

Development of biogas technology for livestock farms in Thailand

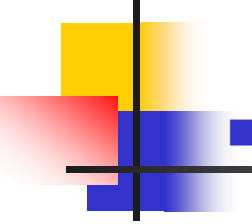


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Introduction

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- In the past, livestock farms in Thailand were at rather small-scale integrated with crop production such as rice and field crops.
 - Major livestock such as cattle and buffalo were commonly raised for draft purposes. A few pigs and some 10-20 chickens were raised under backyard or scavenging systems.
 - Until recently, livestock production sector has been developed to commercial or large-scale farming systems.



Introduction

- Especially, pig production could be found only in medium and large-scale farming systems.
- The small pig farms have been operated by mostly the ethnic groups in the upland areas which could be found mainly in Northern part of Thailand.



Introduction

- According to such production systems, the wastes become major problems to be solved by farmers.
- The best solution at present is by introducing biogas technology to reduce wastes and pollution from the farms.

Development of biogas technology



- Biogas technology was first introduced to Thailand around 1950 at Kasetsart University with the Indian floating drum system for dairy farms.
- Later the biogas systems were utilized for the purpose of sanitation on the village level where the farmers usually raised their livestock (cattle, buffalo, pig and poultry) under livestock-cropping systems.



Development of biogas technology

- Therefore, it might be categorized the development of biogas technology in Thailand
- into 3 phases according to the organization and development stages involved.



The first phase

- Began in 1960, the Department of Health, Ministry of Public Health promoted biogas digester
- as a mean of reducing pollution from livestock wastes in the village.
- The project ran from 1960-1992, approximately 6,000 floating drum type biodigesters were constructed.



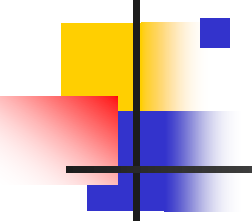




The second phase

- The biogas production systems were operated by National Energy Institute from 1970-1980 during the period of energy crisis.
- In each village at least one floating drum type biodigester was constructed as the demonstration unit
- and if any farmers willing to construct a biodigester, the Government would support the budget for 1,200-1,500 Baht per farm.

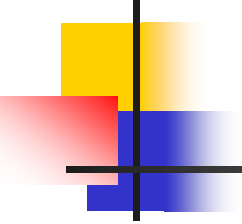


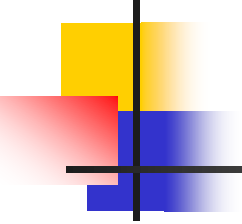
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- During 1980-1989 the Department of Agricultural Extension, Ministry of Agriculture and Cooperative
 - also promoted the farmers to construct simple floating drum type biodigester
 - which similar to the project of Department of Health by whole supported or partially supported (for 1,500 Baht per farm) budget.
 - 1 US \$ = 33 Baht at present

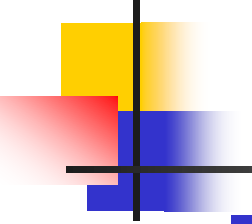
Chinese Fixed Dome System in Pig Farms

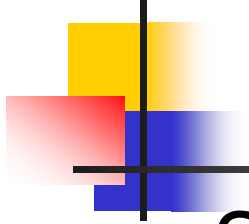


The third Phase

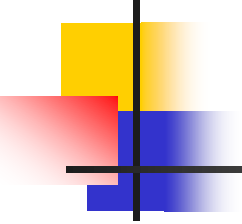
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- **The third phase** of the development of biogas technology began with the Thai-German Biogas Programme (TG-BP) from 1988-1995.

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- This programme was supported by German Technical Cooperation (Deutsche Gesellschaft fuer Technische Zusammenarbeit GmbH-GTZ)
 - in cooperation with Chiang Mai University
 - and Department of Agricultural Extension, Ministry of Agriculture and Cooperative.

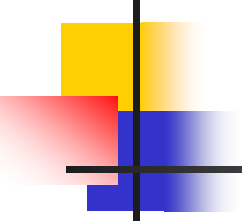
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- During this period the dairy and pig farms were faced problems of demonstration
 - against pollution from wastes (smell, flies, waste water etc.)
 - by neighbourhood and local communities.

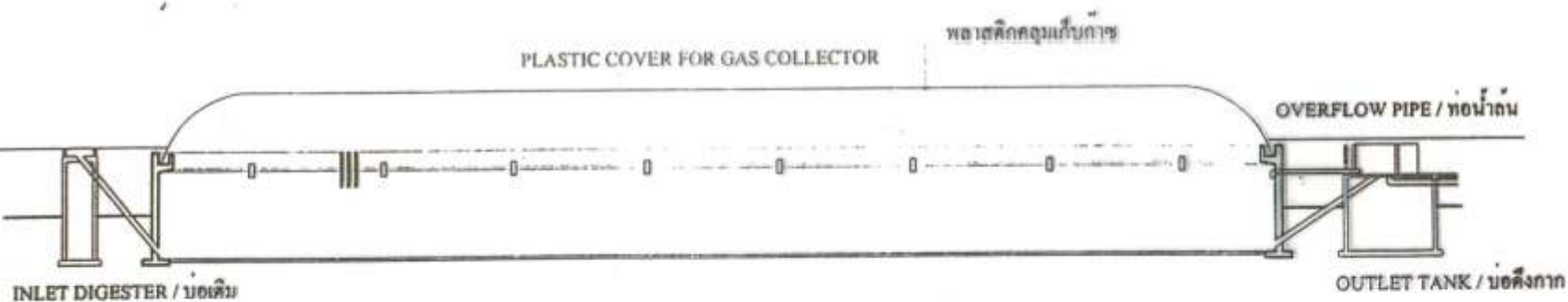
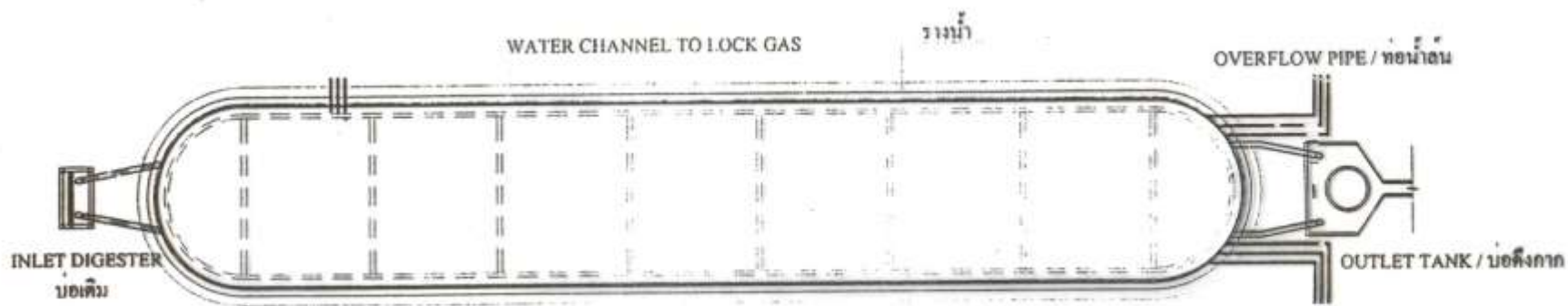


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- So in this project the main objectives
 - were to design and develop the methods
 - to reduce pollution from livestock wastes.

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- The model of plug flow channel type digesters (2 x 100 m³)
 - and a UASB (50 m³) digester in connection with sand-bed filter was constructed
 - as a research and demonstration unit at the Chiang Mai University Farm.

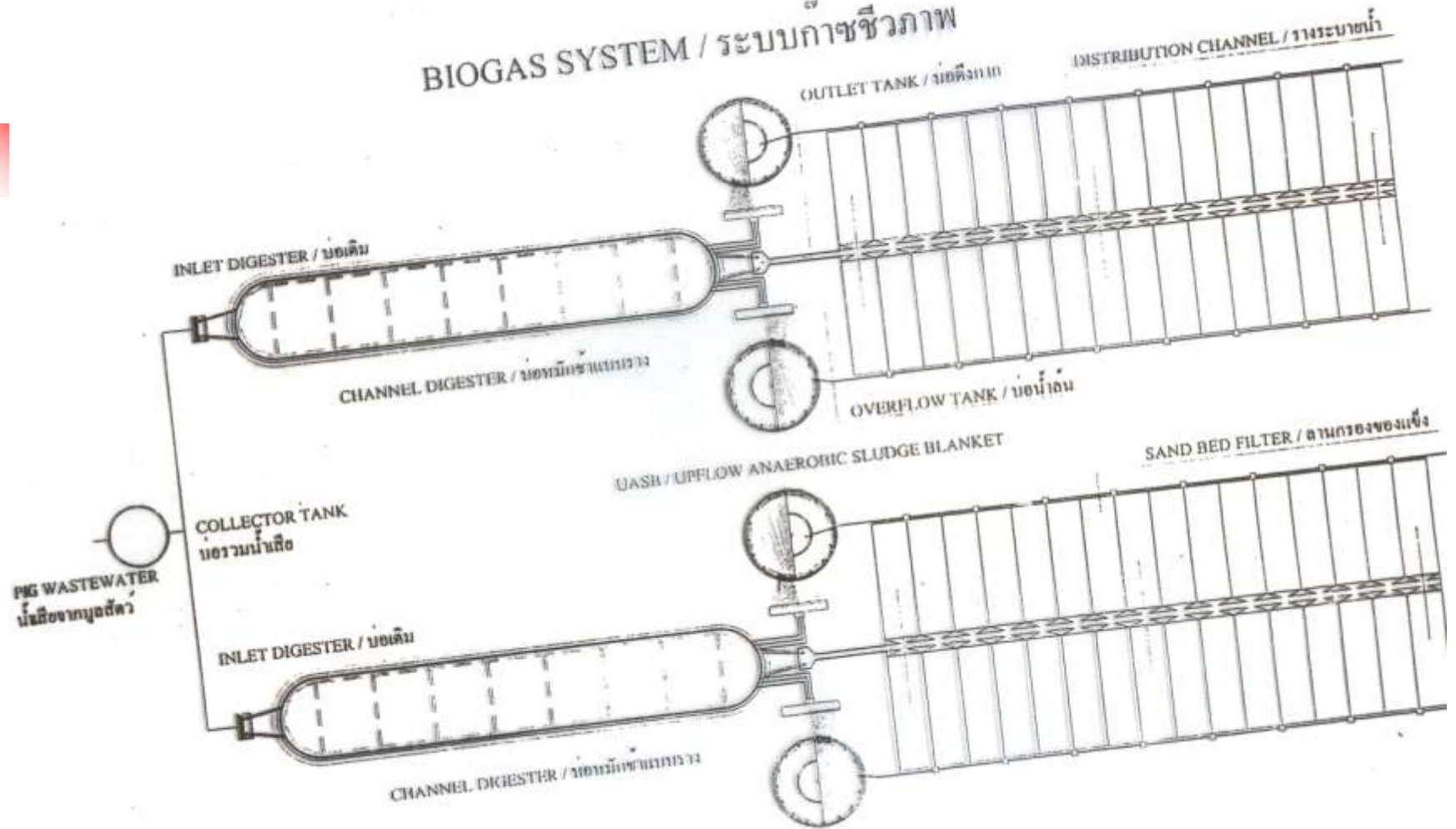


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- In pig farms, the plug flow channel type digester
 - plus the UASB (Upflow Anaerobic Sludge Blanket) digester
 - were designed to use, mainly in medium size
 - and large-scale farming systems (sizes of 600 and 1,000 m³).



CHANNEL DIGESTER / บ่อหมักชาแบบราง

BIOGAS SYSTEM / ระบบก๊าซชีวภาพ

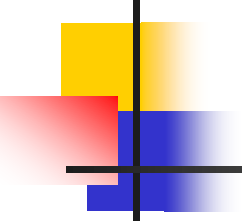






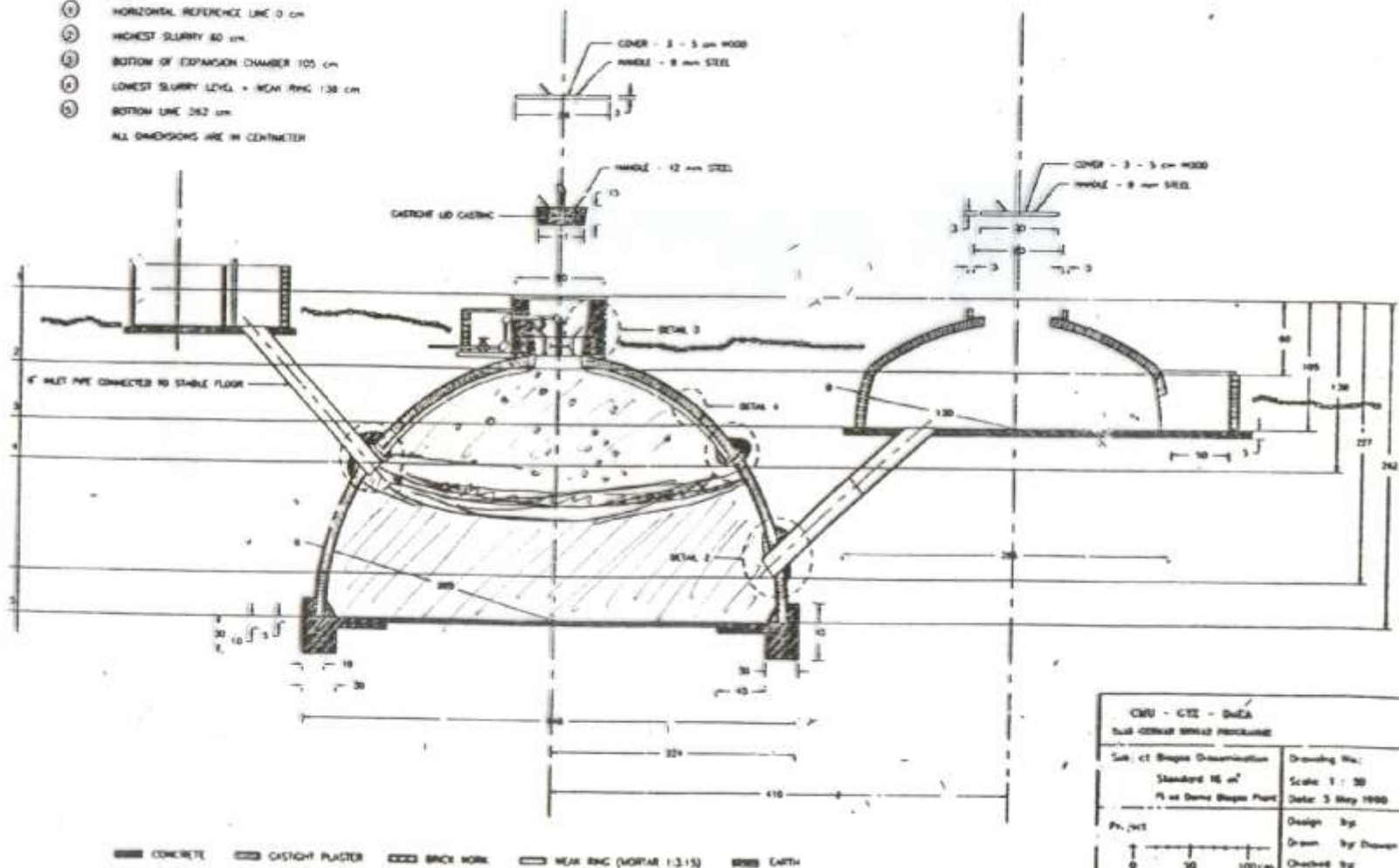




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- For the dairy farms and small-scale pig farms,
 - the fixed dome type digester (sizes of 8, 16, 30, 50 and 100 m³) was designed
 - to fit with wastes from such farms.

- ① HORIZONTAL REFERENCE LINE 0 cm
- ② HIGHEST SLURRY 60 cm
- ③ BOTTOM OF EXPANSION CHAMBER 105 cm
- ④ LOWEST SLURRY LEVEL = NEAR RING 138 cm
- ⑤ BOTTOM LINE 262 cm

ALL DIMENSIONS ARE IN CENTIMETER

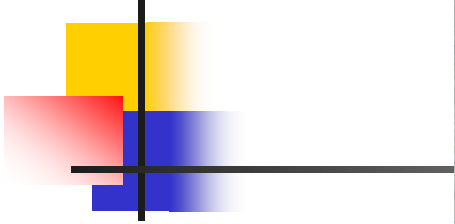


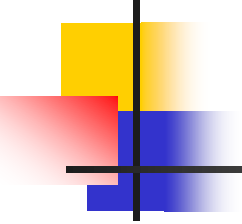
 CONCRETE
  GASTIGHT PLASTER
  BRICK WORK
  WEAR RING (MORTAR 1:3:15)
  EARTH

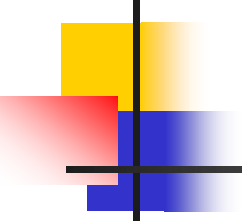
CMU - GYE - SdGA BUILDING OFFICE PROCEDURE	
Sub: ct Biogas Disinfection Standard 16 m ² 1/4 ac Dome Biogas Plant	Drawing No: Scale: 1" = 30' Date: 3 May 1990
Pn. (WT) 	Design by: Drawn by: Drawn Checked by: Approved by:

— : TG-PT (1990) 8, 12, 16, 50, 100



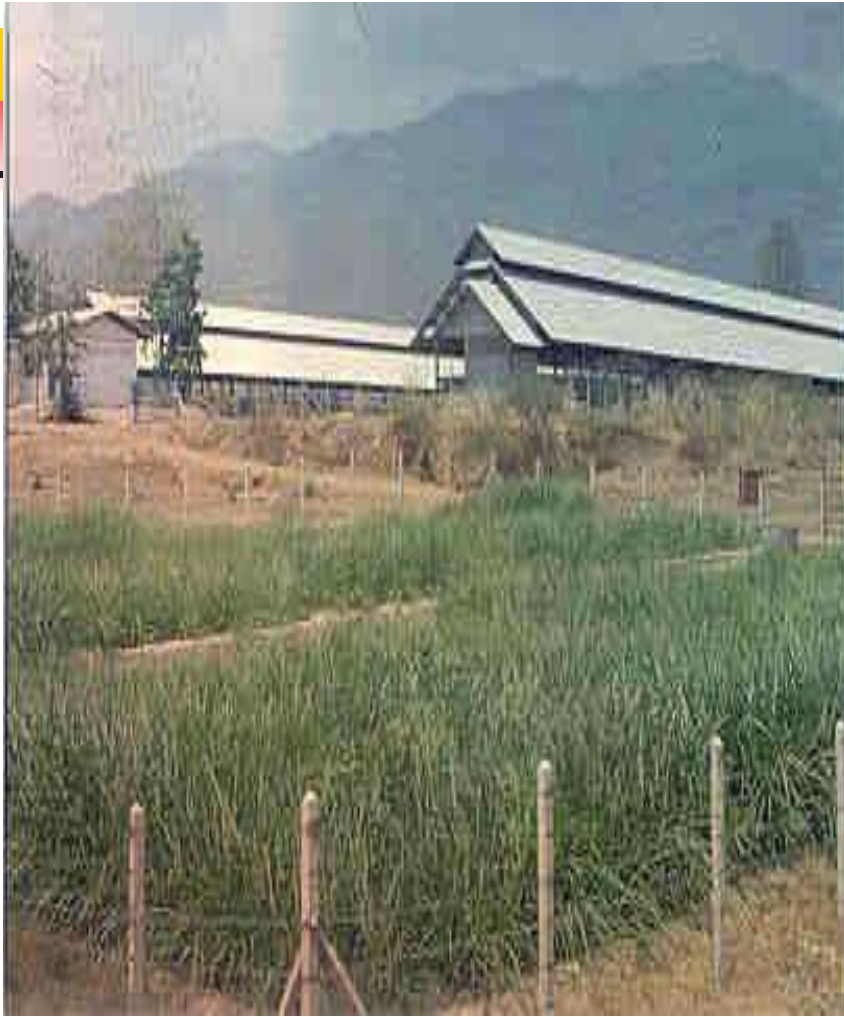


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- In parallel, the studies on the utilization of biogas for household cooking,
 - for producing electricity and for running the engines for other purposes were carried out
 - to prove that farmers could get the pay back or return from energy produced from the biodigester in a certain period of time.

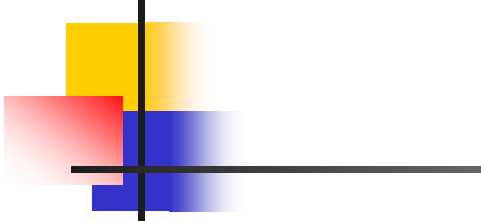
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- Apart from that, studies on utilization of fermented slurry
 - as biofertilizer for vegetables and forages were also carried out (Mikled *et al*, 2002).

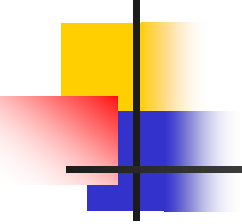


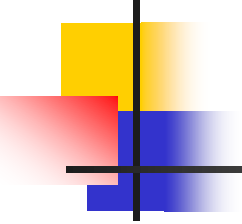


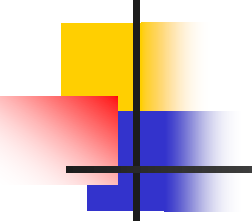


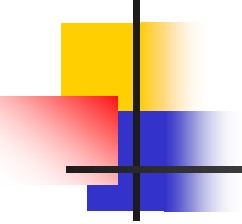


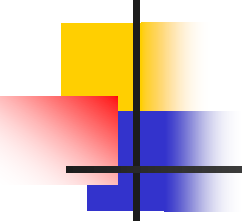


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- During 1999-2000 a study on the potential of biogas production and pollution situation
 - in pig and dairy farms in Thailand
 - under Biogas Map Project was carried out (Potikanond *et al.*, 2000).

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- The data from a total of 19, 239 farms was obtained
 - which were from 5,978 and 13,261 pig and dairy farms, respectively.

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- Most of the farms (73 percent) located near the community between 1-3 km away.
 - More than 63 percent of the dairy farms and 49 percent of the pig farms situated near the public waters.

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- From the survey it was found out that
 - there were 1,984 and 4,590 pig and dairy farms
 - wanted to have a biodigester.

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- The 1,247 and 2,120 pig and dairy farms, respectively were classified as
 - the potential biogas producing farms with the total of 127,946
 - and 22,702 LSU of pigs and dairy cows, respectively.

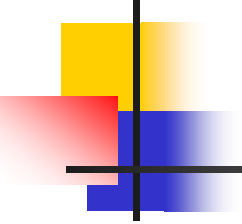
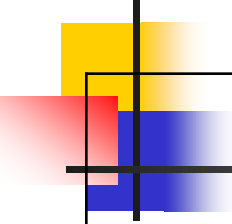
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- They would required a total of 255,892
 - and 45,404 m³ of biodigesters
 - in pig and dairy farms, respectively.

Table 1 Number of pig and dairy farms with potential of biogas production

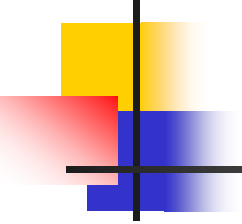


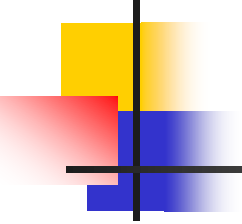
Catories	Pig farm	Dairy farm	Total
-Total no. of farms	5,978	13,261	19,239
-No. of farms wanted to have biodigester	1,984	4,590	6,574
-No. of farms with potential of biogas production	1,247	2,120	3,367
- LSU ¹⁾	127,946	22,702	150,648
- Size of biodigester, m ³	255,892	45,404	301,296

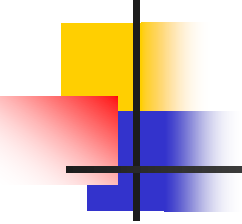
1) 1 LSU = 500 kg LW

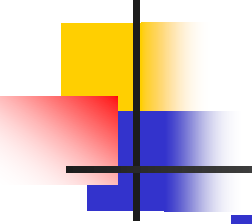
1 LSU required 2.0 m³ biodigester.

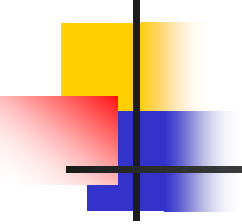
Source: Potikanond *et al* (2,000)

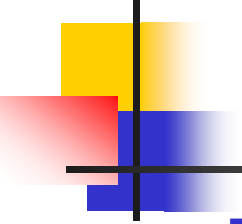
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- If all of the pig and dairy farms which suitable to have a biodigester, it would hold a total of 654,698 LSU
 - which would required 1.3 million m³ of biodigester
 - and equal to 69.9 million m³ of LPG per year.

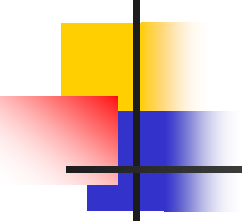
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- As mentioned earlier the Biogas Advisory Unit (BAU), Chiang Mai University
 - has disseminated the biogas production since 1995 after the end of TG-BP project.

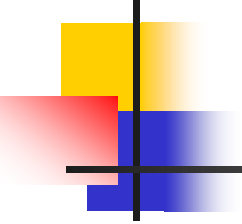
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- The budget has been continuously supported by
 - the Energy Conservation and Renewable Energy Policy Bureau,
 - Energy Policy and Planning Office, Ministry of Energy.

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- The programme of dissemination has been operated according to the budget supported into different phases as follows:
 - **Phase I:** from 1995-1998 with 6 medium and large-scale pig farms and a total volume of 10,000 m³ biodigesters.

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- **Phase II:** from 1997- 2003 with 14 medium and large-scale pig farms
 - and a total volume of 46,000 m³ biodigesters.

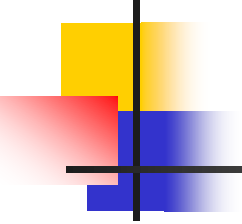
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- **Phase III:** from 2002-2010 which divided into 2 sections as follows:-
 - Section 1: with 215 medium size pig farms and a total volume of 150,000 m³ biodigesters.
 - Section 2: with 34 large-scale pig farms and a total volume of 130,000 m³ biodigesters.

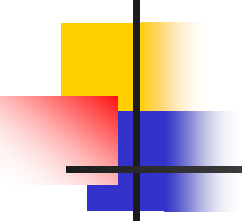
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- **Phase IV:** from 2008-2013 which also divided into 2 sections as follows:-
 - Section 1: with medium size pig farms and large-scale pig farms.
 - Section 2: with small size pig farms (< 60 LSU) used would be CD-Junior (Channel Digester- Junior) plus Fixed Dome biodigesters.

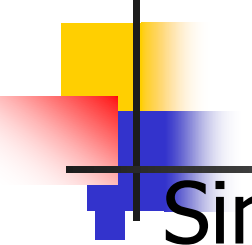
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- The target of this phase would be with at least 240,000 LSU
 - or approximately 2,000,000 pigs for the medium and large-scale pig farms
 - and at least 400,000 pigs in the small size pig farms.

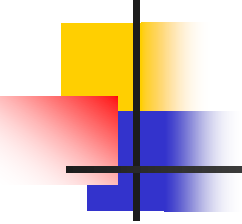




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- Biogas produced contains approximately 65 % methane by volume
 - and can be used as a substitute for LPG, fuel oils
 - or directly supply to biogas engine for power generation.

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- A cubic meter (m³) of biogas contains 23.40 MJ
 - which equivalent to 0.46 kg of LPG
 - or 0.55 liter of fuel oil
 - converting to 1.2 KW-hr of electricity.

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- Since 2006 BAU has been merged with the Institute of Energy Research and Development (ERDI), Chiang Mai University.
 - At present, biogas section is considered the largest technology provider among all academic institute and private sectors.

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- Since the beginning of the project, EDRI completely designs and constructions of more than 300 medium and large-scale biogas systems
 - producing approximately 80 million m³ of biogas per year.

ERDI

Energy Research and Development Institute, Chiang Mai University



Think of Energy
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Biodigester for Large-scale Pig Farms





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Biodigesters for small pig farms



โครงการส่งเสริมการผลิตก๊าซชีวภาพ
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โครงการส่งเสริมการผลิตก๊าซชีวภาพ
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โครงการส่งเสริมการผลิตก๊าซชีวภาพ
ในโรงฆ่าสัตว์



โครงการส่งเสริมการผลิตก๊าซชีวภาพ
ในโรงแปรรูปไก่



Biodigester for Cassava Processing Factory



Biodigester for Pig Slaughterhouse



Biodigester for wastes from hotels





Biodigester for Oil Palm Factory





Anaerobic Covered Lagoon
Using HDPE Plastic Sheet



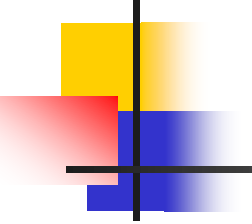




Fixed Dome (Fixed Dome)
with 100 Gall. 2-10





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- The low cost plastic bi digesters was introduced into Thailand in 2004 by Chiang Mai University through
 - the workshop on “Low Cost Plastic Biogesters” from February 22-24, 2004 (Facilitations: Dr. T.R. Preston and Dr. Khang from MEKARN-SIDA/SAREC-Network).
 - Later there were some research works continued from the workshop.














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- Since 2006 the teamwork from Department of Animal Science and Aquaculture, Chiang Mai University,
 - has introduced the adapted low cost plastic biogasters to the smallholder pig and dairy farms.
 - The budget supported has been come from the Clinic of Technology Project, Ministry of Science and Technology.



ถุงกาซชีวภาพจากมูลสัตว์

ถุงก๊าซชีวภาพจากมูลสุกร





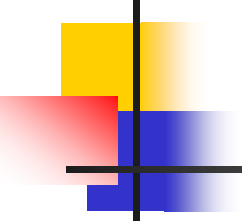




In conclusion



- The biogas production in Thailand becomes increasingly important
- particular to reduce pollution from wastes in the livestock farms.

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- Besides, the biogas is also counted as renewable energy source to replace natural energy sources (oil, gas etc.)
 - and the most important thing is that it is included the national policy
 - and continuously supported by the Government.



Acknowledgement

- The author is grateful to MEKARN-SIDA/SAREC for financial supported and give an opportunity to attend this workshop.



**Thank you
for your kind attention**