

# Energy Saving for Air-Conditioning at Shopping Mall with High Efficiency Centrifugal Chiller



# About Pakuwon Jati & Tunjungan Plaza



**TUNJUNGAN PLAZA RETAIL MALL**

- **The most famous and symbolic** shopping mall
- Opened in 1985 as the first large-scale mega complex in Surabaya
- Total area 165,000m<sup>2</sup> + a (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 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**



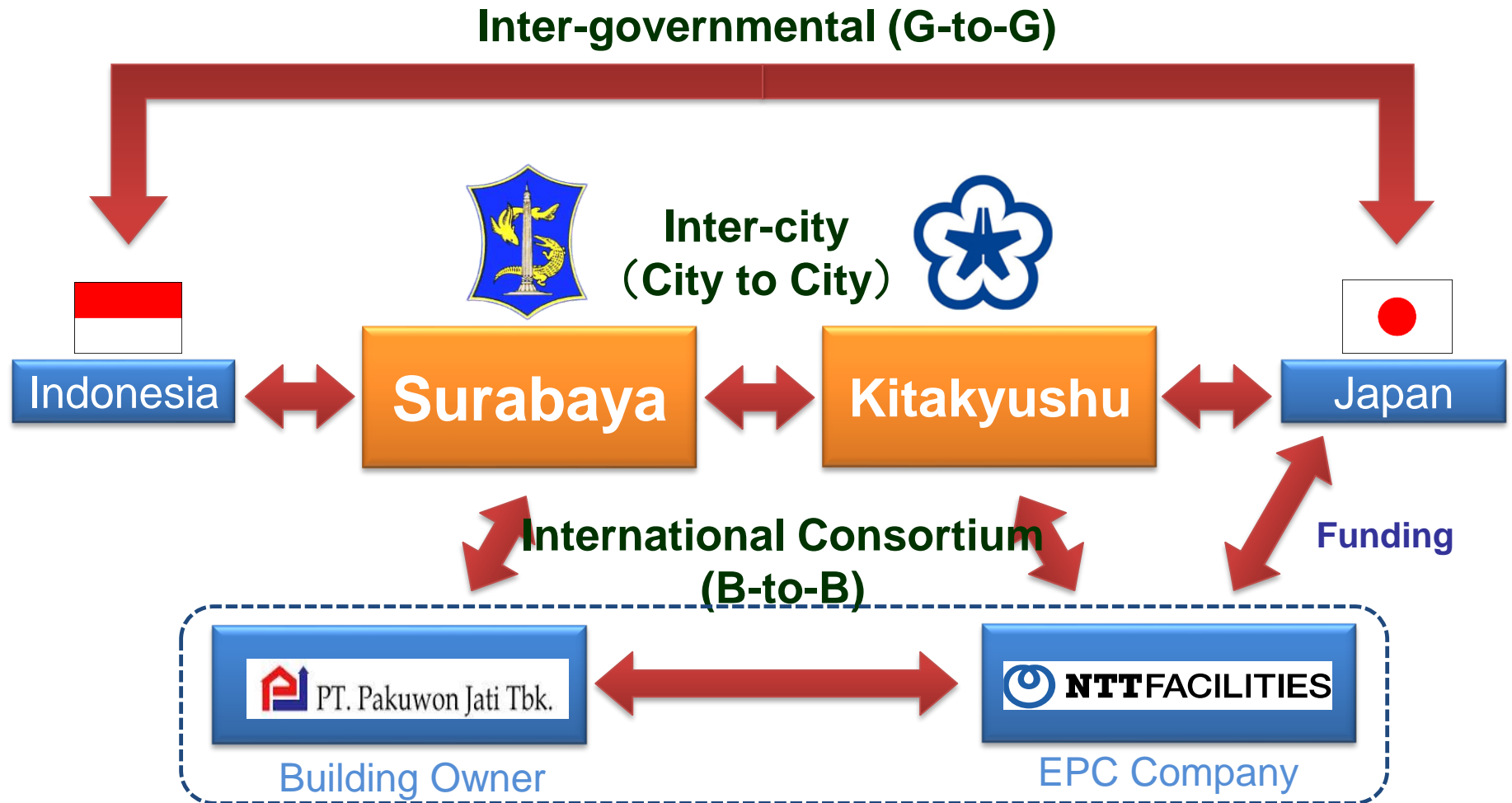
Superblock Tunjungan City is a landmark and lifestyle destination of East Indonesia. Located on a 7.4-hectare site in the heart of Surabaya's City Center. Tunjungan City is the first Superblock in Indonesia and consists of Tunjungan Plaza, Mandiri Office Tower, Condominium Regensi and the five-star Sheraton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

## **SUPERBLOCK KOTA KASABLANKA**



Located on a 9.5 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





# Background of Kitakyushu – Surabaya City-to-City Cooperation

## 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.



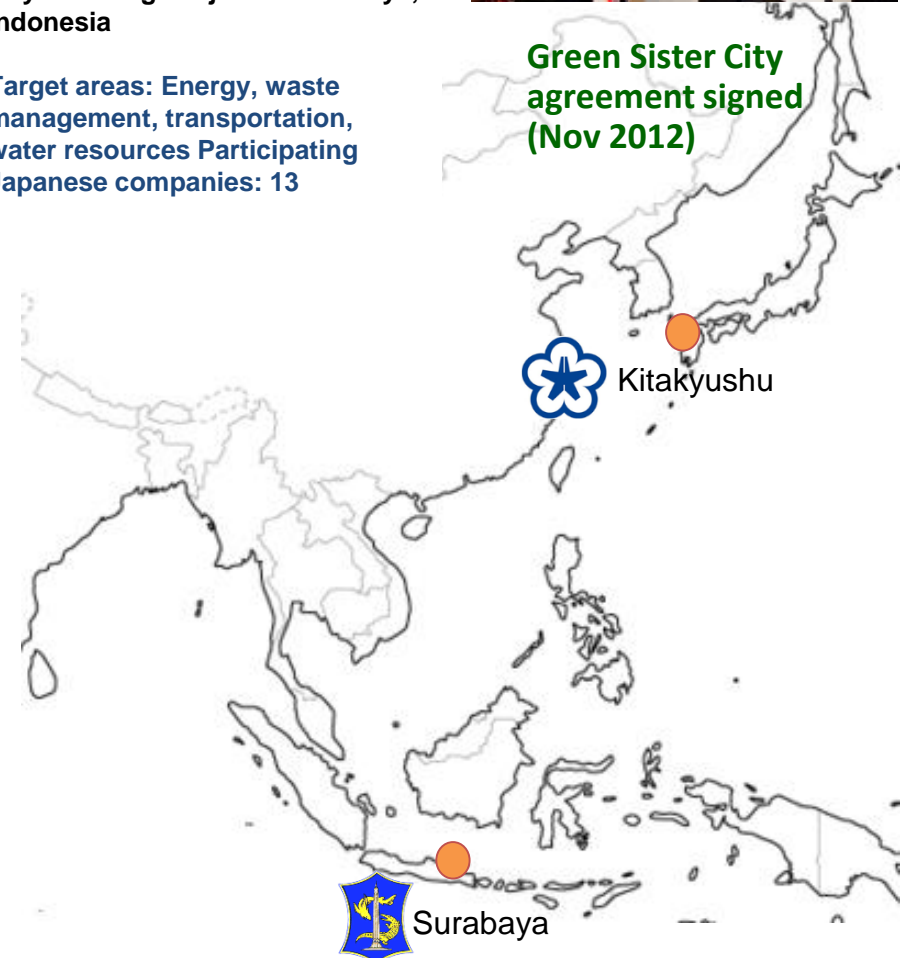
Surabaya,  
Indonesia: 2<sup>nd</sup>  
largest city in  
Indonesia with a  
population of 3

<FY 2013- 2015> Low Carbon  
City Planning Project in Surabaya,  
Indonesia

Target areas: Energy, waste  
management, transportation,  
water resources Participating  
Japanese companies: 13



Green Sister City  
agreement signed  
(Nov 2012)



# Transition of JCM Feasibility Study in Surabaya

**FY2013**

Energy sector

63,000t-CO<sub>2</sub>/yr

Transportation sector

1,000t-CO<sub>2</sub>/yr

Solid waste sector

72,000t-CO<sub>2</sub>/yr

Water resource sector

15,000t-CO<sub>2</sub>/yr

**FY2014**

Energy sector

Solid waste sector

**FY2015**

Energy sector

Solid waste sector



Coordinating Ministry  
for Economic Affairs  
Republic of Indonesia



Ministry of the Environment  
Government of Japan

**Joint Crediting Mechanism (JCM)  
Model Project (2015)  
INDONESIA and JAPAN**

**Prioritization**

(feasibility & cost-effectiveness)

**Application & Expansion**

(feasibility study → model project)

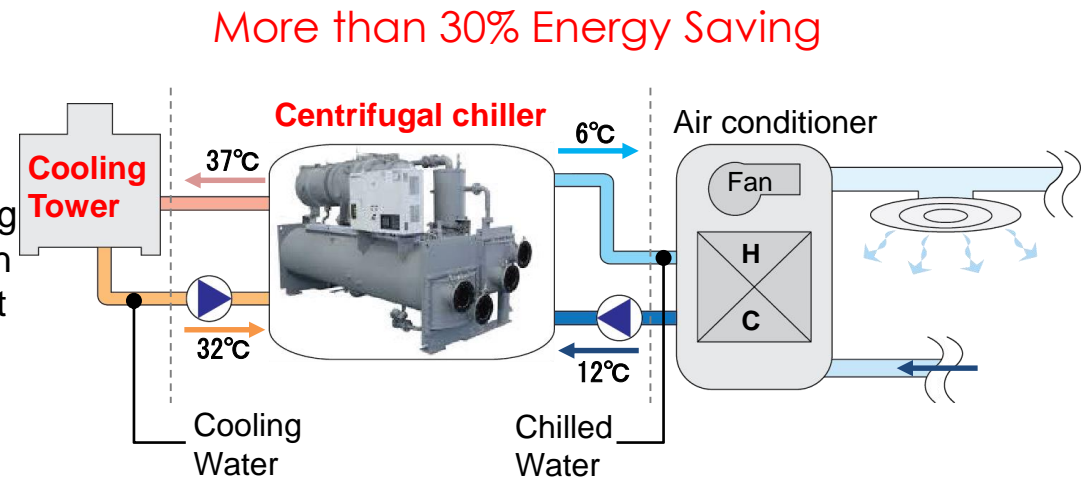
- These FS has been developed by Kitakyushu City and IGES
- Tunjungan Plaza was one of potential buildings in Energy sector

# Project Outline

## 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.

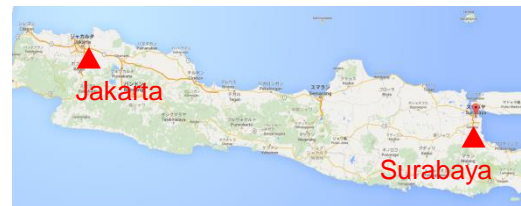


## Estimated GHG Emission Reductions

### 398tCO<sub>2</sub>/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.

## Sites of JCM Project



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  $\Delta T=5^{\circ}\text{C}$ )

*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

	2015	2016				2017				2018			
	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Project Implem entation	▲Project Start Site Survey, Design		Manufacture, Factory test, Shipping									◀ Current	
				Replacement of Chillers and Cooling Towers									
					▲Completion								
MRV				Preparation of MRV methodology PDD					Monitoring				
					▲Validation					▲Registration		▲Verification	▲Credit issuance▲

\*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

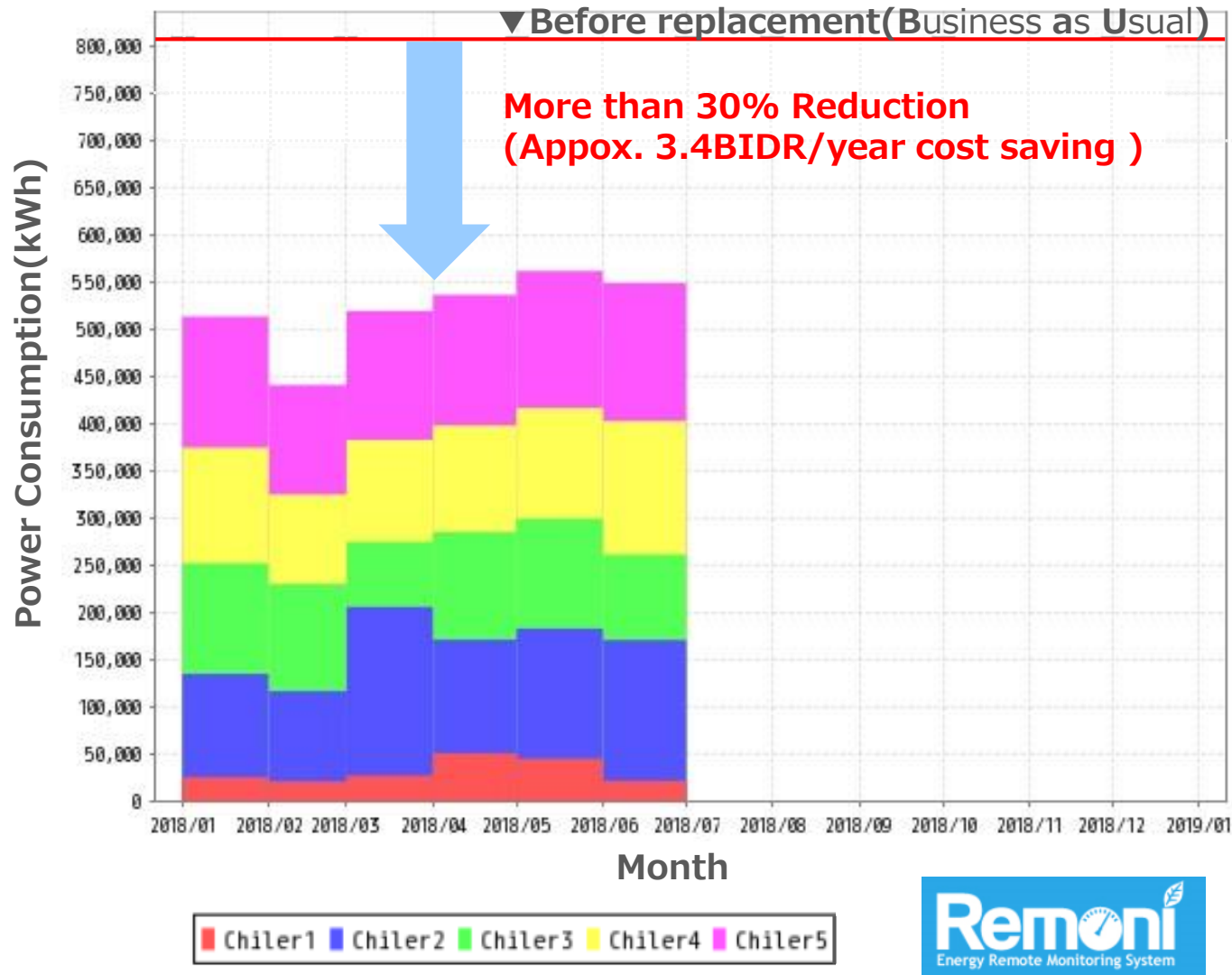


Cooling Towers after replacement

## 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)



# Energy Consumption

<b>MONTHLY</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Januari	1,360,800	1,324,500	1,197,000	953,900
February	1,456,200	1,304,800	1,126,700	882,800
Maret	1,313,100	1,198,700	990,800	795,800
April	1,481,700	1,304,000	1,100,800	893,900
Mei	1,446,200	1,234,800	1,055,900	836,300
Juni	1,406,100	1,310,900	1,727,200	1,140,400
Juli	1,269,200	1,223,100	382,000	1,110,600
Agustus	1,308,200	1,239,200	1,026,500	933,900
September	1,234,500	1,144,100	984,600	665,200
Oktober	1,047,500	1,150,700	869,000	1,246,400
November	1,134,500	1,210,600	926,400	633,700
Desember	1,184,000	1,119,000	896,600	964,400
<b>TOTAL (KWH)</b>	<b>15,642,000</b>	<b>14,764,400</b>	<b>12,283,500</b>	<b>11,057,300</b>



Thank you

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