

Development of Commercial Biogas in Thailand

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Clean Energy Advisors

Background

- ▶ Nearly 200 industrial biogas plants built in last 10 years
- ▶ Biogas has increased energy efficiency and competitiveness for starch and palm oil mills
- ▶ 10 years ago difficult to obtain financing, now local banks provide loans

Presentation Outline

1. RE policies & regulations
2. Biogas development over last decade
3. Factors driving biogas development
4. Main issues & risks

1. RE Policies & Regulations

▶ ENCON Act (1992)

- Compulsory and voluntary programs to stimulate energy conservation
- Major factories and buildings required to prepare energy audits and energy conservation plans
- Awareness campaigns, appliance labeling
- Established ENCON Fund

ENCON Fund

- ▶ Funded by the Petroleum Fund, based on a levy on the domestic sales of fossil fuels
- ▶ Annual budget of US\$ 5 million
- ▶ Supports multiple EE and RE programs:
 - 30% Subsidy Program
 - Tax incentives
 - Energy Efficiency Revolving Fund

Energy Efficiency Revolving Fund (2003–11)

- ▶ Low-interest loans to local banks for on-lending to clients
- ▶ Loans up to US\$ 1.7 million, interest rate max 4%, maximum 7 years
- ▶ 13 public and commercial banks participated, US\$ 500 million loans to 250 projects
- ▶ Instrumental in familiarizing banks with RE

Renewable Energy Development Plans

- ▶ Currently Alternative Energy Development Plan (2012–2021)
- ▶ Target to increase RE to 25% by 2021
- ▶ Biogas target increased from 120 to 600 MW

Very Small Power Producer (VSPP)

- Distribution utilities obliged to purchase electricity generated from RE up to 10 MW
- Retail tariff + 'Adder' (US\$ 1.0–1.7 cents / kWh for biogas)
- By October 2013, 1,329 MW connected, 3,510 MW under development

2. Biogas Development in Thailand

- ▶ HH biogas programs since 1950s
- ▶ Medium and large pig farms in 1990s
- ▶ Early 2000s government supported projects at starch mills (30% subsidy)

Opportunity at Starch Mills

- ▶ Waste water typically treated in open lagoons
- ▶ High organic content suitable for biogas
- ▶ Large industrial sector
- ▶ Industry relies on Heavy Fuel Oil and grid electricity

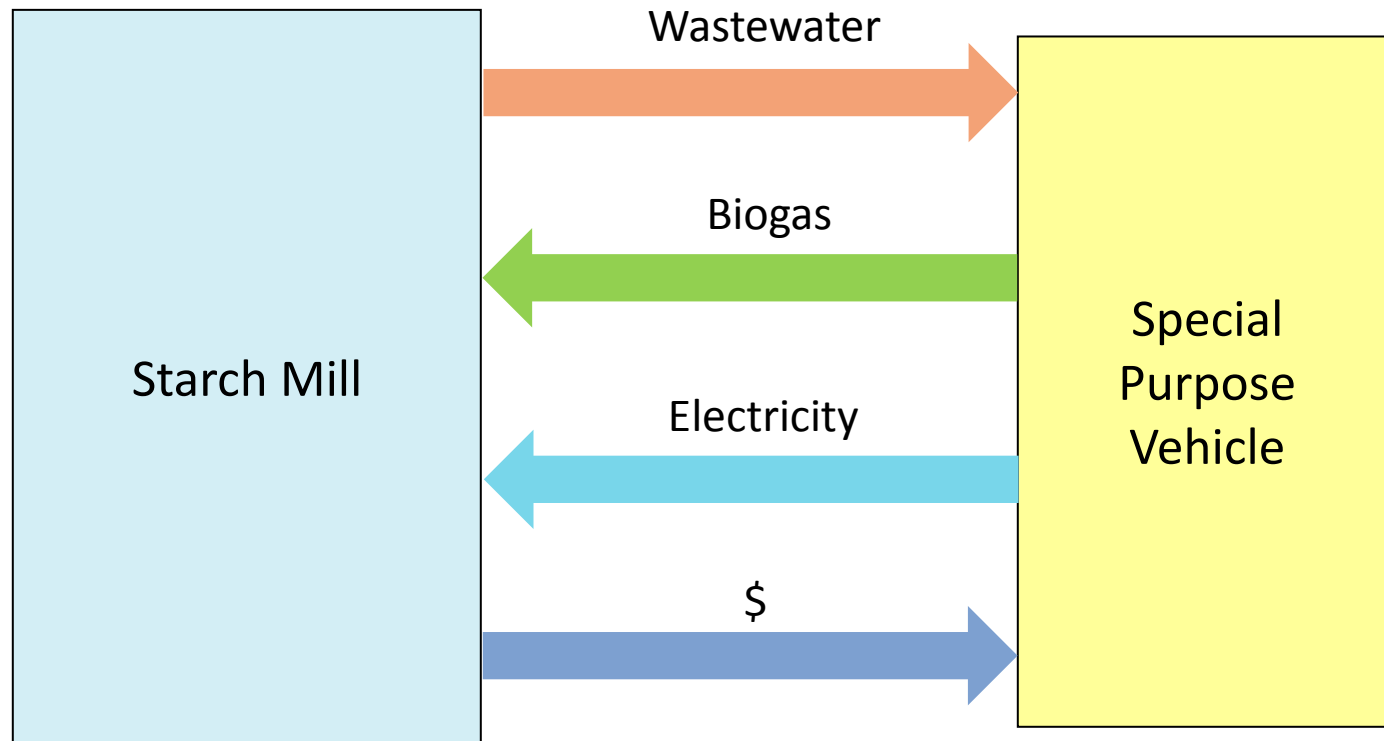
➡ Biogas can significantly reduce energy costs and environmental impacts



KWTE: 1st commercial project

- ▶ 10 year BOOT (Build–own–operate–transfer)
- ▶ Covered lagoon digester (100,000 m³)
- ▶ CAPEX US\$ 4.5 million (all equity)
- ▶ Fixed savings of 20%
- ▶ 3 MW, displaces 7.5 m. liter HFO, 35 GWh/yr
- ▶ Projected 250,000 CERs /yr

BOOT Structure





Biogas Boom

- ▶ High expectations from CDM
- ▶ Initially BOOT, later mostly turn-key
- ▶ Since 2003, 50 plants at starch mills, 60 at palm oil mills
- ▶ Sharp increase in biogas power sales

Electricity Sales from Biogas

- ▶ 87 projects, total 193 MW, 176 MW under development
- ▶ Biogas 15% of VSPP capacity
- ▶ Revenue since 2005 > US\$ 150 million
- ▶ Palm oil mills energy self-sufficient, so VSPP important factor

Univanich Palm Oil

- ▶ Biogas initially to solve odor problem
- ▶ Extra revenue from electricity (6,000 MWh/yr) and carbon (27,000 CERs/yr)
- ▶ Company built 2 more biogas plants



	Electricity <i>(GWh)</i>	Capacity <i>(MW)</i>	# Projects
2005	2	7	8
2006	10	10	11
2007	14	8	17
2008	38	23	24
2009	83	69	42
2010	214	130	53
2011	302	159	61
2012	1,021	193	87

Finance

- ▶ Grant funding for early projects
- ▶ Large interest from carbon finance
- ▶ Most later projects financed by local banks, EERF co-financed 30–40 projects
- ▶ Local banks willing to finance once familiar, but largely as asset-based corporate finance
- ▶ Total investment US\$ 400–500 million

Current Status & Prospects

- ▶ Most major facilities have biogas system
- ▶ Opportunities at smaller facilities, but not always economically feasible
- ▶ Scope for performance improvements at existing plants
- ▶ Opportunities for other feedstock but higher costs and less standardized

3. Driving Factors

- ▶ Favorable regulations & incentives:
 - RE development plans & targets
 - Subsidies, tax credits, financing
 - VSPP

Driving Factors (2)

- ▶ Carbon finance:
 - High expectations, low deliverance
- ▶ Well-established industrial sector:
 - Replicability, access to financing
- ▶ Favorable investment climate:
 - Infrastructure, stability, etc.

4. Main Issues & Risks

- ▶ Wastewater quality and volume:
 - High COD and BOD
 - Fluctuations and disruptions in delivery of the waste stream
 - Changes in waste stream composition

Main Issues & Risks (2)

▶ Technology:

- Different technologies like covered lagoon, UASB, have different strengths & weaknesses
- Tolerate fluctuating volume and quality of waste water supply
- For biogas gensets, install gas scrubbers to remove highly corrosive hydrogen sulfide from biogas

Main Issues & Risks (3)

- ▶ Operation & Maintenance:
 - Biogas not part of core business
 - Under-qualified operators can lead to inefficient operation or shut down
 - Lack of communication between factory and biogas plant can affect performance

In Conclusion

- ▶ Industrial biogas is a mature and bankable technology
- ▶ Highly suitable for agro-industries with high energy demand
- ▶ Favorable regulations and access to finance key to uptake