Energy Vision and Strategy for Sustainable Future

- R & D Efforts in the University of Tokyo-

The University of Tokyo
Institute of Industrial and Science
Collaborative Research Center for Energy Engineering

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Obstructive Factors for Sustainable Development

Constraint on CO2 Emission

- Reduction in CO2 Emission for Mitigation of Climate Change
  - ➡ 50% Cut in CO2 emission till 2050

Constraint on Energy Resources

- Depletion of Fossil Energy Resources
  - ➡ R/P Oil 40 years, Natural Gas 60 years, Coal 200 years

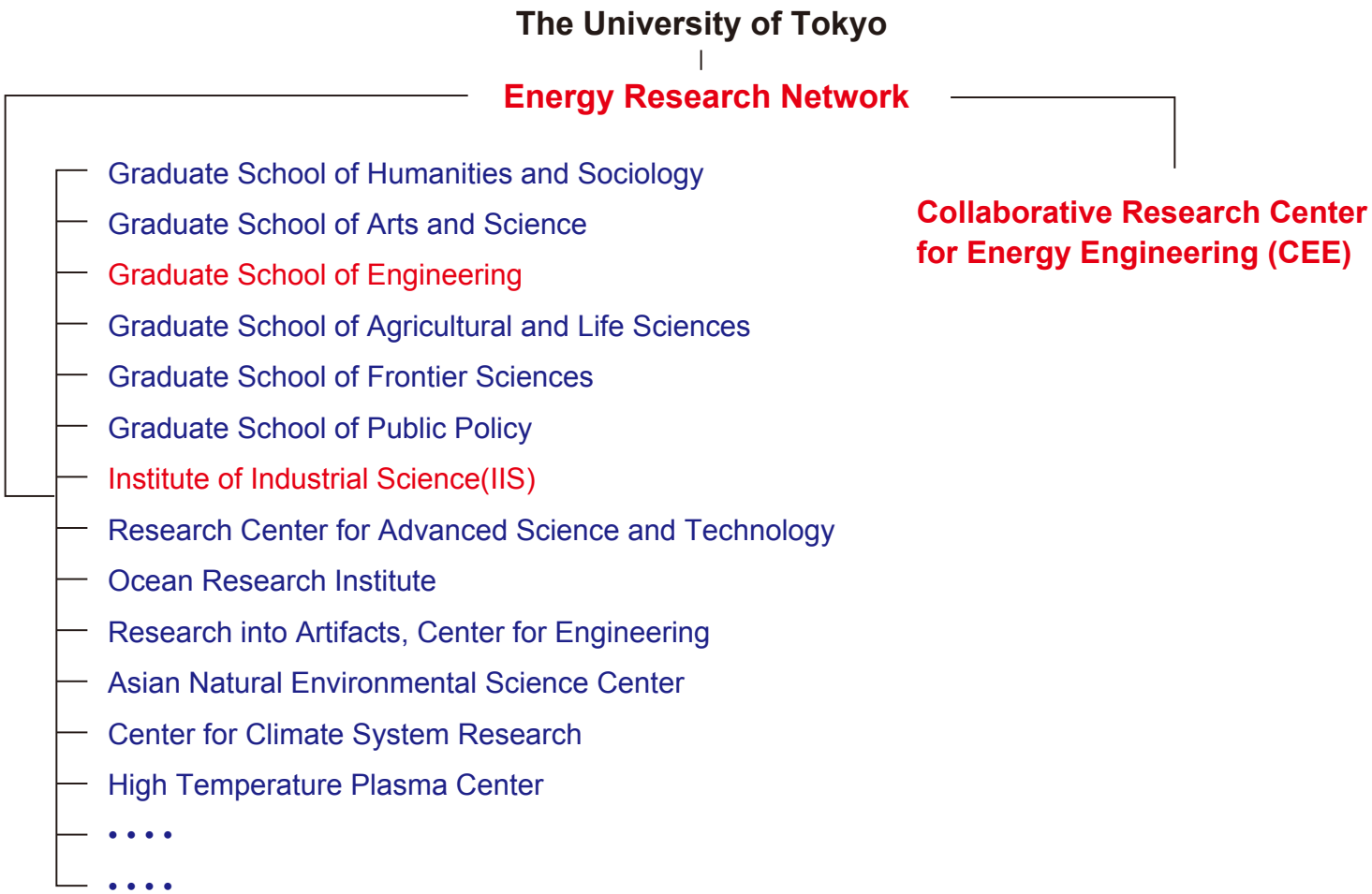
Constraint on Material Recycling

- Increasing waste material
  - ➡ Constraint on final material disposal
- Increasing the consumption of water
  - ➡ limitation of global water resources
- Rare Metals
  - ➡ Recovering and recycling for preserving limited resources

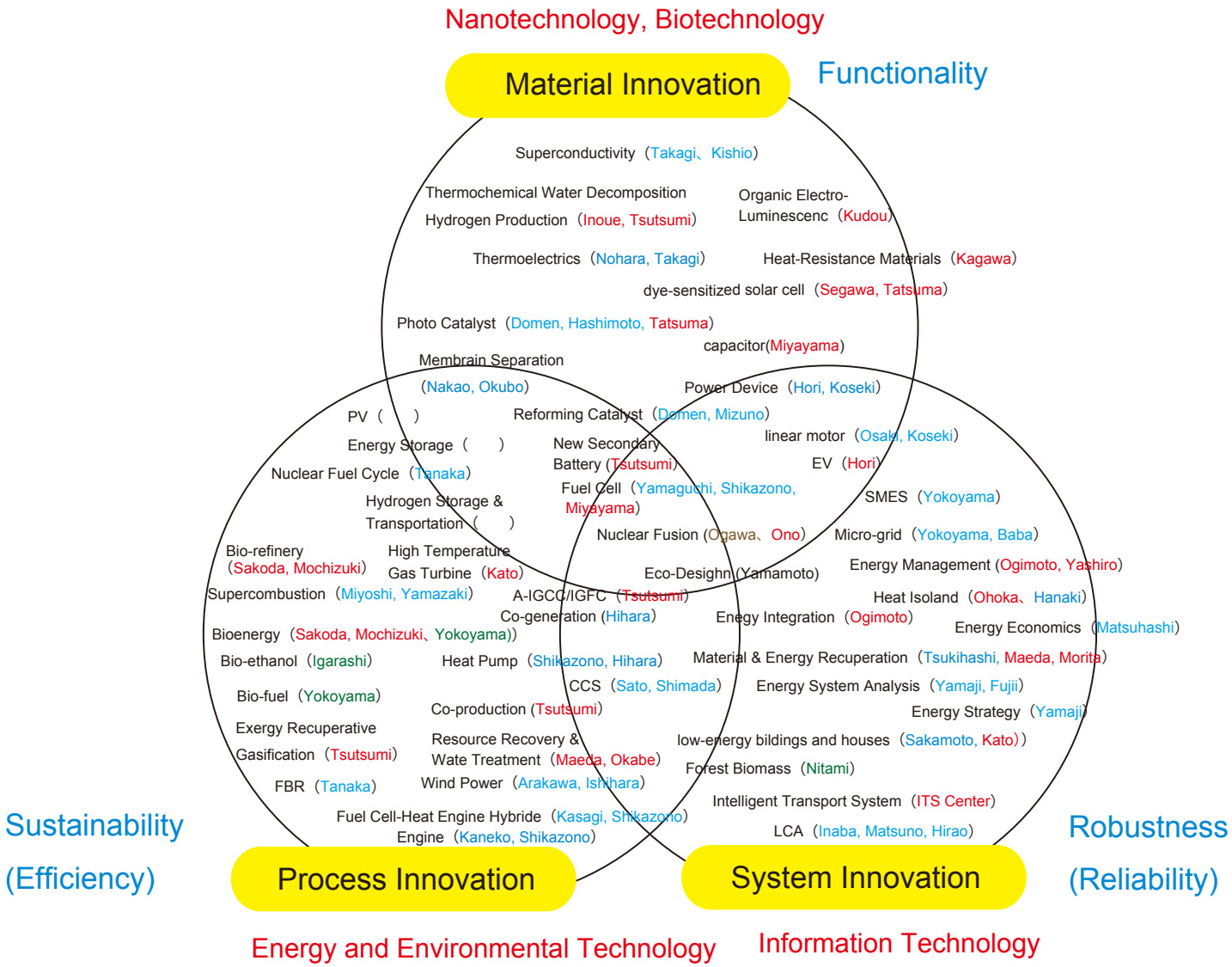
Energy Strategy and Policy Making

- **Bird's-Eye View**
  - **comprehensive grasp on the interdisciplinary information and technology of global circulation of materials and energy**
- **Perspective**
  - **strategic technology roadmapping to ensure the sustainable development**
    - total optimization of material–energy production systems
    - minimize the consumption of energy and materials
    - minimize the exergy loss (improve the efficiency of energy use)
    - metabolic circulation of energy and materials

Organization Chart



Mapping of Researchers and research subjects



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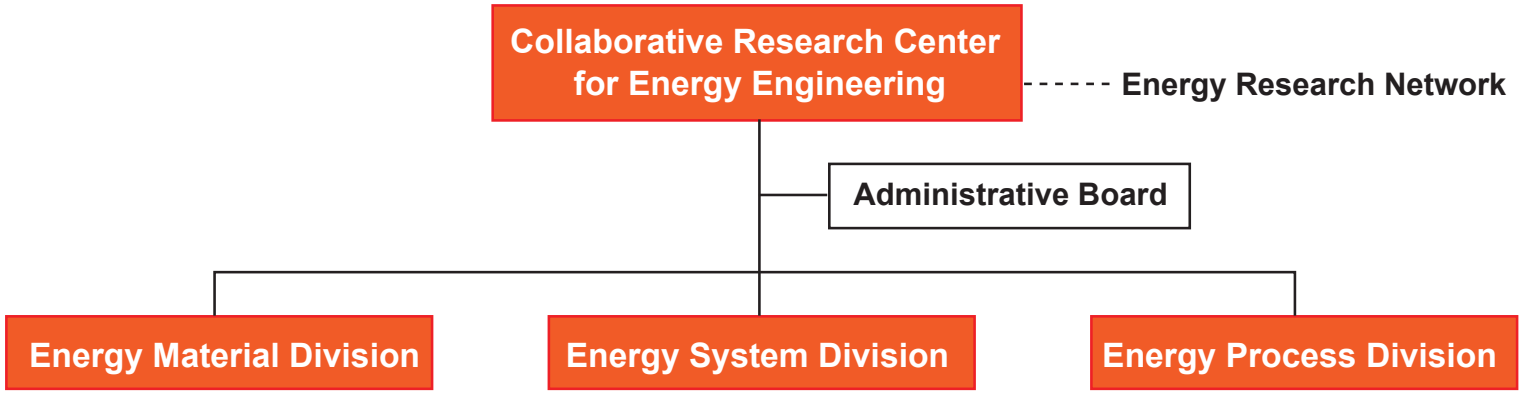

K. Domen, Prof.
A. Tsutsumi, Prof.
K. Mochizuki, Asso. Prof.
C. Fushimi, RA

An innovative functional material is created to achieve the highlly efficient use of energy and materials by means of the fusion of nanotechnology and biotechnology.

K. Yamaji, Prof.
K. Ogimoto, Prof.
Y. Iwafune, Asso.Prof.

Drafting the energy strategy and the grand design for the metabolism of energy and materials, the sustainable society is developed based on the interdisciplinary information and knowledge.

A. Tsutsumi, Prof.
K. Sato, Prof.
T. Tanaka, Prof.
N. Shikazono, Assoc. Prof.

The energy process division aims at drastic saving energy and materials by the process innovation such as highlly efficient energy conversion technologies, material and energy co-oroduction, sustainable manufacturing, etc.

Principle of Grand Design for Sustainable Society

Based on the comprehensive grasp of energy and material flow in the circulation of production, demand and recuperation the sustainable industrial and social system is designed to minimize the waste material and the exergy loss.

- Energy and Material Co-production
  - Efficient Use of Energy and Materials
- Exergy Recuperation
  - Minimization of Exergy Loss
  - Recuperation and Recycling of Degraded Energy
- Material & Energy Regeneration
  - Material and Energy Circulation
- Improvement of material functionality and product performance
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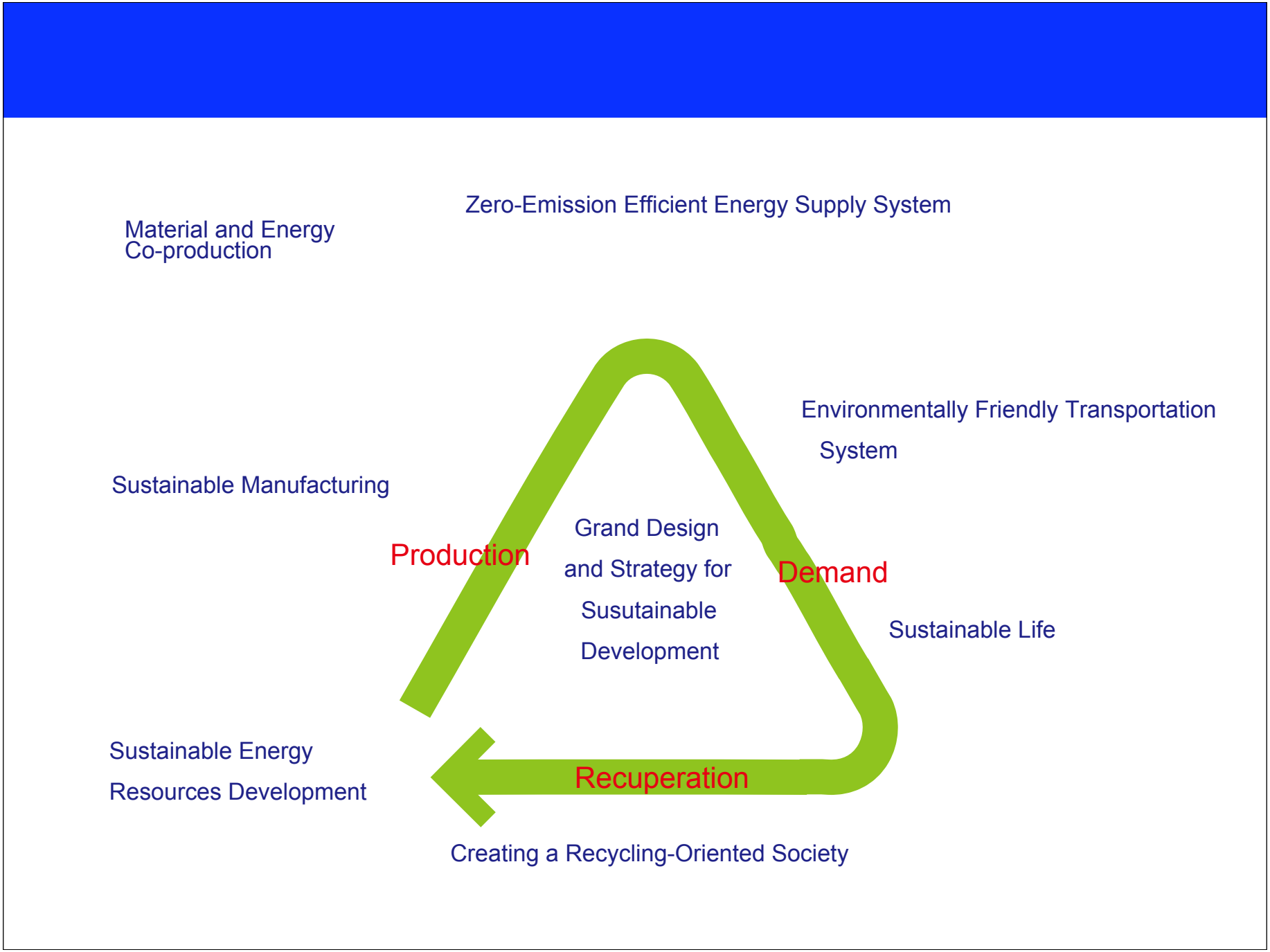
Zero-Emission Efficient Energy Supply System
Material and Energy
Co-production
Environmentally Friendly Transportation
System
Sustainable Manufacturing
Production
Grand Design
and Strategy for
Susutainable
Development
Demand
Sustainable Life
Sustainable Energy
Resources Development
Recuperation
Creating a Recycling-Oriented Society

Grand Design and Strategy for Sustainable Development

Drafting the grand design and energy strategy for the metabolic circulation system of energy and materials, the sustainable society is developed based on the interdisciplinary information and knowledge.

- **energy strategy, action plan, policy making**
- **diagnosis and assessment of energy systems**
- **technology mapping, roadmapping, scenario analysis**

Sustainable Energy Resources Development

Reliable and robust energy supply and demand system is a key to sustainable development as energy security.

- **Diversification of Energy Resources for Energy Security**
- **Sustainable Carbon Cycle**
- **Development of Unconventional Fossil Resources**

Sustainable Manufacturing

Developing technologies to transform materials without emission of greenhouse gases, use of non-renewable or toxic materials or generation of waste

Highly functional materials for efficient energy utilization and reduction in energy and material consumption

- **Sustainable Carbon Cycle Chemistry（SC3）**
- **Create innovative functional materials for energy technology**
- **Green Technology based on Eco-design**
- **Highly functional materials (heat-resistance materials for high temperature gas turbine, electrode of nanocarbon composite for fuel cell, etc.)**

Material and Energy Co-coproduction

The coproduction of energy and material using exergy recuperation technology can reduce the exergy loss significantly, leading to efficient energy utilization and the reduction of CO2 emission.

- **Energy and Eco-material Co-production (Biomass Refinery)**
- **Sustainable Chemicals and Refinery Integration**
- **Innovative Steel Manufacturing with Hydrogen Co-production**

Zero-Emission Efficient Energy Supply System

Promoting the extensive introduction and diffusion of renewable energy, highly efficient energy conversion technology is developed to reduce CO2 emission.

- **Highly Efficient Energy Conversion System**
- **Advanced Integrated Coal Gasification Combined Cycle/Fuel Cell (A-IGCC/IGFC)**
- **CO2 Capture and Sequestration**
- **Hydrogen Combustion Turbine**
- **Nuclear Fuel Cycle**

Environmentally Friendly Transportation System

Zero-emission or near zero-emission transportation system is developed.

- **Technical Development in Intelligent Transport Systems (ITS)**
- **Zero-Emission Vehicles such as FCV, EV, Hybrid FCV, Plug-in Vehicle**
- **Biofuel**

Sustainable Life

- Distributed Energy System and Microgrid
- Heat Pump, Co-generation
- Efficient Machinery and Equipment
- Low-Energy Buildings and Houses

Creating a Recycling-Oriented Society

- Sustainable Compact City
- Material Recycling by Energy and Material Regeneration
- Energy, Material and Water Circulation