Biogas Programmes for Less Pollution

Category: Improving Environmental Standards

The technology of anaerobic fermentation offers a range of benefits. Methane obtained from organic waste provides an additional energy alternative. The use of organic fertiliser and the recycling of biomass within the agricultural cycle is fostered. Waste and waste water treatment is dealt with. And by controlling the release of the greenhouse gas methane in the decaying process of organic material, anaerobic fermentation contributes to combating global warming.

German cooperation projects have been successfully implemented in Thailand (BMZ/GTZ) and Nepal (BMZ/KfW). In Thailand in particular, anaerobic fermentation technology has achieved a high degree of commercialisation as part of the country's energy and environmental policy.

Small farms are interested in reliable and cheap sources of energy and in using organic, non-commercial fertiliser, while political and social pressure is forcing large-scale livestock farms to opt for more environmentally friendly production methods. Last but not least, municipalities and agroindustries have recognised the potential anaerobic fermentation bears for waste treatment.

Challenges

Pig and poultry farms as well as agro businesses such as palm oil mills, which are widespread in South-East Asia, pose a substantial threat to the environment. The faeces of a large pig farm with 20,000 animals correspond to the sewage generated by a municipality of 80,000 inhabitants. Before Germany and Thailand started the biogas programme, most of these agro-related businesses had been discharging waste and waste water into ponds in an uncontrolled manner, with Chemical Oxygen Demand (COD) levels of 10,000 to 15,000 mg/litre. While there was a certain degree of interest in improving the environmental situation, potential investors initially had doubts about biogas technology, given bad experience and unsuccessful imitation of foreign plant design without adaptation to national and local conditions.

Strategy

The most promising solutions were developed and tested in thorough field tests at Chiang Mai University Farm in Northern Thailand. These tests did not start from scratch, but were based on best available practice in other countries and Thailand itself. In particular, know-how was transferred from Tanzania, India and China. This approach aimed at protecting investors against major failures and unnecessary risks.

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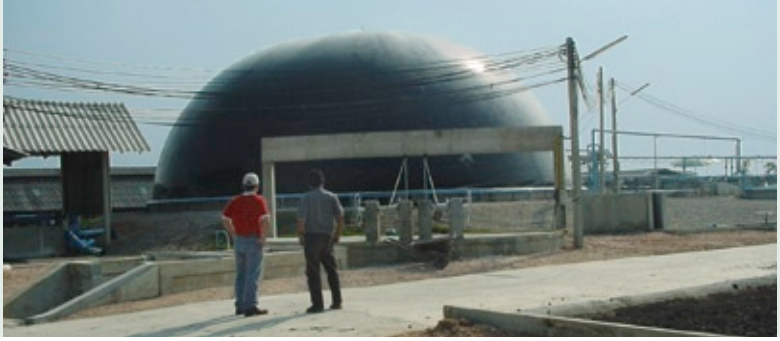

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Main steps

BMZ and GTZ supported the development of appropriate technical, agricultural and institutional solutions adapted to socio-economic conditions from 1998–1994, with BMZ providing a total of € 2.5 million of seed capital. The programme was subsequently extended under the sole responsibility of NEPO, Thailand's National Energy Policy Office, in three phases: phase 1 from 1995–1998, phase 2 up to 2003, and the ongoing phase up to 2009. The needs and the motivation of farmers and other investors were identified with respect to a wide range of agricultural, economic, social, cultural and ecological aspects. Standardised and proven systems in a modular design were developed for different applications: eight 100 m^3 fixed-dome digesters for small and medium-sized farms and modular plastic covered systems of 1000 m^3 digester volume each, which can be combined for different farm sizes and waste water amounts at larger livestock farms.

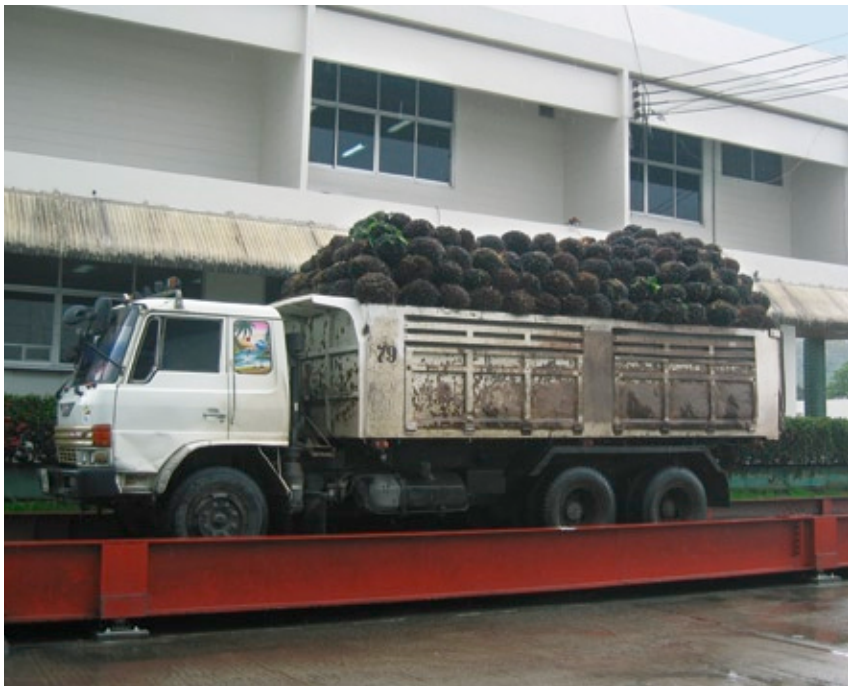
Northern Thailand was chosen as a pilot region to gain more experience with the dissemination strategy. The scheme was integrated into the then emerging Energy Conservation Fund of Thailand (ENCON) as a catalyst to spur private investment in the technology. Policy advice was given to the Pollution Control Department of the Ministry of Science, Technology and Environment (MOSTE) about practicable, internationally recognised standards and regulations for pig farms and other polluters, including means and strategies of enforcement. Tough discussions were held with banks to gain access to matching credit lines for investment.

The programme relied on locally available material, machinery, crafts and managerial as well as engineering knowledge. Independence from exports (both soft skills and hardware) was seen as an important element in achieving sustainability.

Benefits and Impacts

Clean energy and combating global warming: A biogas yield of 12.1 million m^3/year, equivalent to 14.2 million kWh, evolved from the dissemination activities of the programme within phases 1 and 2 until 2003. For the 3rd phase, up to 2009, a biogas yield of 1,140 million m^3 is envisaged.

Utilisation is planned as follows: power generation (957 million kWh), thermal use of methane in order to



Waste water treatment: in the first two phases, a total of 4.13 million m3 of manure was treated.

substitute 131,000 metric tonne of LPG and 31,000 m^3 of fuel oil. A technical lifespan of 15 years per system is assumed. The overall capacity of the anaerobic systems installed will contribute to the control of greenhouse gases (methane) with a magnitude of 9,240 million metric tonne of CO_2 equivalent.

Fertiliser: Phases 1 and 2 delivered 10,000 metric tonne of organic fertiliser per year. For phase 3, an amount of 1,140 million metric tonne is expected. Owing to its considerable demand in urban areas and among horticultural enterprises, organic fertiliser is highly valued on local markets, and its sale contributes to the overall profitability of the anaerobic system.

Waste water treatment: In the first two phases, a total of 4.13 million m^3 of manure was treated. The treatment of 104 million m^3 is envisaged for phase 3. The programme will have covered approx. 30% of Thailand's standing pig population with termination of phase 3. After phases 1 and 2, 70% of the farms cooperating in the scheme corresponded to valid waste treatment standards. COD is now down to 100 to 600 mg/litre, from 10,000 to 15,000 mg/litre without treatment.

Private investment: During phase 2 of the programme, a private investment by farm operators of US $2,9 million was triggered. The matching public contribution totalled US $2,3 million. For the ongoing phase 3, private investment of US $34,4 million is expected. Public contribution amounts to US $18,6 million. New potentials have been developed for wastewater treatment and energy recovery for agro-industry (breweries, starch factories, palm oil mills, slaughterhouses).

Employment: Presently, about ten construction firms with nearly 200 skilled and 2,800 unskilled staff are active in the programme. Implementation of phase 3 requires approx. 17,000 unskilled and 1,100 skilled staff.

Further effects:

- If they are properly planned and implemented, anaerobic technology programmes can represent successful examples of South-South know-how and technology transfer. Anaerobic technology know-how and experience can be drawn on from China, India, Tanzania, Nepal, Vietnam and Thailand. The Thai programme itself initiated a continuous transfer of experiences with Vietnam and the Lao PDR regarding the technology's practical application in these countries.

- The Thai Energy Conservation Fund gained public and political reputation for the dissemination of a successful example of tapping a renewable source of energy by treating waste and waste water.

- A technology is being promoted that combines national R&D efforts with commercial, investment and job potentials in the fields of environment and energy in rural areas, thus promoting sustainable development.

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Lessons learnt

The Thailand biogas programme is a complex scheme and has been faced with a number of challenging questions, one of which is financing. While Thailand's Environment Fund financed certain pilot systems, the Energy Conservation Promotion Fund (ECPF) offered more attractive and less bureaucratic conditions in the long run. It has been open to innovative approaches as well as to integrating environmental and energy aspects in one strategic approach.

Farmers have shown readiness to invest their own funds in the new technological option – chiefly due to social and political pressure demanding a cleaner environment. In addition, the anaerobic solution's marginal positive financial viability – mainly through energy and fertiliser yields – shows investors and banks that such projects can be worthwhile.

The chief barrier has been the reasonable doubts about the economic and technical feasibility of a biogas programme with a nationwide mandate. Thus the programme had to:

- Eliminate structural deficiencies of previous programmes in a systematic manner and to import best practices from other programmes abroad
- Ease farmers' workload (e.g. regarding requirements on dung collection)
- Develop all advantages of anaerobic fermentation systems in a synchronised and efficient manner
- Ensure proper operation and maintenance
- Rely on local skills and material (up to 100% local manufacturing content).

The Royal Thai Government's threefold approach towards environmental challenges:

- Enforcing standards for pig farms on waste treatment
- Pricing the use of clean underground water
- Its readiness to provide a support structure and financial incentives (subsidising initial investment by approx. 20%) for farms seeking cooperation has been of particular importance to the success of the biogas programme Summing up, anaerobic fermentation programme have the potential to integrate energy, environmental, agricultural and global warming issues in a single strategic approach.

Imprint:

For further information & published by:
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Pictures by:
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

Printed on 100% recycled paper

Design:
© creative republic, 2006
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Kommunikationsdesign
T: +49 69 91 50 85 60
E: contact@creativerepublic.net
I: www.creativerepublic.net

Status: 2004