NEDO's Activities About Energy

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New Energy and Industrial Technology Development Organization

NEDO's Activities on Biomass Energy

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1. What is NEDO?

Introduction of NEDO

NEDO: Incorporated administrative agency under the Ministry of Economy, Trade and Industry (METI) of the Japanese government
- Plot R&D strategies for national projects
- Organize the best teams from industry, academia and government
- Manage projects and disseminate the achievements

NEDO

Implementation of R&D projects & demonstration studies

- Established in 1980
- No. of personnel : about 900
- FY 2016 budget: 130 billion yen

METI
Ministry of Economy, Trade & Industry

Collaboration with policymakers

Industry Academia etc.

Integrate expertise among academia & industry

■ Strategic R&D project management

-Discovery of seeds
-Implementation of mid to long term R&D projects

■ Total coordination among government, academia & industry

-Total coordination of R&D among concerned parties

Realization of innovations

NEDO's Role

Largest Core Organization	- NEDO, Japan's largest core R&D management organization, promotes R&D across a wide range of fields, including advanced industrial, environmental, renewable energy and energy conservation technologies.
Total Coordination of R&D PJ	- NEDO provides comprehensive R&D coordination to achieve superior research results by bringing together the combined strengths of the industrial, academic and government sectors.
Expertise in R&D Management	- NEDO is focused on bringing a professional management approach to R&D management, ranging from the cultivation of new technology seeds to promotion of mid- to long- term projects and support for the development of practical applications

Technology Areas

NEDO's Technology Development Fields

NEDO covers a wide range of technology development fields from energy and environmental technologies to industrial technologies, and it promotes the development of technologies necessary for the future.

Addressing energy and global environmental problems

Energy conservation

Superconducting cable system demonstration using actual grid

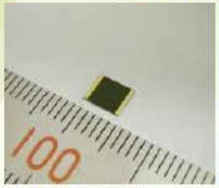
- Energy conversion and supply
- Industrial sector
- Residential and commercial sectors
- Transport sector
- Cross-sector

Rechargeable batteries and energy systems

World's most advanced battery analysis facility (RISING synchrotron radiation beamline)

New energy

- Solar power
- Wind power
- Fuel cells and hydrogen
- Biomass
- Geothermal energy
- Ocean energy



Ultrahigh efficiency solar cells

Demonstration research on offshore wind power generation

Materials and nanotechnology

- Nanocarbon
- Rare earths and rare metals
- Herbal biomass
- Carbon fiber

Vehicle emission purification filter using half the amount of platinum

New manufacturing technology

- Laser

Excitation semiconductor laser

Crossover and peripheral fields

- Sensor system

Infrared array sensor equipped with solar panel

Environment and resource conservation

- Water resource recycling
- 3R technology
- Environmental chemistry
- Fluorinated gas control measures

Energy-saving membrane bioreactor pilot test plant

Clean coal technology

- Low-carbon coal-fired power plant
- Utilization of low-rank coal
- Low-carbon steel industry

Integrated coal gasification combined cycle power generation and CO_2 capture (EAGLE project)

Global warming mitigation

- Green Investment Scheme
- Global Warming Mitigation Technology Promotion Project

Support for international expansion

- Smart communities
- International Projects for Increasing the Efficient Use of Energy

Demonstration of smart grid technologies using electric vehicles (Maui Island, State of Hawaii, USA)

Electronics, information and telecommunications

- CPS (Cyber-physical systems)
- IoT (Internet of Things)
- Computing
- Memory
- Power semiconductors
- Printed electronics
- Optoelectronics

World's highest quality 6 inch silicon carbide (SiC) wafer

Robot technology

- Industrial robots
- Service robots
- Nursing care and medical care robots
- Infrastructure and disaster response robots
- Next-generation fundamental technologies

New Robot Rodem (NRR) electric wheelchair

Helicopter robot

Enhancing industrial technology

Activities Around the World

NEDO plays a leading role by carrying out international demonstration projects and introducing stand-alone technologies as well as system that integrate various technologies. NEDO aims to introduce advanced Japanese technologies to countries and regions around the world having diverse needs and infrastructures.

2. GOJ's Policy for Biomass Energy

Strategic Energy Plan (approved by the Cabinet, April 2014)

■ Renewable energy

・It is an important energy source which can contribute to energy security as it can be domestically produced, free of greenhouse gas emissions.

・GOJ accelerates the introduction of renewable energy as much as possible for three years from 2013, followed by continuous active promotion.

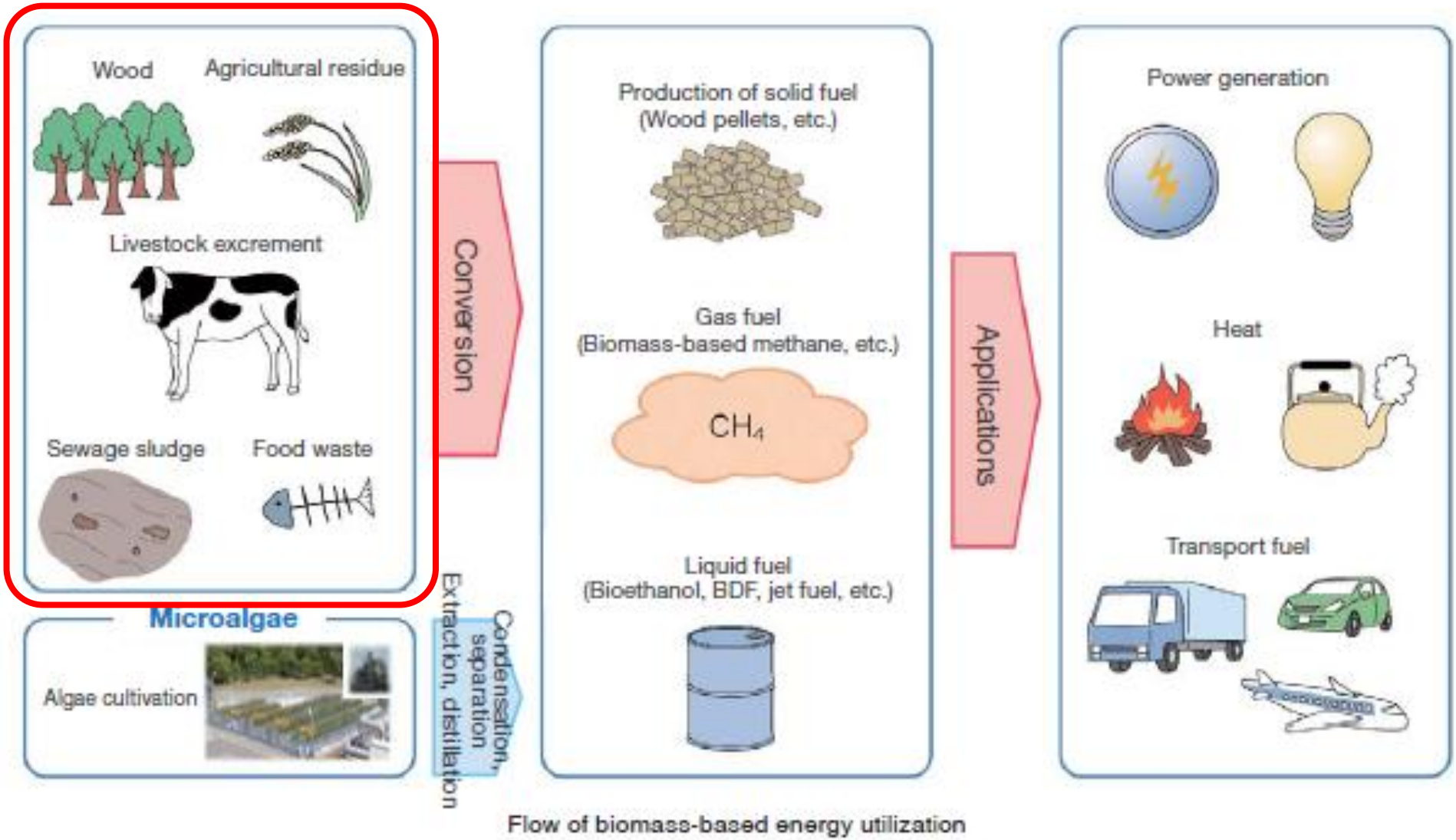
■ Woody Biomass and so on (including biofuels)

・The introduction of biomass energy by pursuing merit of scale and adopting mixed combustion at existing thermal power plants should be increased.

・Continuous introduction of biofuels should be promoted while taking into consideration the international situation and the technology development trend concerning next-generation biofuels.

3. NEDO’s Projects

Conversion from Biomass to Energy



Flow of biomass-based energy utilization

Characteristics of Biomass

Features of biomass energy

Biomass from food and farm produce is an energy source that does not release CO_2 into the air (being known as carbon neutral) and can be used as a fuel in a variety of forms such as liquid fuel and heat.
Biomass resources are distributed widely and thinly, requiring high costs to collect and transport resources and convert them into energy.

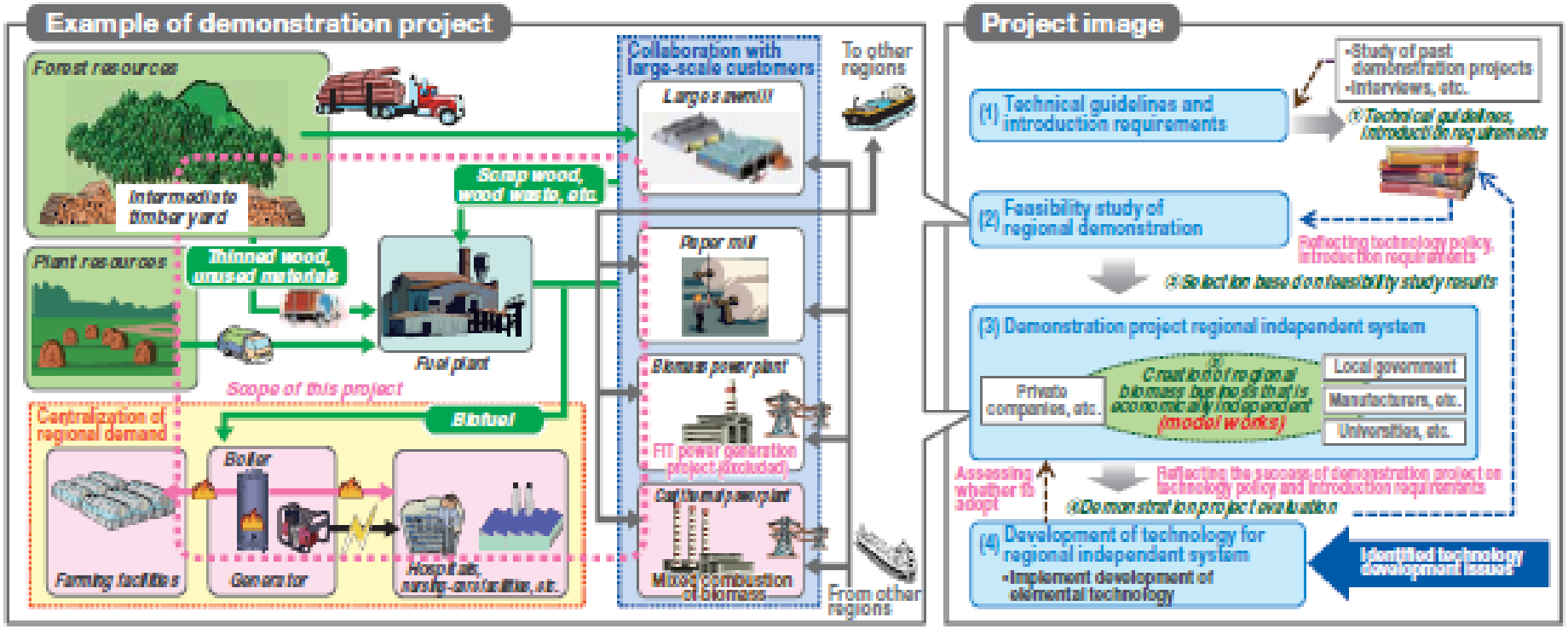
NEDO's activities

- We develop the technology for making biomass power generation and heat utilization with high efficiency and at a low cost and the next-generation technology for producing fuel from microalgae.
- We are engaged in elemental technology development and demonstration programs for steadily producing transportation fuel (bioethanol) from biomass such as inedible plants.
- We will implement demonstration projects to promote the introduction of biomass energy with the aim of establishing an independent local biomass energy cycle.

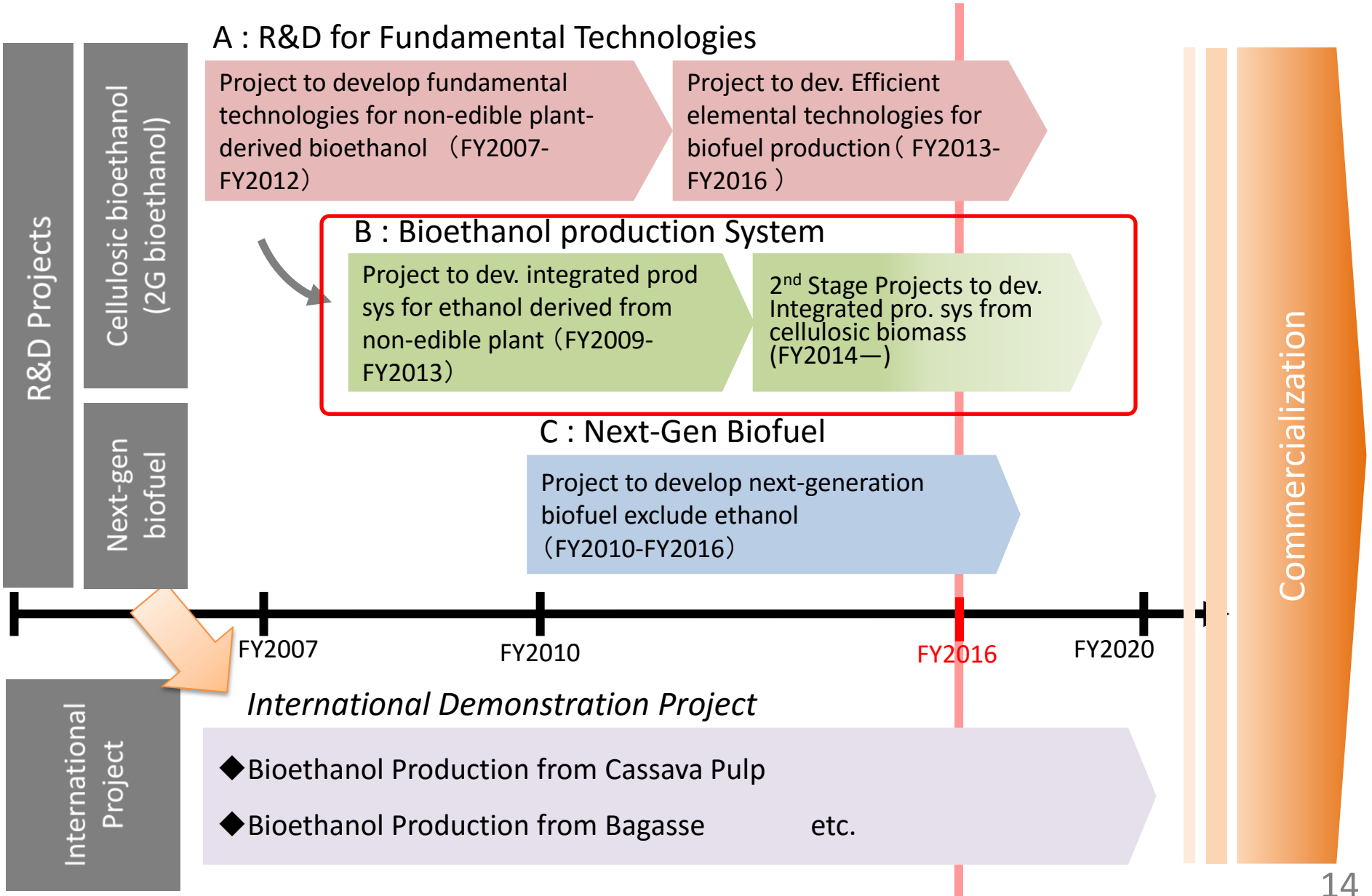
Domestic Project in Local Area in Japan

Demonstration project on regional independent system for biomass energy

NEDO carries out case studies in Japan and abroad, and formulate the guidelines regarding relevant technology and economic efficiency to facilitate the independent use of biomass energy by each region. Based on the guidelines, we will support businesses aiming to utilize biomass energy in their regions.



Outline of Biofuel R&D Projects in NEDO



Development Benchmarks for Cellulosic Bioethanol

		Benchmarks indicating achievement of each individual technology by "Biofuel Technology Innovation Plan" in 2008
Feedstock	Dry-yield	・Herbaceous plants : 50 t/ha per year ・Woody plants : 17t/ha per year
Production	As an integrated process	・Energy consumption 6MJ/kg-biomass ・Ethanol yield 0.3 l/kg-biomass ・Energy recovery 35%
	Pretreatment	Pretreatment that makes enzyme saccharification efficiency 80%
	Enzyme saccharification	・Enzyme consumption 1mg/g-produced sugar ・Sugar yield 500g/kg-biomass
	Ethanol fermentation	・Ethanol yield 95%
	Condensation / dehydration	・Energy consumption 2.5MJ/l-ethanol

Source: Biofuel Technology Innovation Plan,2008

Overview of Development of Cellulosic Bioethanol

A : R&D for Fundamental Technologies

Project to Develop Base Technologies for Non-edible Plant-derived Bioethanol （FY2007-FY2012）

Project to Develop Efficient Elemental Technologies for Biofuel Production (FY2013-FY2016)

Theme	Biomass
(1)Cultivation Technology of Biomass Resource	
・Research and Development for Increased Woody Biomass Production through Genome Breeding and High Efficiency Forestry Operations	Eucalyptus
(2)Production Technology of Efficient Saccarifying Enzyme	
・Research and Development on Producing Woody –Biomass Pulp Degrading Enzymes by Microbial Cultivation on Soluble Sugars	Eucalyptus
・Construction of Innovative Saccharifying Enzyme-producing Microorganism and Development of Manufacturing Technology of the Enzyme for the Biofuel Commercialization	Eucalyptus Bagasse
(3)Fermentation Technology using Efficient Microorganism	
・Development of Fermentation Technologies using Efficient Ethanologenic Microorganisms	Eucalyptus Bagasse

Overview of Development of Cellulosic Bioethanol

B : Bioethanol production System

Project to Develop Integrated Production System for Ethanol Derived from Non-edible Plant（FY2009-FY2013）

Theme	Biomass
Development of a Comprehensive Bio-ethanol Production System from Fast Growing Trees Using Mechanochemical Pulping	Woody biomass (Eucalyptus)
Development of an Integrated System for Low-cost Cellulosic Bio-ethanol Production from Energy Crop Cultivation to Conversion Process Based on Environmentally-friendly Pretreatment Technology	Herbaceous plants (Napier grass, Eriunthus, etc)

2nd Stage Projects of Dev. Integrated Pro. Sys from Cellulosic biomass (FY2014—)

Eucalyptus

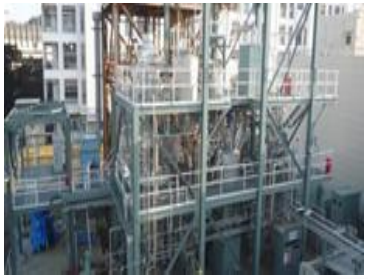
Eriunthus

NEDO Project 1

Dividing of an integrated system for low-cost cellulosic bioethanol production from energy crop cultivation to conversion process based on environ-friendly pretreat technology

Raw Materials imported	Pretreatment	Enzymatic Saccharification	Fermentation	Conc. & Dehydration

Indonesia



Distillation tower

Dehydration membrane equip

Membrane Recovery

Napier Grass Cultivation → NH_3 Treatment → Home-made Enzyme → Mem Conc → C6 Ferm → C5 Ferm → EtOH Conc → Dehydra-tion

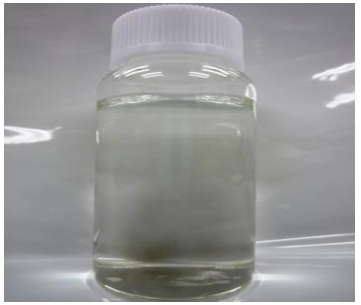
Harvested

Dried and cut

Fluid Product

Viscous suspension

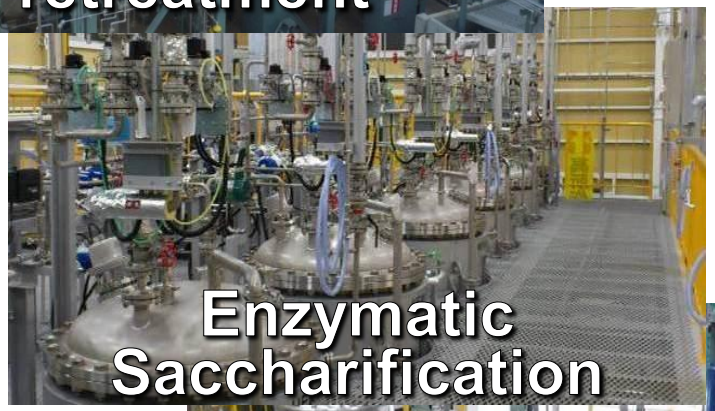
Operation



Dehydrated ethanol

NEDO Project 1 Achievements – Pilot Plant, Japan –

Development of an Integrated System for Low-Cost Cellulosic Bioethanol Prod from Energy Crop Culti to Conv Proc Based on Environ-friendly Pretreat Tech



Prod Capacity 25 kL/yr

- JX Nippon Oil & Energy Corp
- Mitsubishi Heavy Ind Mechatronics Sys, Ltd.
- TOYOTA MOTOR CORP
- KAJIMA CORP
- SAPPORO ENGI LTD.
- Toray Ind, Inc.
- The University of Tokyo

NEDO Project 1 Evaluate System -Energy Balance-

Development of an Integrated System for Low-Cost Cellulosic Bioethanol Prod from Energy Crop Culti to Conv Proc Based on Environ-friendly Pretreat Tech

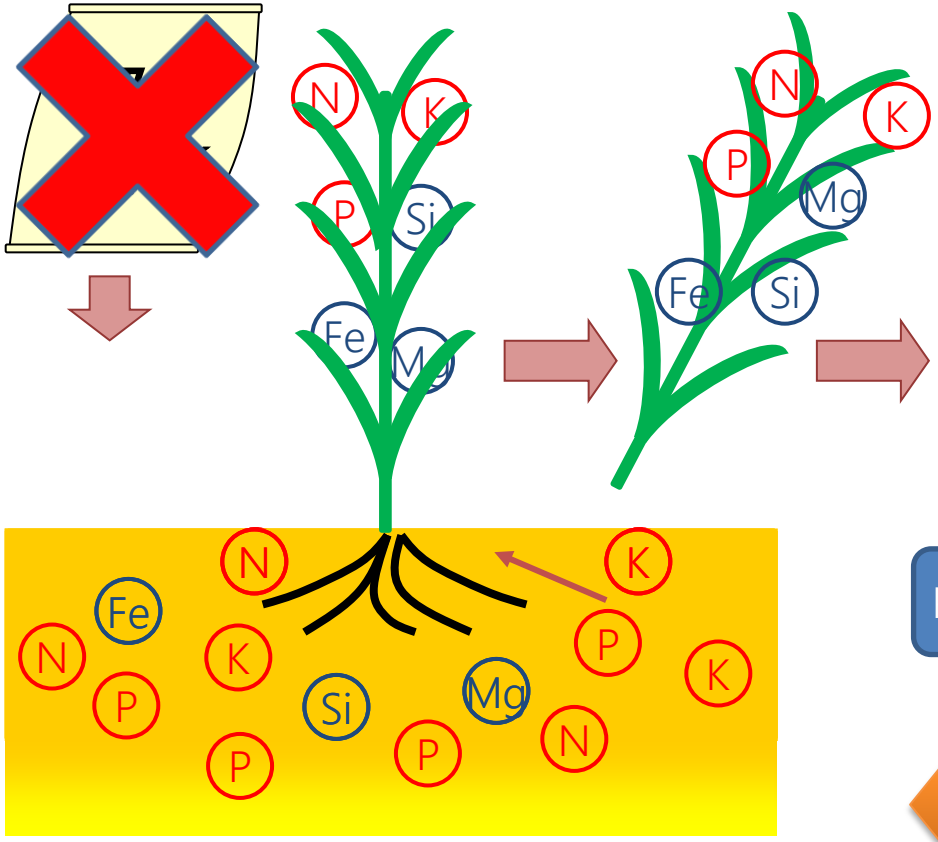
Residue

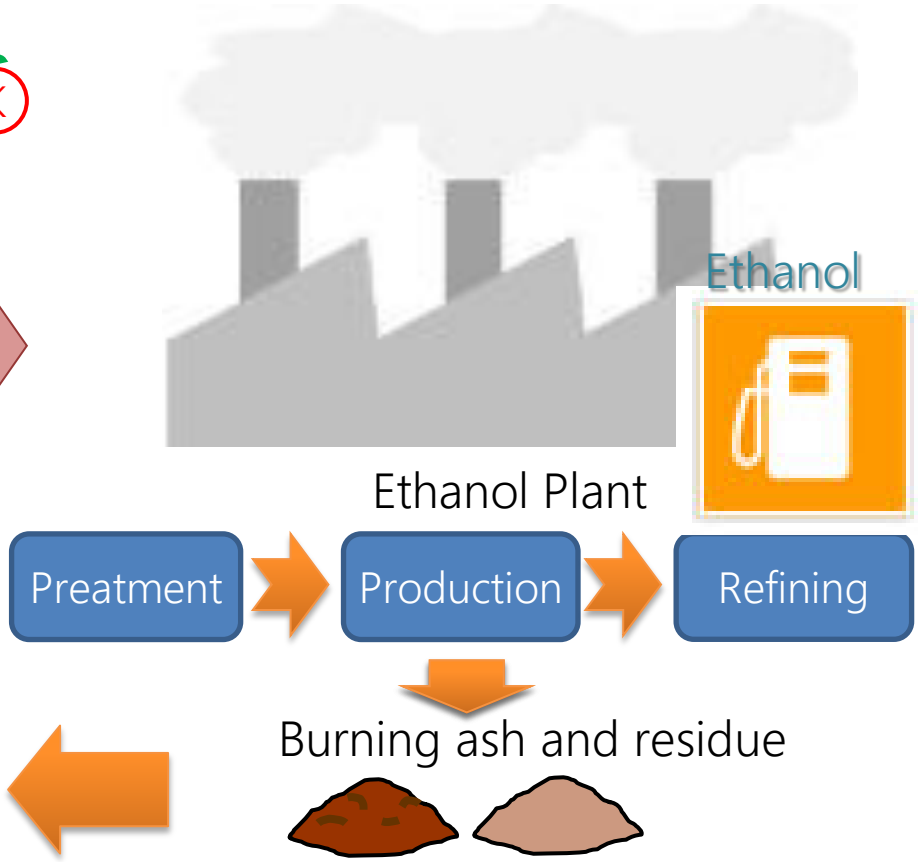
Heat from Biomass Boiler

Use for Distillation

NEDO Project 1 Sustainability -Material circulation-

Circulation of mineral by reduction to the production field of buening ash.





NEW Project -Cultivation Feedstock for Ethanol and Pellet-

Whole plant

Seedling

Plant

Germinate

4month/cycle

Ratooning

Harvest

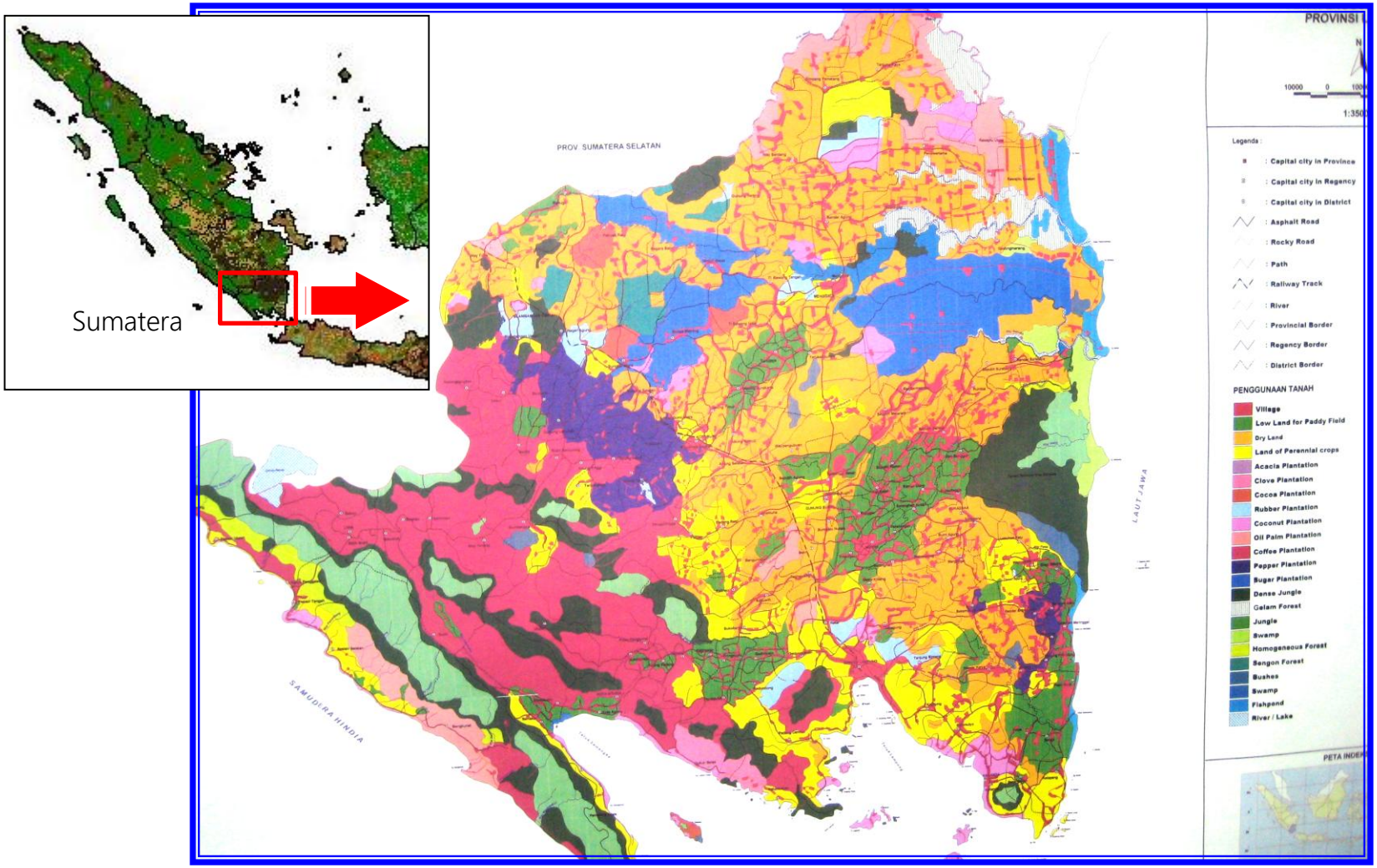
Cultivate

Feedstock for Ethanol

Feedstock for Pellet

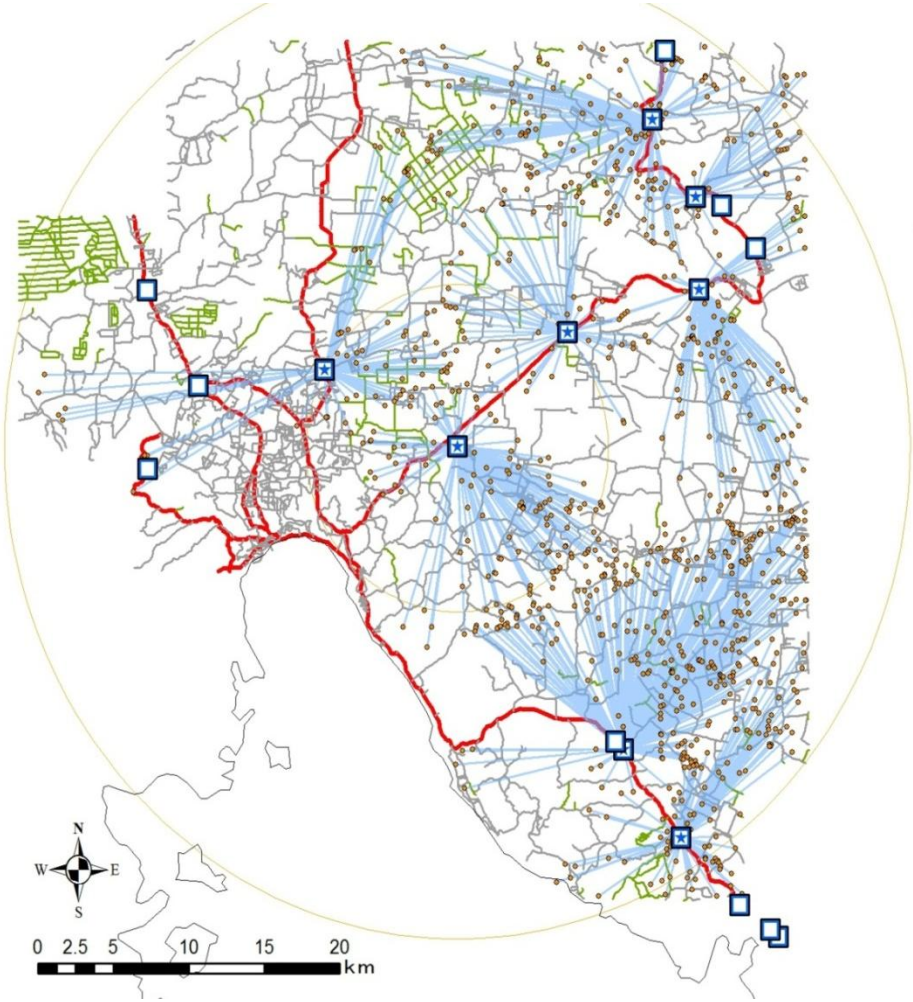
Finding Production Fields

- Estimate Production Field by Utilization Map in Lamgpung Prof., Indonesia



Investigate Transportation Scheme of Feedstock

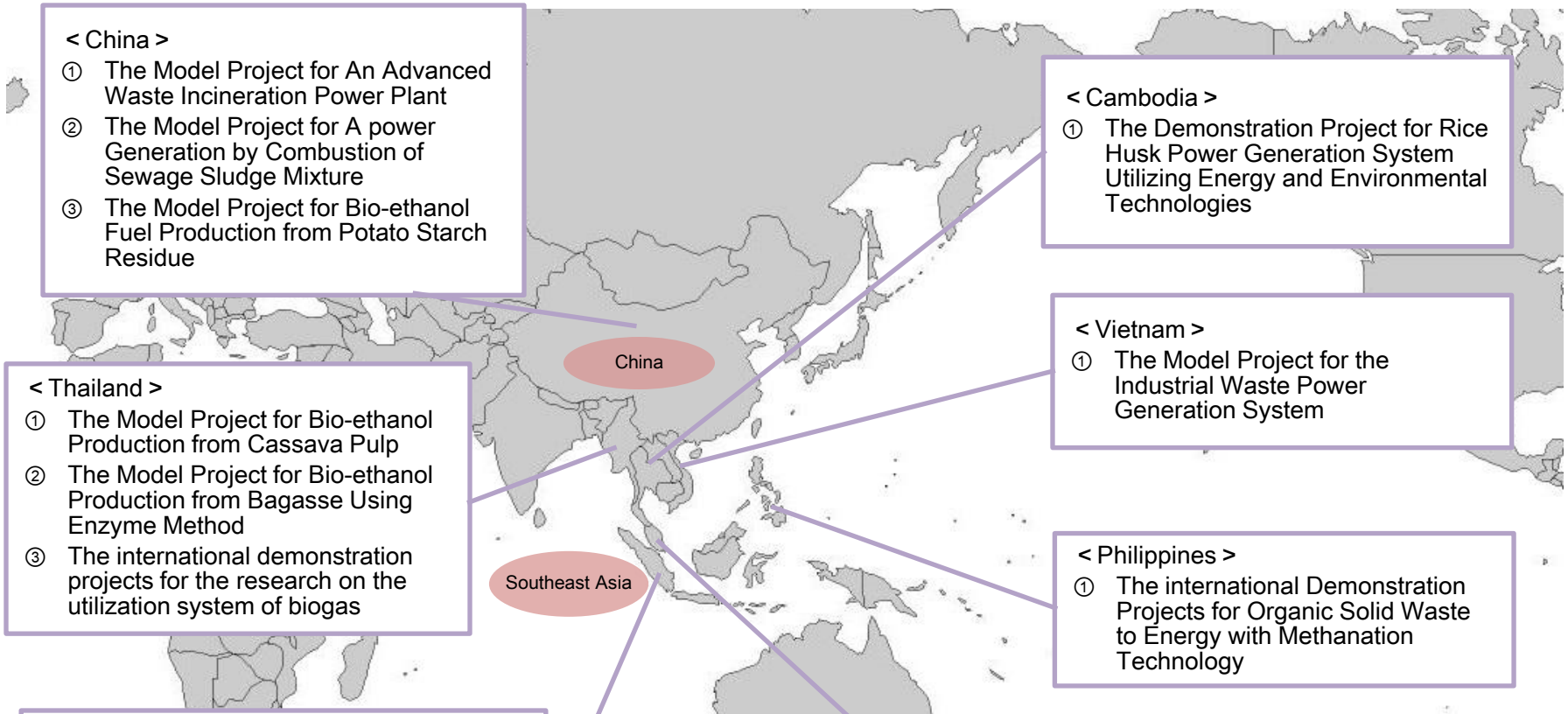
- Estimate Cost and Energy Usage on Transportation
- Find the Best Transportation Scheme of Feedstock



・衛星画像から道路をGISデータ化
・運搬距離、時間に基づき最適な中間集積所を選定する手法を構築

課題
・プラント、港までを含む輸送コストを評価するシステムの構築

Other International Projects related in Bioenergy



< China >
① The Model Project for An Advanced Waste Incineration Power Plant
② The Model Project for A power Generation by Combustion of Sewage Sludge Mixture
③ The Model Project for Bio-ethanol Fuel Production from Potato Starch Residue

< Cambodia >
① The Demonstration Project for Rice Husk Power Generation System Utilizing Energy and Environmental Technologies

< Vietnam >
① The Model Project for the Industrial Waste Power Generation System

< Thailand >
① The Model Project for Bio-ethanol Production from Cassava Pulp
② The Model Project for Bio-ethanol Production from Bagasse Using Enzyme Method
③ The international demonstration projects for the research on the utilization system of biogas

< Philippines >
① The international Demonstration Projects for Organic Solid Waste to Energy with Methanation Technology

< Indonesia >
① The Model Project for Ethanol Production from Molasses in a Sugar Factory
② The international demonstration projects for Reduction Technology of Fossil Fuel Consumption and System Utilizing Unutilized Biomass Resources

< Malaysia >
① The Model Project for Alternative Fuel Combustion In The Cement Industry

Model Project of Bagasse Ethanol (2011-2016）

1. Project Overview

In this project, technology to produce ethanol from bagasse in the sugar mill in Thailand, through fermentation using enzymes and yeast generated on site will be verified and demonstrated at a pilot plant.

Country	Thailand
Entrusted companies	Tsukishima Kikai Co., Ltd. JFE Engineering Corporation
Project site	Thai Roong Ruang Energy
Counterpart	Office of the Cane and Sugar Board
Ethanol production volume	800 L/batch (demonstration scale) 17,000 kL/y (commercial scale)
Energy conservation effect	378.9 TJ/y (commercial scale)
GHG emission reduction	27,483 t-CO2/y (commercial scale)
Project cost	1,143 million yen

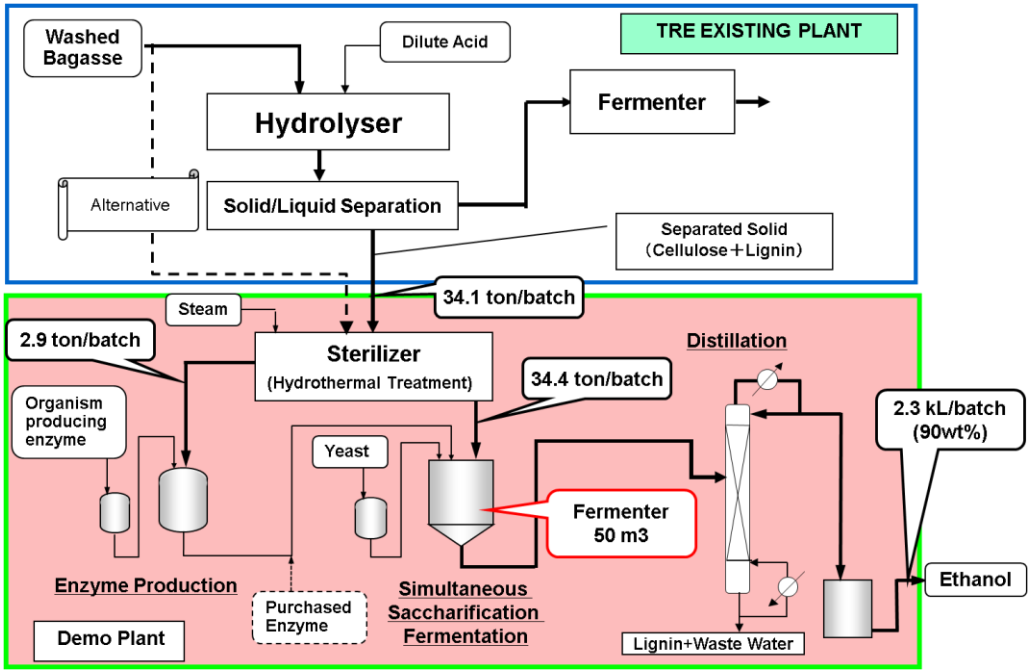
2. Technological Elements

The elements of technology to produce ethanol from bagasse are as follows:

1. Pretreatment
Equipment to continuously sterilized bagasse has been installed.

2. Enzyme production
Cellulase composed of unique microorganisms is produced on site.

3. Saccharification and fermentation
Saccharification and fermentation are carried out simultaneously to avoid contamination and maintain high rates of saccharification.



Achievements – Pilot Plant, Thailand –

Model Project for Bioethanol Production from bagasse using Enzyme Method in Thailand

2t/day(100t/yr)

TSUKISHIMA KIKAI Co., Ltd

JFE Engineering Corp.

Thai Roong Ruang Energy Co., Ltd

Summary

- Biomass resources are distributed widely and thinly, requiring high costs to collect and transport resources and convert them into energy.

- In order to effectively utilize limited biomass, it is important to accurately grasp the biomass amount. Further, it is important that use up energy of the resulting biomass.

- NEDO is also in cooperation with universities and the private company, we will continue to develop new technologies to ensure an optimal balance in the energy use of biomass in the future.

Thank you for your kind attention!

For further information, please visit NEDO's website.

http://www.nedo.go.jp/english