Economic Potential of Biomass Utilization
Case of Thailand

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Presentation outline

- Biomass Resources and Potential
- Bioenergy status
- Enabling Environment for Biomass usage
- Essential Lessons Learnt
- Challenges and Barriers

Biomass Resources

a) Agri-residues and wood wastes

- Rice husk & straw
- Cane leaves, top & bagasse
- Corn leaves, cob & stalk
- Palm fibre and shell
- Cassava roots
- Leaves and stems of bean plants
- Wood chips, sawdust, shavings, slabs and branches (rubber, eucalyptus, etc)

Major agricultural crops

Cassava

Sugarcane

Oil palm

Maize

Paddy Rice

Wood and fast growing trees

Rubber/Para wood

Eucalyptus

Acacia

(Source: DEDE., 2015)

Biomass Resources

b) Municipal Solid Waste (MSW)

- In 2012, Thailand generated about 24.73 Mt of MSW
- Only 5.28 Mt (21%) was utilized or recovered;

MSW composition

Composition of waste	Percentage (%)
Food/organic	65.52
Papers	7.60
Plastics	17.59
Glass	3.04
Metals	1.85
Leather/rubber	0.46
Textiles	1.35
Wood/leaves	0.80
Disposable nappy	3.22
Others	0.17

c) Industrial Waste Water

- Cassava starch
- Palm oil
- Ethanol
- Food & Beverage
- Paper
- Rubber

d) Livestock farms

(Source: PCD, 2004; PCD, 2014)

Biomass Potential

AGRICULTURAL RESIDUES
9,231.82 ktoe


EFB : 639 ktoe
Fiber: 86 ktoe
Kernel Shell : 190 ktoe
Frond : 841 ktoe


Bagasse : 0 ktoe
Top & Trashes : 3,672 ktoe


Husk : 800 ktoe
Straw : 1,610 ktoe


Corn Cob : 186 ktoe


Stalk : 447 ktoe
Rhizome : 295 ktoe


Saw Dust : 149 ktoe
Fuel Wood : 54 ktoe


Bark : 262 ktoe

BIOGAS
6,560.82 ktoe


Sow & Boar : 45 ktoe
Native : 7 ktoe
Fattening : 57 ktoe


Dairy-Cattle : 51 ktoe
Non-dairy Cattle : 100 ktoe


Buffalo : 44 ktoe


Chicken : 58 ktoe


Duck : 2 ktoe


Elephant : 0.5 ktoe


MSW : 269 ktoe


Wastewater : 5,927 ktoe

BIOFUELS
1,020.24 ktoe


Bio-Ethanol :
642.40 ML (324 ktoe)

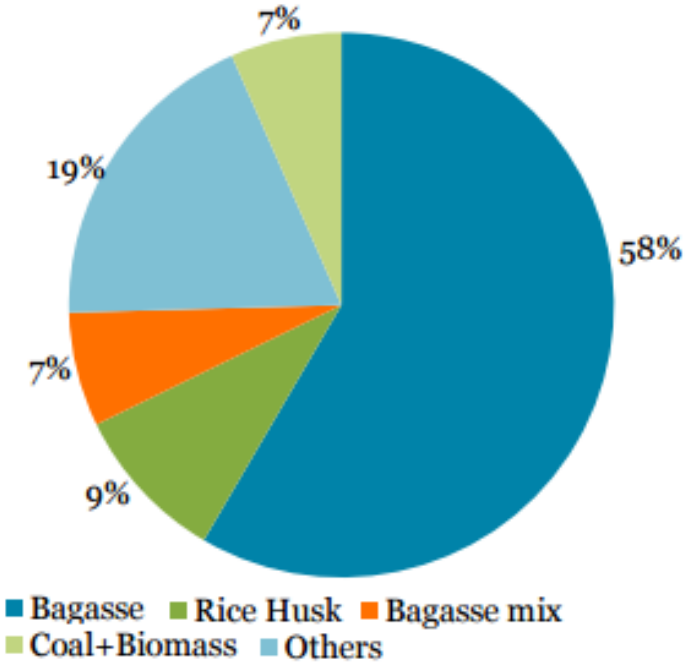

Bio-Diesel :
883.30 ML (697 ktoe)

Estimated Biomass potential in Thailand is about 16,813 ktoe (in 2012)

(Source: Thailand Bioenergy Technology Status Report, 2013)

Bioenergy status (Biomass)

- 1,957 MW of Power & 4,346 ktoe of Heat (Dec.2012)
- Technology Type:
  - Large Scale – High pressure boiler
  - Small Scale – Gasification
- Size: 1-40 MW
- Challenges
  - Feedstock supply certainty
  - Too low incentives
  - Limit of transmission line

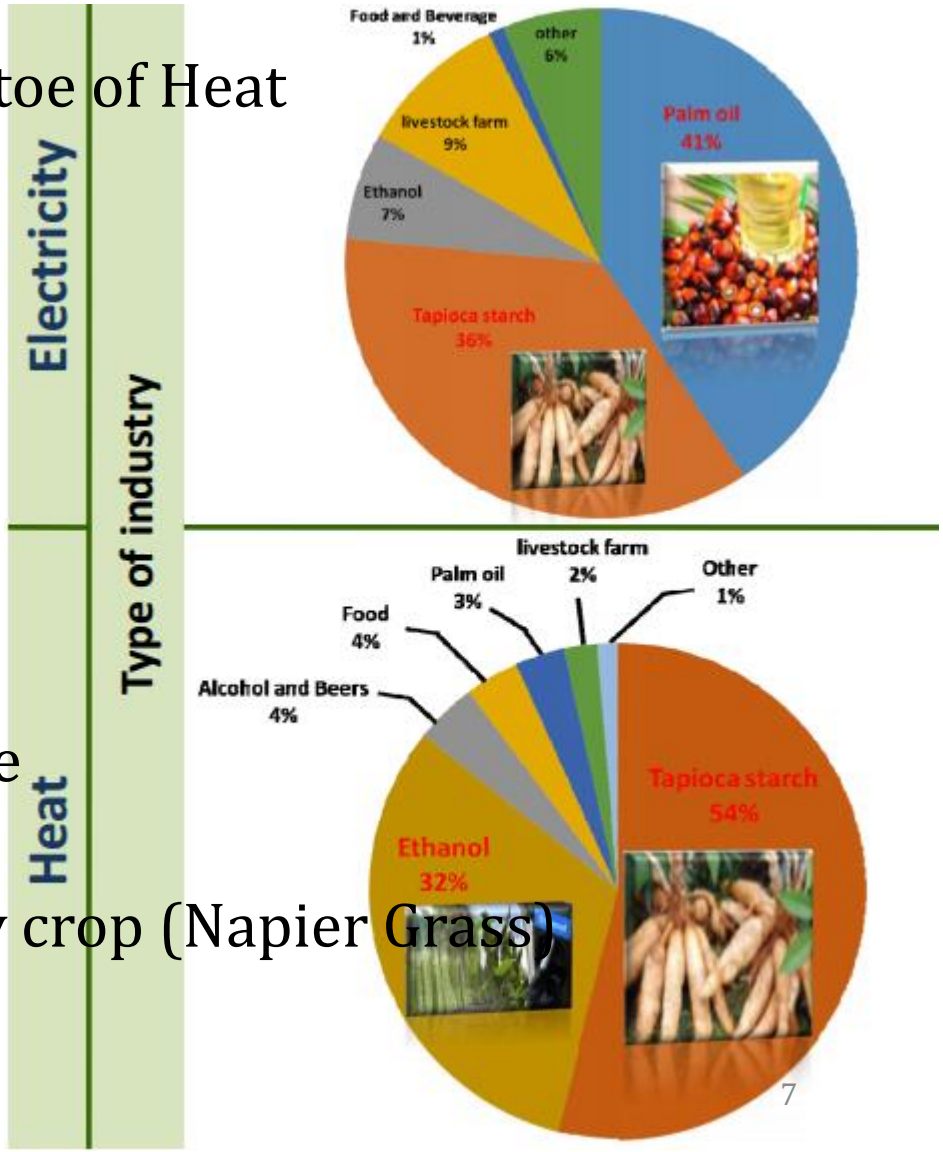


Share of biomass feedstock used for electricity generation

(Source: EPFL, 2013)

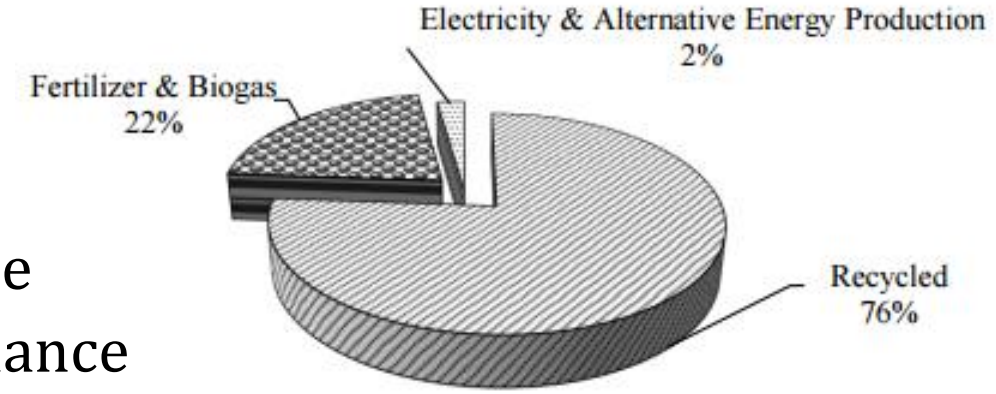
Bioenergy status (Biogas)

- 193.4 MW of Power & 458 ktoe of Heat
- Technology Type:
  - Anaerobic digestion with Gas Engine
- Size: 1-6 MW
- Challenges
  - Availability of feedstock
  - Too low incentives
  - Limit of transmission line
  - Safety
  - Plantation of new energy crop (Napier Grass)



Bioenergy status (Waste-to-energy)

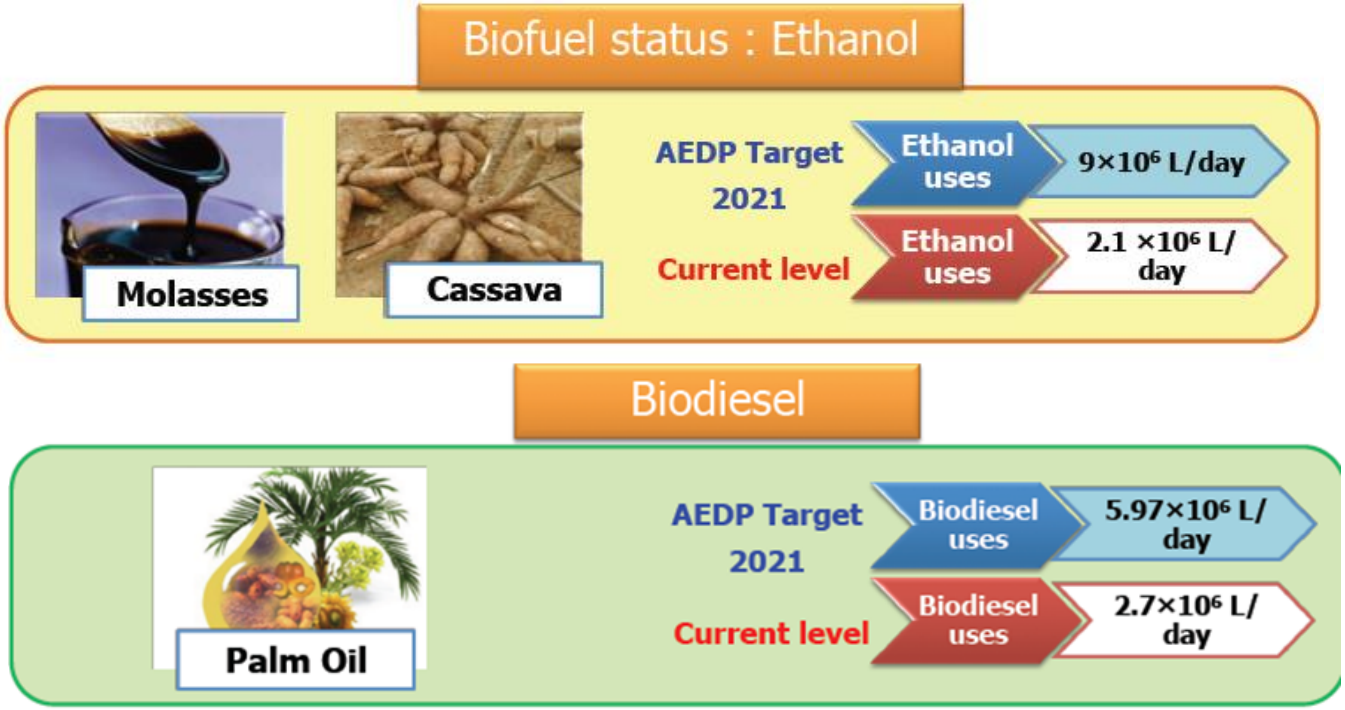
- 47 MW Power & 458 ktoe of Heat (Dec. 2012)
- Technology Type:
  - Boiler with steam turbine and gas engine
- Feedstock: MSW + Biogas from landfill
- Size: 1-6 MW
- Challenges:
  - Local political issues
  - Community acceptance
  - Environmental compliance



Proportion of MSW utilization in 2012

(Source: PCD, 2013)

Bioenergy Status (Biofuel)



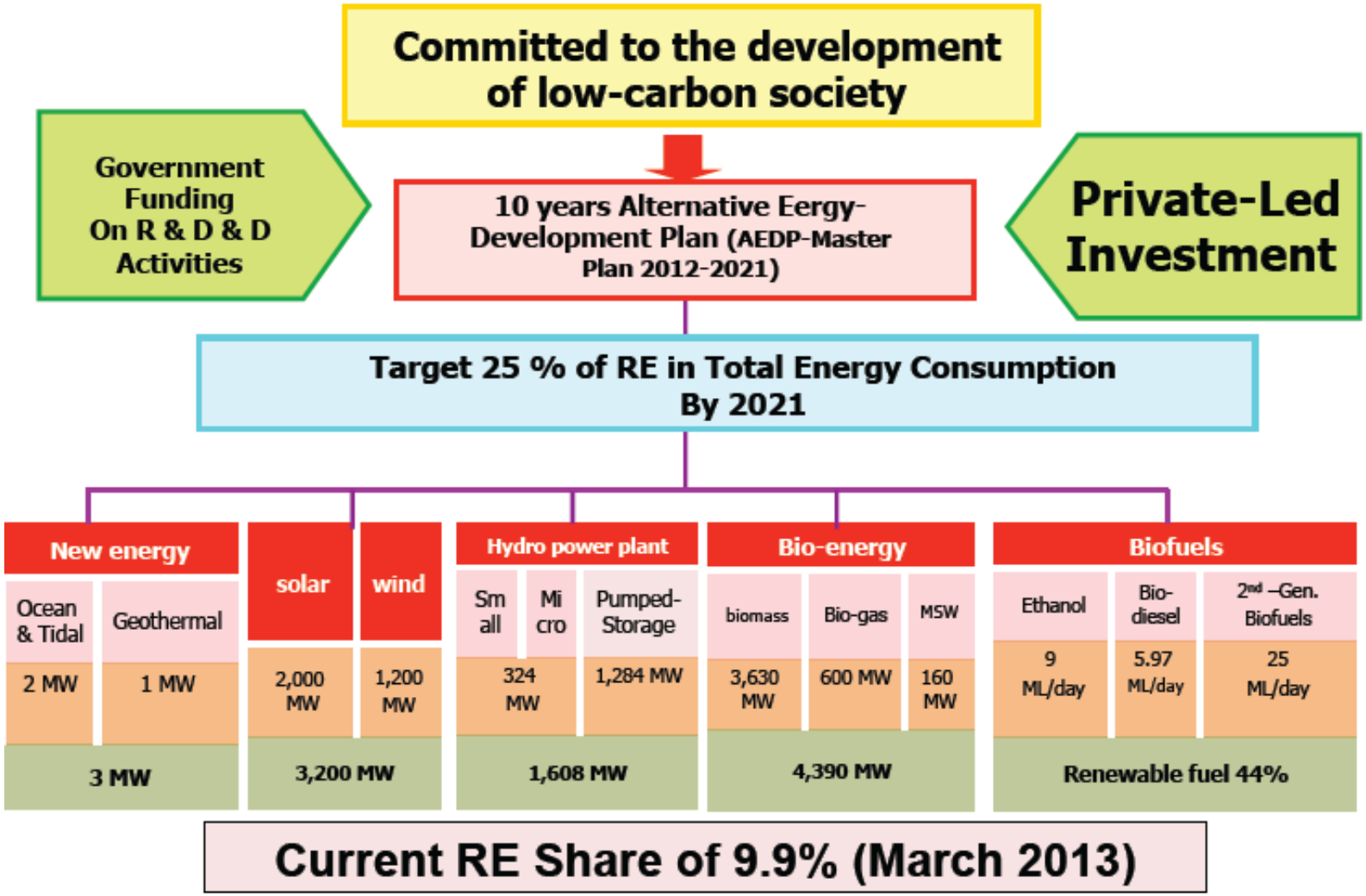
Interesting Facts:

- Plenty of energy plants, cassava and sugarcane for ethanol production
- Promote plan of action to increase the usage of ethanol in transportation sector
- Amending the laws and regulations to support ethanol free trade in AEC 2015
- Only country that mandates biodiesel mix in every litre of diesel sold, normally 5% since 2012

(Source: DEDE, MoE)

Enabling Environment for Biomass Usage

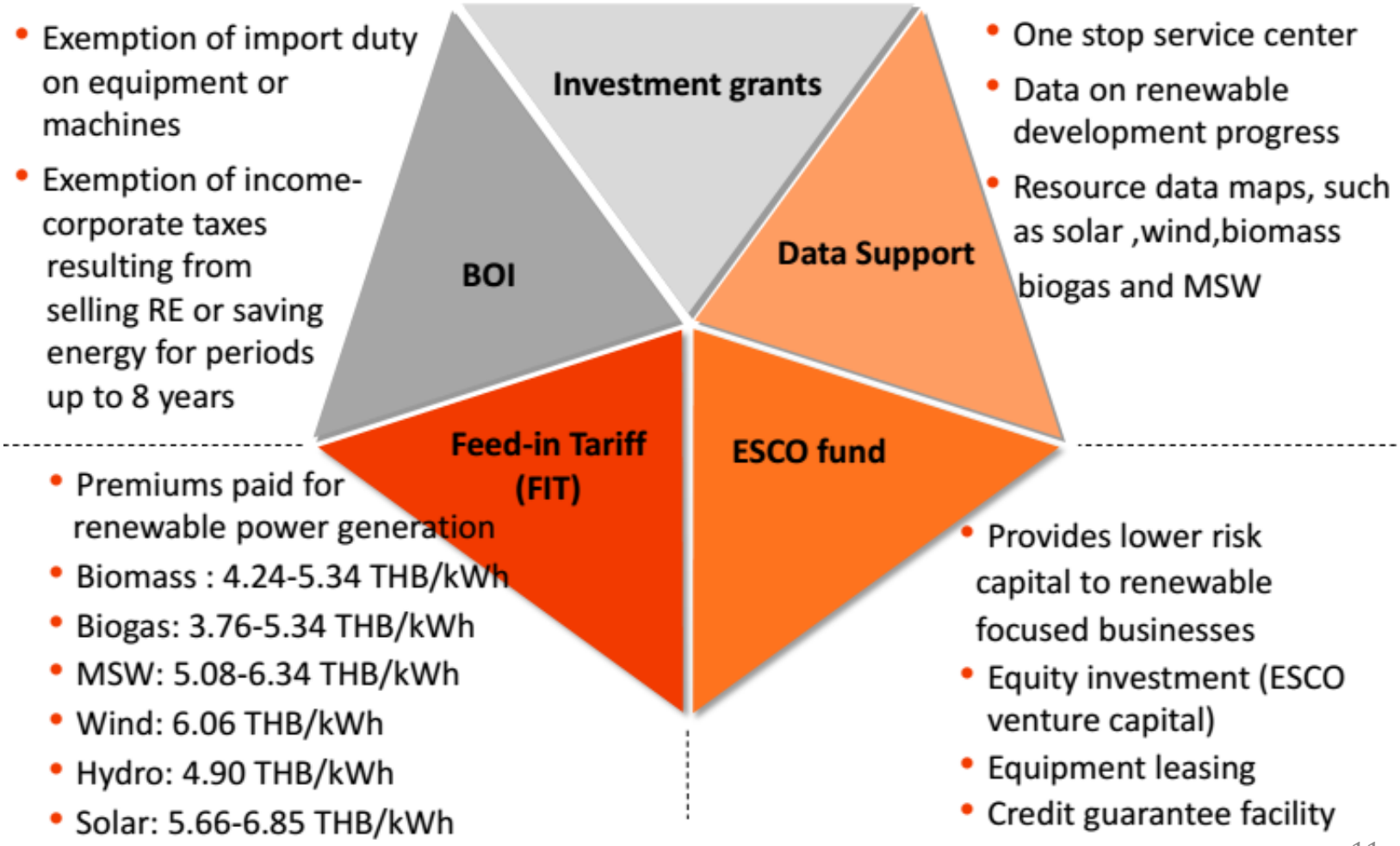
a) Alternative Energy Development Plan (AEDP)



(Source: DEDE, MoE)

Enabling Environment for Biomass Usage

b) Investment Facilitation (BOI, FiT, ESCO Fund etc.)



Enabling Environment for Biomass Usage

c) National Economic and Social Development Plan

- Develop natural resource to strengthen agricultural base;
- Enhance agricultural productivity & value creation;
- Enhance food & bioenergy security & biomass at household & community level;

d) Promotion of Biogas

- Government funding through several mechanisms.
- Support from Ministry of Energy (Mostly through the ENCON)
  - Investment Subsidy (20% in 2007, 50% in 2009)
  - Soft loan with 4% interest rate (not more than 50 M baht)
- Support from NSTDA
  - Soft loan with low interest rate (75% of investment cost but not more than $1.5 M, 1 year grace period)
  - 22 companies benefitted

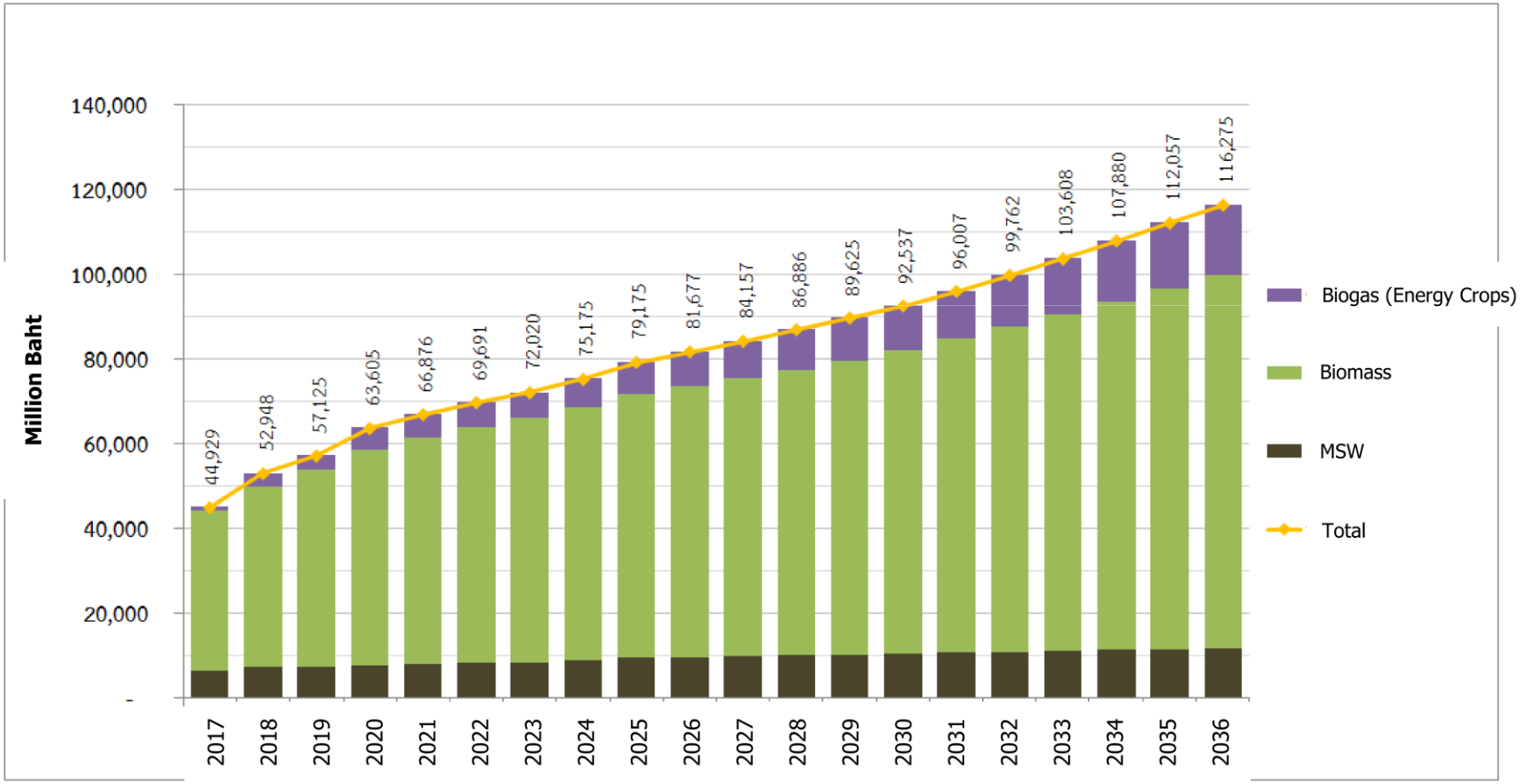
Enabling Environment for Biomass Usage

e) Policies for Promotion of Biofuel

Agricultural Sector	Automotive Sector	Fuel Market
Support R&D activities for yield improvement of Sugarcane and Cassava	**Reduce excise to car makers** to support manufacturing of E85	**Prohibit sale of non blended fuel** at fuel stations from Jan 2013
Quota (35%) for Cassava based ethanol to accommodate increasing demand of ethanol	Requirement of E85 cars procurement for official /government agencies	**Set prices of E20 lower than Gasohol 95 and E10**
Cassava based ethanol fetches 3 Baht per litre more price than Molasses based ethanol	**Support research** to increase ethanol demand e.g applying conversion kit for old cars	**Price benchmarks** Ethanol feedstock Price Brazilian ethanol Price International Crude Oil Price

- New National Palm Plantation Plan (2013-2017) to achieve the goals of area expansion, increased yields and the higher oil extraction rate (OER)
- Promotes research into new technologies allowing higher blending ratios with ethanol;

Bioenergy impact on the economy (Projected)



(Source: Chavalit Pichalai, n.d.)

Essential lessons learnt

Resources related:

- Stable and secure biomass supply requires reasonable prices to make project sustainable
- Power plant zoning and supply logistics should be considered when securing biomass supply
- Use long-term bioenergy feedstock supply contracts to guarantee stable price of feedstock supply;
- Competition in the use of biomass resources leads to issues of availability and cost
- Diversification of feedstock supply between seasonal agricultural residues and non-seasonal agroforestry firewood reduces risks on biomass supply
- It is advantageous to develop programs to empower farmers under contract to boost crop cycle profits;

Essential lessons learnt

Technology related:

- Imported technologies are not often suitable for operation with local biomass feedstock and limit the use of readily available biomass resource thus contributing to increased production cost.
- Major barrier is the lack of know-how of technologies, skilled labours as well as experts in the field, thus also limiting financing institutions from providing support

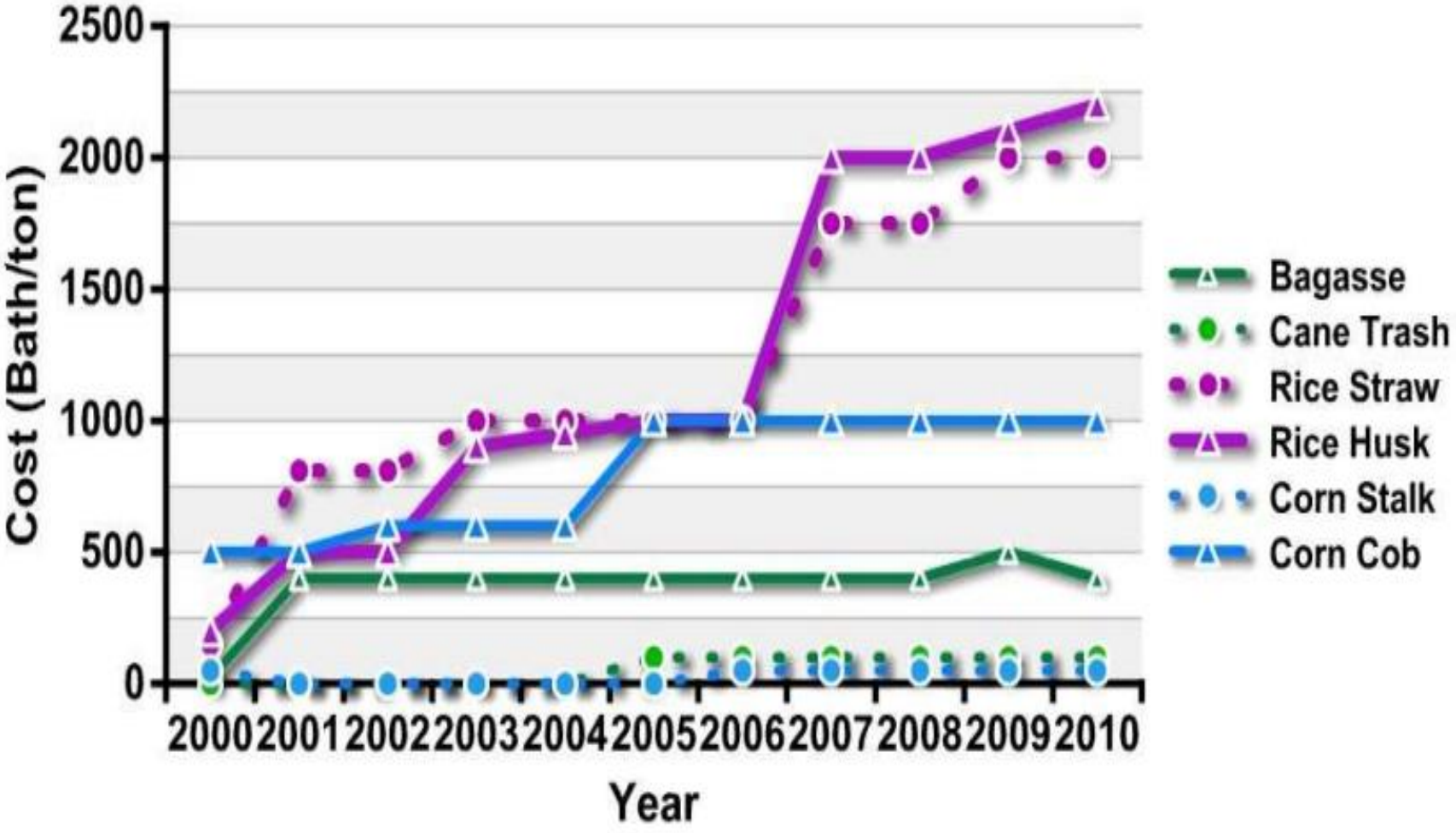
Enabling environment related:

- A consistent focus on local environmental impacts and benefits is required to mitigate opposition to power plant development
- Collaborations with industry for co-development can increase the uptake of local R&D for commercialization;
- Information and regulatory support is more significant than financial support for barrier removal

(Source: ERI, 2013; David R. Bell et al., 2011; JGSEE-CEE, 2014; Supannika Wattana, 2014)

Essential lessons learnt

Biomass Cost increased over the years



Some challenges and barriers

- No long-term S&T roadmap and funding policy to promote bioenergy RD&D;
- Lack of an unified energy plan: Many existing energy plans do not synchronise;
- Lack of integration of renewable energy with other types of policies, including environmental, agricultural and water policies;
- Frequent change in energy policies and targets, which defers bioenergy project investment;
- Long approval process of government support such as loans and other incentive mechanisms for project implementation;
- Lack of an effective monitoring and evaluation system;

(Source: ERI, 2013; David R. Bell et al., 2011; JGSEE-CEE, 2014; Supannika Wattana, 2014)