BIOTEC
MTEC
NECTEC
NANOTEC
TMC
members of NSTDA

Overview of NSTDA and Cluster-Based Research on Energy and Environment

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Chairperson, Energy and Environment Cluster and Director, Sustainable Environment Program

National Science and Technology Development Agency (NSTDA)

Ministry of Science and Technology (MoST)

NSTDA at a glance

- **Establishment:** December 1991 by Science and Technology Development Act, 1991, as an autonomous government agency
- **Vision:** "NSTDA is a key partner towards a Knowledge-based Society using science and technology."
- **Missions:**
  - Research & Development
  - Technology Transfer
  - Human Resource Development
  - S&T Infrastructure
- **Key units:**
  - BIOTEC
  - NECTEC
  - MTEC
  - NANOTEC
  - TMC
- **Human resource:** 2,704 employees (as of Apr. 2015)

1,848 Researchers (68.34%)	**231 Managements** (8.54%)	**625 Operations** (23.11%)

557 Ph.D.s (20.60%)	**1,189 Masters** (43.97%)	**874 Bachelors** (32.32%)	**84 Others** (3.11%)

Mission: S&T Infrastructure

THAILAND SCIENCE PARK
Infrastructure to support S&T Development

- Established in 2002 as Thailand First & Fully Integrated Hub for R&D
- Houses Headquarter of National Science and Technology Development Agency (NSTDA) and its 4 National Research Centers plus more than 70 technology companies
- Objectives:
  - Provide High Quality R&D Space for Public and Private Sector.
  - Incubate Technology Business Start-ups
  - Support Linkage between Private Companies, NSTDA, and Universities.

Mission: S&T Human Resource Development

Basic Education	Higher Education	Professional Researchers

Primary Education → High School → Bachelor – Doctoral Degrees → Researchers → Professionals

Science Learning Promotion

Sirindhorn Science Home

Children's University

Little Scientists' Home

Inspiring Kids to join Science Programs

Junior Science Talent Project (JSTP)

Graduate Capacity Building

Young Scientist and Technologist Program (YSTP)

Thailand Graduate Institute of Science and Technology (TGIST)

NSTDA-University-Industry Research Collaboration (NUI-RC)

Thailand Advanced Institute of Science and Technology (TAIST)

Entering Research Careers

Professional Education

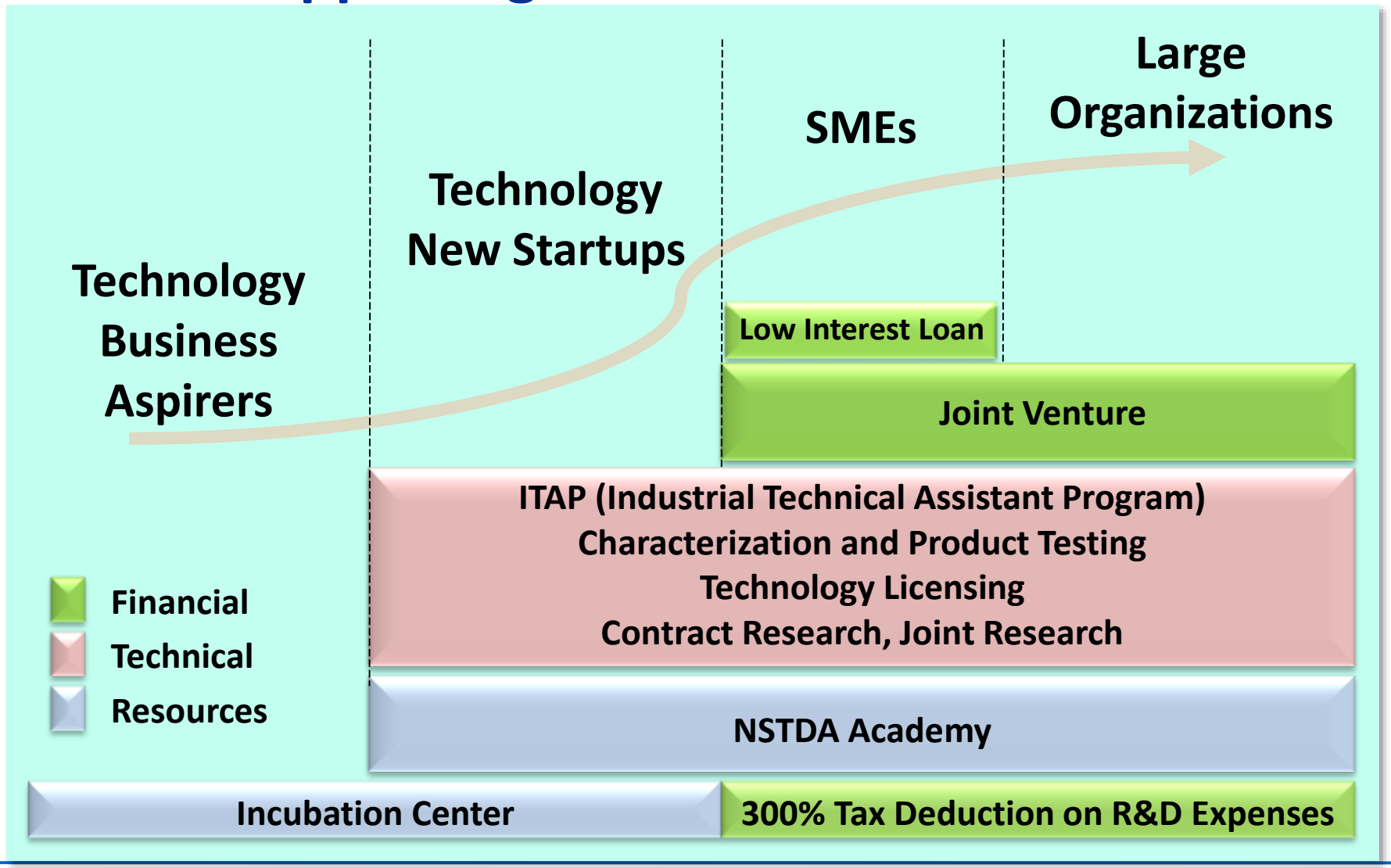
NSTDA ACADEMY

New Entrepreneur Education

Personnel are supported by National Research Centers, Thailand Science Park, and members of Innovation Clusters (universities and private sectors)

Mission: Technology Transfer

NSTDA Supporting Mechanisms



Mission: Research and Development

NSTDA Research Programs (2011-2016)

Cluster

- Agriculture and Food
- Energy and Environment
- Health and Medicine
- Bioresources, Communities and the Underprivileged
- Manufacturing and Service Industries
- Cross Cutting Technology

- Platform
- Technology

BIOTEC a member of NSTDA

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BIOTEC unit : Research field linked to Energy & Env.

Research units : *at Thailand science park*

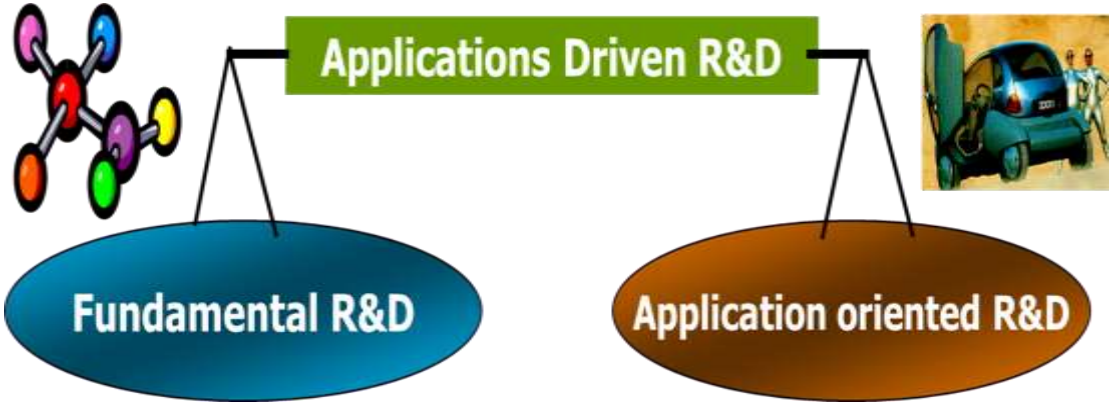
- **BioresourceTechnology Unit**
- Agricultural Biotechnology Research Unit
- Food Biotechnology Research Unit
- Medical Molecular Biology Research Unit
- Genome Institute

Research units : *BIOTEC's satellite units at universities and government agencies*

- **Biochemical Engineering and Pilot Plant Research and Development Unit (KMUTT)**
- **Cassava and Starch Technology Research Unit (KU)**
- Medical Biotechnology Research Unit
- Rice Gene Discovery Unit
- Peat Swamp and Rainforest Research Station
- **Center of Waste Utilization and Management (KMUTT)**
- **Center of Excellence for Marine Biotechnology (CU)**
- Center of Excellence for Shrimp Molecular Biology and Biotechnology
- Center of Excellence for Molecular Biology and Genomics of Shrimp
- Biomedical Technology Research Center

MTEC - Research & Focus Unit

7 R&D Units 2 Focus Units



Polymers Research Unit

Ceramics Technology Research Unit

Materials Reliability Research Unit

Biomedical Engineering Research Unit

Materials for Energy Research Unit

Environment Research Unit

Design and Engineering Research Unit

Focus Unit

Natural Rubber

Oil Palm Processing Technology

From the concept of the New Electric Power Network (Smart Grid/Community/House)

NECTEC

Goal
Smart Energy Solution

Product

Power Monitoring System	Renewable Energy Source and Energy Storage Systems	Energy Management System
. Smart Energy Monitoring . Lighting with Secure Communications . Zero-Watt Standby . Near-Zero-Watt Standby . Power Consumer Monitor . NetSense . Cloud remote controller	. Battery Energy Storage System (Lithium-ion battery management) . Solar Battery Charger . Solar Energy Management System . Solar air . Pure sine wave inverter	. PV Hybrid System & Energy Management . Demand Side Management . Simulation Model

NANOTEC Research Center

Research Unit

- Nano Delivery System (NDS)
- Nano-Molecular Target Discovery (TDI)
- Hybrid Nanostructure & Nanocomposites (HNN)
- Nanomaterials for Energy & Catalysis (NEC)
- Nanoscale Simulation (SIM)
- Nano Functional Textile (NFT)
- Nano Safety & Risk Assessment (SRA)
- Integrated Nano System (INS)
- Functional Nanomaterials & Interfaces (FNI)

Development Unit

- Nano Cosmeceuticals (NCM)
- Nano Characterization (NCL)
- Engineering & Manufacturing (ENM)

Mission: Research and Development

NSTDA Research Programs (2011-2016)

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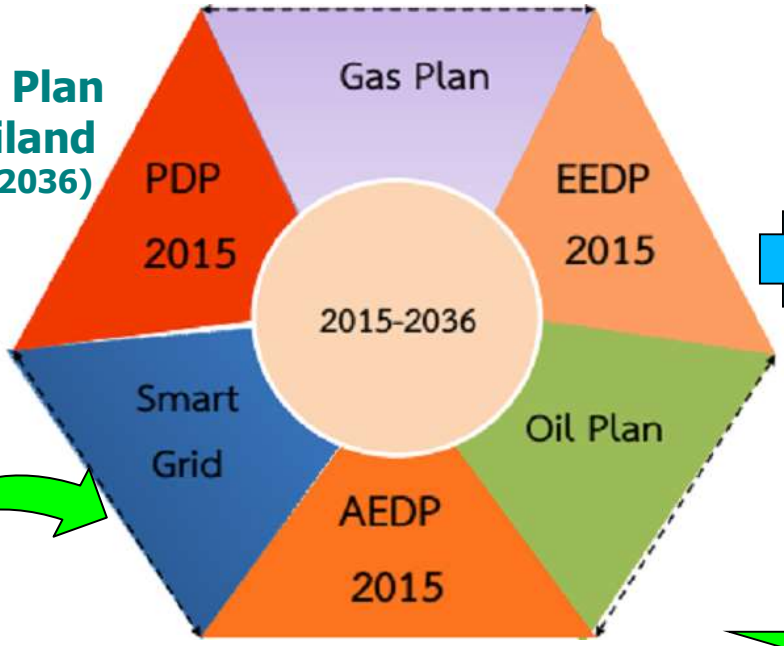
Cluster R&D Promotion on Energy & Environment

Energy Plan of Thailand (2015 – 2036)



•(17 Goals & 169 Targets)

+

7-20% GHGs ↓ (BAU) by 2020

20-25% GHGs ↓ (BAU) by 2030

- Energy security
- Energy accessibility
- Climate change
- Sustainable development
- Competitiveness

GOAL for STI Development on Energy-Env

1. **Energy-efficient economy**
2. **Low-carbon society**
3. **Green energy leader**
4. **Self dependence on Energy Technology and Equipment/ Products on green energy**

Energy & Environment Cluster : NSTDA

1.Sustainable Environment Program

2.Resource & Energy Efficiency Program

3.Renewable Energy & New Energy Technology Program

Assessment Technology

LCI /LCA

Carbon/water footprint/ Eco-eff.

Mitigation Technology

Resource-Energy efficiency



Renewable energy/ Zero emission Technology

Biomass / Biogas / Biofuel/ etc.



Enhance Energy Security

Reduce Env. Impact (GHGs Emission)

Enhance Industrial Competitiveness ***(Env. & Trade: focus on Agri-Food)***

Life Cycle Thinking Concept: throughout value-chain (cradle to grave)

R&D Focus (@ Cluster) on Environment

1. Sustainable Environment Program

LC Sustainability Assessment Tool (LC Thinking Concept)

Social dimension | Environmental dimension | Economical dimension

Management Level

POLICY

Objective

ORGANIZATION

Concept PRODUCT

Green Growth

Low Carbon + Sustainability

LIFE CYCLE THINKING

Strategies

LIFE CYCLE MANAGEMENT

Strategies	Corporate social responsibility	Pollution Prevention	Product- and supply chain management
Systems	OHSAS 18001	ISO 14001 & POEMS	ISO 9001, TQM, EFQM
	(LCA: ISO14040/44 + ECODESIGN: ISO 14062)		
	LC Social Assessment	LC Env Assessment	LC Cost Assessment
Tools	Work place assessment LC Social assessment	Cleaner Production, LCA, EcoDesign,	EMA & LCC

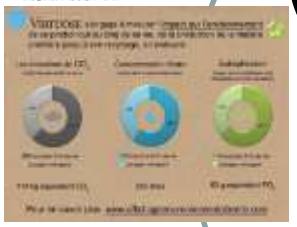
(Infrastructure) Life Cycle Database

Explanations: OHSAS = Occupational Health And Safety, POEMS = Product Oriented Environmental Management System, TQM = Total Quality Management, EFQM = European Foundation for Quality Management, LCA = Life Cycle Assessment, EMA = Environmental Management Accounting, LCC = Life Cycle Cost Analysis.

Source: adapted from UNEP

1. Sustainable Environment Program

LCA-EcoDesign Applications (towards Green Growth)



3.7 **SCP-SD Indicators/ Institutional framework** (since 2013)

3.1 **Carbon Footprint** (since 2009)

GHG emission factors

Life Cycle Thinking

3.2 **EcoProducts Development** (since 2009)

Water/ Environmental Footprint (since 2011) 3.6

Experts & Networking

LCA Inventory data

LCA, Eco-Design

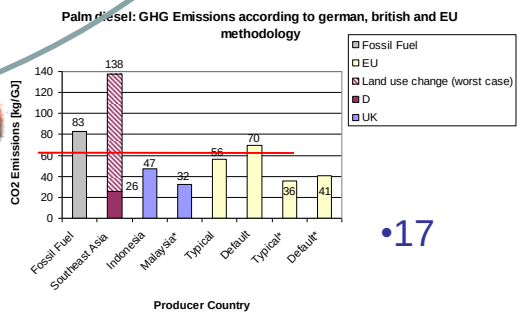
3.3 **Green Public Procurement** (since 2012)

Policy Justification (since 2012) 3.5

3.4 **Sustainability assessment (Biofuels, Bio-products,..)** (since 2010)

- **Food vs. Feed vs. Fuel** ?
- **Green GDP/Green Industry**
- Eco-efficiency/ Factor X
- Adder/ Externalities ?
- Env. Tax, etc.

Sugar cane/ Molasses/ Cassava/ Oil palm/ Jatropha



R&D focus (@ Cluster) on Energy

MOU between
Ministry of Energy
and
Ministry of Science and Technology
on the **R&D Cooperation** on
Alternative Energy Development

Action Plan on the Use of R&D and Innovation for Alternative Energy Development 2012-2016

1. New Energy
2. Wind
3. Solar
4. Biomass
5. Biogas
6. MSW
7. Ethanol
8. Biodiesel
9. Diesel Substitute

Organizations involved:

- 5 Ministries (Energy, Science & Techechnology, Agriculture, Industry, Education)
- Research organizations and State Enterprises

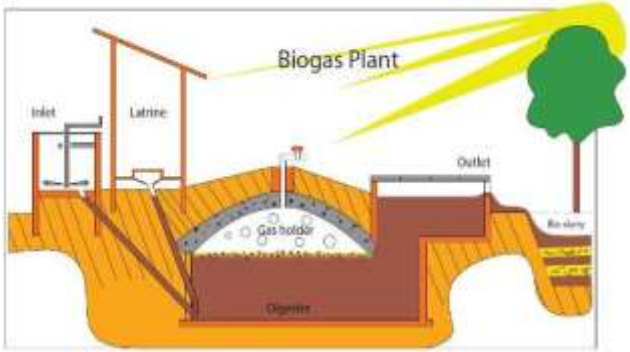
During 2012-2016

Prototype of Energy-Efficient Equipment

- Air Conditioner, LPG stove, Motor, Boiler, etc.

Prototype of Energy-Efficient Biogas Production Technology

- Meet quality and safety international standard
- Highest efficiency
- Biogas from Cellulosic materials (Industrial/ Agricultural wastes, Fast growing crops)



Prototype of Biomass Utilization Technology for Biofuel Production

- Ethanol from Sugar cane & Cassava: meet sustainability Criteria
- Ethanol from Cellulosic materials (non-food)
- Demonstration plant

Prototype of Energy- Efficient Equipment

Energy Saving Rice Cooker

Energy Saving : 34 – 61%

Objective

- To develop a field prototype of the energy-saving rice cooker by applying embedded technologies in place of thermostat controlling system.

Types of rice	Electrical energy consumption (unit)		Energy saving (%)	Electricity bill per year (Baht)		Saved expense (Baht)
	Traditional rice cooker	Energy-saving rice cooker		Traditional rice cooker	Energy-saving rice cooker	
Jasmine rice	0.75	0.46	38.67	1,798.8	1,101.42	694
Jasmine brown rice	1.525	0.6	60.65	3,651.46	1,436.64	2,215
White rice	1.27	0.84	33.85	3,040.89	2,011.30	1,030

Improvement on the Performance of High pressure Gas Stove Project

Burner A Burner B Burner C

Objective: This project aims at encouraging and supporting the gas cook-stove manufacturers in Thailand to produce high-performance stoves for supplying to the market.

Saving:

LPG price	25	B/kg
Saving 3.76% (15% of total production)	0.94	B/kg
LPG consumption (100%)	7,386	10^3ton/year
Household+industrail (50%)	3,693	10^3ton/year
Money saving	3,470	10^6 Baht/year
LPG saving	139	10^3 ton/year

Energy and Resource Optimization : Tapioca Starch Industry




- Standardization of Water and Energy Use in the Tapioca Starch Industry Project
- Minimization of Resources and Energy in Tapioca Starch Industry – A Near Zero Discharge Starch Factory Project

- Having efficient production process
- Utilizing water, energy, and resource efficiently
- Producing high quality product
- Expanding to other starch factories
- Strengthening the starch industry for competitiveness

➢saving 20 million $US annually **(32 factories ,2011-2014)**

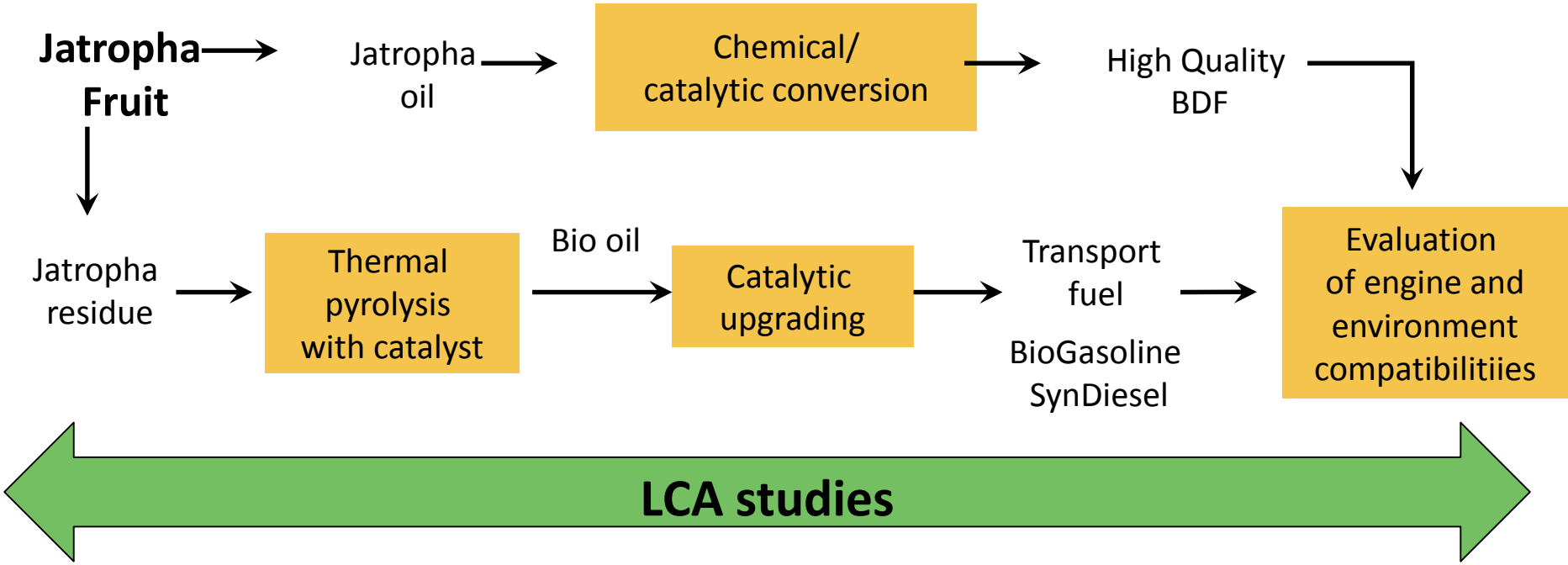
Biogas from Closed-type Anaerobic Reactor

- A highly effective **Closed-type Anaerobic Reactor**.
- It has advantages over the older treatment methods by requiring an installation area only **one fifth** the size of that required for the open wells system.
- It also produces **biogas** that replaces fossil fuels (including natural gas) for heat and electricity.

Full-Scale Technology Transfer of Anaerobic Fixed Film Reactor (AFF) and Anaerobic Hybrid Reactor (AHR) to Industries

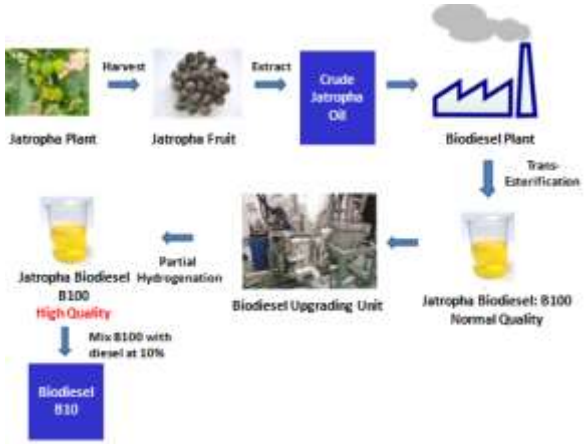
	Biogas Utilization	Saving	Other benefit
Rice Flour Mill (1 factory)	Electricity	60,000 $US annually	No impact on community
Tapioca Starch (6 factories)	Fuel oil replacement and Electricity	1.2- 1.8 million $US annually	No impact on community
Dehydration fruit (2 factories)	Fuel oil replacement	200,000 $US annually	No impact on community
Tuna canning (1 factory)	Biomass (wood) replacement	170,000 $US annually	Reclaim WWTP space for other purpose

Cooperation between Thai and Japan on Advanced Biofuels Project: Innovation on Production and Automotive Utilization of Biofuels from Non-Food Biomass



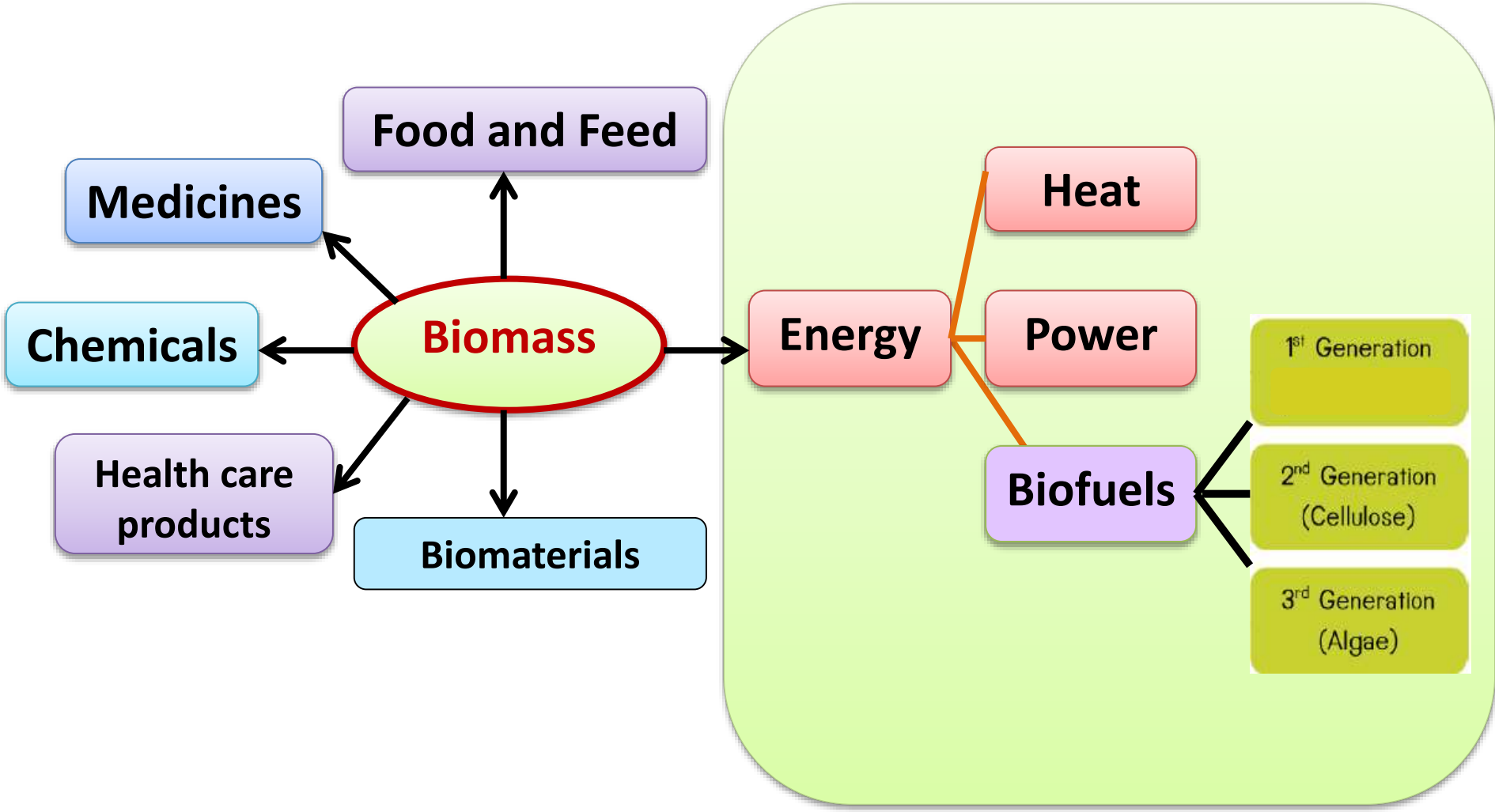
- **Japan** National Institute of Advanced Industrial Science and Technology (AIST)
Waseda University
- **Thailand** National Metal and Materials Technology Center (MTEC),
- National Science and Technology Development Agency (NSTDA)
- Thailand Institute of Scientific and Technological Research (TISTR)
- King Mongkut's University of Technology, North Bangkok (KMUTNB)

Road Test of High Quality Jatropha Biodiesel



- **High quality jatropha biodiesel** is obtained from partial hydrogenation technique. 10% of this high quality biodiesel is mixed with regular diesel; this is known **as B10**.
- Key collaborators on production process are MTEC/NSTDA & TISTR, KMUTNB of Thailand and AIST & Waseda University of Japan.
- Road test of B10 is performed by MTEC in partnership with **Tripetch Isuzu and PTT.**

Challenges: Biomass for BIOECONOMY



Thank You

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