

AGRI + CHEMICAL PROCESS: Biogas Technology for 1.5th - 2nd Gen Biomass

July 2015



IHI Enviro Corporation

1. About IHI Enviro
2. Background
 - 2.1 Environmental Issues
 - 2.2 Renewable Energy Opportunities in South East Asia
 - 2.3 Our missions
3. AGRI + CHEMICAL Concept and Technology
 - 3.1 Introduction of Agri+Chemical
 - 3.2 The basic concept of the process
 - 3.3 Introduction of Key Technology: IHI-IC Reactor
4. Overview of KMUTT-JIRCAS-IHIE Partnership
5. Concluding Remarks
6. Q&A

1. About IHI Enviro



**Social
Infrastructure
And Offshore
Facilities**

**Resources,
Energy and
Environment**

**Industrial System
and
General-Purpose
Machinery**

**Aero Engine,
Space and
Defense**

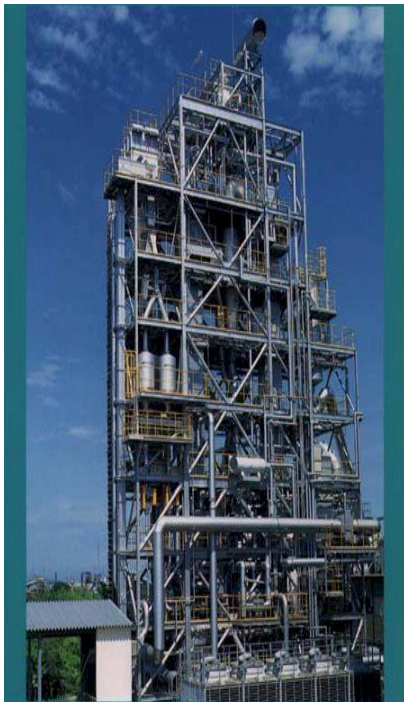
IHI Enviro

- Trade Name: IHI Enviro Corporation
- Head Office: Tokyo, Japan
- Date of Establishment: July, 1984
- Capital: JPY200 m (USD2 m)
- Employees: 654 (March 2014)
- Annual Turnover
 - 2006 - JPY14.0 b (USD140 m)
 - 2007 - JPY14.7 b (USD147 m)
 - 2008 - JPY17.3 b (USD173 m)
 - 2009 - JPY17.3 b (USD173 m)
 - 2010 - JPY13.8 b (USD138 m)
 - 2011 - JPY14.3 b (USD143 m)
 - 2012 - JPY17.8 b (USD178 m)
 - 2013 - JPY16.8 b (USD168 m)

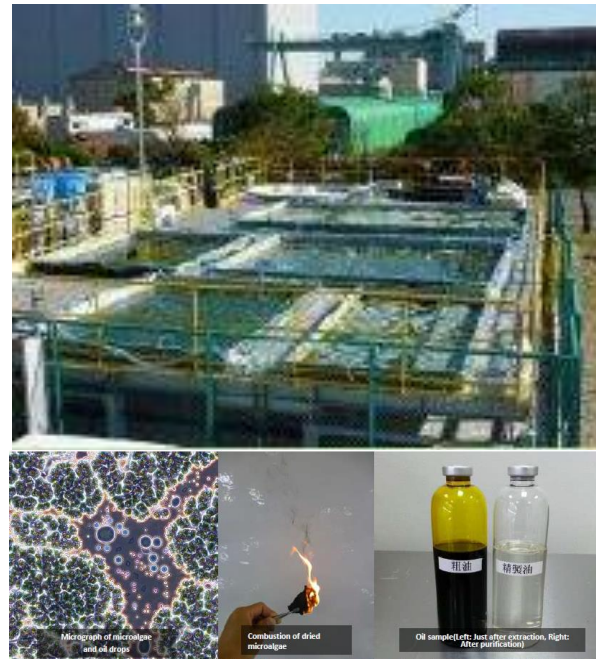
IHI Enviro Corporation

1.1 New Business Opportunities in Biomass

IHI views biomass and renewables as one of its strategic business areas for the future



**Biomass Gasification
(TIGAR)**



**Biofuels from
Microalgae**



AGRI+Chemical

2.1 Environmental Issues

Palm Industry



Water pollution by Palm Oil Mill Effluent (POME)

Palm Industry



Soil pollution by waste Oil Palm Trunk (OPT)

Cassava Industry



CH4 emissions and Odour from Cassava pulp,

Greater Environmental Impact



Conversion to **sustainable agriculture** by reducing environmental impact



Energy Policy to utilize unused biomass

- Huge amount of biomass generated from various industries are still untapped
- The biomass has the potential to be converted into huge amount of renewable energy
- Treating this biomass could reduce environmental impact and at the same time could contribute to energy sector

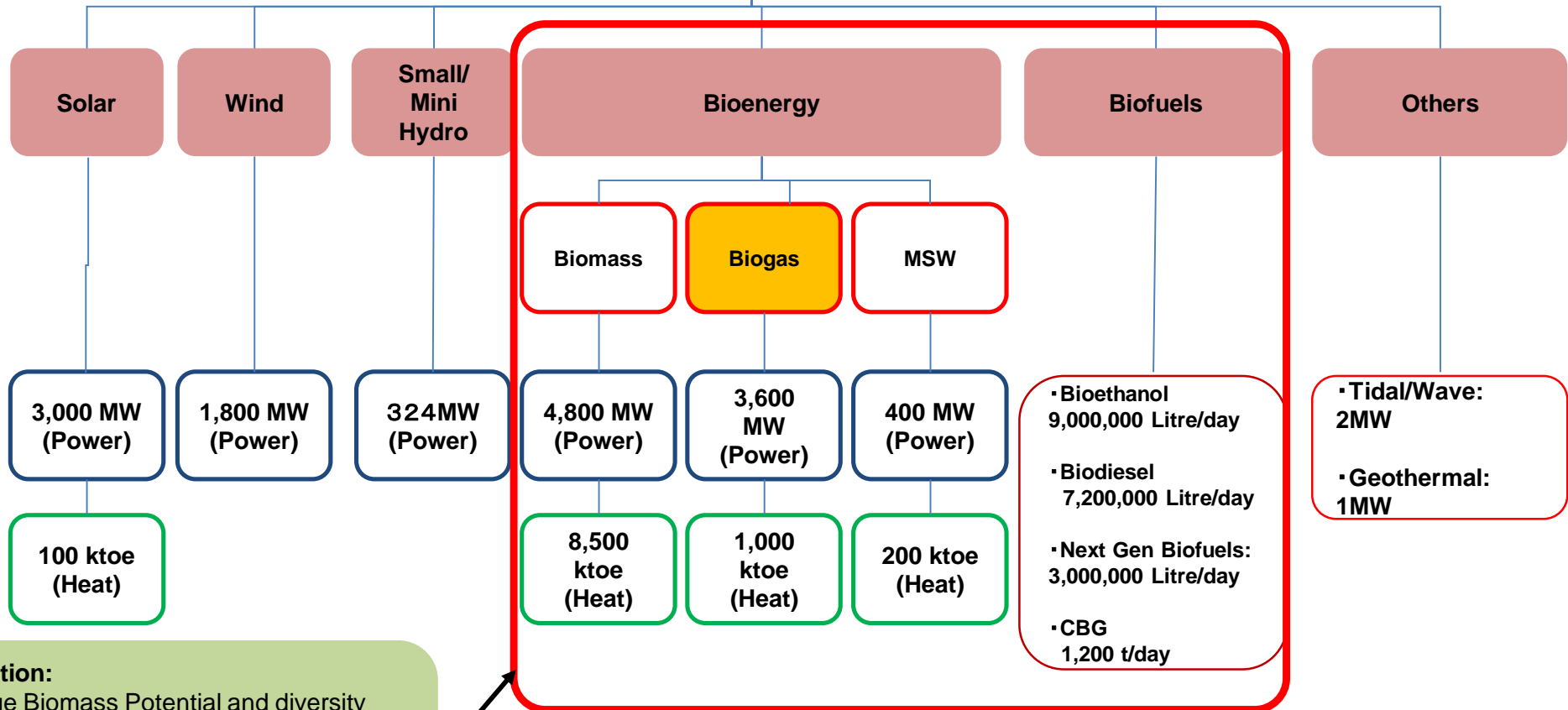


Fact about the potential of palm industry in Indonesia and Malaysia:

- Size of palm plantation area = 3 times of Tokyo Kanto Area ($9.1 \cdot 10^5 \text{ km}^2$)
- Size of palm tree cutting area = 2 times of Tokyo Metro ($0.46 \cdot 10^5 \text{ km}^2$)
- BOD load in POME = 12 times of sewage treatment in Tokyo Metro (3.57 Mton-BOD/y)
- Unused energy hidden in biomass \approx Energy of natural gas supplied by Tokyo Gas ($4,538 \text{ M-Nm}^3 / \text{y}$)

2.1 RE Opportunities in SE Asia

Alternative Energy Development Plan (AEDP)
Target of 25% renewable energy by 2021



Motivation:

- Large Biomass Potential and diversity
- Supportive Government policies and FIT rates

Challenges:

- Existing methods fail to utilize full biomass energy potential

2.2 Our Missions

1. To contribute to the society by reducing environmental impact
2. To fully utilize the untapped potential of biomass (1.5th -2nd Generation Biomass) by using Agri+Chemical Process

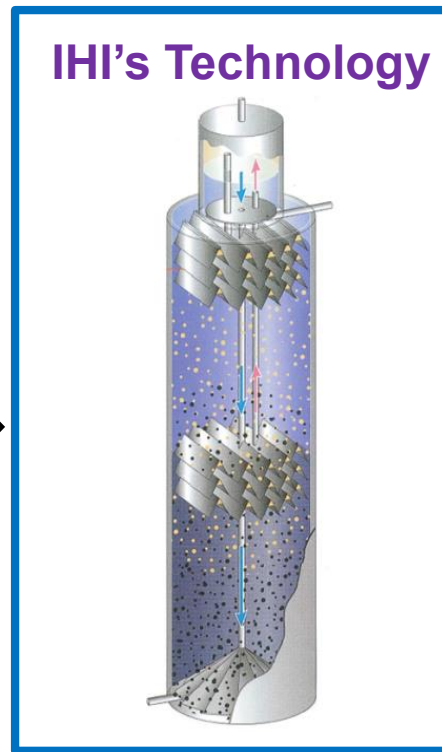


Napier Grass

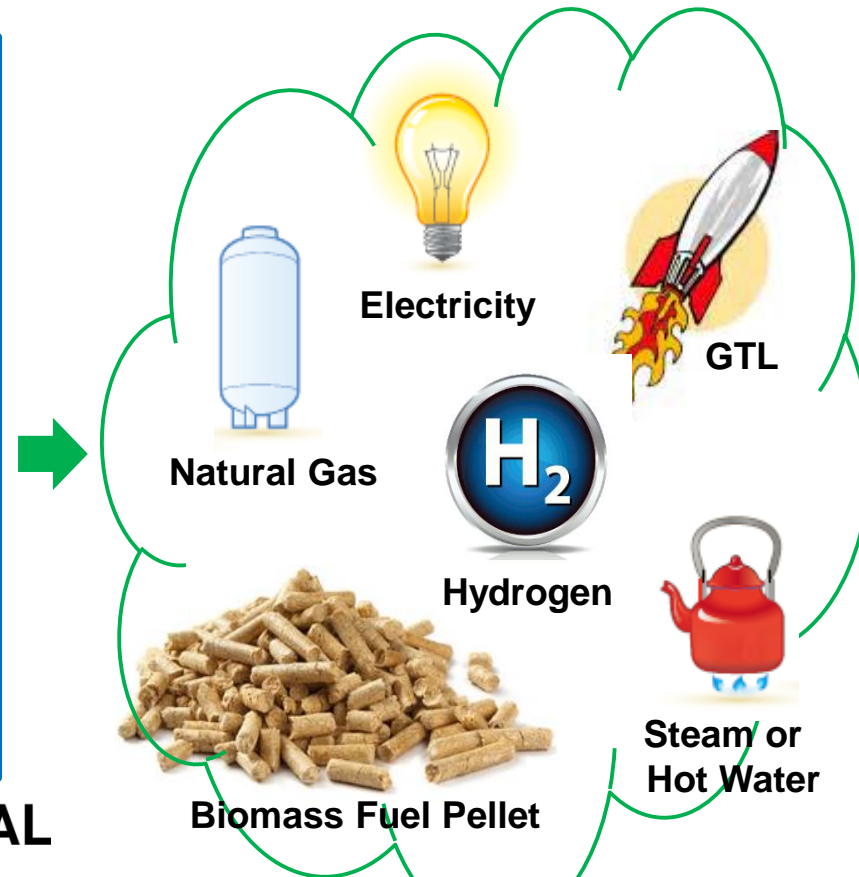
Sugarcane

Bagasse

Cassava Pulp



 **AGRI+CHEMICAL**



IHI Enviro Corporation

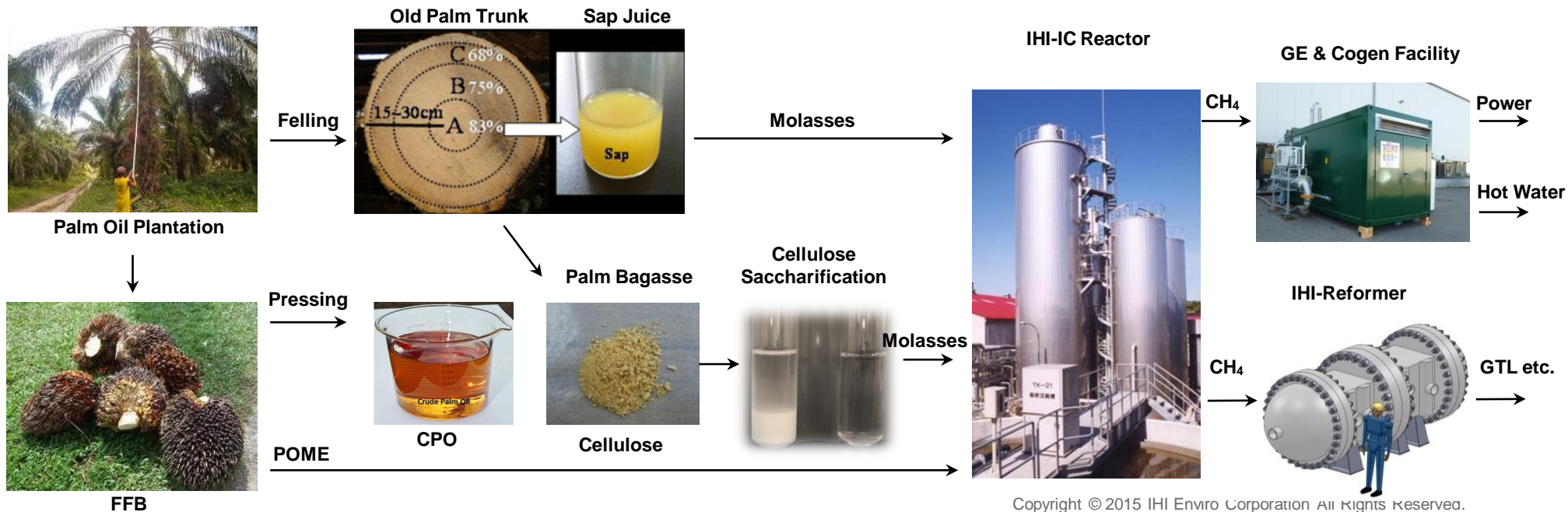
Oil Palm Trunk (OPT) WW(POME, Cassava)

Lignocellulosic biomass

3.1 Introduction of AGRI+CHEMICAL

- New business model to create different kinds of renewable energies from methane derived from biogas generated by IHI-IC reactor such as follows:
 - Power (electricity)
 - Solid fuel (pellet etc.)
 - Biofuels (via GTL technologies)
 - Compressed Natural Gas (CNG)
 - Hydrogen (steam reforming), etc.
- The focus is on unused 1.5th – 2nd Generation Biomass like cassava pulp, oil pump trunk (OPT), bagasse etc.
- Key technologies:
 - IHI-IC Reactor (IHI Enviro)
 - Biological saccharification of lignocellulose biomass (KMUTT + JIRCAS)

Example: Agri+Chemical for palm industry



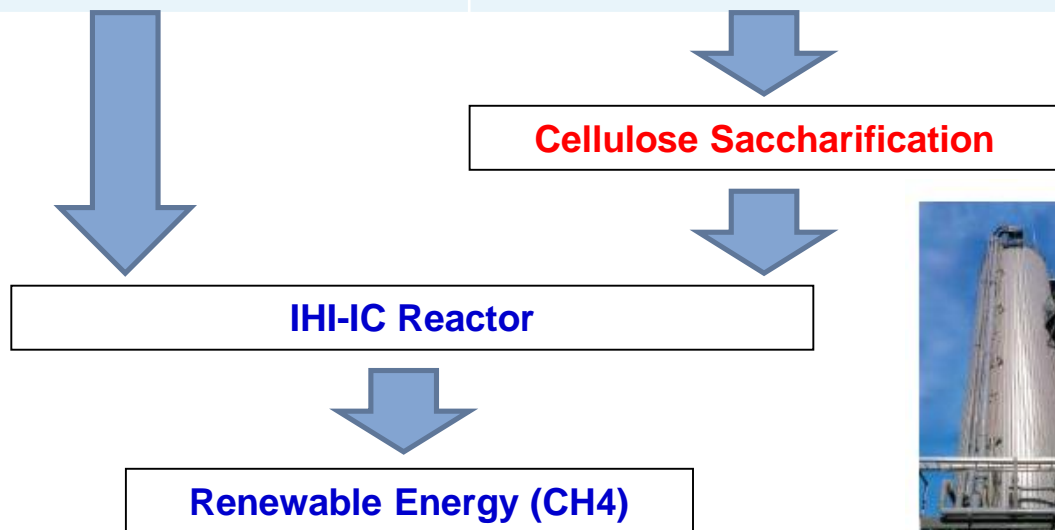
3.1 Introduction of AGRI-CH₄EMICAL

Industry (Target Biomass)	Liquid Biomass	Solid Biomass
Palm	POME / Sap juice	OPT / Palm bagasse
Cassava (starch)	Wastewater (washing)	Cassava pulp
Sugar (Sugarcane)	Waste molasses	Bagasse
Brewery	Wastewater (production)	Residues in husking wheat, Waste yeast
Paper/Pulp	Wastewater (production)	Waste pulp
Shochu (Japanese alcohol)	Shochu lees	Sweet potato pulp

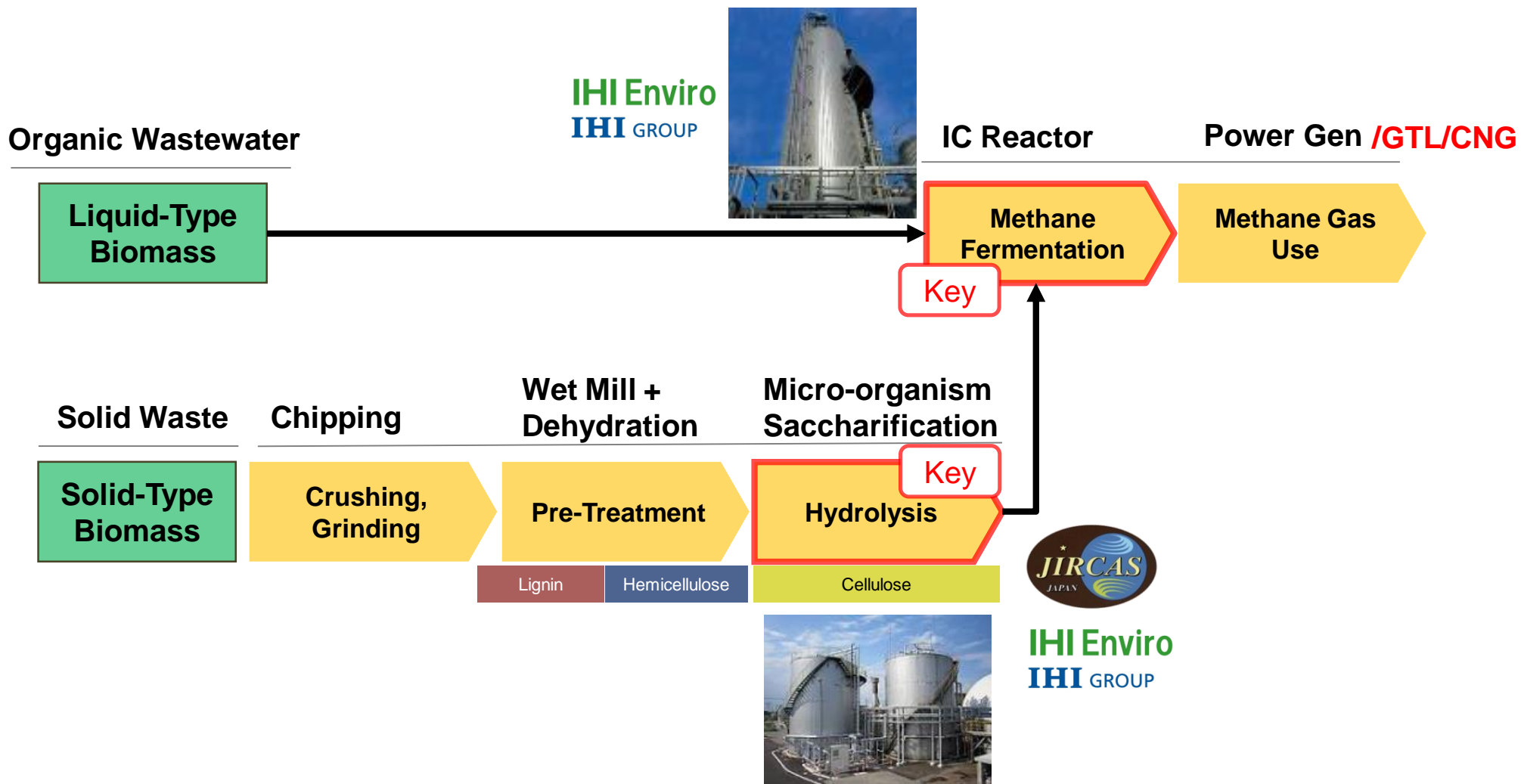
What's new?

This new technology makes it possible to reuse these solid biomasses effectively by cellulose saccharification and create renewable energy from derived methane (CH₄).

Recycling of these solid biomasses have not been developed before.

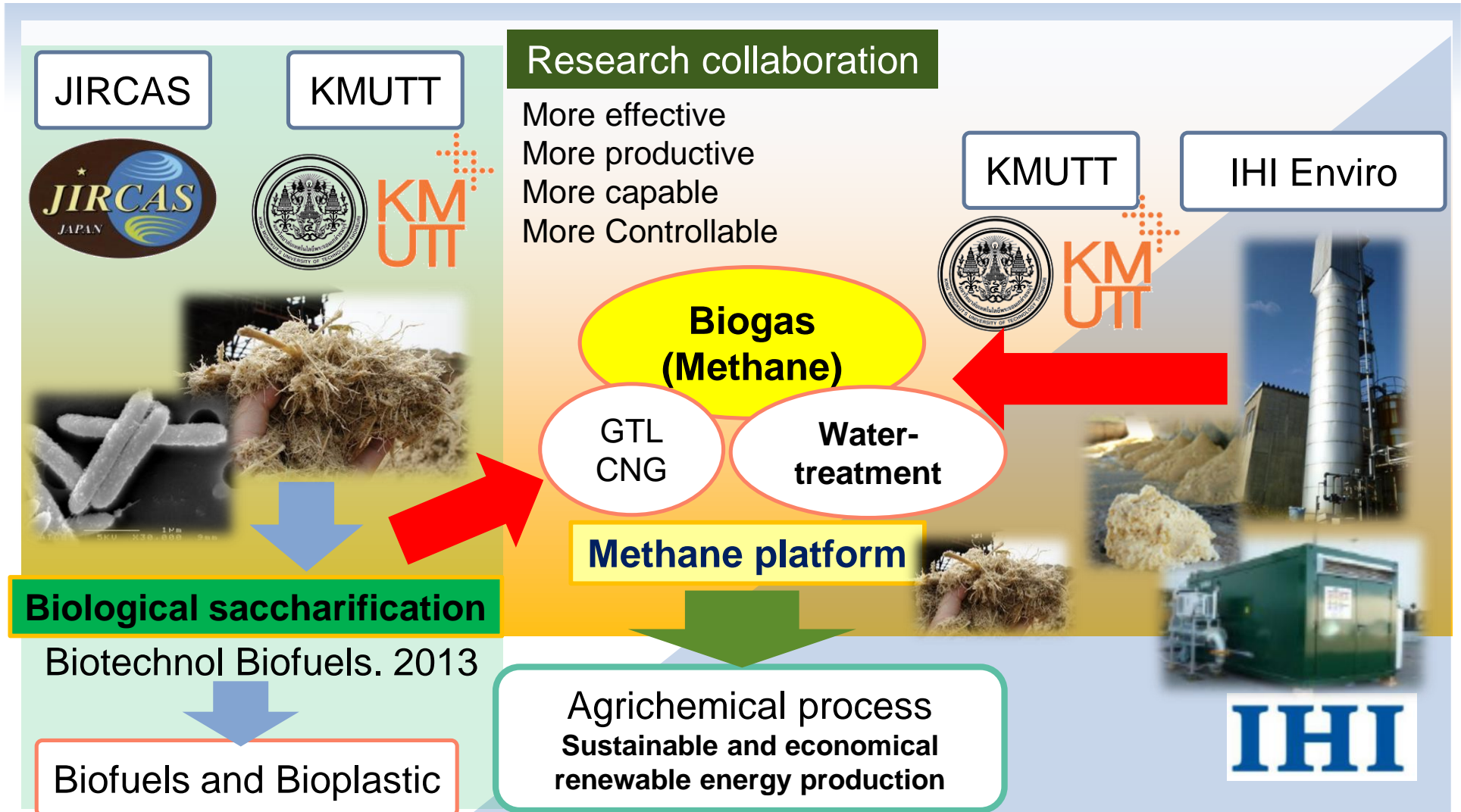


3.2 Basic concept of the process



3.3 Introduction of Key Technology: IHI-IC Reactor

4. Overview of KMUTT-JIRCAS-IHI Partnership



4. Overview of KMUTT-JIRCAS-IHI Partnership

Joint Research Agreement between (JRA) between KMUTT-JIRCAS-IHIE signed on 20 May 2015

Article in The Nation Thailand
(5th June 2015)



The increase in energy usage in the South East Asia has been rising rapidly in the last decades due to economic and demographic expansion in the region. South East Asia has a warm and humid climate suitable for growing crops and agriculture, resulting in an abundant supply of lignocel-

5. Concluding Remarks

- SE-Asian countries such as Thailand are ideal for testbedding new solutions for renewable energy, due to the availability of different kinds of biomass
- Rely on a local partner eg. Academia who have a deep understanding of local environment and conditions
- Establish win-win partnerships that benefit both private and public entities

Q&A



Thank you

IHI

Realize your dreams