変える力を、ともに生み出す。
NTT DATAグループ

11th Asia-Pacific Eco-Business Forum Materials

Development of low-carbon petrochemical recycling technology and business in the city of Kawasaki

February 5, 2015

Senior manager, Socio & Eco Strategic Consulting Unit, NTT Data Institute of Management Consulting, Inc.
／Representative of board of directors, Resource Circulation Network, Inc.
Takamasa Hayashi

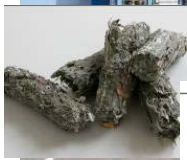
Development of low-carbon petrochemical recycling technology and business in the city of Kawasaki

1. Resources Recycling Facilities
2. Companies' Collaboration in Kawasaki Eco-Town
3. Characteristics and advantages of Kawasaki Eco Town
4. Moving ever forward: City of Kawasaki Green Innovation Guidelines
5. Issues in achieving more advanced, lower-carbon recycling
6. Study of the feasibility of a waste plastic oil conversion business
7. Status of technological development to facilitate the commercialization of an oil-conversion business
8. Properties of recycled oil and anticipated applications
9. Green innovation driven by partnerships among government, manufacturers, and recyclers

1. Resources Recycling Facilities

変える力を、ともに生み出す。
NTT DATAグループ

SHOWA DENKO K.K.
Material production for ammonia from waste plastics

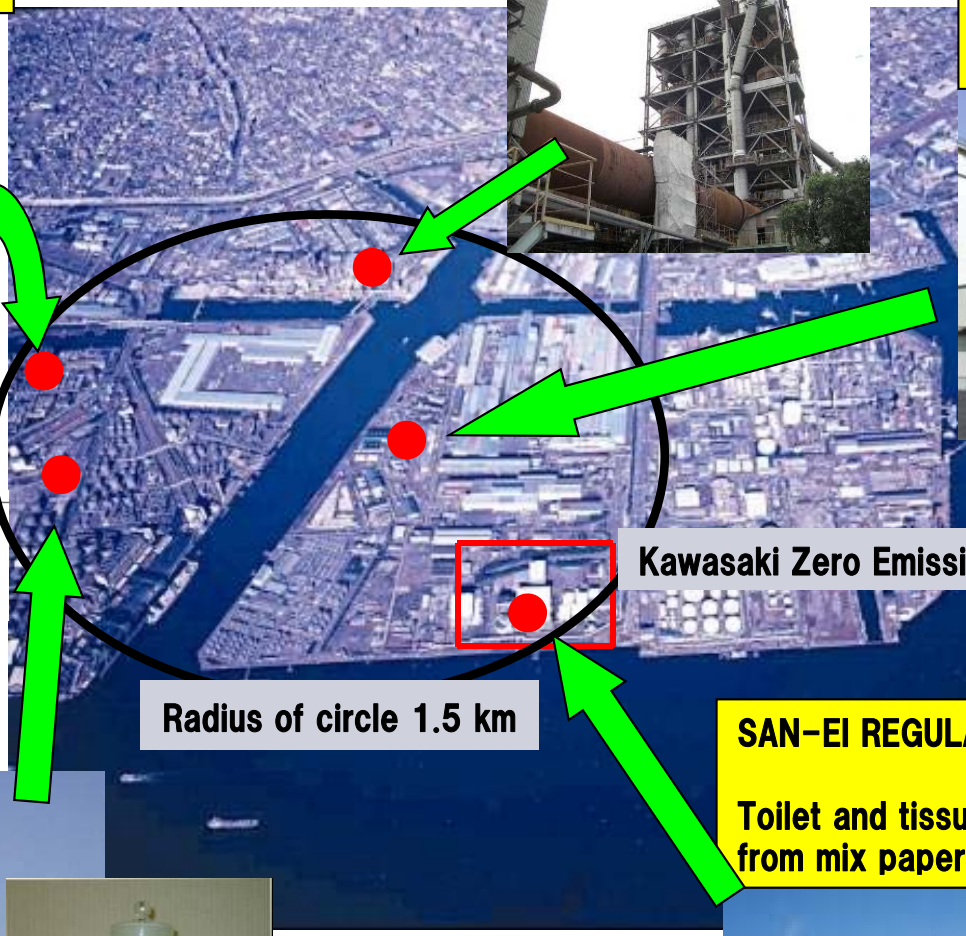


DC CO.,LTD.

Recycling cement production

JFE group companies

Reusing material for blast furnace from waste plastics/Concrete setting frame production from waste plastics/Used electric appliances recycling



Kawasaki Zero Emissions Industrial Park

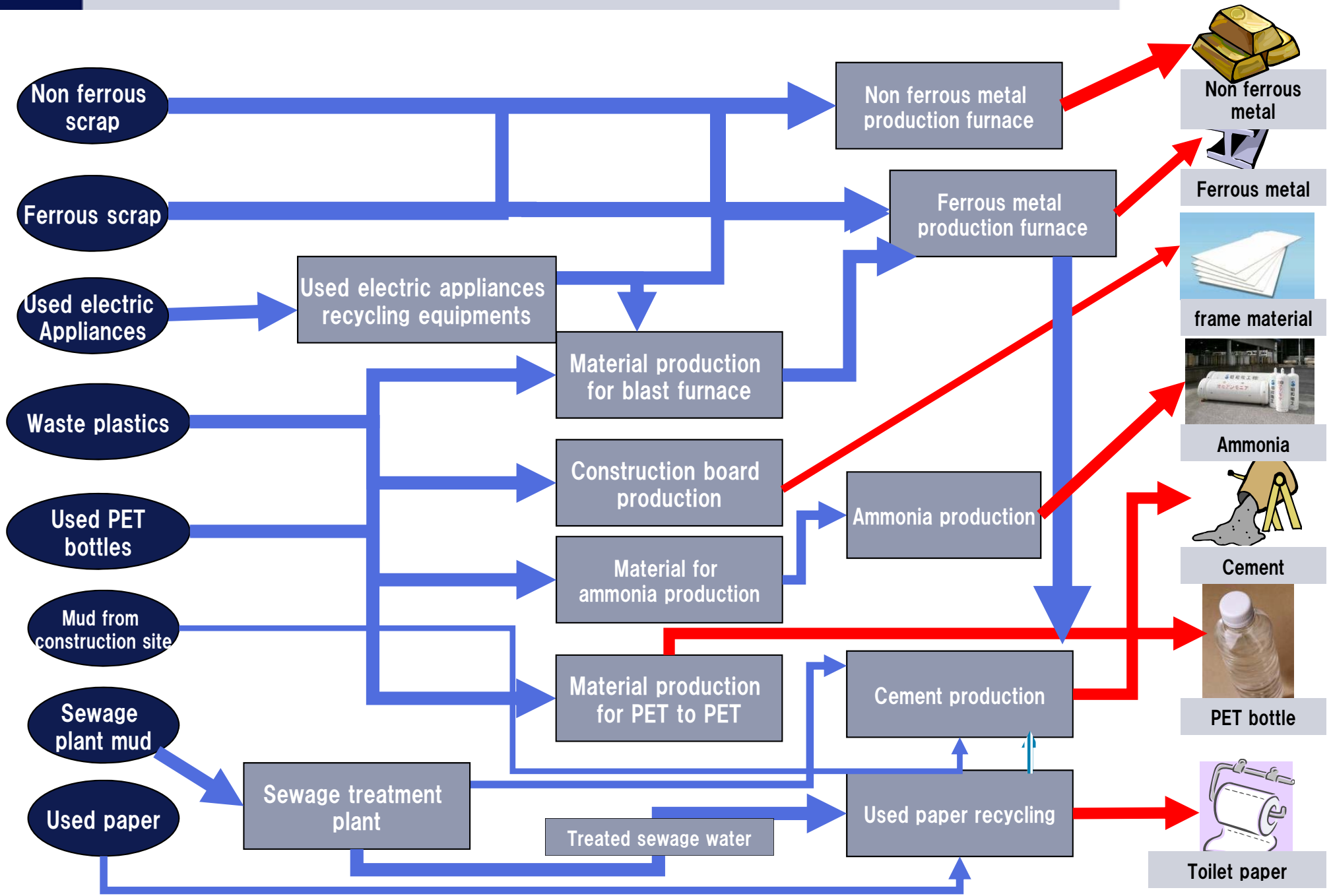
Radius of circle 1.5 km

PET REFINE TECHNOLOGY CO.,LTD
Material production for new PET bottles (PET to PET)

SAN-EI REGULATOR CO.,LTD.

Toilet and tissue paper production from mix paper in used papers

2. Companies' Collaboration in Kawasaki Eco-Town



3. Characteristics and advantages of Kawasaki Eco Town

変える力を、ともに生み出す。
NTT DATAグループ

Urban planning-oriented approach	*Comprehensive planning*	*Incrementalism*
Urban planning from the perspective of recycling		
Typical success model (Japanese eco town approach)	Kitakyushu Eco Town	Kawasaki Eco Town
Similar overseas model	• Recycling economic zones located throughout China (Tianjin, Dalian, etc.)	• Kalundborg Eco-industrial Park • EIP in Ulsan, South Korea, etc.
Business advantages	◇ Capacity to accept a variety of recycled resources ◇ Advanced use by means of facility-to-facility transactions ◇ Regional branding, etc.	◇ Stability in acceptance and sale of recycled resources ◇ Lower environmental impacts and costs associated with distribution ◇ Surplus energy transactions between facilities, etc.
Urban planning direction	Recycling complex model	Smart community model
Future target areas	◆Primarily in developing nations • New industrial parks and other complexes built in coastal and suburban regions	◆In developing and advanced nations •Existing industrial zones undergoing redevelopment projects that are integrated with energy- and water-saving measures, etc.

4. Moving ever forward: City of Kawasaki Green Innovation Guidelines

I. Formulation of guidelines

1. Background

● Region-scale environmental problems
○ Global warming and other environmental problems constitute urgent global issues.
● Energy problems
○ It is important to seize the opportunity presented by the Great East Japan Earthquake to address energy problems.
○ The national government is studying how to reassess its basic energy plan and reform its power system.

2. Issues

● Addressing environmental, energy, and other problems
○ Implementing a sustainable society in Kawasaki and working to address the need to create, save, and store energy
○ It is necessary to take advantage of environmental technologies and other resources available in the city to develop and promote widespread use of even more innovative technologies.
● Improving the environment in Asia's cities and elsewhere
○ In cities such as those in rapidly growing Asia, it is necessary to pursue measures to address not only global warming, but also pollution, waste treatment and disposal, and other issues.

3. Kawasaki's strengths and characteristics

● Accumulated environmental technologies and industries
○ Kawasaki is home to a cluster of environmental technologies and industries involving low-carbon, anti-pollution measures, resource recycling, and energy.
● High environmental awareness on the part of businesses and citizens
○ Kawasaki is home to businesses with a high level of environmental awareness and numerous citizens who are pursuing regional initiatives.
● A history of initiatives designed to harmonize environmental and economic priorities by creating a virtuous cycle
○ Kawasaki has a successful track record of initiatives designed to harmonize environmental and economic priorities in a virtuous cycle, including the city's low-CO_2 plant certification program and its hosting of international environmental technology exhibitions.

Formulation of the Kawasaki Green Innovation Guidelines (tentative name)
By having the Economics and Labor Affairs Bureau and the Environmental Protection Bureau orchestrate a government-wide green innovation program by taking the lead in redoubling and expanding a series of initiatives that have been undertaken to leverage the city's environmental technologies and industries, this effort seeks to foster a new generation of vitality in the city while creating a sustainable society that will lead to the maintenance and improvement of pleasant citizen lifestyles.
○ Pursuing initiatives to develop and promote widespread adoption of innovative technologies to solve issues
○ Fostering the "greening" of the economy and society so that environmentally conscious behavior can permeate citizen lifestyles and business activities

II. Basic approach

Creating a sustainable city that takes advantage of environmental technologies and industries
(1) Revitalizing the region's economy through the promotion of environmental technologies and industries
(2) Utilizing exceptional environmental technologies and industries in citizen lifestyles
(3) Fostering cooperation with a variety of key actors in order to utilize environmental technologies and industries
(4) Utilizing Kawasaki's environmental technologies and industries to contribute to international society

III. Four pillars of the effort to pursue green innovation

The city has outlined four general directions to guide initiatives based on its basic approach:

1. Promoting environmental technologies and industries

○ Work to revitalize the region's economy by supporting new initiatives and overseas expansion of companies involved in environment-related businesses and facilitating new use and development of Kawasaki's regional characteristics in the future.

2. Creating environmentally friendly mechanisms that make use of exceptional technologies

○ Create environmentally friendly mechanisms in an effort to promote widespread adoption of exceptional technologies and incentivize their introduction.
○ Urge the national government to relax or change regulations and to make other changes as necessary.

3. Practicing urban planning in a way that takes advantage of environmental technologies through cooperation with a variety of key actors

○ Create a society that takes advantage of environmental technologies through partnerships and cooperation with a variety of key actors.
○ Actively introduce exceptional environmental technologies into citizen lifestyles and business activities.

4. Taking advantage of environmental technologies to make international contributions

○ Contribute to international society by taking advantage of the accumulation of environmental technologies and industries that is both a strength and defining characteristic of Kawasaki to harmonize environmental and economic priorities in a virtuous cycle on a regional scale.

IV. Building structures to implement these initiatives

Build structures such as programs, business schemes, and information in order to effectively implement the initiatives that serve as the four pillars of green innovation.

1. Building a green innovation cluster
○ Build a cluster (network) that links businesses, related organizations, and other stakeholders.

2. Developing projects that foster partnerships among a variety of key actors
○ Carry out projects in partnership with a variety of key actors, for example through publicly-offered solicitation of business proposals.

3. Pursuing joint research and projects with international organizations
○ Pursue projects in partnership with international organizations such as the United Nations Environment Programme (UNEP).

4. Sharing and disseminating information
○ Disseminate cities' knowledge and expertise and businesses' environmental technologies by integrating them into discrete packages.

5. Carrying out leading projects
○ Carry out leading projects consisting of initiatives that can be expected to trigger a ripple effect.

5. Issues in achieving more advanced, lower-carbon recycling

変える力を、ともに生み出す。
NTT DATAグループ

Changes in the external environment

Power shortages, etc. (in Japan)

Transformation in the approach to a low-carbon recycling (Standardized indicators of initiative results)

Introduction of Scope3

Expansion of GHG assessment and calculation techniques throughout the value chain by emitters

Toward pursuit of a low-carbon society through recycling

Approach to the benefits of a low-carbon approach (Project techniques)

Baseline scenario

−

〔Projects〕

Conserving resources

+

Using alternative energy sources

+

Reducing methane gas emissions

Etc.

−

GHGs generated during the recycling process

Need to establish concrete, fair indicators, calculation techniques, etc.

Achievement of more advanced, lower-carbon recycling

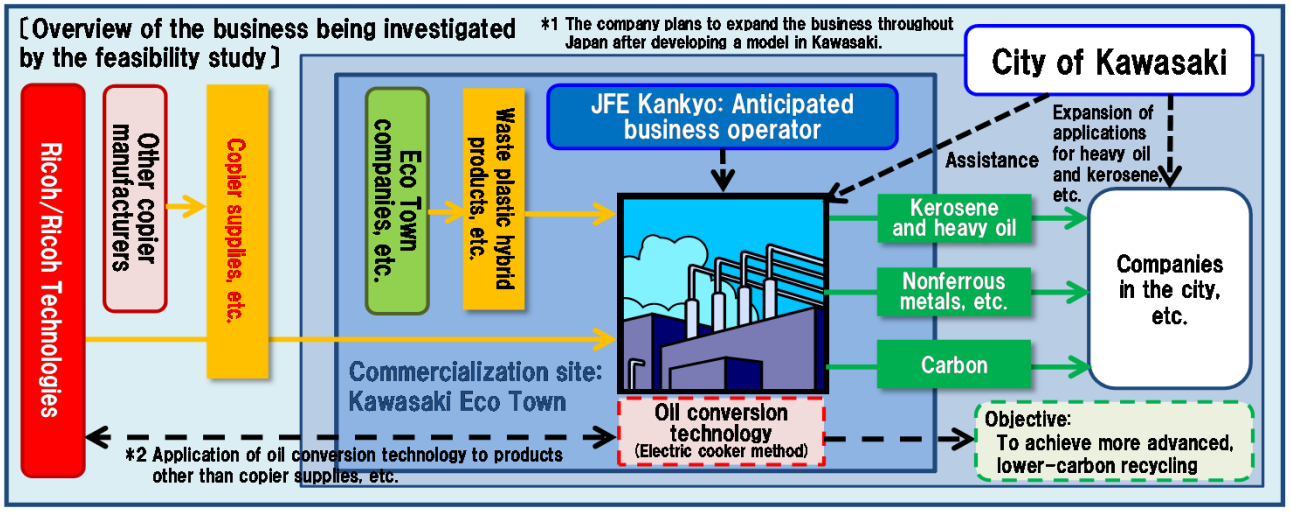
6. Study of the feasibility of a waste plastic oil conversion business

変える力を、ともに生み出す。
NTT DATAグループ

Study background

- In 1997, Kawasaki received approval from the Ministry of Economy, Trade and Industry (then known as the Ministry of International Trade and Industry) for an eco-town area consisting of the city's entire coastal area.
- Some of the companies operating key recycling facilities in Kawasaki Eco Town are facing challenges such as procuring recycled materials and obtaining customers for recycled resources. These companies are studying how to develop their businesses in the future from a variety of angles.
- JFE Kankyo Corporation, which is pursuing a recycling business in Kawasaki Eco Town, is studying whether to develop a waste plastic oil conversion business that it would operate in partnership with Ricoh Company, Ltd., which would provide processing and other technologies.
- Ricoh is developing new technologies to facilitate the chemical recycling of copier supplies (toner cartridges and bottles, etc.), which are currently recycled using thermal (heat recovery) processing, in order to recover kerosene, heavy oil, and carbon in a process known as oil conversion.

Overview of the feasibility study



Entity carrying out study: City of Kawasaki
Cooperating entities

- JFE Kankyo Corporation (anticipated operator of project)
  ⇒ JFE Kankyo studied the feasibility (acceptance, processing, sales) of a waste plastic oil conversion business in Kawasaki Eco Town of which it would serve as the operator.
- Ricoh Company, Ltd., etc.
  ⇒ Ricoh studied the feasibility of technology for more advanced oil conversion of waste plastics.
- NTT Data Institute of Management Consulting, Inc.
  ⇒ NTT Data Institute of Management Consulting measured the benefits of a low-carbon approach, regional revitalization, and other aspects of the proposed project.

Effects of the project

- Pursuit of green innovations that use waste processing technologies originating in Kawasaki
- Implementation of more advanced, lower-carbon waste processing by companies located in Kawasaki Eco Town
- Promotion of resource recycling in Kawasaki Eco Town and of the environmental industry in the city

7. Status of technological development to facilitate the commercialization of an oil-conversion business

変える力を、ともに生み出す。
NTT DATAグループ

Commercial operation at pilot plant

*Trials are being carried out at a test facility to resolve additional technical issues.

Toner cartridges, etc.

Heavy oil, kerosene

Iron and nonferrous metals

Carbon

8. Properties of recycled oil and anticipated applications

変える力を、ともに生み出す。
NTT DATAグループ

Although carbon and hydrogen are the principal components of heavy oil, the substance also contains small amounts of sulfur and trace amounts of inorganic compounds and other substances. Sulfur content ranges from 0.1% to 3.5% by weight, while inorganic compounds account for 0.03% of ash or less by weight.

Heavy oil consists of distillation residual oil or a mixture of distillation residual oil and kerosene, and the viscosity, residual carbon, sulfur content, flow point, and other characteristics of the final product are adjusted according to the intended application.

Generally speaking, there are three types of heavy oil: heavy oil A (JIS K 2205, Class 1), heavy oil B (JIS K 2205, Class 2), and heavy oil C (JIS K 2205, Class 3).

Equivalent to heavy oil A and used as a fuel for boilers in buildings and other facilities and for heating greenhouses

Property	Type					
	Class 1		Class 2	Class 3		
	No. 1	No. 2		No. 1	No. 2	No. 3
Reactivity	Neutral					
Flash point (℃)	≥60			≥70		
Kinematic viscosity (50℃) (mm^2/s, {cSt})	≤20		≤50	≤250	≤400	≤1,000
Flow point (℃)	≤5		≤10	—	—	—
Residual carbon content by weight (%)	≤4		≤8	—	—	—
Moisture content by weight (%)	≤0.3		≤0.4	≤0.5	≤0.6	≤2.0
Ash content by weight (%)	≤0.05		—	≤0.1		—
Sulfur content by weight (%)	≤0.5	≤2.0	≤3.0	≤3.5	—	—

9. Green innovation driven by partnerships among government, manufacturers, and recyclers

◇ Kawasaki's coastal area comprises a world-class industrial cluster where partnerships with the material industry and other innovations have lead to the introduction of advanced recycling technologies and facilities.

◇ The City of Kawasaki is giving shape to a policy of "moving ever forward" by implementing measures to address global warming and energy problems in keeping with a series of Green Innovation Guidelines.

◇ The waste plastic oil conversion business is one leading project being pursued by the City of Kawasaki in partnership with a variety of key actors in order to take advantage of environmental technologies and industries.

◇ Going forward, the city will continue to work to give shape to technological development and business models that help achieve the dual priorities of more advanced, lower-carbon recycling while receiving support from the Ministry of the Environment.

☆*The goal is to lead the world in developing and commercializing low-carbon oil conversion recycling technology by integrating the city's policy proposal capabilities, manufacturers' technological skills, and recyclers' field capabilities.*