Deployment of a bio-economic ‘hub’ in rural Thailand by means of a centralized biogas plant

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Biogas in Thailand

National AEDP targets:

- 680 MW from napier grass, plus
- 600 MW from agro-industry & agricultural waste
- Total target = 1,280 MW before 2036

Exploitation so far:

- Biogas based on wastewater from agro-industry widely applied (e.g. sugar mills, canned tuna & pineapple, starch & ethanol production);
- Current production = 897 mill. m3 annually (from 238 EPPO projects).
- Biogas based on agricultural waste (manure);
- Current production = 180 mill. m3 annually (mostly pig-manure).

Estimated potentials:

- Total potentials agro-industry = 1,000 mill. m3 annually **??**
- Total potentials agricultural waste = 1,060 mill. m3 annually.

= Large unused potentials within the livestock sector (pig *and* cattle).

Growing dairy markets

- Livestock plays an important role in the Thai society.
- Almost 4 mill. families are a part of the livestock sector.
- Provide 2.5 % of GDP equal to 382.5 billion USD in 2012.
- Number of dairy cattle increased 23 % from 2008-2012, thus
- From 470,000 head to 580,000 head, mostly in North East area.
- Total milk production in North East Thailand = 968,000 tons/y.
- Farmers organized in cooperatives & deliver milk to local dairy.



Problem area & Research question

Increasing dairy production in Thailand face challenges:

- New house-keeping facilities be applied, hereunder
- Manure handling practices improved, and thus
- Reduce emissions of GHG's to the atmosphere (N2O & CH4).
- Leakage of slurry/manure to surface and groundwater resources.
- Dairy cattle health & milk yield low (use of medicine & house-keeping).

Would it be possible to:

- Collect the cattle manure and digest in a biogas plant, and
- Use relevant biomass waste from local agro-industry /farm residues etc. to
- Produce renewable energy substituting fossil fuels at the dairy plant.

We pose the following research question

"How can Thai milk dairies undergo a transition to a more sustainable and efficient milk production, with a biogas plant constituting a development 'hub' for bio-economic solutions in rural Thailand"?

Methodology

- Interviews in Thailand (policy makers, technology manufactures, project developers, researchers etc.).
- Interviews in Denmark (farmer organizations, project developers).
- Case study of Ban Kor Dairy cooperative, hereunder
- Interview & visit at the dairy company.
- Visit 4 of 188 dairy farmers in Ban Kor Dairy cooperative.
- Interviews & visit in local agro-industries in Tambon Ban Kor area.
- Interview and visit a Napier research center.
- Literature studies & peer review journals.
- Statistical data review.

Tambon Ban Kor Dairy & Local area

Farmers:







- Livestock = 34 to 53 milk cattle, hereof 50 % calf & heifers for breeding.
- Cattle feed = rice-straw, ruzi grass & napier grass, cassava-pulp, etc.
- Manure = piling up in stables (half with cement flooring & half bare soil).
- Solid manure moved to land for drying in the sun; later sold as fertilizer.
- Slurry (liquid) = run-off to local recipients, groundwater and evaporates.
- New stables with manure collection options need to be established.
- 'Cow kennel' stable: cement floor with 2,5 degree slope to center pathway.
- Here the manure is collected; send to storage; transported to biogas plant.
- Estimated price = 1,000 Euro peer cow per head.

Local agro-industry & others:





- Cassava company = 600 t. by-products (peel & pulp) relevant for biogas; some used for animal feed, but not all. - Use napier grass instead !!
- The cassava rhizome can also be utilized, now discharged!
- Rubber factory = waste water from rubber factories relevant for biogas, as it contains sugar, protein and natural nitrogen.
- Municipal solid waste =200 t. collected per day from Tambon Ban Kor.
- The organic fraction can be digested and nutrients return to farmland ☺
- Singha beer company = Yeast; limited use as fodder & WW; no biogas.
- Surplus rice-straw from local farmers are available for biogas production.

The Dairy company:







- Raw milk = 20 tons processed per day; school-milk = 6.1 mill ltr./y.
- Dairy capacity = 30 tons; from farmer 38 tons; 18 tons 'exported'.
- The company would like to expand with a cheese production ☺
- The dairy use a fossil fuel boiler for process heat (26,660 l. diesel/y.)
- Also 240,000 kWh electricity from the national grid (high fossil mix).
- Heat = used to heat up and pasteurize the milk by a heat exchanger.
- Waste water = 20 m3/day; is treated and send to an open lagoon.
- Waste water could be used for biogas production substituting diesel.

Technical opportunities for biogas

- Establish a CSTR (Continuously Stirred Tank Reactor) at the dairy company.
- Technology from Chiang Mai; proven & reliable Thai application.
- Improve the stables at 4-5 farmers, as demonstration projects.
- Feedstock for biogas plant: manure, agro-industry waste, farm residues etc
- Scale up with additional reactor tanks, as more farmers improve stables.



Biogas plant as a 'development hub'

- Knowledge from this case study can be applied on appx. 6,000 cattle and beef cooperatives in Thailand; hereof many dairy cooperatives.
- The biogas plant provides many benefits locally, and constitutes a 'hub' for sustainable development in rural Thailand, and can
- Enhance the opportunities for bio-economic projects to evolve ☺

Bio-economic 'hub'

