

# Country Report Japan

October, 2014



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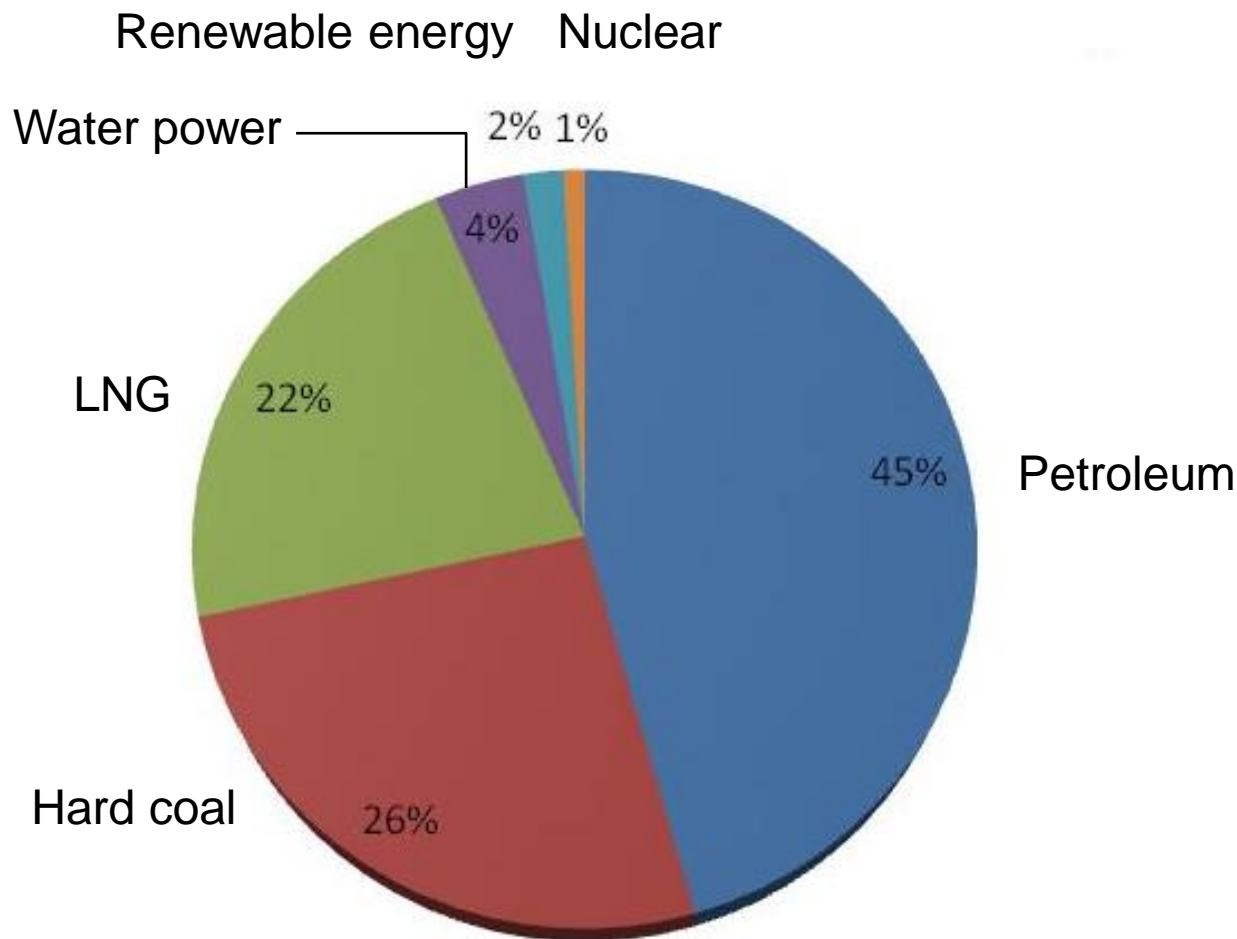
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- Country specific energy consumption
- Biomass use for energy and non-energetic applications
- Biomass related (national) policy issues
- Biomass related sustainability aspects
- Running commercial biorefineries
- Biorefinery demonstration and pilot plants
- Major R&D projects
- Major national stakeholders involved in the field of biorefining
- Other issues

# Country specific energy consumption in 2012



Source: BP Statistical Review of World Energy, June 2013

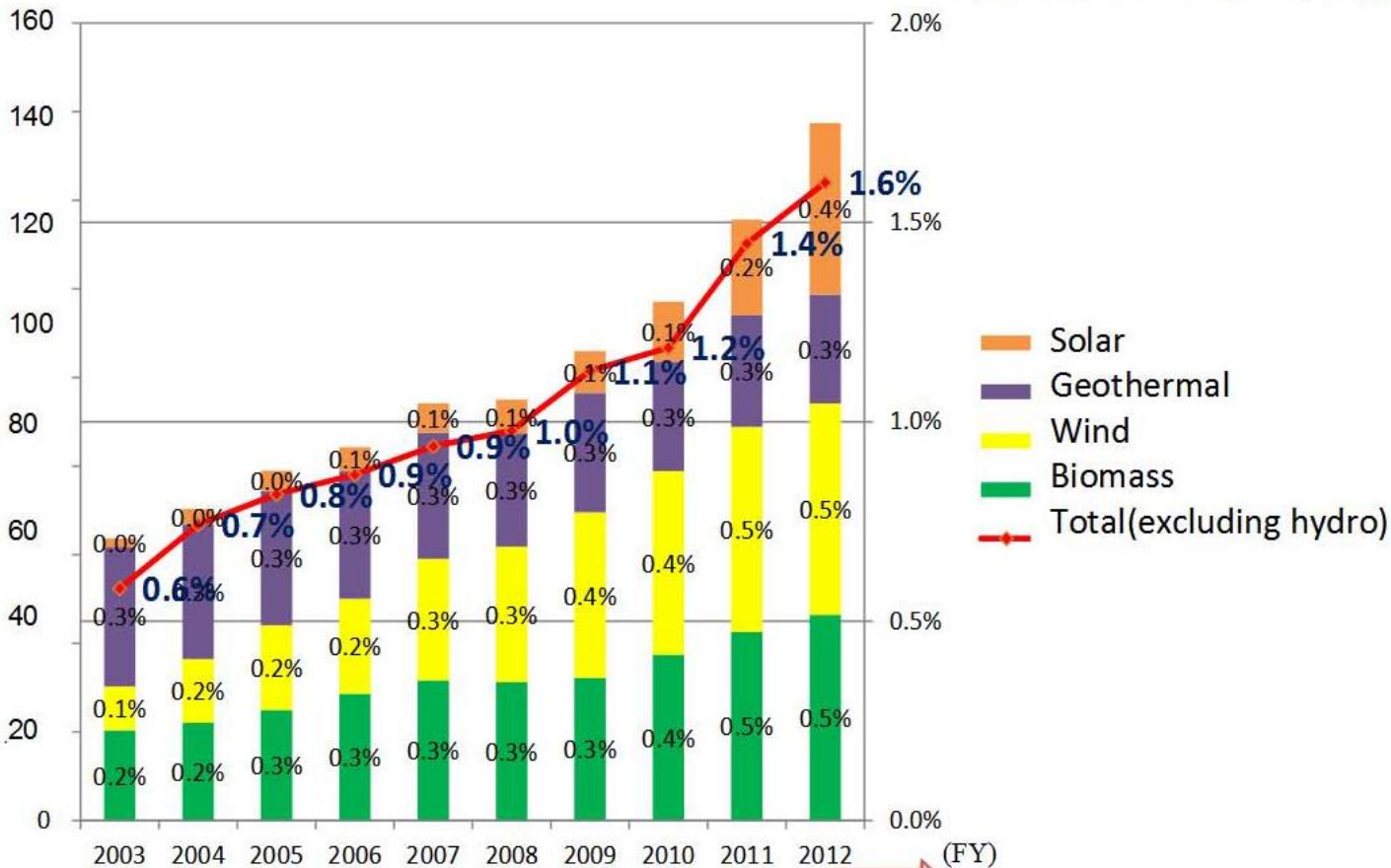
Country Report **Japan**

# Country specific energy consumption in 2012

(100 million kWh) 180

### Japan's use of renewable energy in percentage

(Percentage to the total power generation)



RPS Scheme

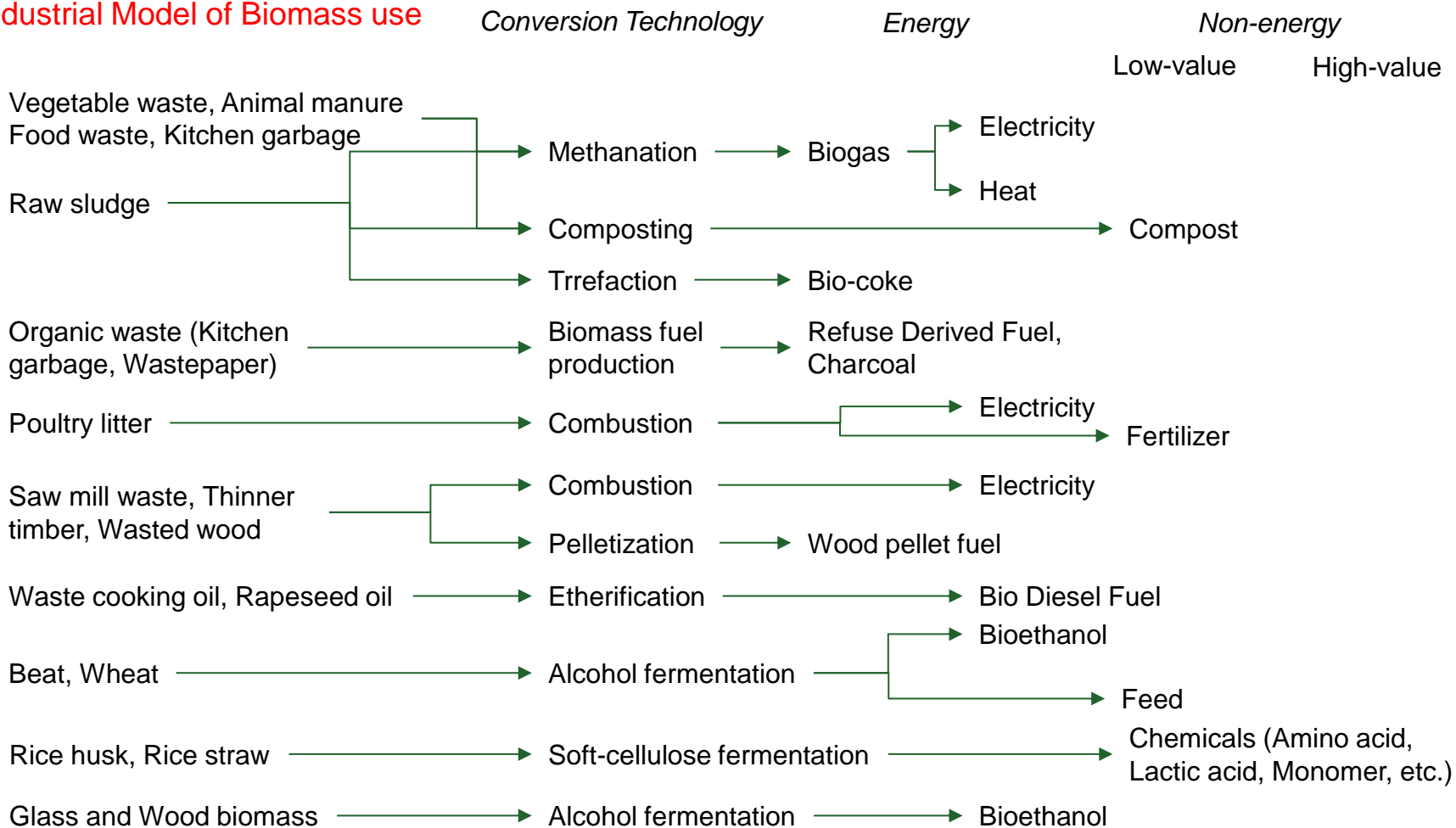
Residential Surplus Electricity Purchasing Scheme

Feed-in Tariff Scheme

\* Created by the Agency for Natural Resources and Energy using Electric Power Statistics, RPS data, buyback under the Feed-in Tariff Scheme, etc.

# Biomass use for energy and non-energetic applications

### Industrial Model of Biomass use



Source: Ministry of Agriculture, Forestry and Fisheries (2012)

# Biomass related (national) policy issues

### Major Development of Biomass Policy in Japan

Biomass utilization promotion was incorporated in basic national strategy in 2002, and the Basic Act was established in 2009. After the Great East Japan Earthquake and subsequent nuclear accident happened, the biomass industrialization strategy was drawn as principle to create regional green industry and fortify an independent and distributed energy supply system.

Year	Policies	Outline
2002	Biomass Nippon Strategy	- Providing basic national strategy to realize sustainable society with full biomass utilization - Begins to create Biomass Town in 2014
2005	Kyoto Protocol Target Achievement Plan	- Promoting widespread use of biofuels including fuel for transportation (500,000 kL by 2010) - Building Biomass Towns and developing biomass energy conversion technologies
2006	Biomass Nippon Strategy (Revised)	- Aims to use biomass energy, including fuel for transportation - Fortifying Biomass Town creating, (Goal; 300 Biomass Towns by 2010)
2009	Basic Act for the Promotion of Biomass Utilization	- Aims comprehensive and planned promotion of biomass utilization policy - Drawing up the National Biomass Policy Council
2010	Basic Energy Plan	- Introducing renewable energy in 10% primary energy supply by 2020 - Increasing biofuel at a volume equivalent to 3% cut of gasoline demand nationwide by 2020
2010	Act Concerning Sophisticated Methods of Energy Supply Structure	- Requiring oil refiners to produce a certain amount of biofuels (FY2011: 210,000kL to FY2017: 500,000kL (crude oil equivalent))
2010	National Plan for the Promotion of Biomass Utilization	- Setting targets for 2020 - Setting basic policies on the department of technologies for biomass utilization
		Great East Japan Earthquake and Fukushima nuclear plant accident (2011.3)
2012	Biomass Industrialization Strategy	- Specifying the targeted conversion technologies and biomass for realizing biomass industrialization - Setting principles and policies for realizing biomass industrialization

# Biomass related (national) policy issues

### Strategy in Japan

- Basic strategy*
- Promotion of industrialization by selection and concentration of biomass resources and technologies
  - Construction of the consistent system from materials production to collection, conveyance, manufacture, and use
  - Creation of local jobs and strengthening of independence and decentralized energy supply system local biomass
  - Offer of the structure of the stable policy to which entry of an investor and an entrepreneur is urged

### *Technological strategy*

- Offer of the structure of the stable policy to which entry of an investor and an entrepreneur is urged
- Decision of technological road map (evaluation of industrial technology utilized for commercialization), and reexamination of technological road map
- Technological development acceleration for biomass use by cooperation of industry, academia and government research institution

- Target in 2020*
- Market size of Biomass related industries; 5 billion USD
  - Amount of biomass use; 2.6 million ton - CO2 per year

Source: Biomass Industrialization Strategy (2012)

# Biomass related (national) policy issues

### Individual preferable strategy

#### Woody biomass

Configuration of efficient collection and delivery system for unused thinner timber etc. and integrated and preponderant promotion for energy use

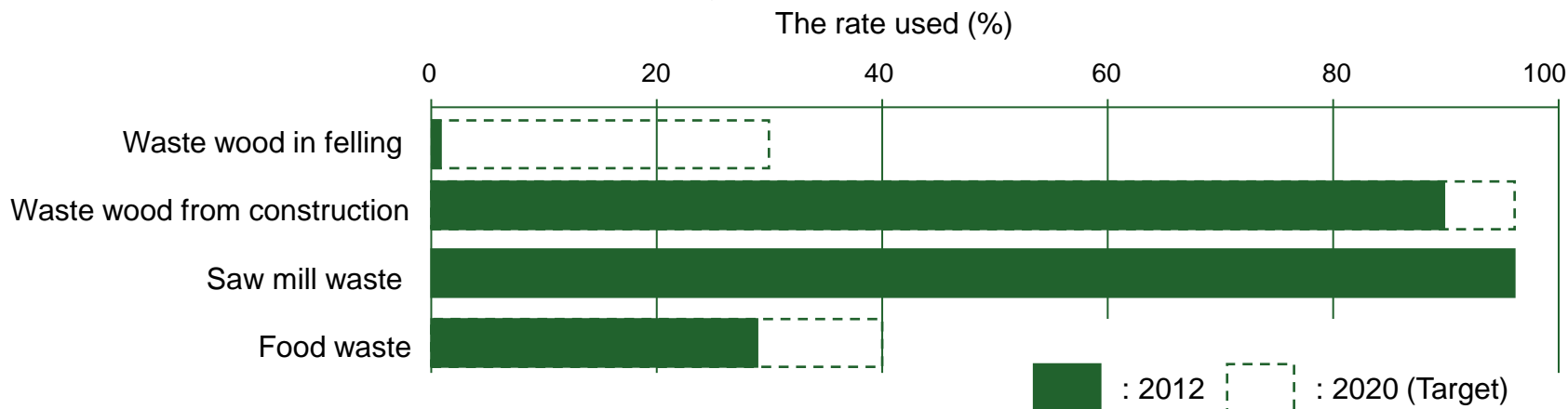
Promotion of use of saw mill waste etc. to a papermaking material and energy, etc.

Promotion of use of waste wood from construction as materials for paper and wood board or energy, etc.

#### Food waste

Promotion of reclamation by complete separation and conversion to biogas and solid fuel etc.

Check of the enforcement situation of Law on Recycling Food Wastes



Source: Biomass Industrialization Strategy (2012)

# Biomass related (national) policy issues

### Individual preferable strategy

#### Raw sludge

As the base of biomass utilization of local area, promotion of energy use by conversion to biogas and solid fuel etc.

Improvement in the energy recovery rate by mixed use of raw sludge and food waste, etc.

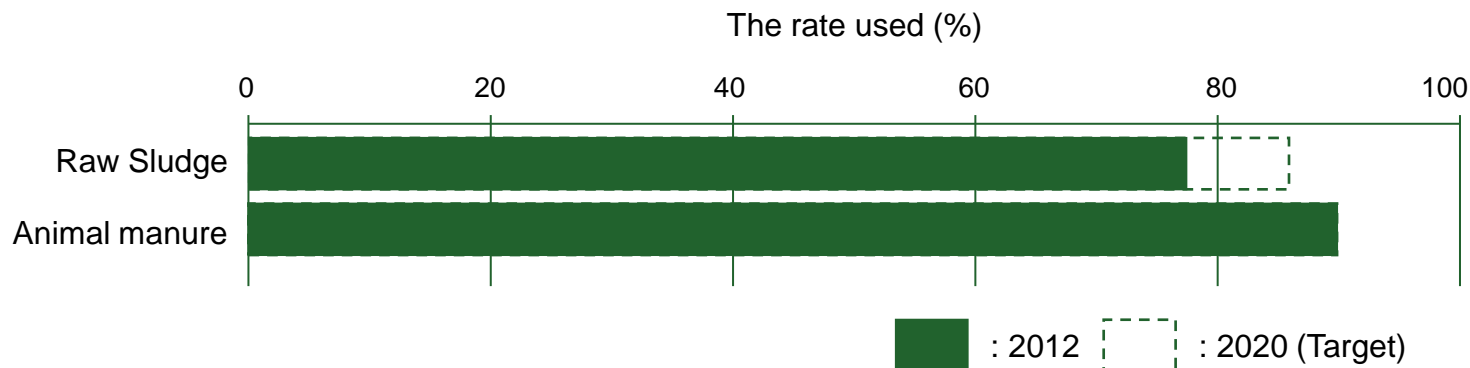
Demonstration of innovation technology with low cost and high efficiency

#### Animal manure

Promotion of energy use by methane fermentation and direct combustion

Improvement in the energy recovery rate by mixed use of animal manure and food waste

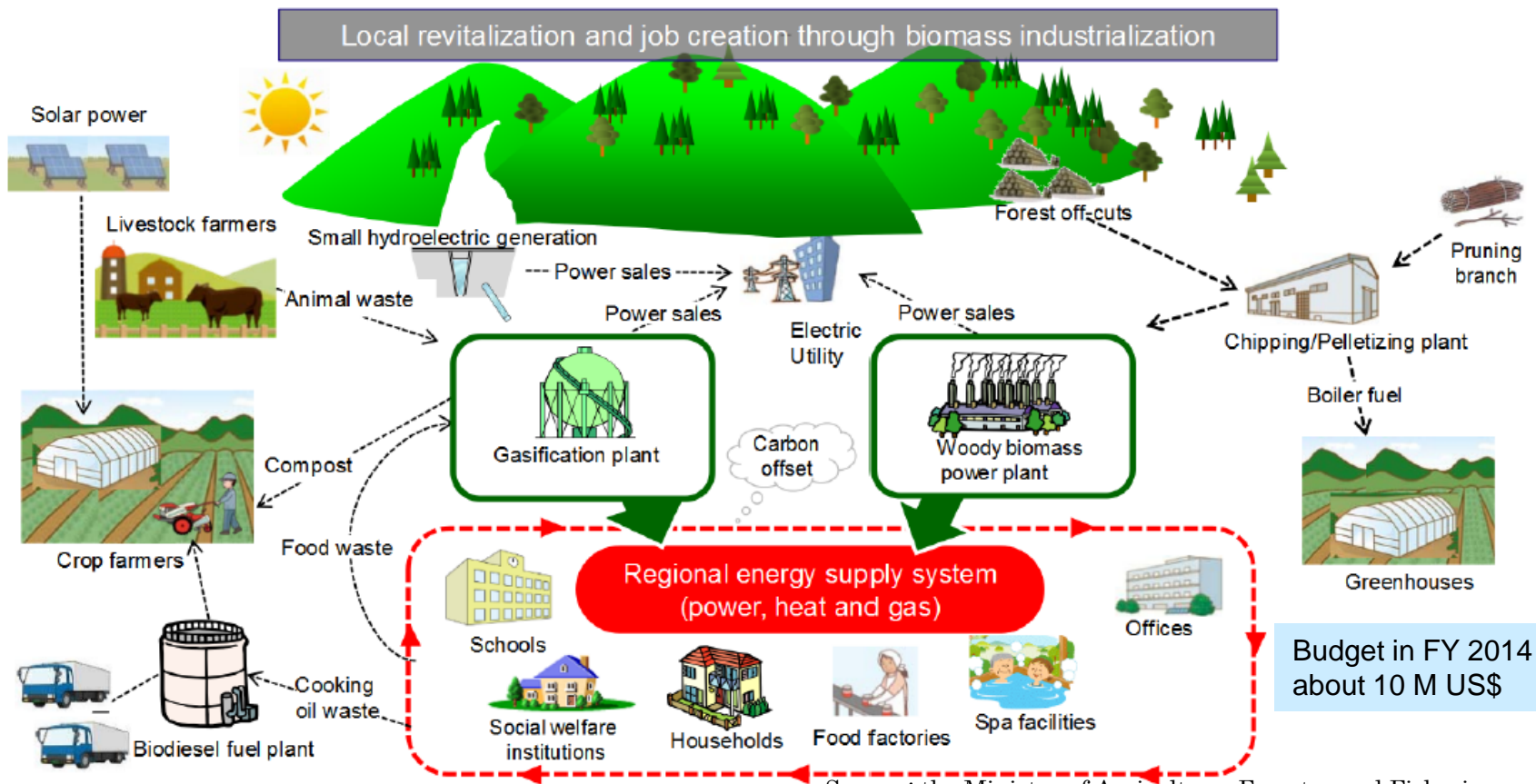
Development and diffusion of use of methane fermentation digested liquid as fertilizer



Source: Biomass Industrialization Strategy (2012)

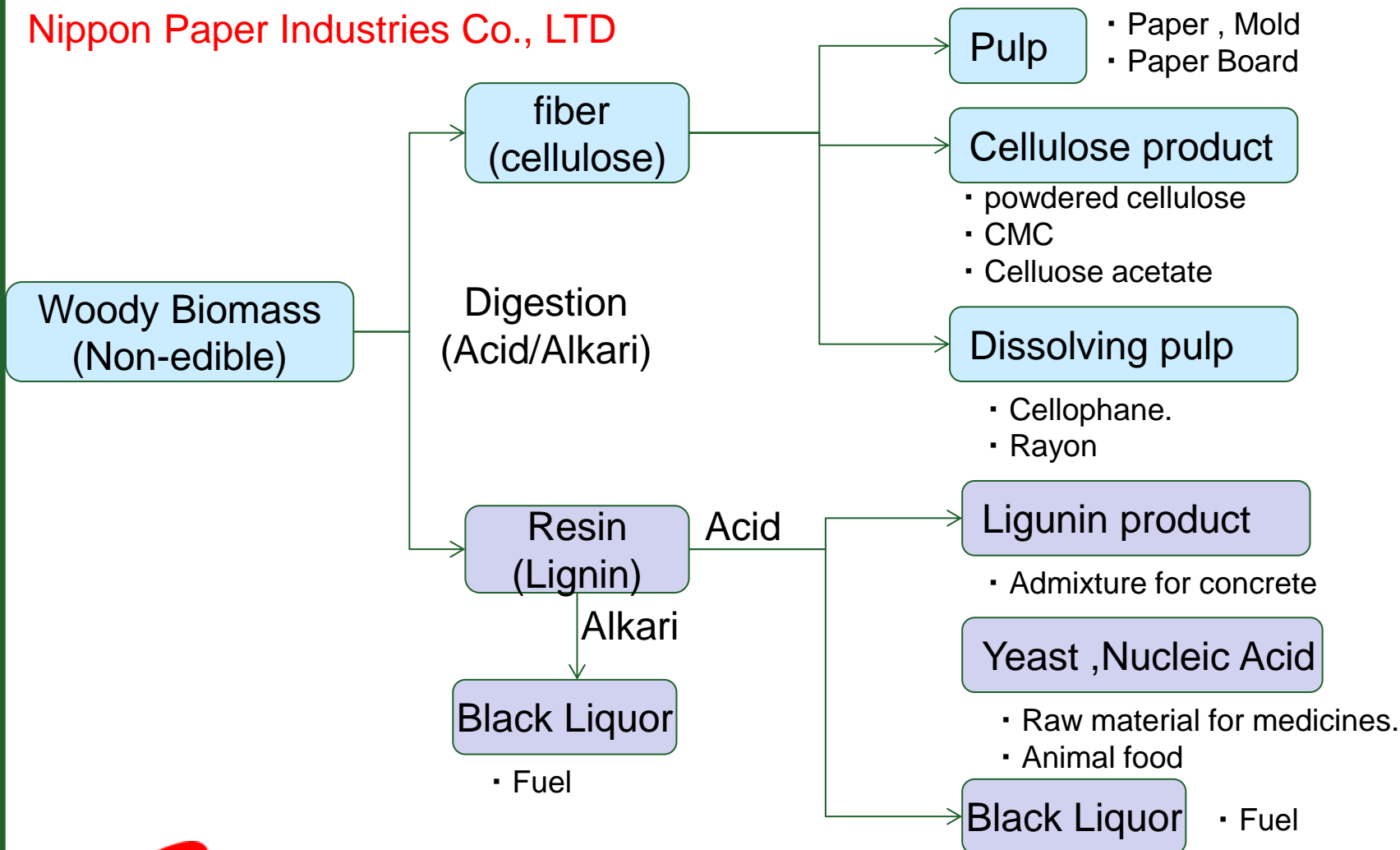
# Biomass related sustainability aspects

- Establishment of green industry utilizing regional biomass and recycling-based energy system in combination with solar and small-scale hydro-electric power generation.
- Creation of environmental-friendly and disaster-resistant communities (Biomass Industrial Communities), centering on the biomass industry.



# Running commercial biorefineries

Nippon Paper Industries Co., LTD



# Biorefinery demonstration and pilot plants

## Bioethanol Production from Fast Growing Trees

Pilot plant  
250 L /day (80 kL / year)

Hiroshima, Japan

NEDO project

Oji Holdings Corp  
Nippon Steel & Sumikin Engineering Co., Ltd.  
AIST



Japanese Government  
Ministry of Economy , Trade and Industry(METI)

Budget

Coordination with  
policymaking authorities

Budget

Management,  
Finance

 NEDO

 National Institute of  
Advanced Industrial Science  
and Technology  
**AIST**

Partnership

Research and Development

academia

industry

Public research  
laboratory

**NEDO:**

**Budget:** approx.\$13billion in FY2014

**Personnel:** 800 as of 2014

**AIST:**

**Personnel:** 2,900 as of July 2014

## Task 42 Biorefining

### Development for Integrated production Process from Non-edible Biomass to Chemicals

Japanese Government → NEDO → Private company, Universities and R&D institutes

2013 Budget : 6.5 M US\$ for 18 projects  
Duration: From 2013 to 2019

Purpose



Change of Materials



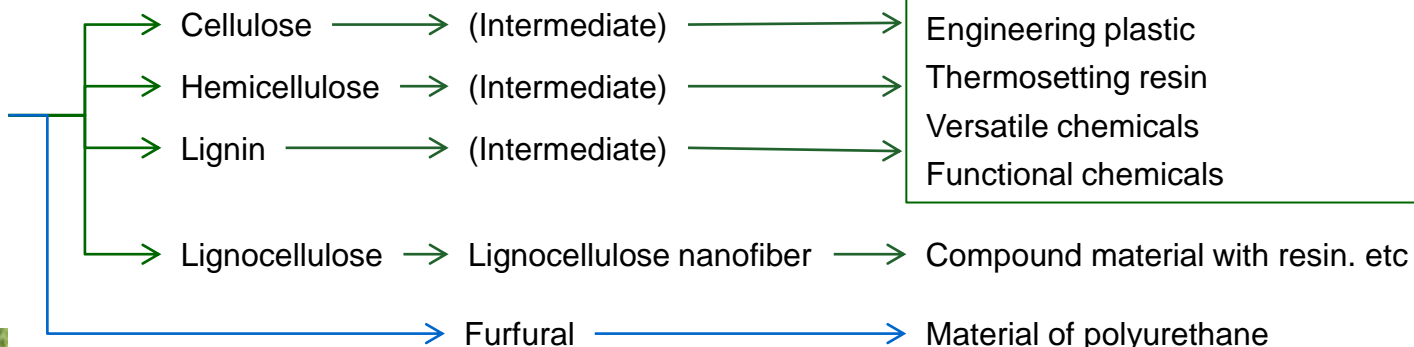
Non-edible biomass



Outline



Woody biomass



Chinese gutta percha → crude poly-isoprene → Purified poly-isoprene → Shock-proof biomaterials



## Task 42 Biorefining

### Strategic Development of Next-generation Bioenergy Utilization Technology

Target is to establish manufacturing technology that utilizes BTL and microalgae-derived biofuels by 2030

Japanese Government → NEDO → Private company, Universities and R&D institutes

Budget in FY2013 :approx.18M US\$  
Duration: from FY2010 to FY2016

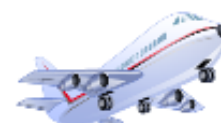
Cultivation, harvest, extraction  
conversion etc.



Microalgae etc.  
(*Botryococcus* etc.)



Hydrocarbon etc.



Jet-fuel



Gasoline

Gasification, purification,  
FT-synthesis, distillation



Woody biomass etc.



Hydrocarbon



Bio-diesel



15  
Kerosene

## Task 42 Biorefining

### R&D of Biomass Refinery Research Center, AIST

Where

JAPAN

South-East Asia

Resources



Wood residue

MSW

Unused biomass (Ligunocellulose)

Rice straw

Bagasse

Palm oil residue

Wood chip residue

Technology

Fibers are loosened and a plastic is mixed

Gasification and FT-synthesis

Pre-treatment + saccharification + fermentation

Products

Cellulose nanofiber  
Bio-nanocomposit

Jet-fuel

Bioethanol

Chemical materials



High intensity materials for automobile or home electronics



Photo: Japan Airlines



Commercialization

2016~

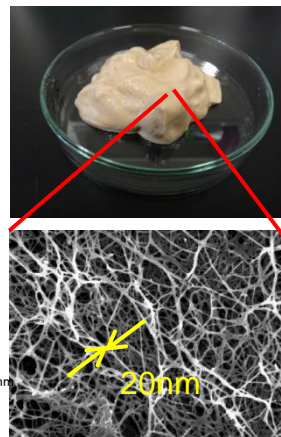
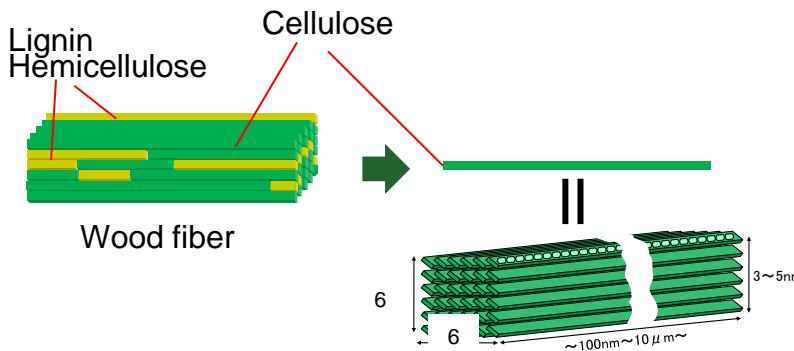
2020~

2016~

2025~

## Task 42 Biorefining

### Cellulose nanofiber for Material



*The feature of cellulose nanofiber*

The intensity is 5 times of steel, the weight is 1/5 of steel

More detailed than the wavelength of visible light (360 – 830 nm)

Low-thermal expansion same as silica glass

Recycling is easy

Renewable resource

Safe product of nature

*Index of high efficiency*

*Desired value of high efficiency*

*Functional material*

Transparent

Optical transmittance (%) 3mm



Glass substitution  
93



Optical film  
92



Optical material

Light and high-intensity

Tensile strength (MPa) / specific gravity



Automobile parts  
200 / 2.1 to 300 / 1.3

Constructional material

Dimensional stability

Thermal expansion coefficient ( $10^{-6}/K$ )



IC package  
62 (Epoxy)



Printed circuit board  
54 (Polyimide)



Electronic industry material

Gas barrier property

Permeability of vapor ( $g/m^2$  day)



Packaging material  
 $1 - 10^{-1}$  (Vapor deposition film)



Organic EL board  
 $<10^{-2}$  (Multilayer deposition film)



Packaging material

Control of fine pores



Highly efficient filter  
Nano-size



Separation and support material

Control of viscosity and elasticity

Viscosity (mPa s)



Thickener for food and cosmetics  
7 – 14,000 (CMC)



Thickening and dispersing material

# Major national stakeholders involved in the field of biorefining

Field	Name	Type	Website
Policy	Minister of Economy, Trade and Industry Agency of Natural Resources and Energy	Government	<a href="http://www.enecho.meti.go.jp/en/">http://www.enecho.meti.go.jp/en/</a>
	Ministry of Agriculture, Forestry and Fisheries	Government	<a href="http://www.maff.go.jp/e/index.html">http://www.maff.go.jp/e/index.html</a>
	Ministry of the Environment	Government	<a href="http://www.env.go.jp/en/">http://www.env.go.jp/en/</a>
	Ministry of Land, Infrastructure, Transport and Tourism	Government	<a href="http://www.mlit.go.jp/en/index.html">http://www.mlit.go.jp/en/index.html</a>
	Cabinet Office	Government	<a href="http://www.cao.go.jp/index-e.html">http://www.cao.go.jp/index-e.html</a>
	Ministry of Internal Affairs and Communications	Government	<a href="http://www.soumu.go.jp/english/index.html">http://www.soumu.go.jp/english/index.html</a>
	Ministry of Education, Culture, Sports, Science and Technology	Government	<a href="http://www.mext.go.jp/english/">http://www.mext.go.jp/english/</a>
Technology providers	Biomass Refinery Research Center, AIST	R&D institutes	<a href="https://unit.aist.go.jp/brrc/eng/">https://unit.aist.go.jp/brrc/eng/</a>
	New Energy and Industrial Technology Development Organization	R&D institutes	<a href="http://www.nedo.go.jp/english/index.html">http://www.nedo.go.jp/english/index.html</a>

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