superblock in Indonesia and consists of Tunjungan Plaza, Mandiri Office Tower, Condominium Regensi, and the five-star Sheraton Surabaya Hotel and Towers.

**Superblock Kota Kasablanka**

Located on a 2.5 hectare site, Superblock Kota Kasablanka is the largest integrated mixed-use development in South Jakarta, with a total gross floor area of 564,784 square meters and over 4,000 car park lots. Positioned as a "one-stop lifestyle hub" Superblock Kota Kasablanka consists of a retail mall (Kota Kasablanka).
Project Scheme

Inter-governmental (G-to-G)

Inter-city (City to City)

Surabaya

Kitakyushu

Indonesia

Japan

International Consortium (B-to-B)

Building Owner

EPC Company
1. Objective of the Kitakyushu Model

Kitakyushu, which faced and overcame pollution for the first time in Asia, became a leading environmental city in Japan.

Kitakyushu is developing the Kitakyushu Model (support tool) that systematically arranges information on the technologies and know-how of Kitakyushu from its experience in overcoming pollution to its quest as an environmental city.

Kitakyushu is utilizing the Kitakyushu Model to promote the export of customized infrastructure packages to cities overseas, and grow together with Asia.

2. Applications of the Kitakyushu Model

Support tool to examine future ideal city image and for cities to take appropriate measures and procedures to achieve this.

Support tool to examine management systems for waste, energy, water and sewage services, and environmental protection.

Support tool to develop sustainable master plans that integrates waste, energy, water and sewage services, and environmental protection.
Transition of JCM Feasibility Study in Surabaya

<table>
<thead>
<tr>
<th>FY2013</th>
<th>FY2014</th>
<th>FY2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy sector</td>
<td>Energy sector</td>
<td>Energy sector</td>
</tr>
<tr>
<td>Transportation sector</td>
<td>Solid waste sector</td>
<td>Solid waste sector</td>
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<tr>
<td>Solid waste sector</td>
<td>Solid waste sector</td>
<td>Solid waste sector</td>
</tr>
<tr>
<td>Water resource sector</td>
<td>Solid waste sector</td>
<td>Solid waste sector</td>
</tr>
</tbody>
</table>

**Prioritization** (feasibility & cost-effectiveness)

- These FS has been developed by Kitakyushu City and IGES
- Tunjungan Plaza was one of potential buildings in Energy sector

**Application & Expansion** (feasibility study → model project)
The project aims to reduce electricity consumption in the shopping mall through introducing advanced & efficient Japanese centrifugal Chiller system. The project is to replace existing central cooling system with high efficient centrifugal chiller with capacity of 966TR x 4 units and 569TR x 1 unit in Pakuwon’s shopping mall, Tunjungan Plaza, as well as to replace existing 8 cooling towers with efficient Japanese models.

**Estimated GHG Emission Reductions**

398tCO₂/year
The GHG emission reductions are calculated based on the estimated electricity consumptions based on the conservatively estimated COP of a reference cooling system and a project COP of the centrifugal chiller as well as the grid emission factor.

**Outline of GHG Mitigation Activity**

- The project aims to reduce electricity consumption in the shopping mall through introducing advanced & efficient Japanese centrifugal Chiller system.
- The project is to replace existing central cooling system with high efficient centrifugal chiller with capacity of 966TR x 4 units and 569TR x 1 unit in Pakuwon’s shopping mall, Tunjungan Plaza, as well as to replace existing 8 cooling towers with efficient Japanese models.

**More than 30% Energy Saving**

Centrifugal chiller in the A/C system

**Sites of JCM Project**

- Jakarta
- Surabaya
- Java Island
- Tunjungan Plaza(@Surabaya)
Advantages of Introduced Technology

**HC-F-GXG-S/GFG-S Series**

1. **Ozone-Safe HFC-134a**
   Adopting HFC134a refrigerant

2. **High Efficiency**
   COP over 6.5 (in case of ΔT=5 °C)
   Excellent Energy Saving

3. **Compact Design**
   Space Saving & Easy Replacement

4. **Easy Operation**
   With Color Touch Panel Screen

5. **High Reliability**
   based on 80 years’ experiences
   with various unique technologies
   Wide operation range (at high CW temp)
   No Surging Design etc.

**Capacity Range**

300 ~ 2,500RT (1,055 ~ 8,790kW)

with single compressor
380~460V, 3/3.3kV, 6/6.6kV, 10/11kV, 50/60Hz

Max. 5,000RT (17,580kW) with
Twin Module (LEAD-LAG) Application
# Project Progress

## Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>4Q</td>
<td>1Q</td>
<td>2Q</td>
<td>3Q</td>
</tr>
<tr>
<td><strong>Project Implementation</strong></td>
<td>▲Project Start</td>
<td>Design, Manufacture, Factory test, Shipping</td>
<td>Replacement of Chillers and Cooling Towers ▲Completion</td>
<td></td>
</tr>
<tr>
<td><strong>MRV</strong></td>
<td>Preparation of MRV methodology ▲Validation</td>
<td>Monitoring ▲Registration</td>
<td>▲Verification Credit issuance ▲</td>
<td></td>
</tr>
</tbody>
</table>

*Utilize existing MRV methodology(ID_AM002)*

## Implementation Image

- Chillers before replacement
- Carrying out
- Unloading Machinery
Project Progress

Implementation Image

Demolishing wall for unloading
Unloading Chiller
Lifting Chiller from unloading shaft
Chillers after replacement
Cooling Towers before replacement
Cooling Towers after replacement

Challenges in Implementation
- Every Chillers and CTs had to be replaced one by one, while keeping normal operation of shopping mall.
- Unloading conditions of Chillers and limited time and work space of CTs
Energy Saving Result (vs BaU)

More than 30% Reduction
(Approx. 3.4BIDR/year cost saving)
## Energy Consumption

<table>
<thead>
<tr>
<th>MONTHLY</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td>Januari</td>
<td>1,360,800</td>
<td>1,324,500</td>
<td>1,197,000</td>
<td>953,900</td>
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<td>February</td>
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<td>882,800</td>
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<tr>
<td>Maret</td>
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<td>990,800</td>
<td>795,800</td>
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<td>April</td>
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<td>1,304,000</td>
<td>1,100,800</td>
<td>893,900</td>
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<td>Mei</td>
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<td>1,055,900</td>
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<tr>
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<td>1,310,900</td>
<td>1,727,200</td>
<td>1,140,400</td>
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<td>Juli</td>
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<td>1,223,100</td>
<td>382,000</td>
<td>1,110,600</td>
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<td>Agustus</td>
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<td>1,239,200</td>
<td>1,026,500</td>
<td>933,900</td>
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<tr>
<td>September</td>
<td>1,234,500</td>
<td>1,144,100</td>
<td>984,600</td>
<td>665,200</td>
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<tr>
<td>Oktober</td>
<td>1,047,500</td>
<td>1,150,700</td>
<td>869,000</td>
<td>1,246,400</td>
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<tr>
<td>November</td>
<td>1,134,500</td>
<td>1,210,600</td>
<td>926,400</td>
<td>633,700</td>
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<tr>
<td>Desember</td>
<td>1,184,000</td>
<td>1,119,000</td>
<td>896,600</td>
<td>964,400</td>
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<tr>
<td>TOTAL (KWH)</td>
<td>15,642,000</td>
<td>14,764,400</td>
<td>12,283,500</td>
<td>11,057,300</td>
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</tbody>
</table>
Thank you

Our goal is to provide reliable environmentally-friendly integrated facilities service, as your most trusted partner.