

## Thailand's current S and T and financial mechanism that support the implementation of utility based renewable energy and efficiency



By... **Paritud Bhandhubanyong**  
 Advisor to President of NSTDA  
 Thailand

National S&T Development Board  
 Chaired by H. E. Minister of Science and Technology

NSTDA President

BIOTEC

MTEC

TMC

NECTEC

NANOTEC

- **Research, Development, Design, and Engineering**
- **Technology Transfer**
- **S&T Human Resource Development**
- **S&T Infrastructure Development**

## Bridging between academic and industry through coordinated S&T programs

Research Collaborations



## NSTDA Strategic Clusters

Foods and Agriculture

Health

Software, Microchips  
 Electronics

Automobiles

Alternative  
 Energy

Textile and  
 Chemical

S&T for society

Environment

Platform  
 Technology

## Thailand Science Park at a glance



**Area:** 80 Acres  
**Space:** 90,000 square metre  
 (200,000 M<sup>2</sup> for the whole project)  
**National Research Centers :** BIOTEC,  
 MTEC, NECTEC, NANOTEC  
**Space for private sector:** incubator units,  
 multi-tenant buildings, long term leased land  
**Projection in 3 years:** 35,000 M<sup>2</sup> available  
 for private sector  
 - 200 companies  
 - 4,000 knowledge workers  
 - turn over of \$ 100 million/year

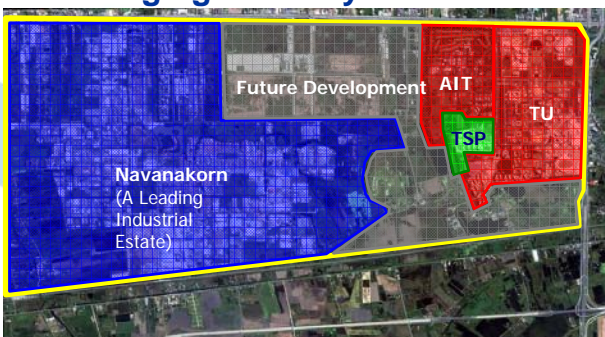
- 61 companies are already operated
- more than 10 companies are in the Pipeline (as of March 2009)

## Thailand Science Park Phase 2



1. Total 124,860 sq. m. gross area  
 - 40,000 sq.m. net for Private Sector  
 - 30,000 sq.m. net for NRCs
2. Accelerator for growth of surrounding areas

## An Emerging S&T City of Thailand



■ Manufacturing Activities    
 ■ Industrial Research Activities    
 ■ Human Resource Activities

## Thailand's Economy in 2007

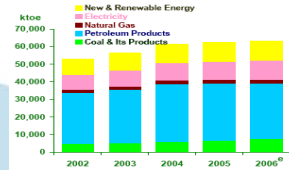
- 65 Millions Population ~ 1% of World; Per capita 3,625\$
- GDP \$245 Billions
- Agriculture: 8.9% of GDP, 39% of Employment
- Manufacturing: 39.3% of GDP, 15.1% of Employment
- 1<sup>st</sup> Import Item : Crude Oil (15.6% of import bill)



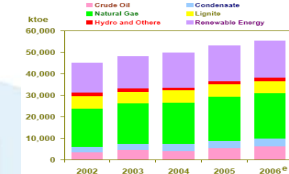
# Thailand's Energy Situation



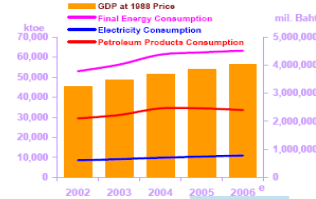
## Final Energy Consumption



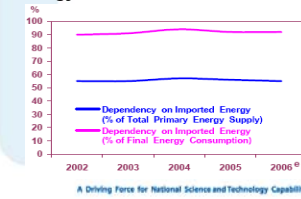
## Domestic Production



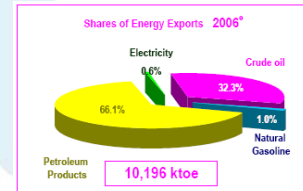
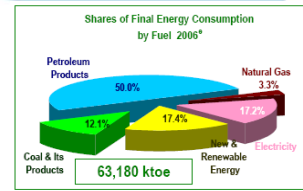
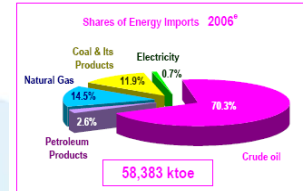
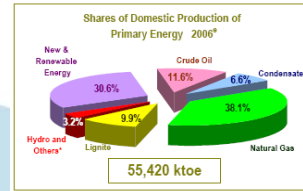
## Energy & Economy



## Energy Indicators



# Thailand's Energy Situation 2006



## VALUE OF ENERGY IMPORT

UNIT : MILLION BAHT

ENERGY TYPE	2004	2005	2006	2007
CRUDE OIL	486,627	644,933	753,783	715,789
PETROLEUM PRODUCTS	41,533	55,680	62,350	48,317
NATURAL GAS	46,053	62,827	77,843	78,901
COAL	12,275	15,422	18,896	29,656
ELECTRICITY	5,659	7,114	8,294	7,414
<b>TOTAL</b>	<b>592,148</b>	<b>785,976</b>	<b>921,166</b>	<b>880,078</b>

Source: Energy Policy and Planning Office (EPPO), Ministry of Energy

A Driving Force for National Science and Technology Capability

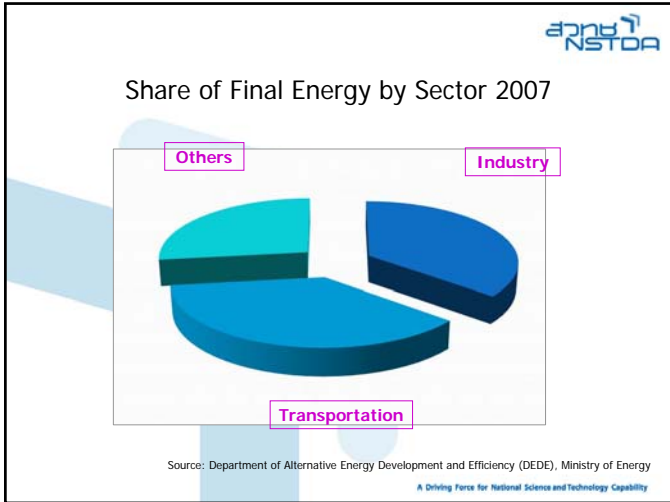
## CONSUMPTION AND IMPORT (NET) OF COMMERCIAL PRIMARY ENERGY

UNIT : BBL/DAY (CRUDE OIL EQUIVALENT)

	2003	2004	2005	2006	2007	2008
IMPORT (NET)	868,283	988,292	979,920	978,121	997,646	941,261
CONSUMPTION	1,346,027	1,450,114	1,519,821	1,547,765	1,606,492	1,623,874
IMPORT/CONSUMPTION	65	68	64	63	62	58

Source: Energy Policy and Planning Office, Ministry of Energy

A Driving Force for National Science and Technology Capability



NSTOR

## Thailand's Energy Strategies

- Strategies for Energy Efficiency**  
Reduce Energy Elasticity from 1.4:1 to 1:1 by 2007
- Strategies for Renewable Energy Development**  
Increase share of RE from 0.5% to 8% of total final energy by 2011
- Strategies for Energy Security**  
Ensure sufficient and reliable energy supply for at least 30 yrs
- Strategies for Thailand as a Regional Energy Center**  
Develop Strategic Energy Land Bridge and Energy Hub

A Driving Force for National Science and Technology Capability

NSTOR

## Strategies for Energy Efficiency

**Shares of Final Energy Consumption by Fuel 2006\***

Fuel	Share
Petroleum Products	50.0%
Coal & Its Products	12.1%
Natural Gas	3.3%
Electricity	17.2%
Renewable Energy	17.4%

Total: 63,180 ktoe

**Transportation**  
Private → Public  
Improving Logistics

**Commercial/Industrial**  
Energy Elasticity 1.2 → 1.0

**Residential**  
Motivate appropriate energy use

**STRATEGIES for ENERGY EFFICIENCY**  
Energy Elasticity 1.4 → 1.0

A Driving Force for National Science and Technology Capability

NSTOR

## Energy Efficiency (Industrial & Commercial Sector)

**Commercial and Industrial Sectors**

Energy Elasticity  
1.2 → 1.0

**TARGET**  
Reduce Energy Elasticity from 1.2:1 to 1:1 by 2007

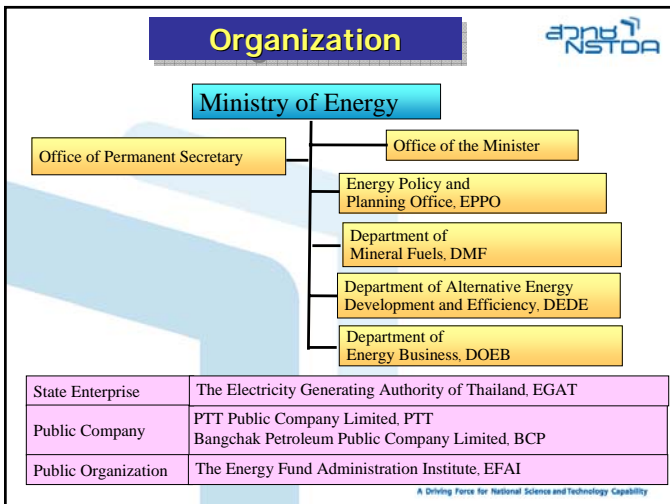
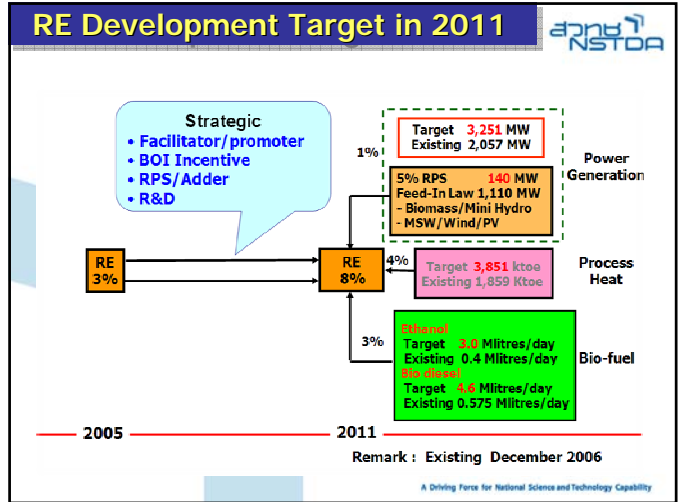
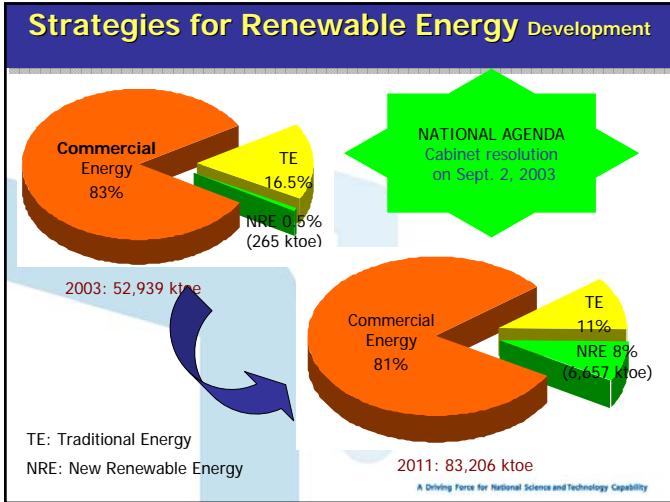
**Strategies:**

- ✦ Restructuring Industrial Sector  
High Energy Intensive → Low Energy Intensive
- ✦ Promoting Energy Management in Commercial and Industrial Sector
- ✦ Encouraging Supports from Financial Institutions
- ✦ Sharing Know-how & Technology

**Tools:**

1. Tax Incentives
2. Investment Privileges
3. Soft Loans
4. Revolving Fund
5. Energy Efficiency Regulations
6. Technical Support

A Driving Force for National Science and Technology Capability



### Latest Development of Biofuels in Thailand

**ETHANOL**

**BIODIESEL**

A Driving Force for National Science and Technology Capability

## Gasohol Summary



### Target in 2007

- Increase gasohol 95 & 91 market share to substitute ULG95, ULG91

### Current consumption

- Gasohol 3.94 million liters/day (Gasohol 95 = 3.52 & Gasohol 91 = 0.42 million liters/day)
- Gasohol service station 3,504 (as of Mar 07)

### Current ethanol production

- 7 existing plants with total installed capacity of 955,000 liters/day
- 12 plants under construction with total installed capacity of 1,970,000 liters/day
- Previously, 45 companies approved for licenses
- At present, Free market fuel ethanol industry



Thai Alcohol

Khon Khan Alcohol

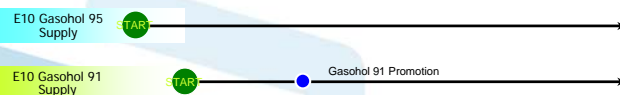
Thai Nguan Ethanol

## BIOFUEL: Ethanol



### Ethanol Strategic Plan

(Year) 04 05 06 07 08 09 10 11 12 13



### E10 Promotion Plan



Types	Makes	04	05	06	07	08	09	10	11	12	13
Gasohol 95	Shell, PTT, etc.										
Gasohol 91	Shell, PTT, etc.										
ULG 95 RON											
ULG 91 RON											
HSD 0.05%S											
HSD Premium											
Palm Diesel											

### < Supply Side >

E10 is supplied in 3,504 stations. (as of Mar 2007)

### < Demand Side >

Price difference :

- ULG 95 more expensive than Gasohol 95 by 2.50 Baht/liter
- ULG 91 more expensive than Gasohol 91 by 2.00 Baht/liter

## Status of existing ethanol plants

Companies	Installed cap. (Liters/day)	Raw mat.	Province	Commencing date
1. Pornwilai International Group Trading	25,000	Molasses	Ayuttaya	Oct 03
2. Thai Alcohol	200,000	Molasses	NakhonPathom	Aug 04
3. Thai Agro Energy	150,000	Molasses	Suphanburi	Feb 05
4. Thai Nguan Ethanol	130,000	Cassava	Khon Khan	Nov 05
5. Khon Khan Alcohol	150,000	Molasses	Khon Khan	Jan 06
6. Petrogreen	200,000	Molasses	Chaiyabhum	Dec 06
7. Thai Sugar Ethanol	100,000	Molasses	Kanchanaburi	Apr 07
<b>Total</b>	<b>955,000</b>			

## Ethanol plants under construction

Company	Installed Capacity L/d	Feedstock	Province	Expected operation
1. International Gasohol Corp.	150,000	Cassava	Rayong	Q3-Q4 07
2. Farkwanthip Co., Ltd.	60,000	Cassava	Prachinburi	Jun-07
3. Akekarat Pattana Co., Ltd.	200,000	Cassava	Nakhonsawon	Apr-07
4. K.I. Ethanol Co., Ltd.	100,000	Molasses	Nakhonratsima	Jun-07
5. Ratburi Ethanol Co., Ltd.	150,000	Cassava/Molasses	Ratburi	Nov-07
6. Thai Rungruang Co., Ltd.	120,000	Molasses	Saraburi	Dec-07
7. Petrogreen Co., Ltd.	200,000	Molasses	Kalasin	Dec-07
8. ES power Co., Ltd.	150,000	Cassava/Molasses	Sarakaew	Feb.-08
9. Sima Inter Product Co., Ltd.	150,000	Cassava	Chasengsao	Dec-07
10. Sapthip Co., Ltd.	200,000	Cassava	Lopburi	Mar-08
11. P.S.C. Starch Product Plc.	150,000	Cassava	Chonburi	Dec-07
12. TPK Ethanol Co., Ltd.	340,000	Cassava	Nakhonratsima	Early 08
<b>Total</b>	<b>1,970,000</b>			

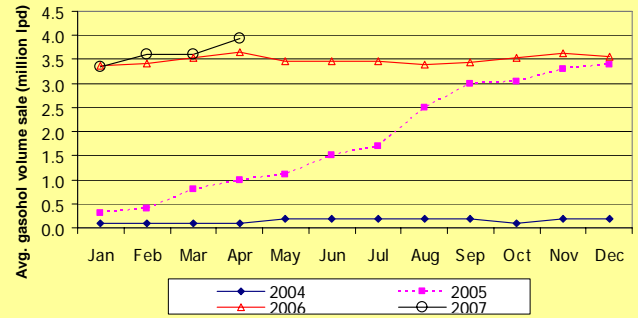


## Gasohol service stations

	Jan 06	Jul 06	Dec 06	Mar 07
PTT	1,209	1,197	1,211	1,204
Bangchak	664	698	690	686
Shell	545	552	548	545
Eso	203	366	503	506
Caltex	170	251	296	296
Conoco	77	77	88	88
TPI	39	38	39	36
Petronas	17	48	58	65
SUSCO	11	14	21	23
Paktai	-	-	12	3
Pure	-	-	-	52
<b>Total</b>	<b>2,935</b>	<b>3,241</b>	<b>3,466</b>	<b>3,504</b>

A Driving Force for National Science and Technology Capability

## Avg. Gasohol Volume Sale



A Driving Force for National Science and Technology Capability

## Gasohol Measures

- **Clear Policy and Target Establishment:**
  - **E10 nationwide** by the end of year 2011
- **Government Support:**
  - **BOI privilege** for fuel ethanol plant
  - **Waiver** on excise tax for the ethanol blended in gasohol
  - **Low rate** of oil fund levy
  - **Market Incentive:** retail price of gasohol95 lower than that of ULG95 of at least 4 c/liter => current price difference
    - ULG91 – Gasohol91 = 7 c/liter
    - ULG95 – Gasohol95 = 7 c/liter (as of 4 May 07)
- **Enforcement :** all government gasoline fleets must be refueled only gasohol
- **Public Relations:** Create confidence & trust of gasohol use to public via media i.e. TV, press conference, booklets
- **Reformed biofuel organization:** Sub-committee on ethanol under Energy Policy Administration Committee was appointed to direct and manage the development & promotion of bioethanol in Thailand efficiently
- R & D: allocate grant for research & development

## Latest Development of Biofuels in Thailand

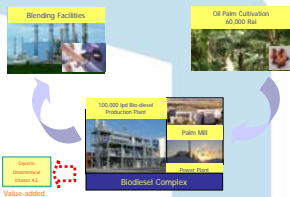


A Driving Force for National Science and Technology Capability

## Thailand Policies on Biodiesel

### 1 Strategic Plan on Biodiesel Promotion and Development (Jan 18, 05)

**TARGET**  
Promoting Domestic Production and Use of Biodiesel to Replace 10% of Diesel Consumption in 2012.



### 2 Action Plan on Biodiesel Promotion and Development (May 17, 05)

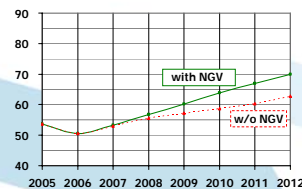
- Promote **5-million Rai** palm oil cultivation within 2009. (6.25 Rai = 1 hectare)
- Promote **community-based** biodiesel production and use during 2005 – 2006.
- Promote **commercial** biodiesel production and **B5 use** from 2007.
- Enforce B5 nationwide in 2011.
- Enforce B10 nationwide in 2012.

April 2, 2007  
Due to excess B100 supply, B2 will be enforced nationwide in April, 2008, while B5 is still optional.



## BIOFUEL: Biodiesel

### 1 Diesel Demand (Ml/day)

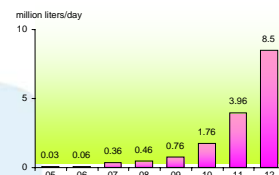


Diesel Demand	2008	2009	2010
with NGV	57	67	70
without NGV	56	60	63

Source: Energy Policy and Planning Office



### Bio Diesel Demand



Source: Ministry of Energy and Ministry of Agriculture and Co-operative

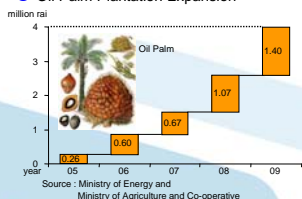
Government policy to ensure sufficient future supply of bio diesel

- Increase oil palm plantation area in Thailand to 6,400 million m<sup>2</sup> by 2009
  - grow another 1,600 million m<sup>2</sup> of oil palm in neighboring countries
- Look for alternative raw material

A Driving Force for National Science and Technology Capability

## Biodiesel: Feedstock

### 1 Oil Palm Plantation Expansion



Source: Ministry of Energy and Ministry of Agriculture and Co-operative



- Pictured here are typical 18 month old oil palms.
- Harvesting will commence 28 months from planting.



- By age 7 years the young palms have reached full maturity.
- Fruit bunches like these ripen and are harvested throughout the year.

### 2 Growing oil palm in neighboring countries

#### Alternative Raw Material : Jatropha Curcus

- Jatropha curcus is a drought-resistant perennial, growing well in poor soil. It is easy to establish, grows relatively quickly and lives, producing seeds for 50 years.
- Jatropha produces seeds with an oil content of 37%. The oil can be combusted as fuel without being refined. It burns with clear smoke-free flame, tested successfully as fuel for simple diesel engine.



A Driving Force for National Science and Technology Capability

## Commercial Biodiesel: Current Status (As of Jun 30th, 2007)

### 1 SIX Potential Biodiesel Production Plants

Plant	Capacity (Ml/day)
1. Bioenergy Plus	10,000
2. Suksomboon Energy	50,000
3. Patum Vegetable Oil	80,000
4. Bangkok Renewable Energy	200,000
5. Green Power Corporation	200,000
6. AI Energy	500,000
<b>Total</b>	<b>1,040,000</b>



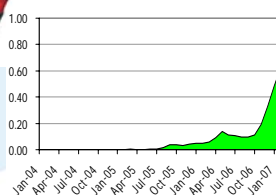
Commercial Biodiesel Standard Enforcement: October 1, 2006

- TWO B5 Sellers:**
  - Ptt Plc. and
  - Bangchak Petroleum Plc.

800 Gas Stations are selling B5 with 0.70 Baht/litre lower price than petroleum diesel. (35 Baht /US\$)

- 1.5 million litres/day of B5 is sold in Jun 2007.

### B5 Sale Volume (Ml/day)





## Community-based Biodiesel

### Current Status

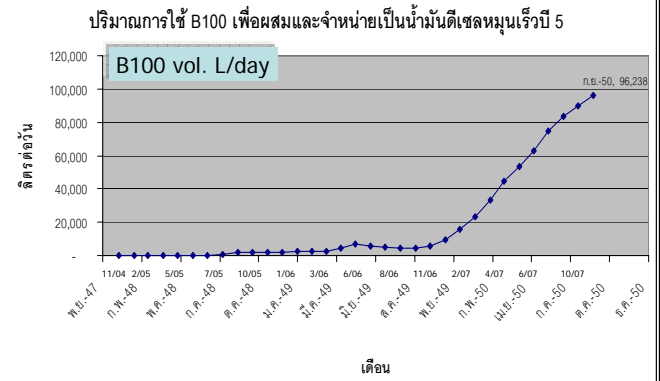
#### Community-based Biodiesel

- Objectives:
  - to promote biodiesel production from local raw material
  - to replace diesel use in agricultural machines
  - to deploy sustainability and self-sufficient economy
- DEDE's Roles: Surveying, Providing Technical Support
- Community's Roles: Operating
- 72 communities are running B100 Unit from their local supply for their local use.

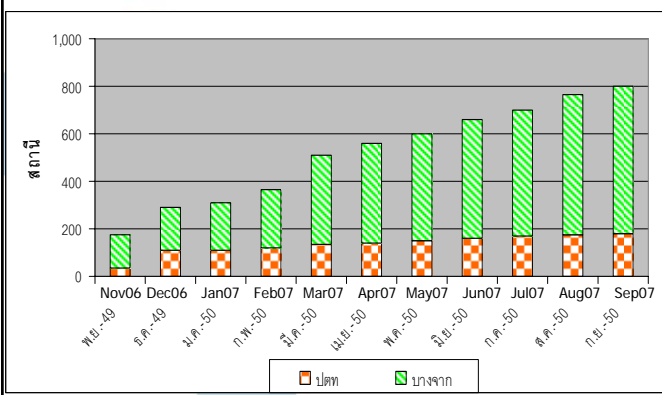


**Community-based Biodiesel Standard Enforcement: July 21, 2006**

## Biodiesel B100 = 100,000 L/d by Sept. 2007



## Biodiesel Stations (PTT&BCP) Sept. 2007



NSTDA

## Biogas Project for Tapioca Starch Factory

A Driving Force for National Science and Technology Capability

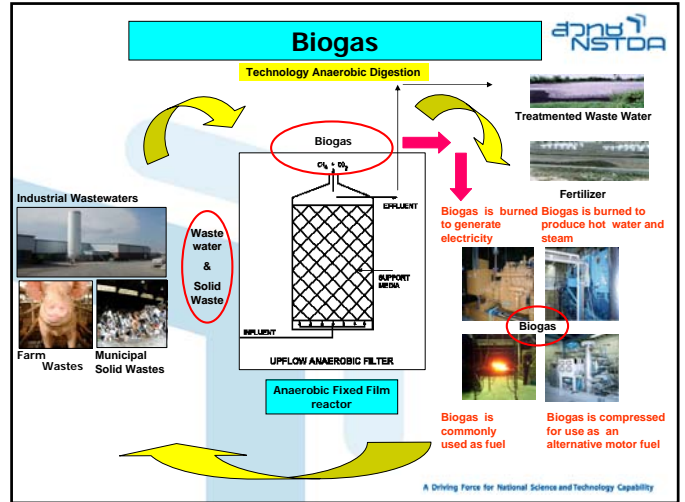
## Biogas Potential in Agro-industrial Sector



	Biogas Potential			
	Energy (kTOE/y)	Power (MW <sub>e</sub> )	EE Power (GWh/y)	Fuel oil (M. litres/y)
<b>Tapioca starch</b>	142.2	47.9	344.4	<b>143.5</b>
Palm oil	23	7.7	55.5	23
Seafood Canning	8	2.7	19.5	8.1
Fruit & Veg. Canning	1.9	1.1	4.6	1.9
Slaughterhouses	0.7	0.6	1.8	0.7
Sugar Industry	0.5	0.5	1.2	0.5
<b>Total</b>	<b>176.3</b>	<b>60.5</b>	<b>427</b>	<b>177.8</b>

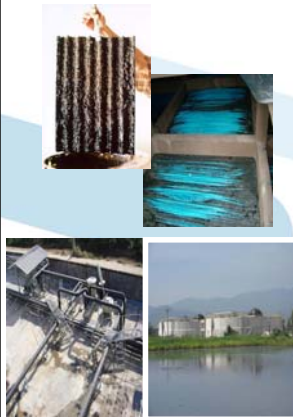
Source: Progress report "TRF", 2006

A Driving Force for National Science and Technology Capability



A Driving Force for National Science and Technology Capability

## Anaerobic Fixed Film Reactor



- High rate anaerobic
- Single stage
- Less space
- Biofilm on media
- Higher shock load tolerance
- Suitable with high suspended solid wastewater

Total Reactor Vol. (Dia 32m x 7.5m)	12,000	m <sup>3</sup>
Organic Loading	55,200	kg COD/d
Biogas Production	17,600	m <sup>3</sup> /d
Equivalent to Fuel oil	8,300	litres/d

A Driving Force for National Science and Technology Capability

## BIOGAS (AFFR) Project



### Biogas Project for Tapioca Starch Factory



Biogas Production in Tapioca Starch Factory	Parameter	Value	Unit
	Starch production	240	Ton dry starch/day
	Volume of waste water	2,400	m <sup>3</sup> /day
	COD	23,000	mg/l
	Organic loading	55.2	Ton COD/day
	Reactor capacity	12,000	m <sup>3</sup>
	Biogas production rate	17,600	m <sup>3</sup> /day
	Equivalence to crude oil	8,270	L/day

A Driving Force for National Science and Technology Capability

## Project CDM from Biogas in Thailand



1. Korat waste to Energy Project, Thailand Ratchaburi Farms Biogas Project
2. Ratchaburi Farms Biogas Project
3. Wastewater Treatment with Biogas System (UASB) in Starch Plant for Energy and Environment Conservation at Nakorn Ratchasima
4. **Wastewater Treatment with Biogas System (AFFR) in a Starch Plant for Energy and Environment Conservation at Chachoengsao**
5. **Northeastern Starch (1987) Co., Ltd.-LPG Fuel Switching Project**
6. Chumporn Applied Biogas Technology for Advanced Waste Water Management, Thailand
7. Natural Palm Oil Company Limited-1 MW Electricity Generation and Biogas Plant Project

Source : office of Natural Resources and Environmental Policy Planning (8-09-50)



Biogas Project at Sima Interproducts 2

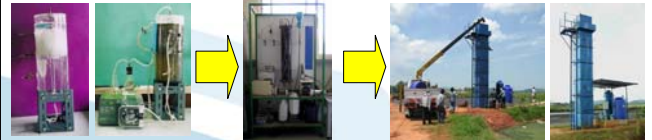


Biogas Project at Northeastern Starch (1987)

## BIOGAS Project in 2008



### Biogas Project for Palm oil factory



5 L lab-scale study

12.4 L lab-scale study

6 m3 pilot-scale AHR study



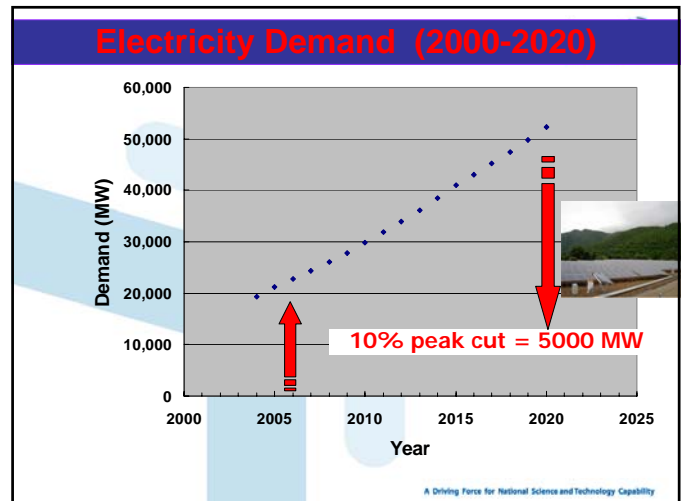
Thachana Palm.

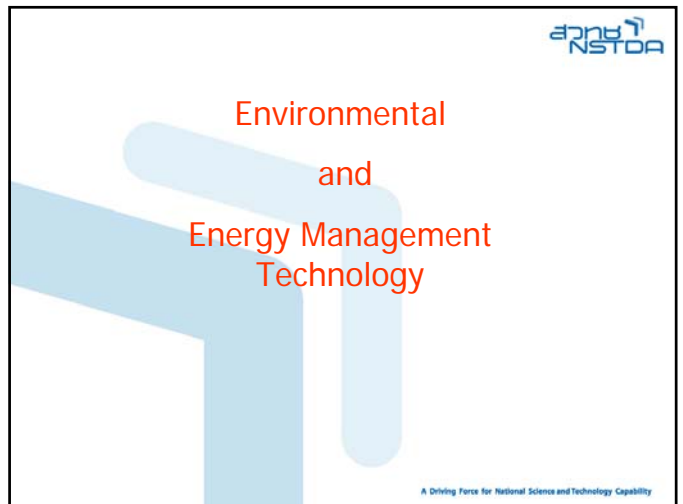
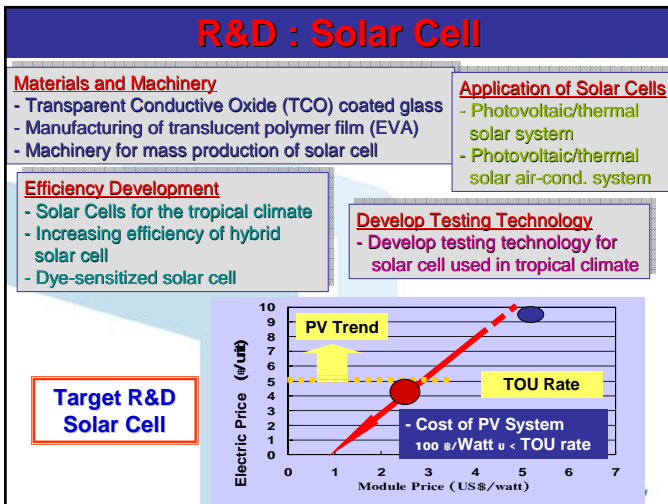
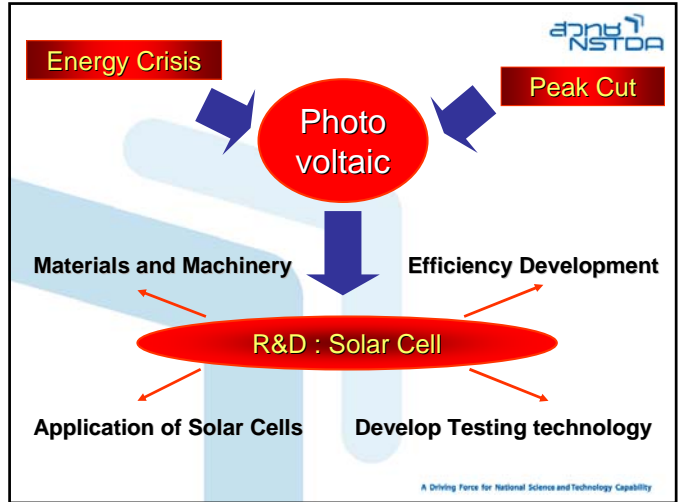
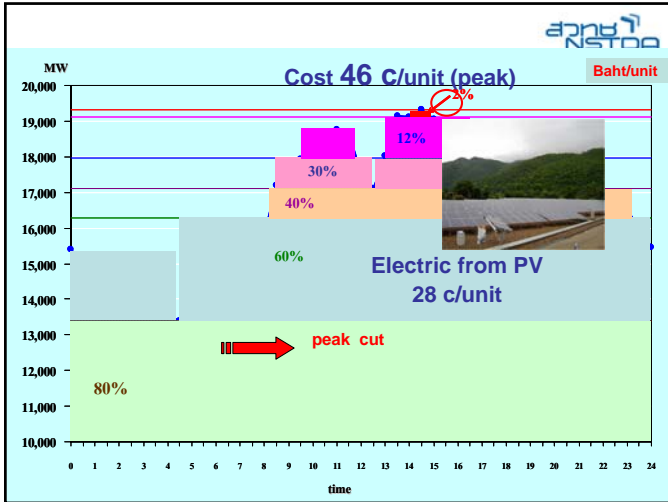


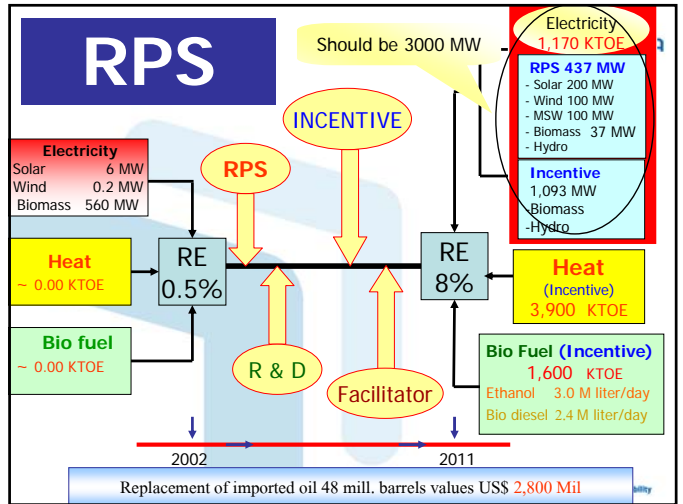
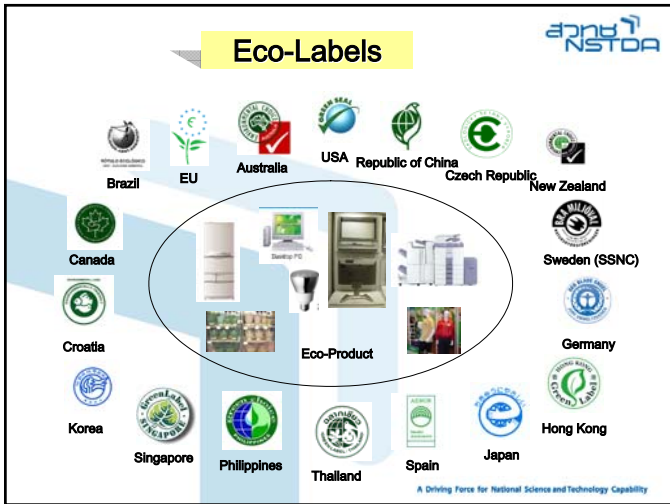
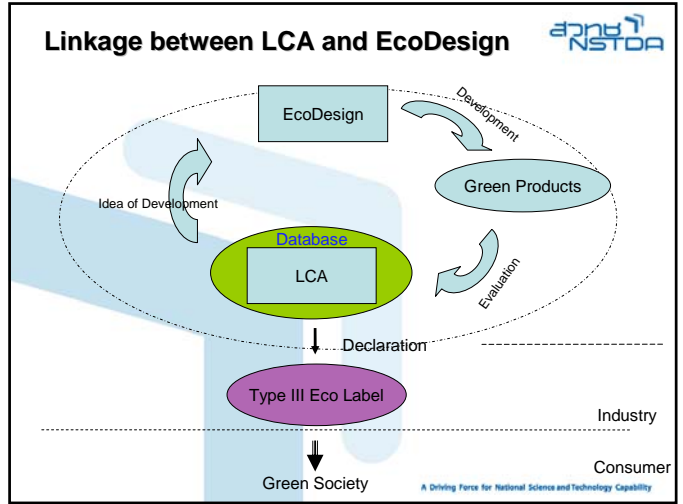
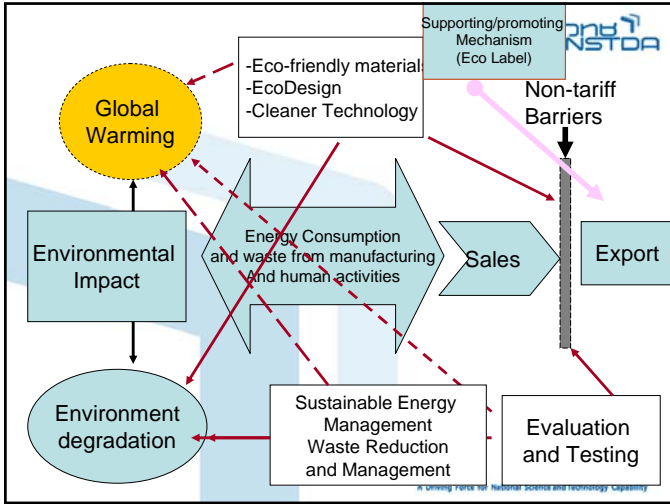
A Driving Force for National Science and Technology Capability

# Solar Cell

A Driving Force for National Science and Technology Capability







## RPS: Renewable portfolio Standard

- **Renewable Portfolio Standard (RPS):** obligates each retail seller of electricity to include in its resource portfolio a certain amount of electricity from renewable energy resources.
  - The retailer can either:
    - (a) owning a renewable energy facility and producing its own power, or
    - (b) purchasing power from someone else's facility.
  - RPS rules can allow retailers to "trade" their obligation.

A Driving Force for National Science and Technology Capability

## RPS: Renewable portfolio Standard

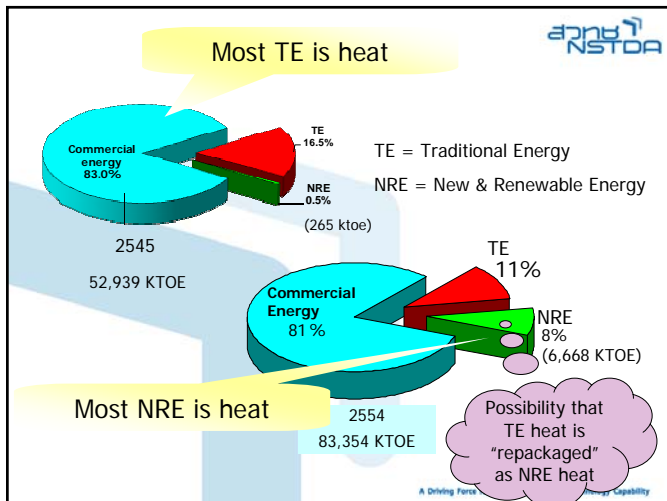
### Concerns about Thai RPS

- In other countries, RPS requires functioning wholesale market
- Needs independent regulator
- RPS favors large developers over small
- RPS has mixed track record
- In Thai version, only applies to new fossil generation.
  - Ties new renewable development to development of fossil generation
  - Big hydro exempted from obligations
- In Thai version obligation based on MW rather than GWh encourages gaming

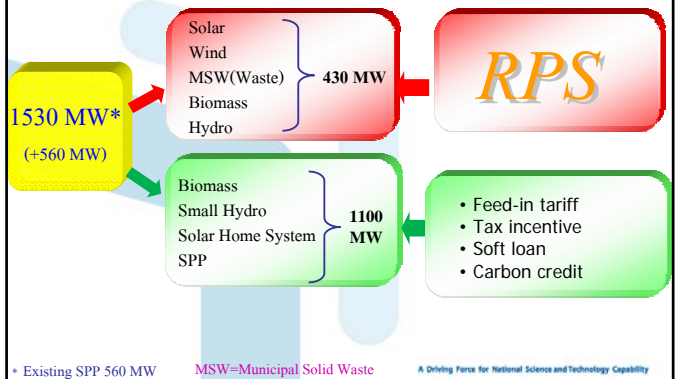
See more at:

<http://www.palangthai.org/en/docs/sustain.pdf>

A Driving Force for National Science and Technology Capability



## RPS: Renewable portfolio Standard





## feed-in tariff in Thailand



### Paid per kWh of electricity generated

- a guaranteed power sales price
- a guaranteed market (electric utilities must take)
- Favors smaller renewable energy producers
- Simple
- Less prone to cheating

A Driving Force for National Science and Technology Capability

## feed-in tariff in Thailand



### Feed-in Tariff Mechanism

- The Feed-in Tariff mechanism completed below are based on 2006 estimate load factors and calculate the Feed-in Tariff that would be required if 6% or 8% of delivered energy was derived from RE projects
- The reality is that in 2006 Thailand has only approximately 640 MW which results in only approximately 4500 GWhr of delivered energy to the Thai electricity grids
- On the basis the MoE could employ a step approach to the imposition of the surcharge on delivered energy whether applied to all delivered energy or only on non-RE energy delivered

A Driving Force for National Science and Technology Capability

## feed-in tariff in Thailand



### Surcharge on delivered energy to support..... RE policy objective

2006 Estimated delivered energy	140,287 GWhr	
Surcharge on delivered energy	*USD 0.0014/KWhr	
Contribution to Feed-in Tariff Fund	USD 197.42 million	
Proposition of delivered energy From RE Projects	8%	6%
Total contribution on RE Projects	11,223 GWhr	8,417 GWhr
Average Feed-in Tariff available	USD 0.017/KWhr	USD 0.023/KWhr

Based on Thailand Load Forecast dated 27 July 2006 by Thailand Load Forecast Subcommittee.  
Source: EPPO

\*1 USD = 35.53 THB

A Driving Force for National Science and Technology Capability

## feed-in tariff in Thailand



### Surcharge on non-RE energy to support RE policy objective charged to Non-RE energy generators

2006 Estimated delivered energy	140,287 GWhr	
Proposition of delivered energy From RE Projects	8%	6%
Total contribution on RE Projects	11,223 GWhr	8,417 GWhr
Total contribution from non-RE Energy	129,064 GWhr	131,870 GWhr
Surcharge on Non-RE delivered energy (Charged to generator)	USD 0.0001/kHhr	USD 0.0001/kHhr
Contribution to Feed-in Tariff Fund	USD 199.55 million	USD 204.05 million
Average Feed-in Tariff available	USD 0.018/kHhr	USD 0.024/kHhr

A Driving Force for National Science and Technology Capability

## feed-in tariff in Thailand

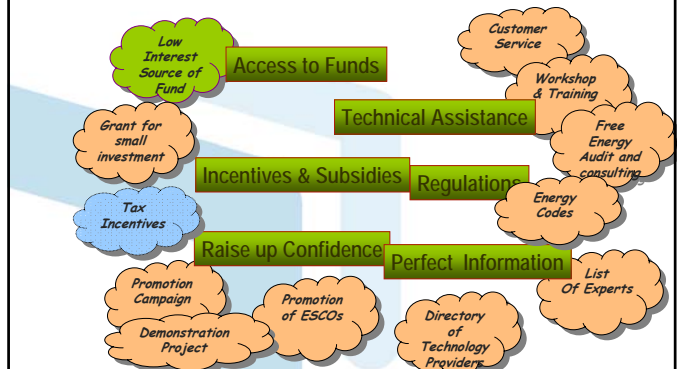


	Cost of Energy (USD/kWh)	Feed-in-Tariff (USD/kWh)
Biomass (Empty Fruit Bunch)	0.06	0.08
Landfill Gas (MSW)	0.25	0.22
Incinerator (MSW)	0.48	0.58
Biogas (MSW)	0.37	0.45
Biomass (Gasifier)	0.07	0.09
Biogas (Pig farm)	0.05	0.08
Biomass (Rice Husk)	0.07	0.08
Wind	0.06	0.11
PV	0.31	0.81

Source: Energy for Environment Foundation

A Driving Force for National Science and Technology Capability

## Create Conducive Environment for EE Investment



A Driving Force for National Science and Technology Capability

## Cooperative Efforts on Energy Management

- Objective: Sustainable energy management through internal cooperative efforts
- Methodologies
  - Educate on concept & method + evaluation
  - Help create and implement EC measures
- **Achievement**
  - ✓ Implemented 500 facilities
  - ✓ Introduced house-keeping measures
  - ✓ Energy saving of 5-10% for each facility (simple payback of 2.5 yrs)

A Driving Force for National Science and Technology Capability

## Revolving Fund for EC Projects

- Budgets allocation from ECP Fund
- Loan approval by Bank
- Technical assistance by DEDE
- Key conditions
  - ✓ Loan size ≤ 1.2 mill USD/project
  - ✓ Interest rate less than 4% (fixed rate)
  - ✓ Repayment in the defined time frame (7yr)

### Present Status

- **82 approved and under construction projects with leverage 80 million USD of EC Investment**
- **Average investment 1 mill USD / a project & average payback 2.3 yrs**
- **Annual savings > 250 GWh and 91 mill. liter of fuel oil**

A Driving Force for National Science and Technology Capability

## Cost Based Tax Incentive

- 25% Tax Break for the Investment in EE Projects Result in Efficiency Improvement
- Applicable for the First 50 mill baht Investment ( 1.25 mill USD )
- Incentive Spread Over 5 Years



A Driving Force for National Science and Technology Capability

## Performance Based Tax Incentive

- 100% of achieved energy saving will become tax deduction
- Max Incentive of 2 million baht (50,000 USD) / Facility
- Pre and Post Audit will be required

A Driving Force for National Science and Technology Capability

## Incentive through ... Board of Investment ( BOI )

**Import duties and Cooperate tax exemption on new investment in...**

### Energy conservation business

- High efficiency machine or equipment and renewable energy equipment manufacturing
- Solar PV manufacturing
- Energy Service Company – ESCO

### Renewable energy production business

- Alcohol or fuels from agricultural products
- Electricity or steam generation

**Incentive last for the max period of 8 years**

A Driving Force for National Science and Technology Capability

## Promotion of ESCOs

- **BOI – Tax Incentive**
  - Maximum 8 years tax exemption for ESCO projects
  - Cooperate Income tax
- **Access to Revolving Fund**
  - Eligible to borrow the low-interest loan from RF program on project-by-project basis
- **ESCO promotion activities**
  - Website
  - Seminars, workshop
  - Publications
  - Lists of ESCOs and successful cases

A Driving Force for National Science and Technology Capability

## *Conclusions*

- Application of RE and promotion of EE, the two prongs of Thai Government
- Positive trend in liquid biofuel application
- Investment promotion for RE facilities
- RPS and Feed-in tariff for utilities based RE
- IPP, SPP, and VSPP are just starting

## **Acknowledgement**

- **Dr. Boonrod Sajjakulnukit**  
Department of Alternative Energy Development and Efficiency  
Ministry of Energy
- **NSTDA**, Ministry of Science & Technology
- **Energy for Environment Foundation**
- **EPPO**
- **BOI**
- **Ms.Jiratchaya Duangburong, ADO Office, NSTDA**