

Kawasaki International Eco-Business Forum on Nov. 15, 2023

# **Expectations for the Development of Green Innovation from Urban-Industrial Symbiosis in Kawasaki City**

## **From Urban-Industrial Symbiosis to Sustainable Future in Kawasaki City**

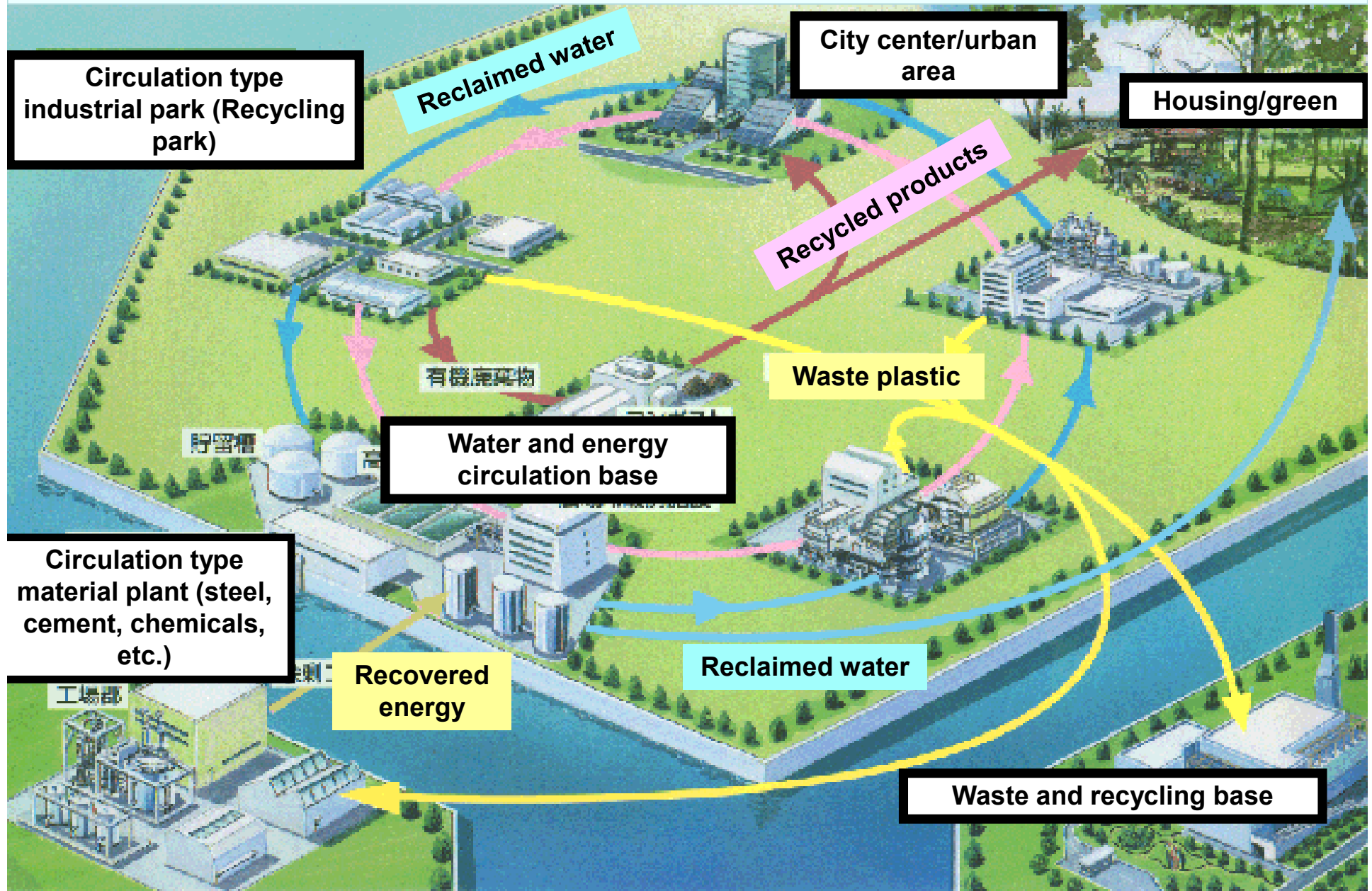
**- Through 20-year Kawasaki International  
Eco-Business Forums -**

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## Worldwide re-boom in eco-town initiatives since 2010

- 1990: Progress in theory and research behind eco-towns  
Industrial ecology, Eco-industrial parks, industrial symbiosis
- 1995: Eco-industrial development as a developed form of cleaner production
- 1997: Eco-towns as bases for cyclic use of waste in Japan, and Kawasaki Eco-town as a leader of such eco-towns  
Becoming a pioneer in the practice of business

# Concept of urban-industrial symbiosis in Kawasaki Kawasaki Eco-Town from the 1990s onward

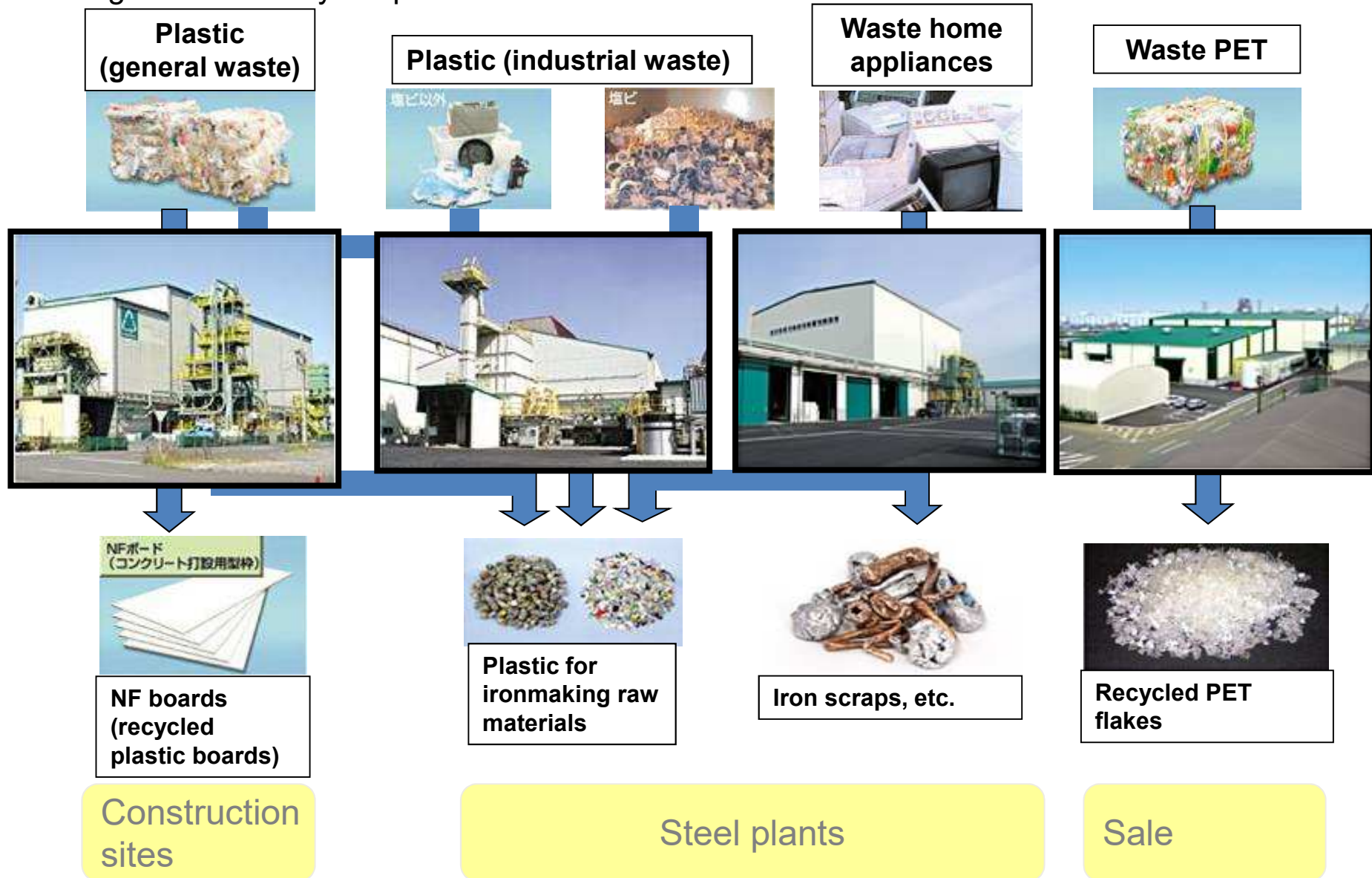


# Kawasaki Eco-town Project

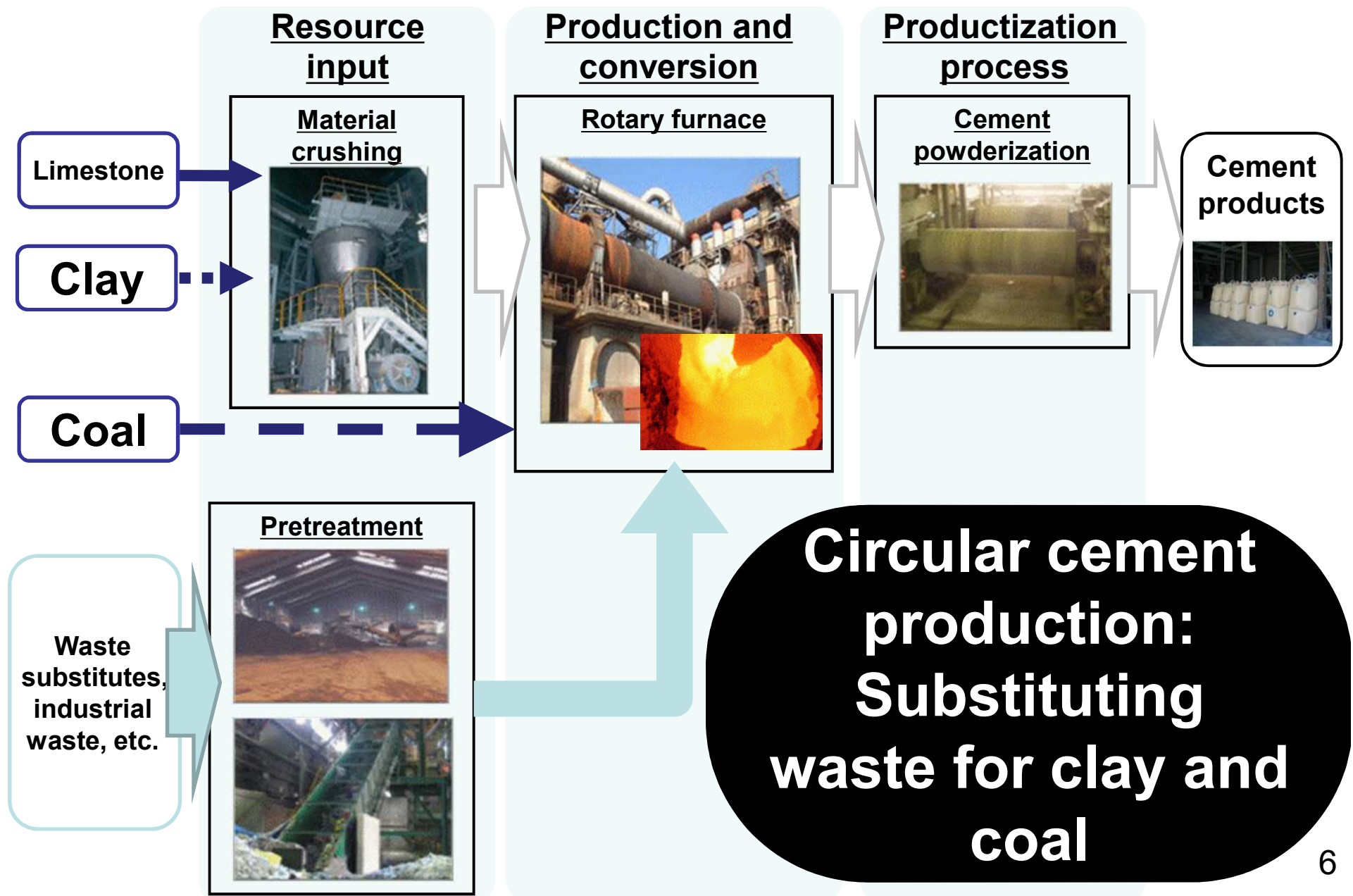


# Location and concentration of resource bases in Kawasaki Eco-town in cooperation with arterial industries

Taking resource circulation as an example among environmental technologies, many recycling technologies are already in operation.

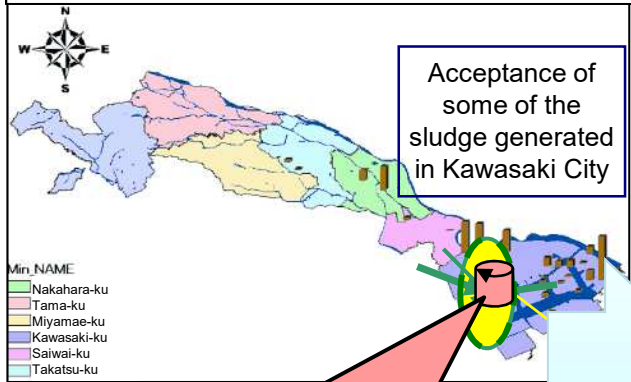


# Circulation system for urban-industrial symbiosis in Kawasaki City



# Example of decarbonization effect calculation for future scenario of urban-industrial symbiosis

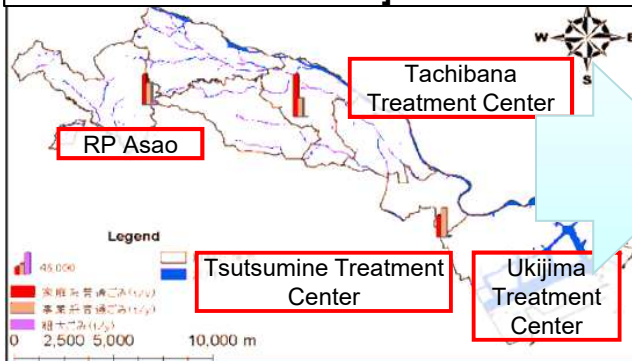
[Distribution of waste generation]



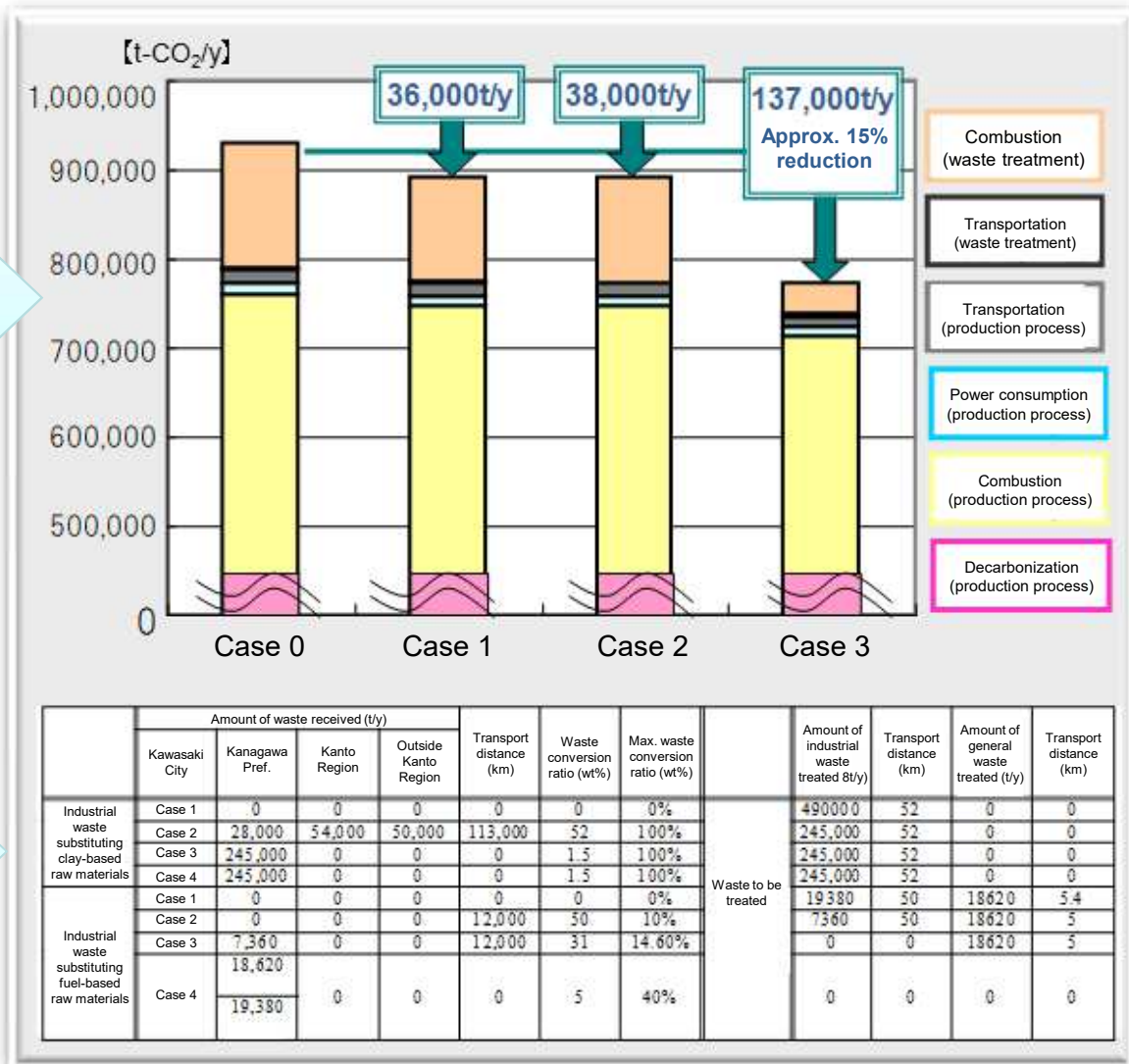
Circular cement plant facility



[Distribution of waste treatment facilities]

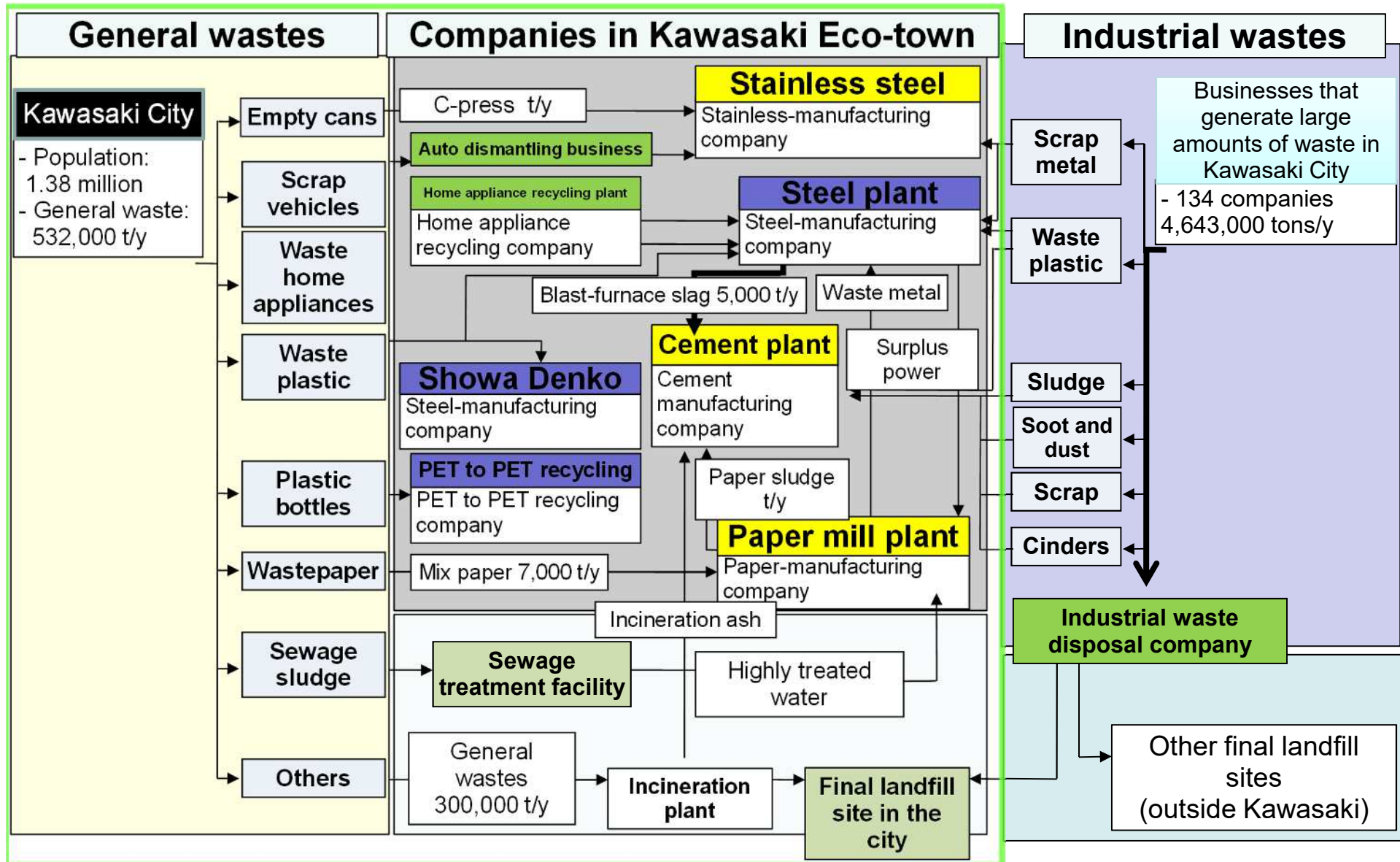


## Example of calculation of potential for regional utilization of circulation type cement industry



# Example of eco-town project: Kawasaki Eco-town

## Formation of a regional network for resource circulation





# Industrial symbiosis-based community development that has been formed in Japan

## URBAN REDEVELOPMENT

### TYPE IIP

## Kitakyushu

Recycle goods retail & sale\*  
Ecological consulting company\*  
Sustainable technology research company\*

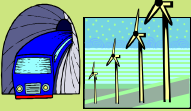


**Environmental Information Business Support CCR**

**EIP Center; Demonstration building\***  
Environmental data bank  
Collaborative marketing purchase  
-Waste collection and recycling  
-Eco-material, Recycled Material  
-Design for environment

Ecological equipment manufacturing

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Clean Energy Supply System  
Energy Storage System\*



Environmental communication\*

Environmental education\*

## Urban Area



**Brownfield Neighborhood**



Industrial complex

Green Institute (Minneapolis)

## Rural Area

Cape Charles Sustainable Farm  
Technology Park (Virginia)



## CITY-FARM COLLABORATION TYPE IIP

## Hokkaido

Compost



Fuel Cell



Methane Fermentation



Residential Districts

## Akita and Osaka



Plastic recycle center\*



Organic waste  
Methane fermentation  
Composting



Building material recycle center\*

Collaboration reverse logistics  
District heat supply



## PRODUCT REMANUFACTURING TYPE IIP

Chen and Fujita et. al.,  
Euro. J. of Operation Research,  
2013

## INDUSTRIAL SYMBIOSIS

### TYPE IIP

Cement factory



Heat



Petro chemical factory

Chemical factory



Heat

Fly ash

Power plant\*



Industrial symbiosis type

## Kawasaki and Minamata

Water Front



# **From urban-industrial symbiosis to green innovation**

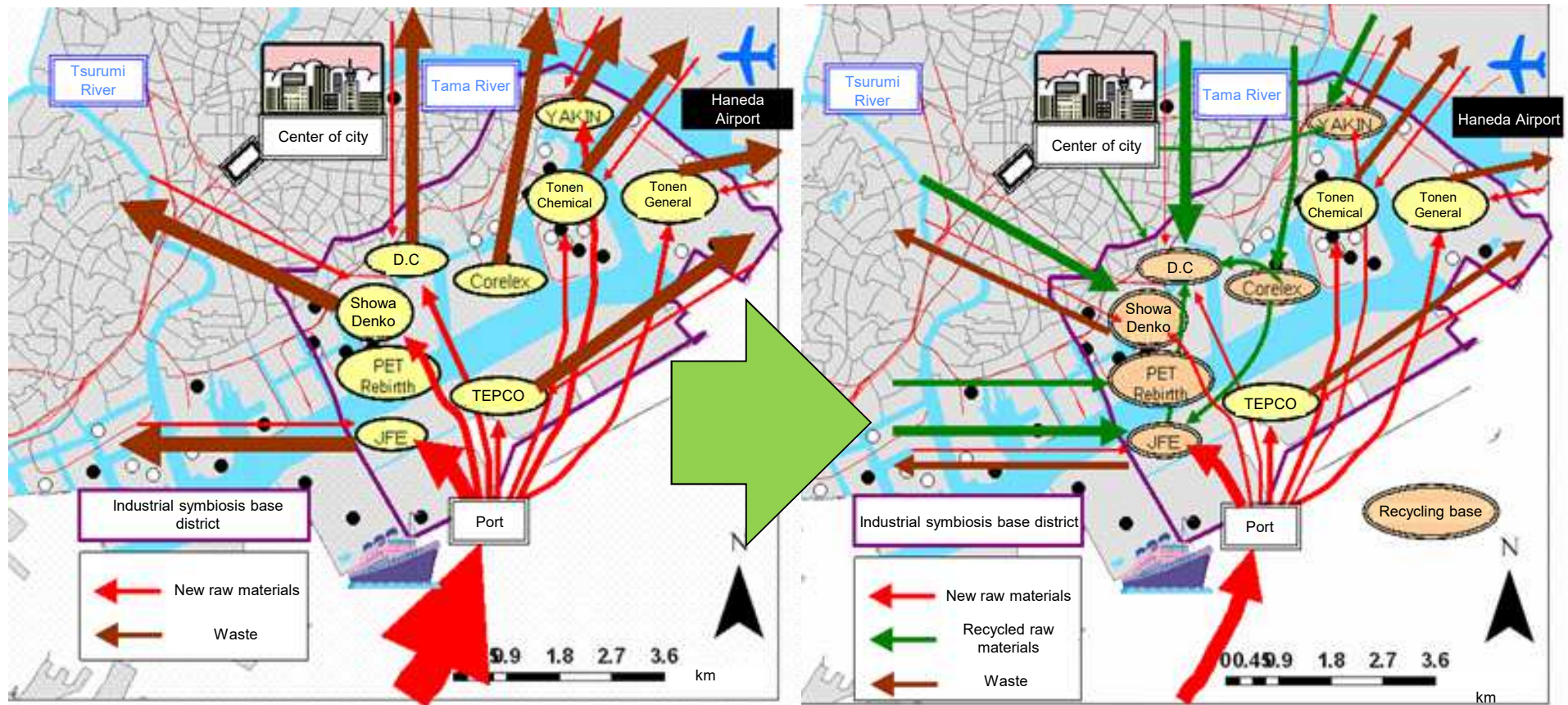
## **Part 1: Becoming a base for the supply of resources to cities and industries for decarbonization**

**Turning the resource “circle” into the energy “circle”  
Double zero emissions**

**From industrial symbiosis to regional revitalization base**

## **Part 2: Becoming a hub for the global network of decarbonized regions with a circular symbiosis system**

# Circular economy of industry, a core function of the city



## Non-circulating material flow

- Industrial waste: Tight final landfill sites and illegal dumping
- Manufacturing industry: Dependence on overseas natural resources
- Circular industry cannot be established.

## Flow of carbon neutral circular economy type

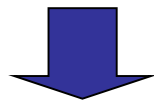
- Wide-area cyclic use of industrial waste
- Manufacturing industry: Resource substitution infrastructure for recyclable resources
- Demonstration project for CN and circular industries

# Becoming a regional green economy base for urban and industrial symbiosis

**Realization of a comprehensive carbon-neutral urban-industrial symbiosis leading district that enables material circulation and energy use between the **eco-town** and **cities** (housing, offices, commercial facilities, etc.) and **regions** (agriculture, forestry and fishery facilities).**

[For example, as a model project]

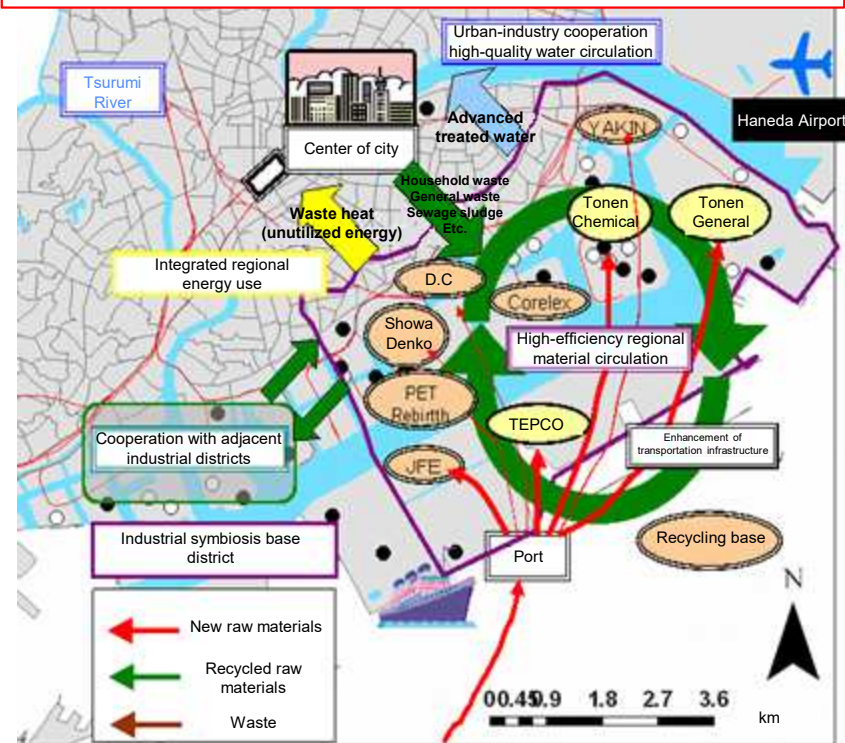
**A model project for social experiment of “regional circulation”** that circulates resources and carbon in the region. Collection and regional recycling of general, industrial and agricultural waste by combining them in a circular manner.



[For example, as a system]

In addition to industrial and environmental policies, integration of urban and port and harbor policies such as urban development, road, sewage, and infrastructure, and **urban circulation infrastructure policies**

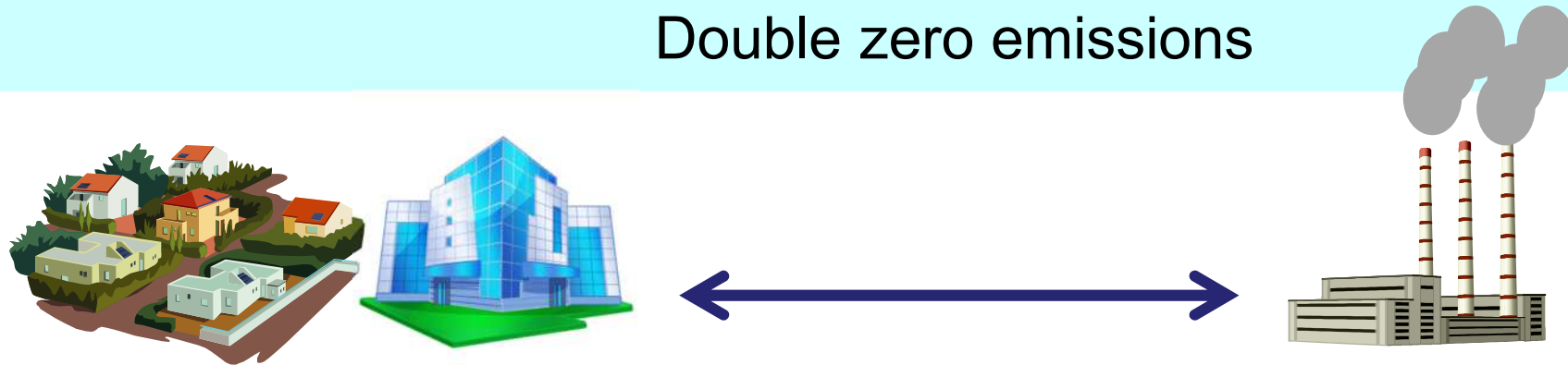
Material flow in Kawasaki eco-town (stage 2 of development)



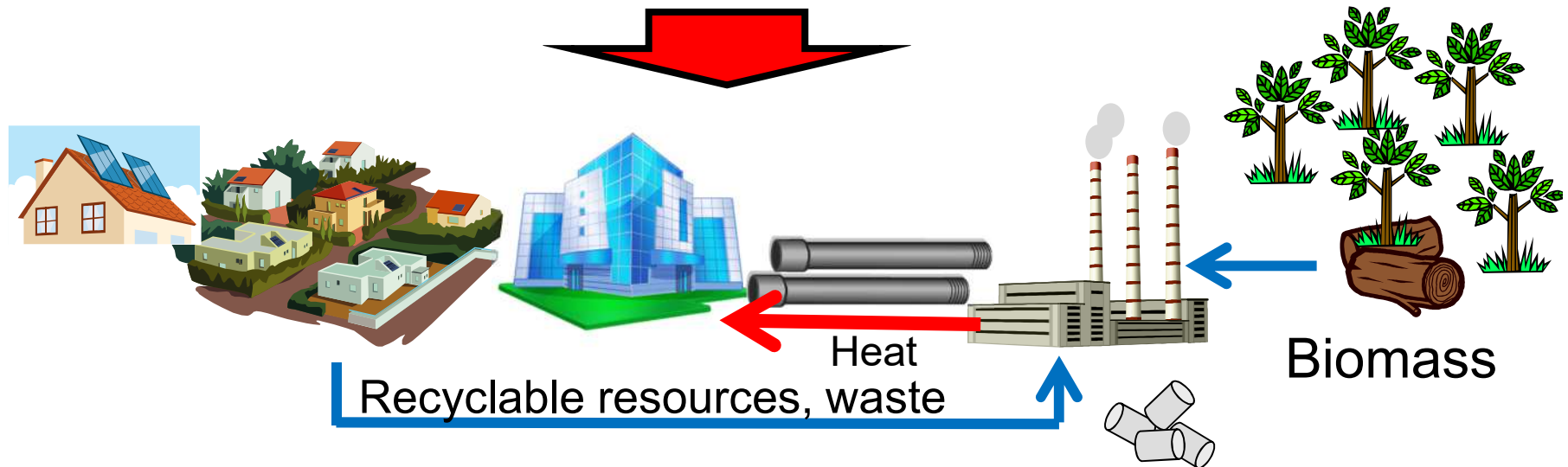
## Carbon free industrial symbiosis district (proposal)

Formation of a comprehensive base district/region that promotes resource efficiency, and low carbon by utilizing circulation and industrial infrastructures

## Part 2: Turning the resource “circle” into the energy “circle” Double zero emissions



If pollution is serious, plants and cities are separated.

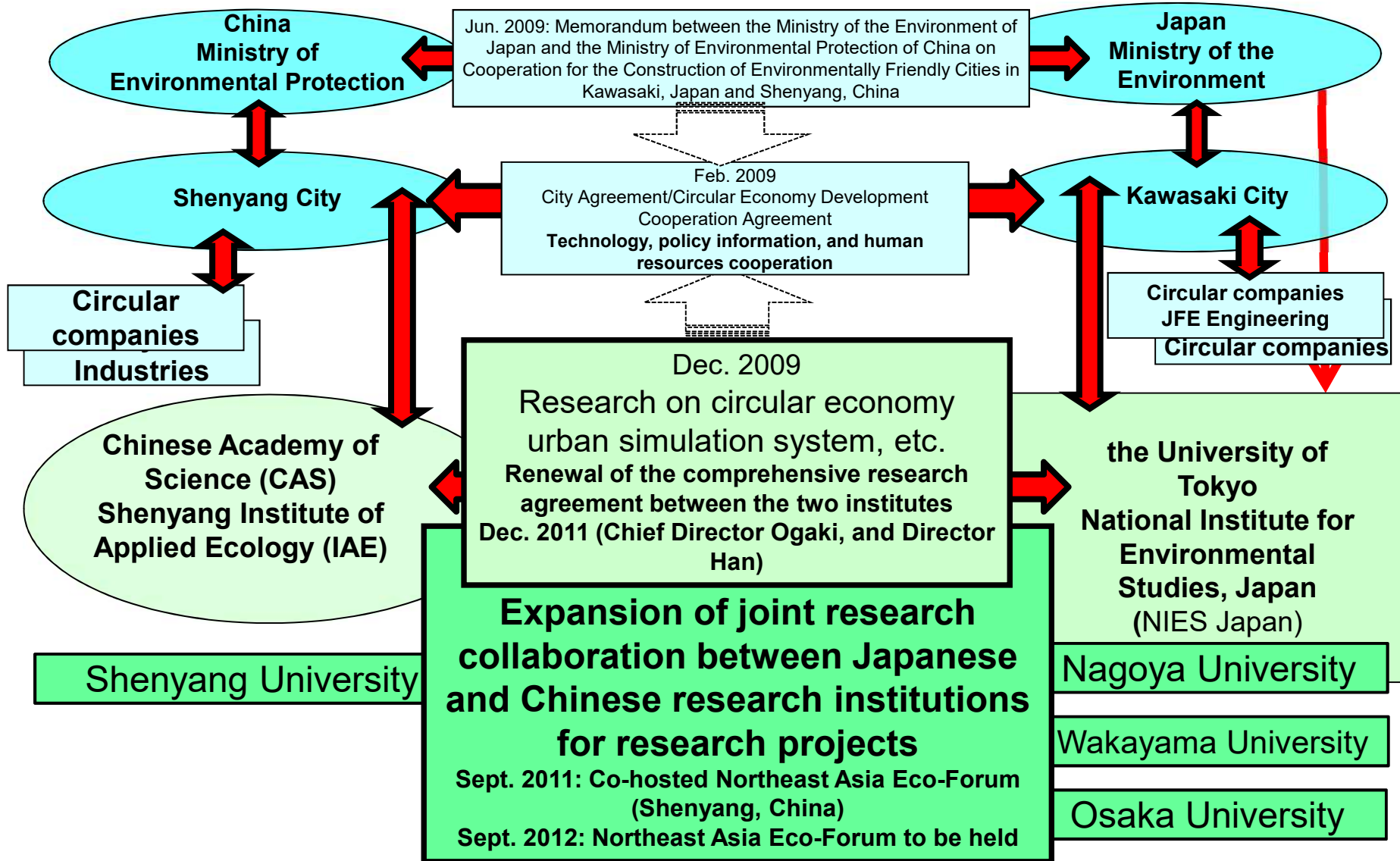


If air pollution control measures are advanced, plants and cities can be located close to each other.

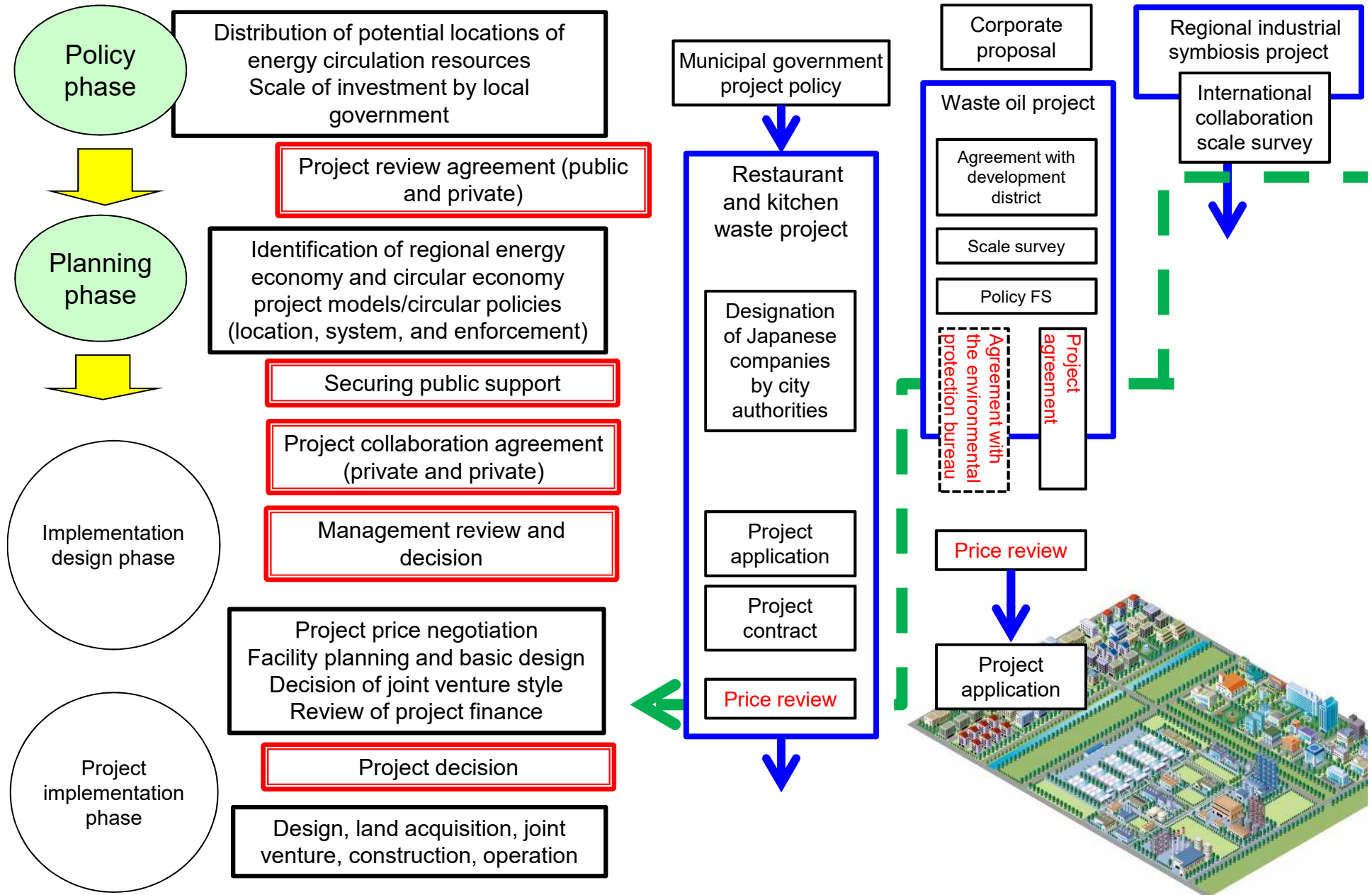
- ➔ Recyclable resources from municipal solid waste, biomass and existing heat can be used at plants (eco-town).

# “Environmentally-friendly City” collaboration between Kawasaki and overseas cities

Establishment of a research collaboration system to develop technology and policy systems originating in Japan in Asia under the framework of “Promotion of Environmental Business Collaboration between Kawasaki and Shenyang” by the Ministry of the Environment of Japan and the Ministry of Environmental Protection of China, which is a preceding example of venous major projects.



# Toward social implementation of urban-industrial symbiosis through industry-government-academia collaboration





## From Kawasaki's urban-industrial symbiosis to mainstream green economy

1990: Progress in theory and research of circular economy and industrial symbiosis

1995: Each country developed ideas and plans for industrial symbiosis and eco-industrial development

1997: Start of the eco-town project in Kawasaki, Japan; taking the initiative in the world in the implementation of a circulation base project



**2005: Eco-industrial development trends in China and Korea  
Development of eco-towns (Kitakyushu and Kawasaki) in Japan as a precedent**

**2010: Expansion of eco-industrial development in Europe  
National Industrial Symbiosis Program (NISP) in the UK  
Eco-town enhancement project in Japan (research and demonstration project)**

**2015: Industrial symbiosis taken up as a theme at G7 Summit**

# From Kawasaki's urban-industrial symbiosis to mainstream green economy

## From the center of industrial society in 20th century

- Supply of industrial products through mass consumption of fossil fuels
- Expansion of industrial functions on a global scale revealed the limits of the ability to accept environmental burdens.
- Impact of industrial bases based on imported resources and of industrial pollution



## To the leader of green innovation in the 21st century

- Reduction of impact through development of environmental countermeasures and environmental observation technology; urban and industrial symbiosis
- Shift of industrial functions to recyclable resources; carbon-neutral regional circulation industrial zone