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SDGs Future City Initiatives Toward Sustainable Revitalization

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SDGsに関する国内動向
National Initiatives for SDGs Future Cities

〇2016 Dec. 政府「持続可能な開発目標（SDGs）推進本部（内閣総理大臣）が「持続可能な開発目標（SDGs）実施指針」を決定
SDGs Implementation Strategy Plan under the leadership of Prime Minister

〇2017. July「地方公共団体における持続可能な開発目標（SDGs）」のために自治体SDGs検討
Guideline for SDGs for Municipal Governments

〇2018. May- SDGs未来都市の選定
National SDGsFututе City Initiative

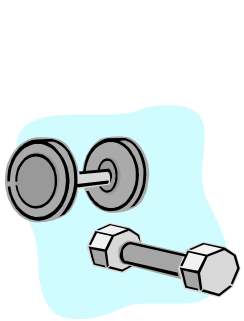
気候変動に備える標準的な都市・地域
SDGs through Climate Change Driven

Resource occupancy

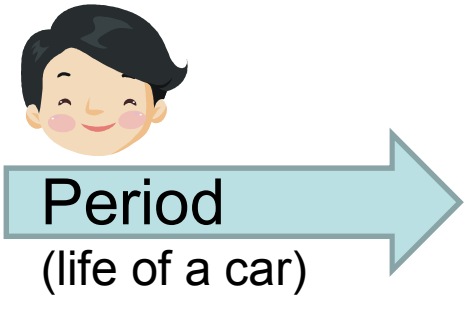
Resource occupancy of iron

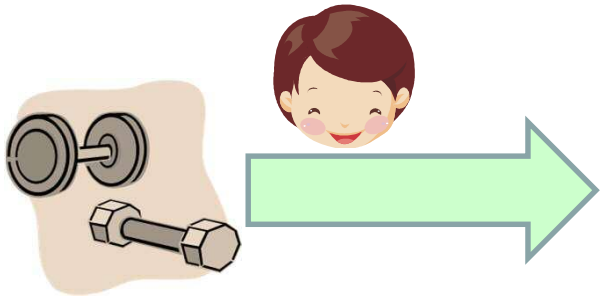
= (amount of iron) x (period)

Iron in a car



Amount of iron





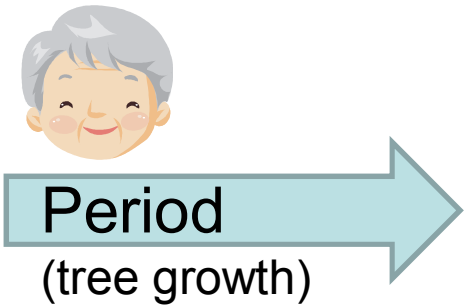
Reversible (potentially sustainable) use

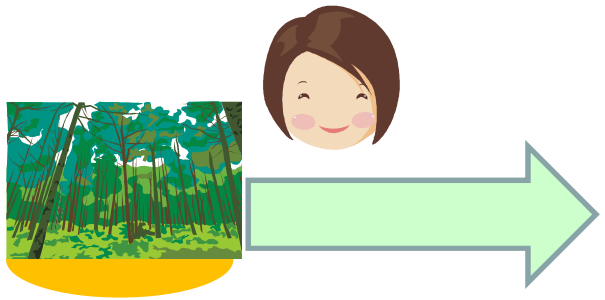
Resource occupancy of land

= (area of land) x (period)

Wood in a house

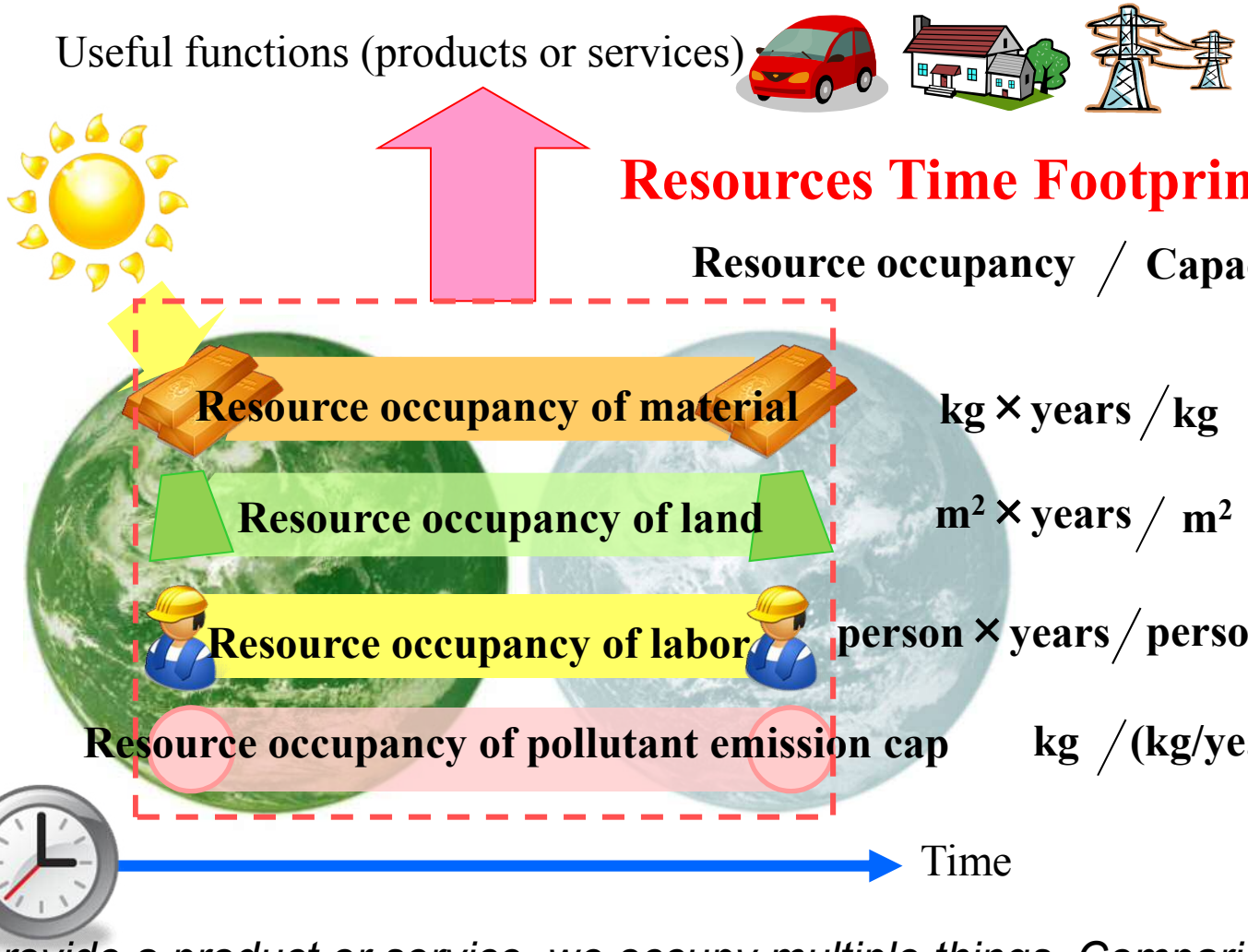
Area of land for wood supply





Reversible (potentially sustainable) use

Indicator for assessing impact on sustainability



To provide a product or service, we occupy multiple things. Comparison of resource occupancy to total capacity in each different aspect provides us a common indicator which is expressed by the unit of years.

Resources Time Footprint

$$RTF = \frac{OA \times OT}{T\ A} \text{ (years)}$$



Resource occupancy (amount x time) / capacity (amount)

where ORT represents occupancy ratio time (years), OA is amount of occupancy (kg, km2, or person, depending on the aspect), OT is period of occupancy (years), TA is total capacity (kg, km2, or person, depending on the aspect).

$$RTF = \frac{CA}{TS} \text{ (years)}$$


Resource occupancy (amount) / capacity (speed)

where CA represents the amount of consumption of freshwater or emissions of pollutants (kg), and TS is the total rate of supply or removal (kg/year).

For example, in a case of freshwater, as the capacity, supply speed of freshwater is more important than the total abundance of freshwater preserved in lakes, underground water vein etc.

RTF for different aspects

ROC ratio is an indicator to evaluate a change (especially brought by a countermeasure) in terms of sustainability by standardizing impacts on multilateral aspects into common unit: years.

RTF of land

$$ROC\ ratio\ of\ land\ [y] = \frac{occupied\ \ area\ [m^2] \times period\ [y]}{total\ \ area\ [m^2]}$$

e.g. Indicator implies that the efficient use of our existing infrastructures is important to enhance our sustainability

RTF of material

$$ROC\ ratio\ of\ material\ [y] = \frac{occupied\ \ amount\ [kg] \times period\ [y]}{recoverable\ amount\ [kg] + accumuration\ [kg]}$$

RTF of labor

$$ROC\ ratio\ of\ labor\ [y] = \frac{occupied\ \ workors\ [person] \times period\ [y]}{total\ \ workors\ \ [person]}$$

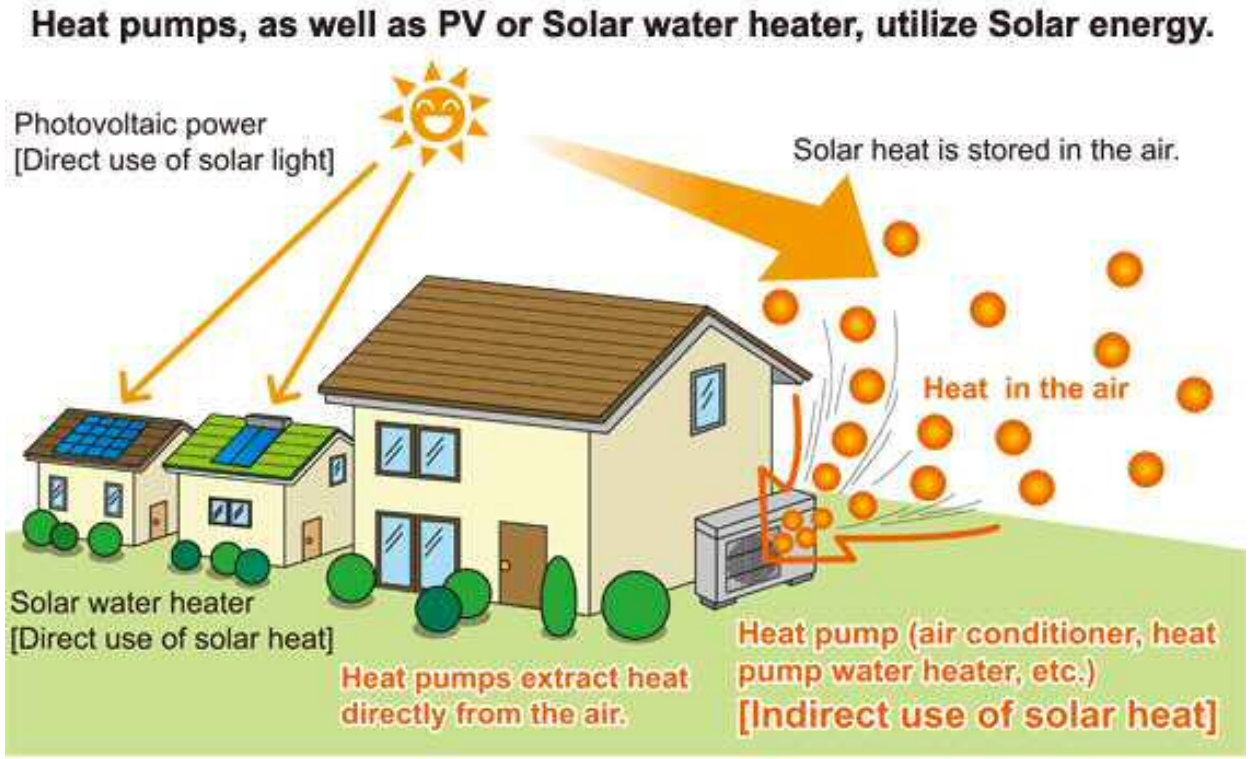
RTF of environmental capacity to absorb pollutants

$$ROC\ ratio\ of\ env.cap.\ [y] = \frac{pollutants\ \ emission\ \ [kg]}{removal\ \ rate\ of\ \ pollutants\ \ [kg/y]}$$

Less RTF means more sustainable (close to a steady state)

Case study

Heat pump vs. Conventional boiler

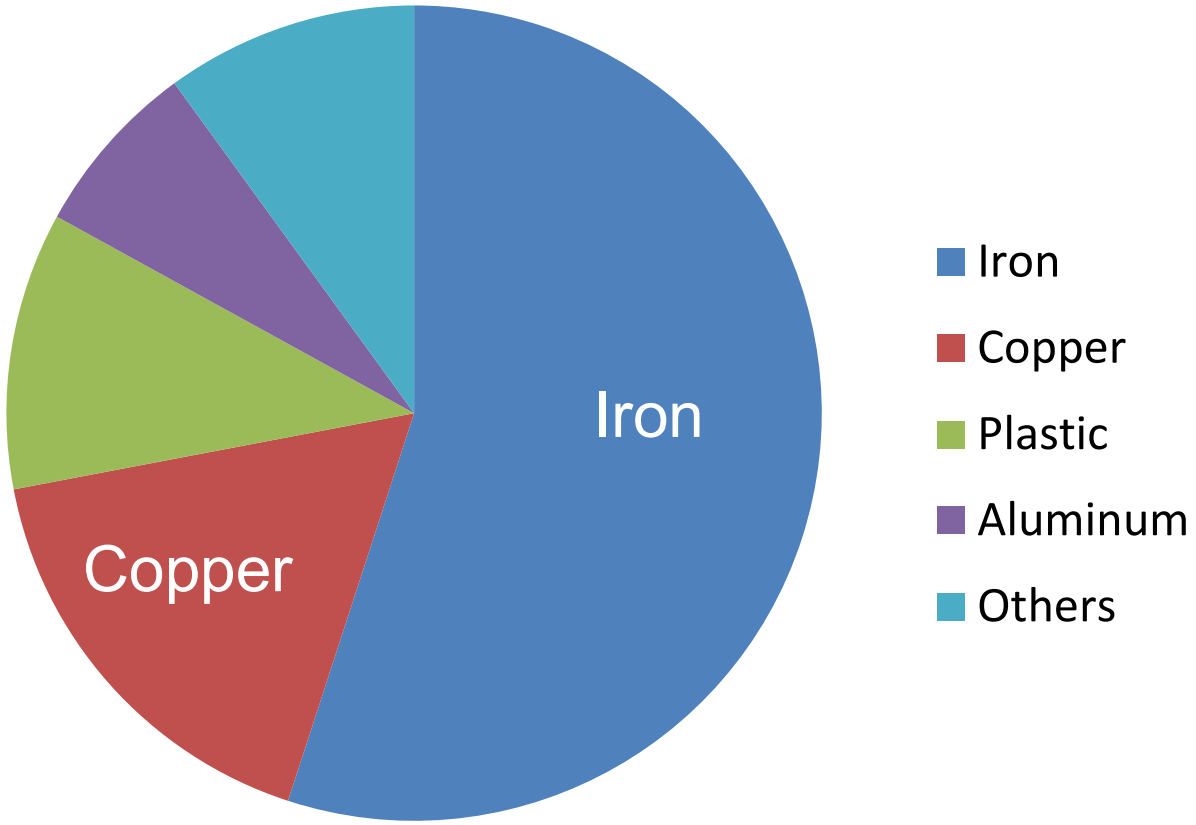


$$ERES^{*1} = Qusable^{*2} \times (1 - 1/SPF^{*3})$$

*1 Amount of ambient energy captured by heat pumps to be considered renewable energy
*2 Estimated total usable heat delivered by heat pumps
*3 Estimated average seasonal performance factor for those heat pumps

Source: HPTCJ

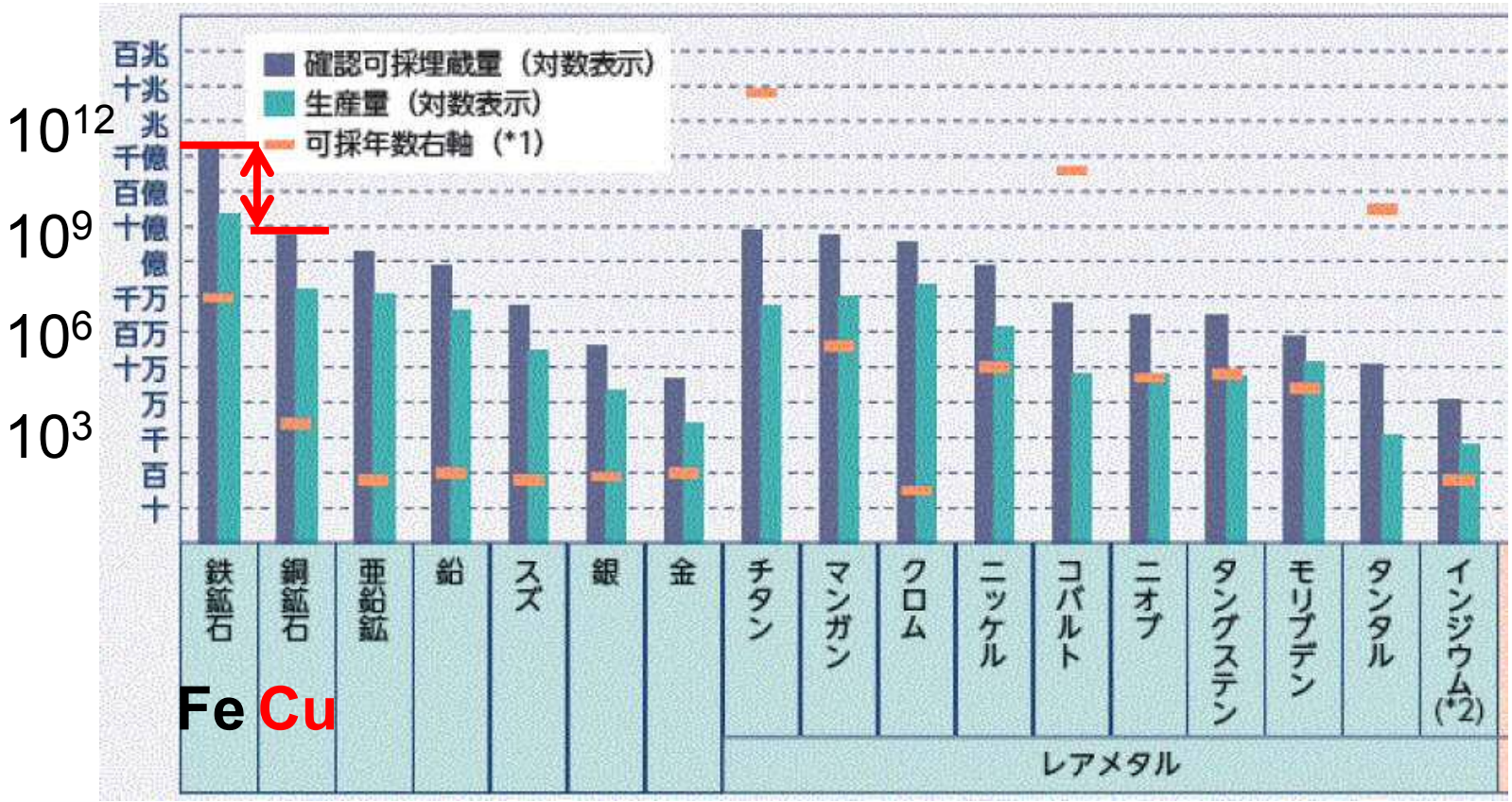
Material constitution of heat pump



Source: Panasonic

Importance of metals

Proven reserves (t)



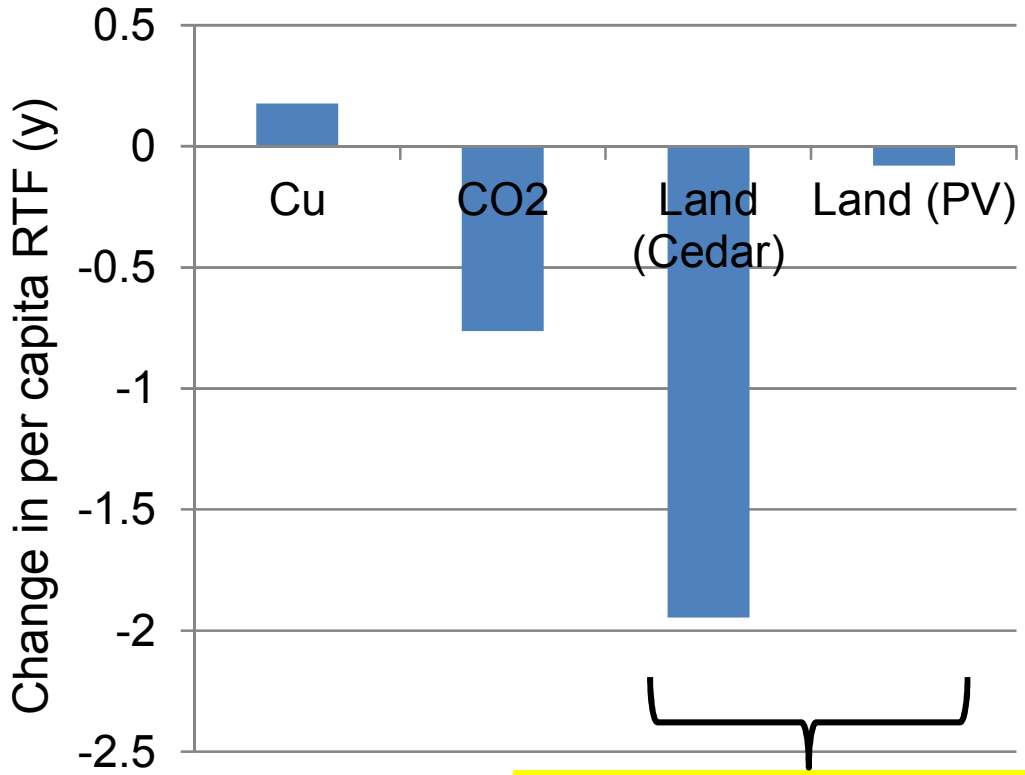
Source: Ministry of Environment, Japan

Case study (condition)

Functional unit	**Hot water supply to a house (3 person household) for 10 years**		
System for comparison	Heat pump	Gas boiler	
Aspects considered	Material	CO_2 emission	Land
	Resource occupancy of Cu	Resource occupancy of pollutant emission cap	Fuel consumption is converted to the occupancy of land

Result (Change in RTF)

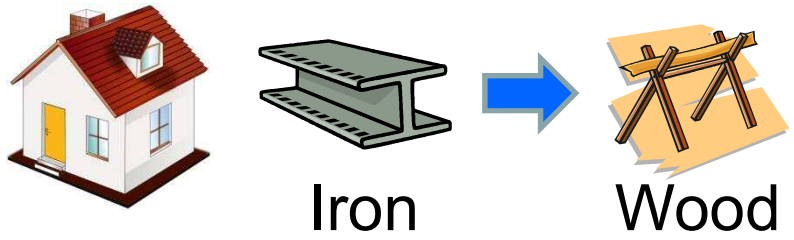
Gas boiler → Heat pump (Hot water supply, 10 years)

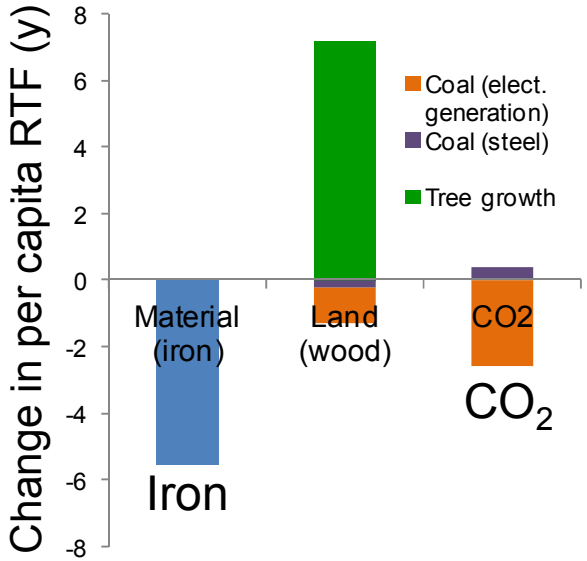


Fossil fuel consumption converted to land occupancy

Applications of the indicator

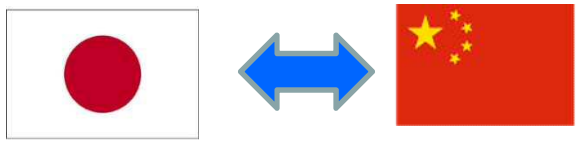
Change to renewable resources

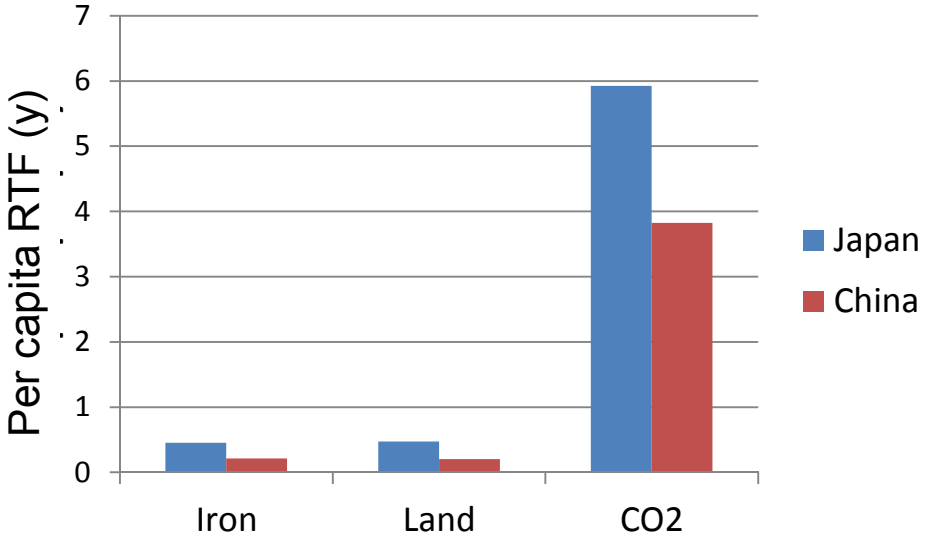




Fujii et al., 2014

Comparison between regions, countries, etc.





Fujii et al., 2015

Integrative Eco-city Simulation Model for Municipal Governments

- *Location theory*
- *Regional science (Weber, Alonso, etc.)*

Regional Future Scenario (Local GDP, Population Land area)

- *Multi-Variable Integration Theory*

Land Use Scenario

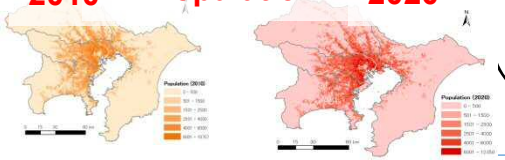
Spatial Distribution (Residential)

Spatial Distribution (Industrial)

Industrial Location Scenario

Future Spatial Scenario

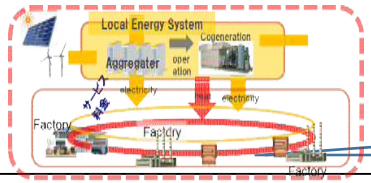
2010 Population 2020



Built Environment Transition

Local Energy Management System

- *CEMS*
- *ADR*



Transportation Management System

Industrial Energy Management System

- *Local energy*
- *FEMS*
- *Industrial Symbiosis*

Waste Management System
Recycle and Industrial symbiosis

- Eco Finance / Behavior Science

Interactive Eco-policy Planning System in Asia

Fukushima Shinchi Township

Community Assist Tablet Network

Local Needs

Regional Environment Information

Planning for Sustainable Future

National Institute for Env. Studies

Urban Spatial Analysis

Local environment diagnosis

Integrated Modelling

Future scenario assessment

Tech. and policy inventory

- low carbon tech
- circulation tech
- industrial symbiosis
- policy / regulation
- land use control

Simulation for recovery roadmap