Experience from Thailand

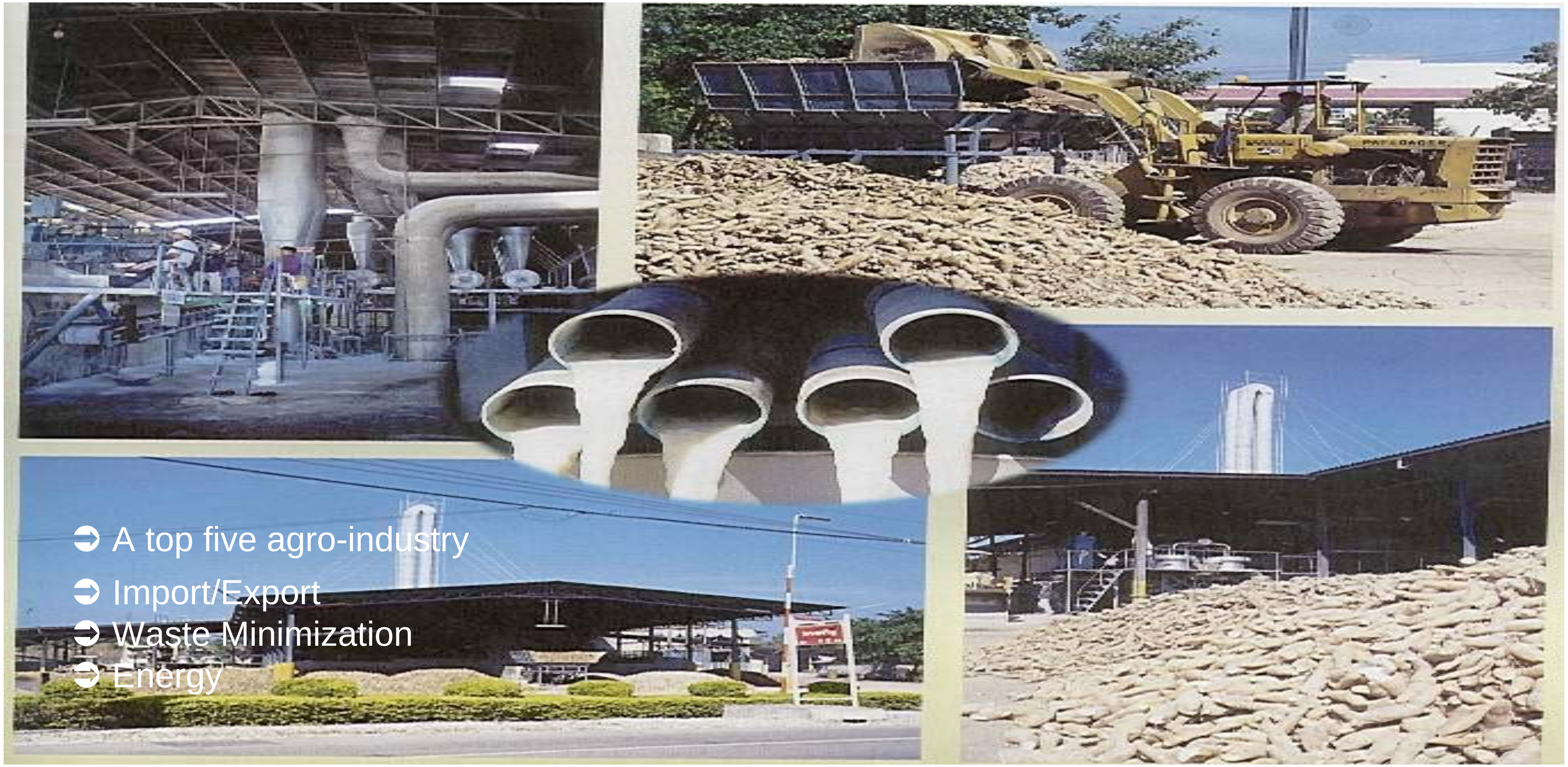
- A Case Study of Cassava Starch Industry -

INVENT – Final Meetings

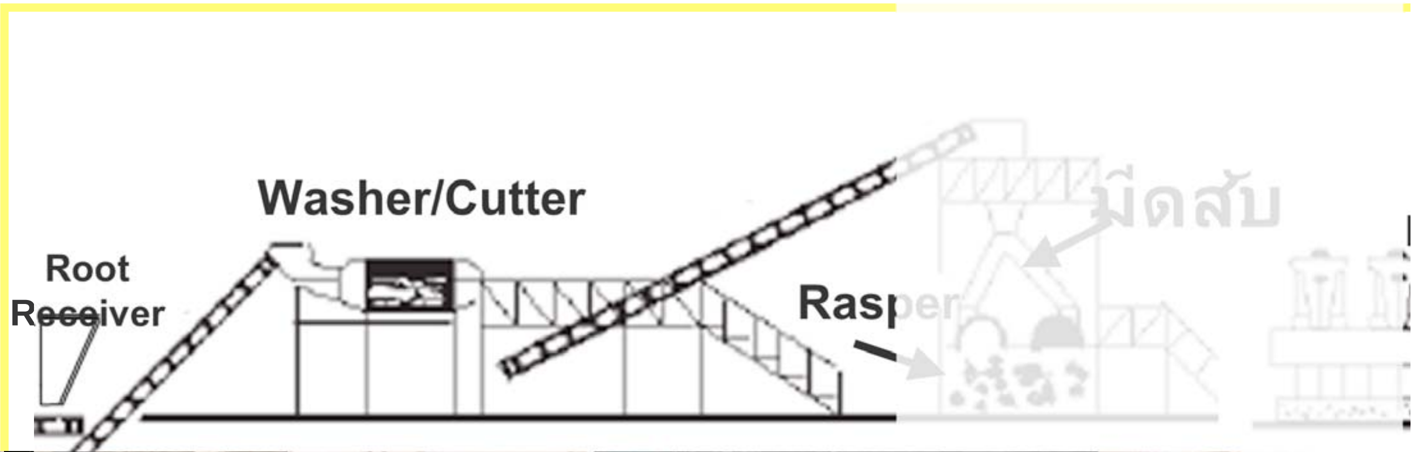
Content

1) Cassava Starch Industry
2) Waste Avoidance and Reduction
3) Biogas Technology
4) Environmental Awareness

A Case Study in Cassava Starch Industry



Cassava Starch Production Process



Thai Cassava Starch Industry

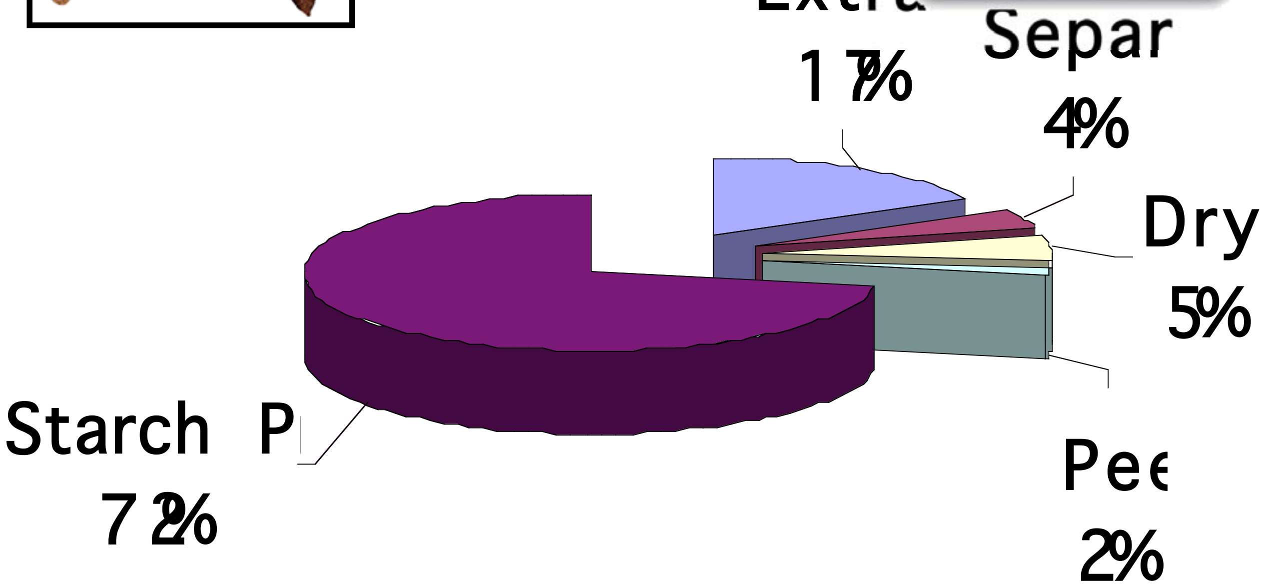
- Production capacity:
  - < 100 tons/day = 9 factories
  - 100 – 200 tons /day = 46 factories
  - 200 tons /day = 6 factories

- Cost of water 50-165 baht/ton dry starch (5 baht /m^3)
  - Electricity consumption 15-20 KWh/ ton starch
  - Cost of electricity 34 baht / ton dry starch (2 baht/KWh)
  - Wastewater 12 – 35 m3/ ton starch
    - biogas 300 million m^3 (150 million liters of fuel oil)
    - Environment & Energy

Waste Avoidance and Reduction

Starch loss

Production process



Waste Avoidance and Reduction

Waste Audit

starch

- starch loss
- product yield 66 - 90%
- Cassava Pulp

Water

- water **9.4–15.8** m3/ton
- water reuse

Chemic al use

- alum
- sulphur

Integrated Waste Management to Academic Curriculum
Starch Engineering and Process Optimization (SEPO)

Production Process Optimization

Clean and Green Manufacturing Practice

- Engineering Skills
- Knowledge
- Industrial Needs

Industrial Linkage

Starch Engineering and Process Optimization Program (SEPO)

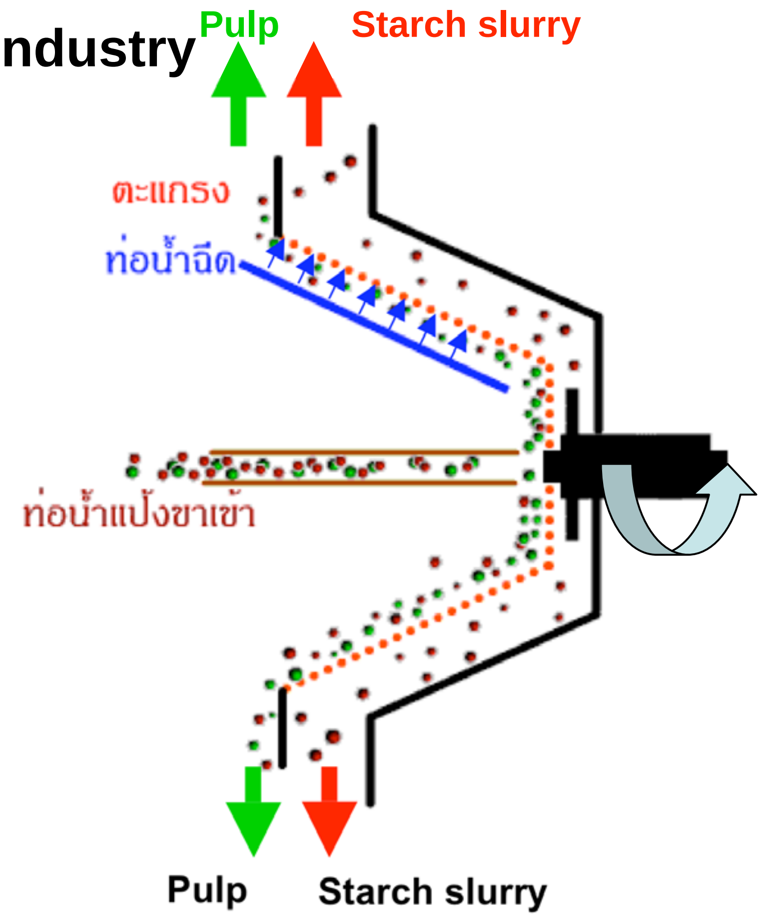
BIOTEC

King Mongkut's University of Technology Thonburi (KMUTT)

Research & Human Resource Development

A Case Study in Cassava Starch Industry

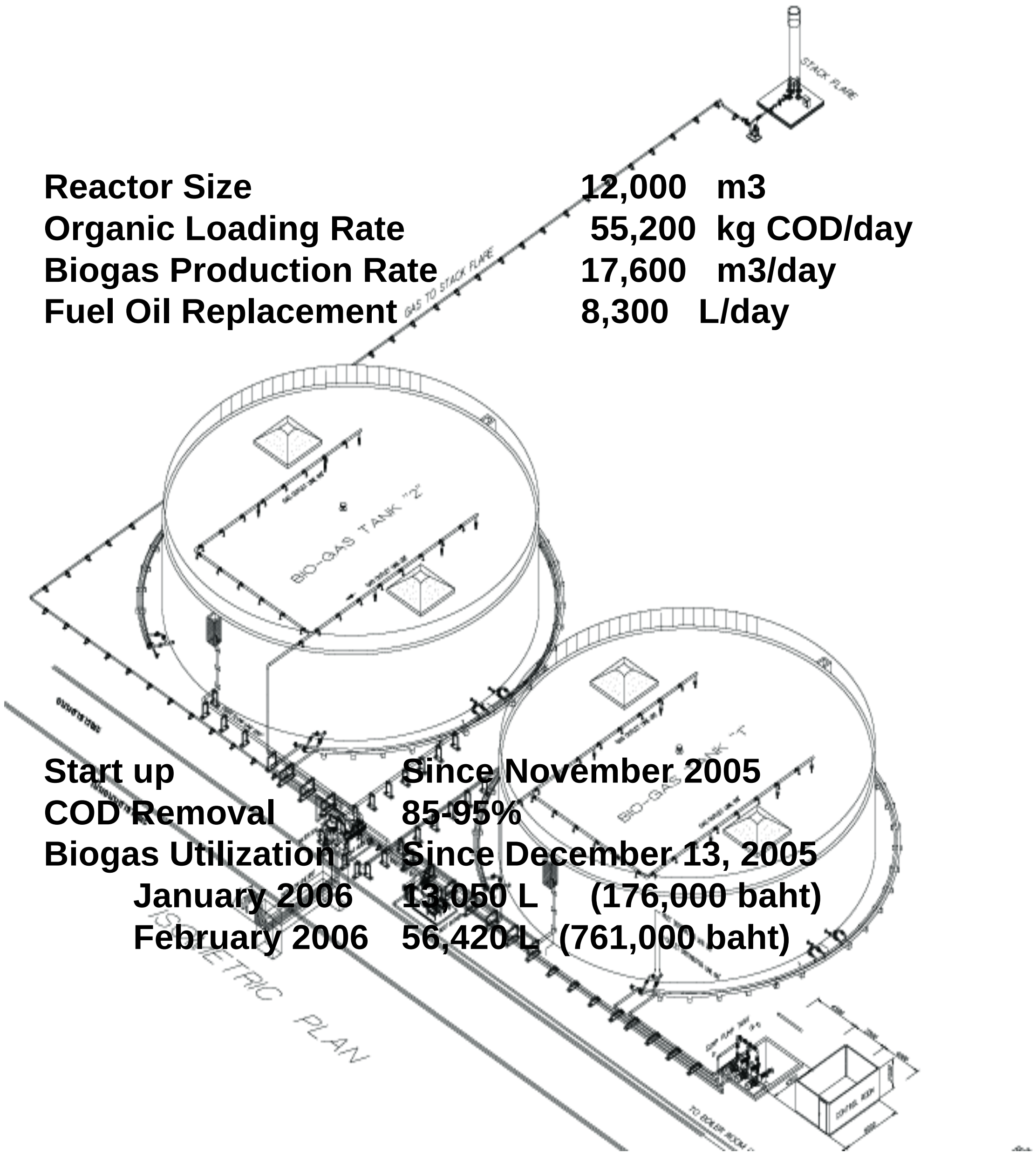
Extractor



starch pulp

Biogas Technolgoy - Anaerobic Fixed Film Reactor

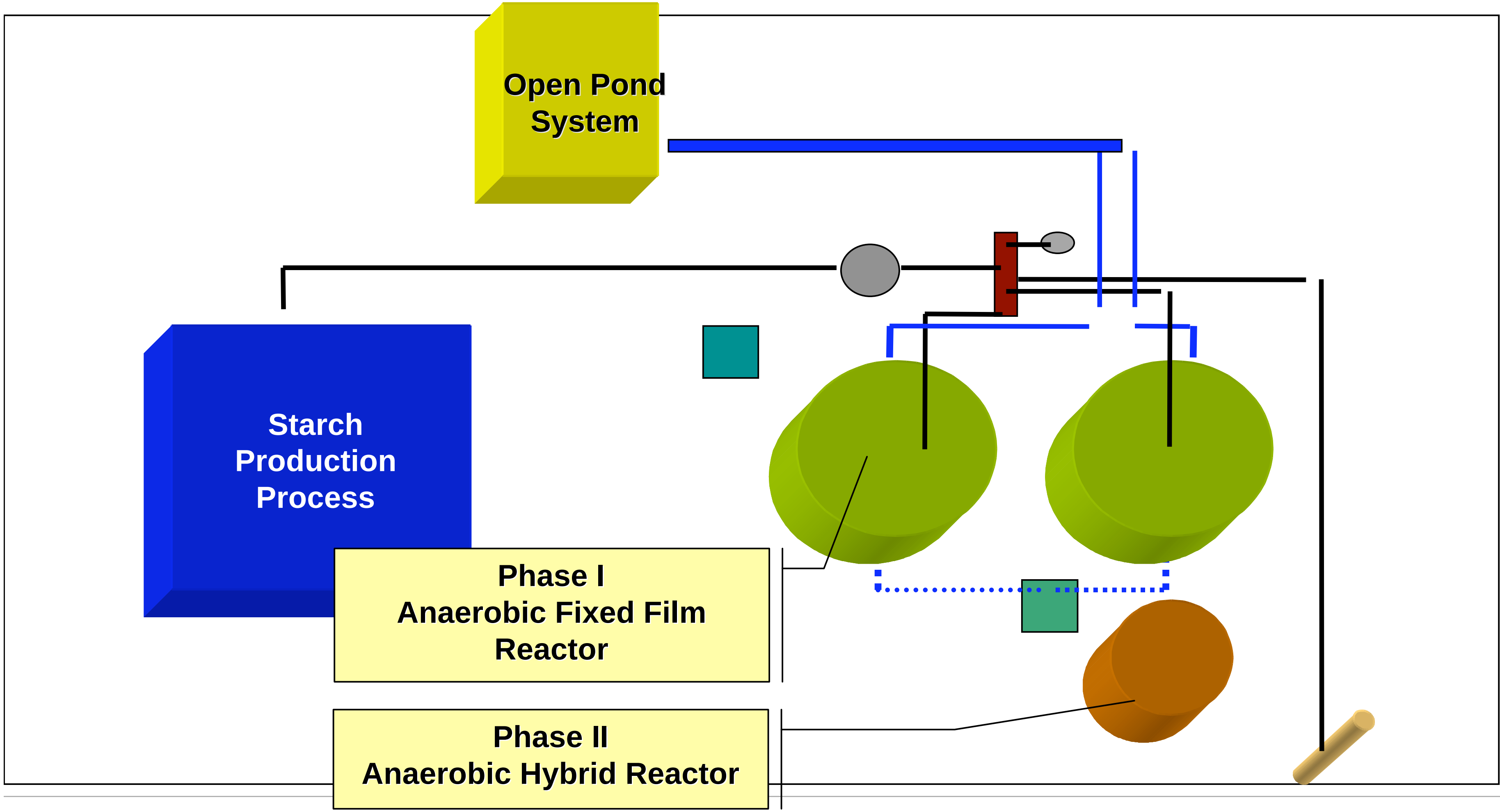
A Biogas Plant at Chonchareon, Co.Ltd. in Chonburi Province



Reactor Size	**12,000 m3**
Organic Loading Rate	**55,200 kg COD/day**
Biogas Production Rate	**17,600 m3/day**
Fuel Oil Replacement	**8,300 L/day**

Start up	**Since November 2005**	
COD Removal	**85-95%**	
Biogas Utilization	**Since December 13, 2005**	
January 2006	**13,050 L**	**(176,000 baht)**
February 2006	**56,420 L**	**(761,000 baht)**

Waste Utilization and Management



Financial Support

- Energy Policy and Planning Office (EPPO) supports 20% of capital investment (~9 million baht)
- Soft loan from Company Directed Technology Development Program (CD), NSTDA
- Investment 40 million baht ($US 1 million)
- IRR 30%

Governmental Support for Biogas Technologies

2003 ENCON Fund

12 biogas demonstration plants for tapioca starch factories

166 million baht (30% of capital cost)

Wastewaters 25 million m^3

4 agencies with different technologies

- Department of Energy Development and Promotion (DEDP) (4 factories – UASB)
- Department of Factory (3 factories – UASB)
- BAU, Chiang Mai University (2 factories – H-UASB)
- KMUTT (3 factories – Anaerobic Fixed Film Reactor)

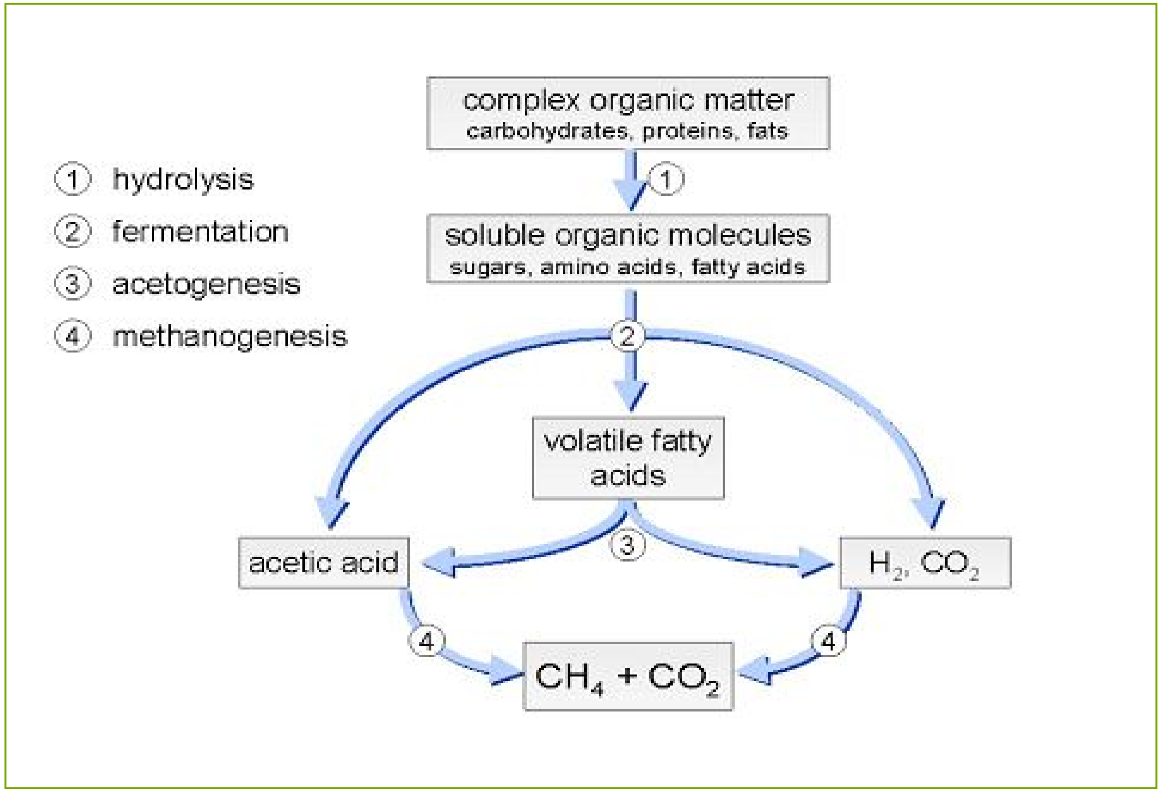
Biogas generated 36 million m^3

Electricity 44 MkWh/year

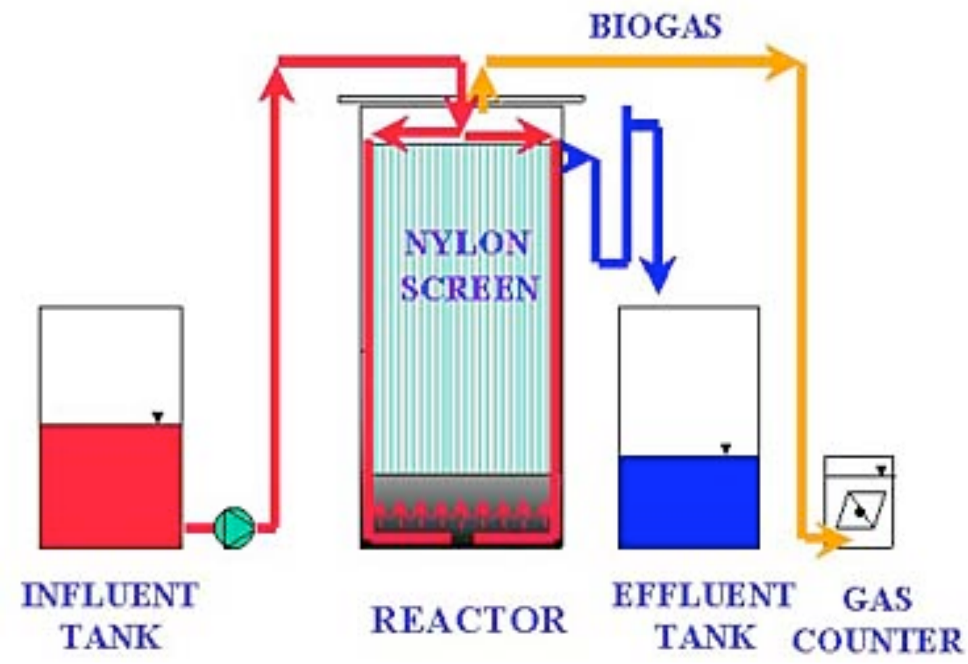
Fuel oil 22 million liters (174 million baht)

Anaerobic Digestion

Biological treatment/stabilization systems applicable to liquid, slurry, and semi-solid waste that collect and combust off-gases



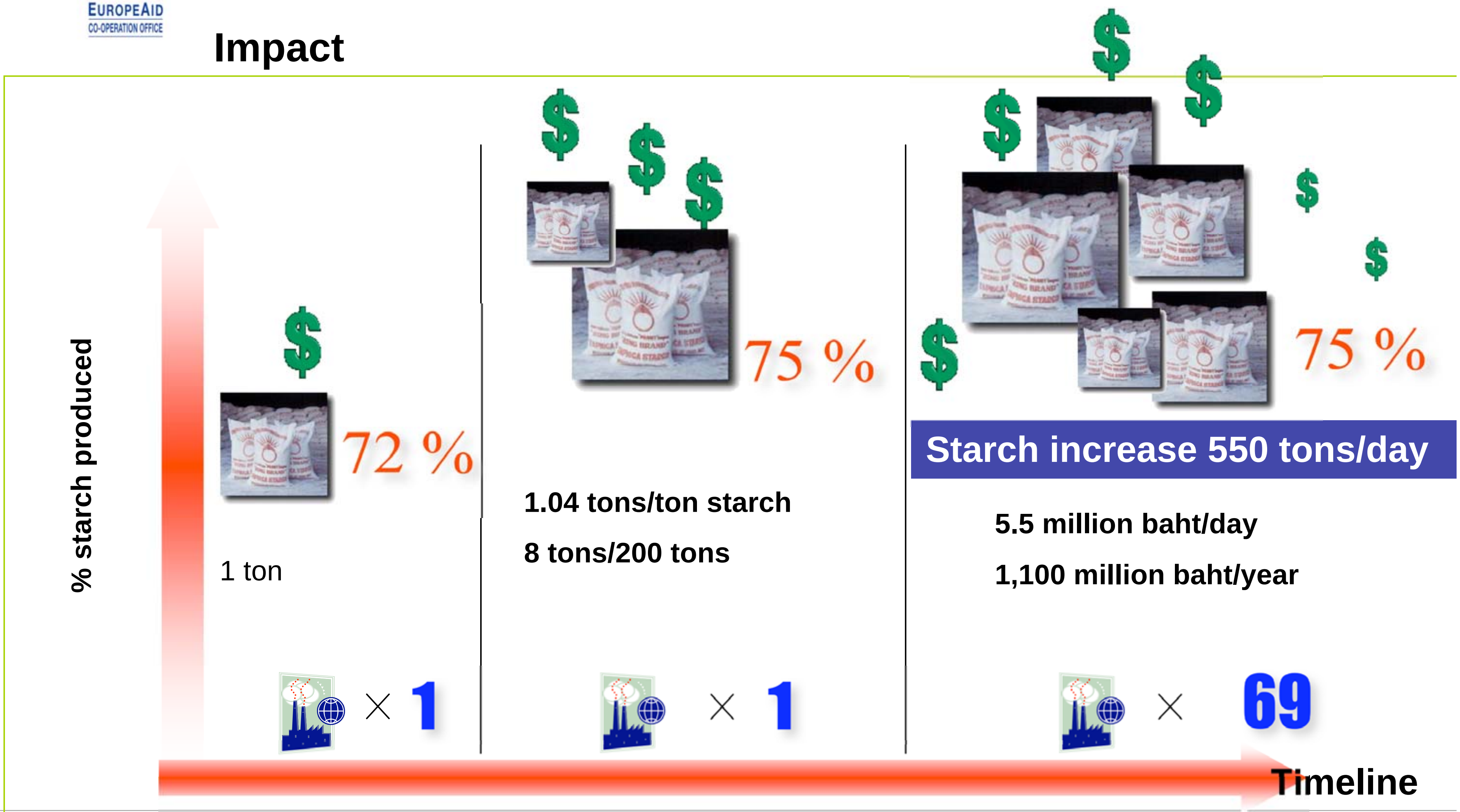
Anaerobic Fixed Film Technology



- Biofilm Formation
- Well Organized Media Installation
- High rate anaerobic
- Less Land Area
- More Tolerance to Toxicity
- Less Granule Washout
- More Stable System

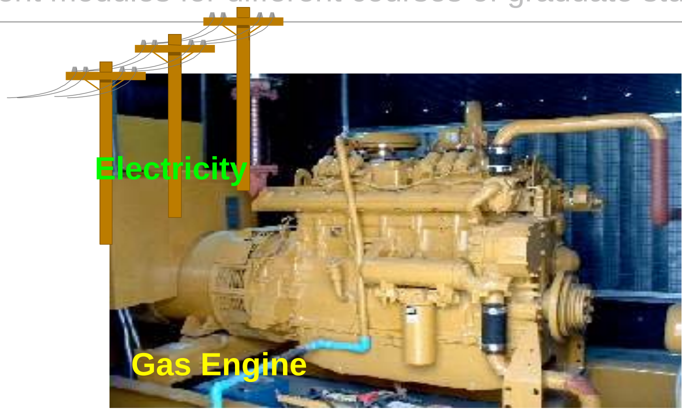
Transfer of Anaerobic Fixed Film Reactor

Impact


% starch produced
72 %
1 ton
× 1
75 %
1.04 tons/ton starch
8 tons/200 tons
× 1
75 %
Starch increase 550 tons/day
5.5 million baht/day
1,100 million baht/year
× 69
Timeline

Rice Flour Factory

Production Capacity	350	ton/d
Wastewater	1,000	m^3/d
Biogas Production	2,400-3,000	m^3/d
or Electricity Production	3,000-3,500	KWh
COD reduction	4,560	kg/d
Reduce chemical cost	0.3	M.B/month



Tapioca Starch Factory

Production Capacity	200	ton/d
Wastewater	3,000	m^3/d
Biogas Production	3.84	$M.m^3/y$
Save fuel oil	1.8	M.Liter/y
Electricity Production	4.8	M.KWh/y
Reduce Pollution (COD)	7,680	ton/y

Reduce odor and use less area for treatment

Cassava Starch Industry

Outcome

- Environment
- Energy
- Process Optimization
- Water Utilization
- Chemical Reduction
- Cost Reduction

Summary
- An Eco-Efficient Cassava Starch Industry -

Efficient Production Process
Efficient Natural Resource Utilization
Good Product Quality
Knowledge Transfer to the Whole Industry
Strenghtening the Industrial Competitiveness
Profits to Industry
Benefit Returns to the Farmers

ECONOMICS, ECOLOGY, AND ENVIRONMENT

Thank you for your attention!