



**Asia-Pacific
Economic Cooperation**



Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

**The 43rd NEW AND RENEWABLE ENERGY TECHNOLOGIES
EXPERT GROUP MEETING (43rd EGNRET Meeting)**

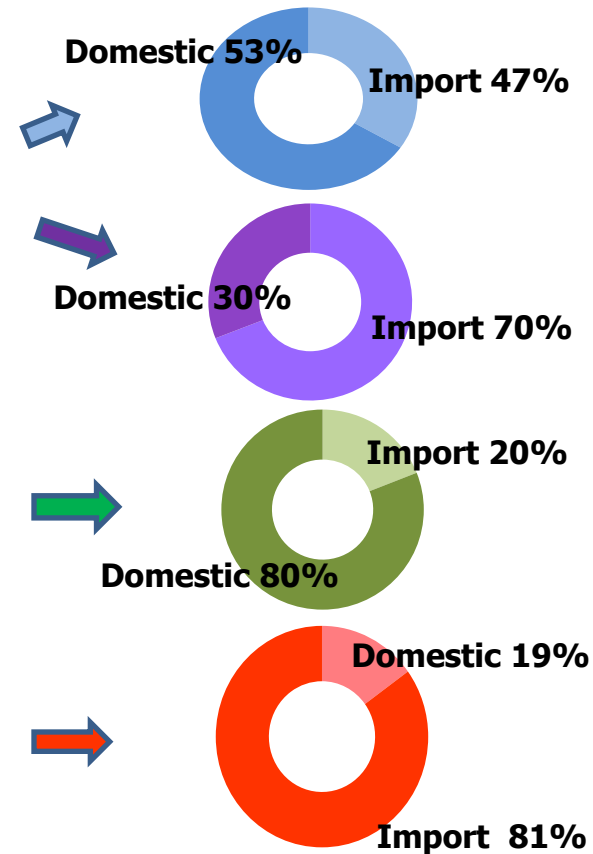
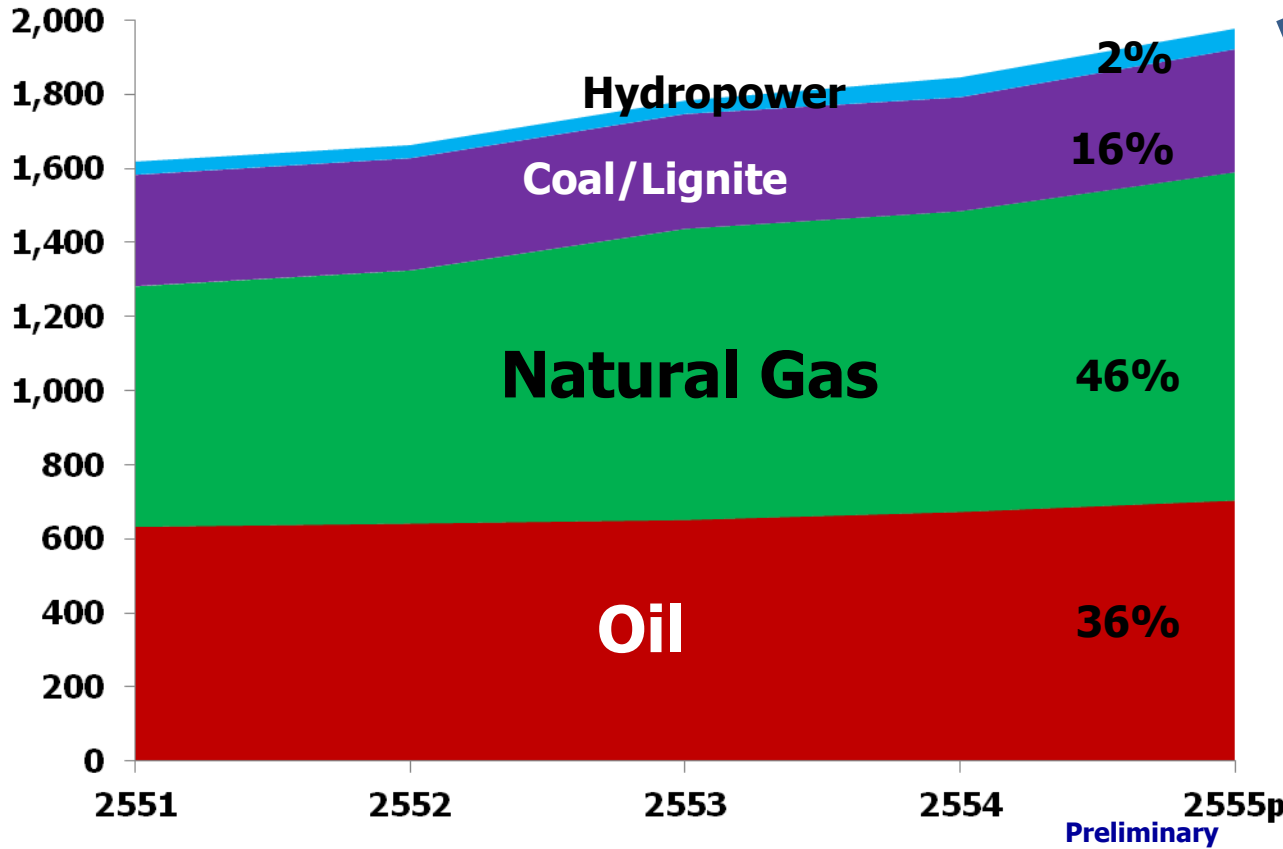
Overview of Renewable Energy in Thailand

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12 – 14 November 2014
Chiang Mai, Thailand**

Thailand's Energy Situation

Final Energy Consumption 2013

Thousand barrel oil equivalent / day



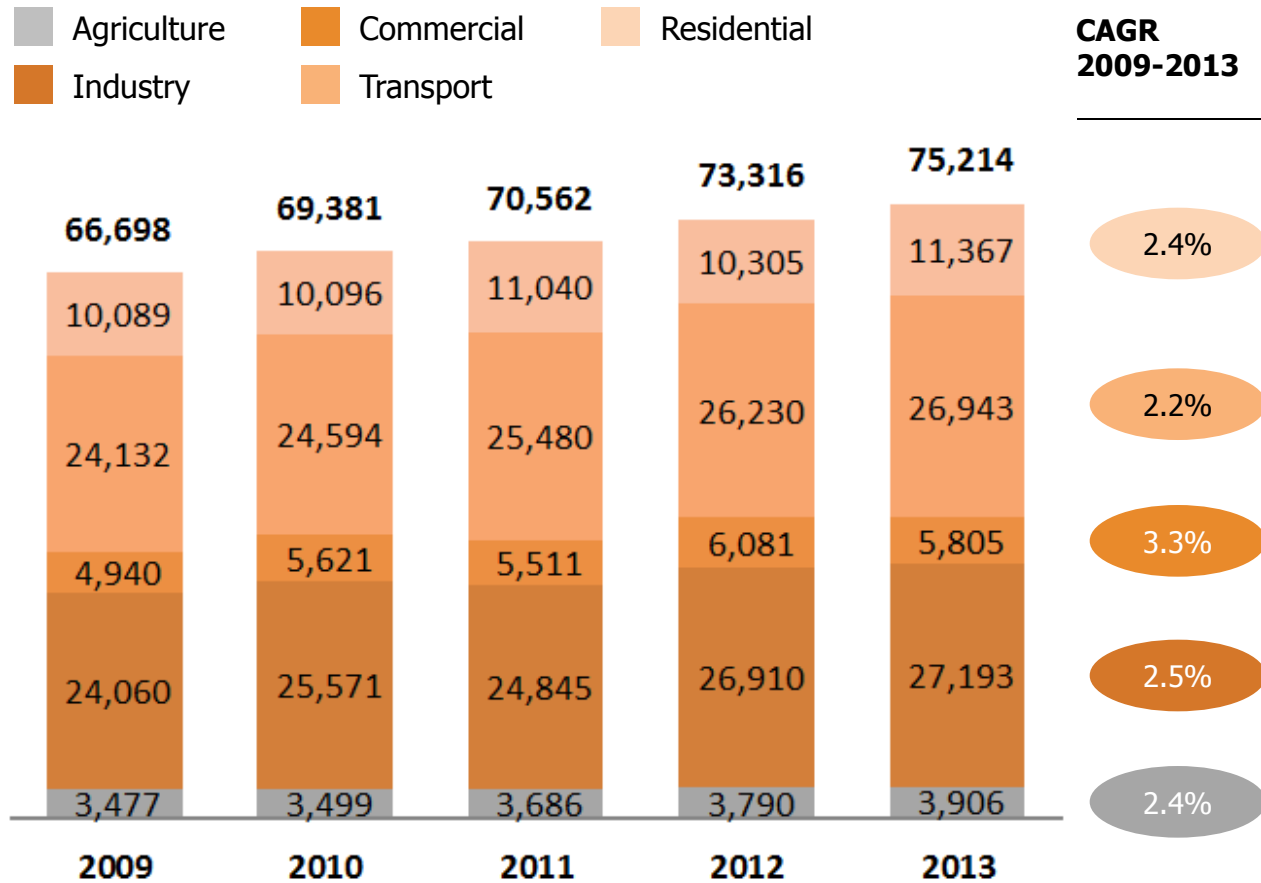
Consumption	Oil	Natural gas	Coal/Lignite	Electricity	Total
Thousand barrel oil equivalent / day	727.56	917.02	313.42	46.64	2,004.63
Growth (%)	4.7	9.2	5.0	3.4	6.7



The transportation and industrial segments account for 72% of Thailand's energy consumption

Thailand final energy consumption by industry, 2009-2013

Ktoe

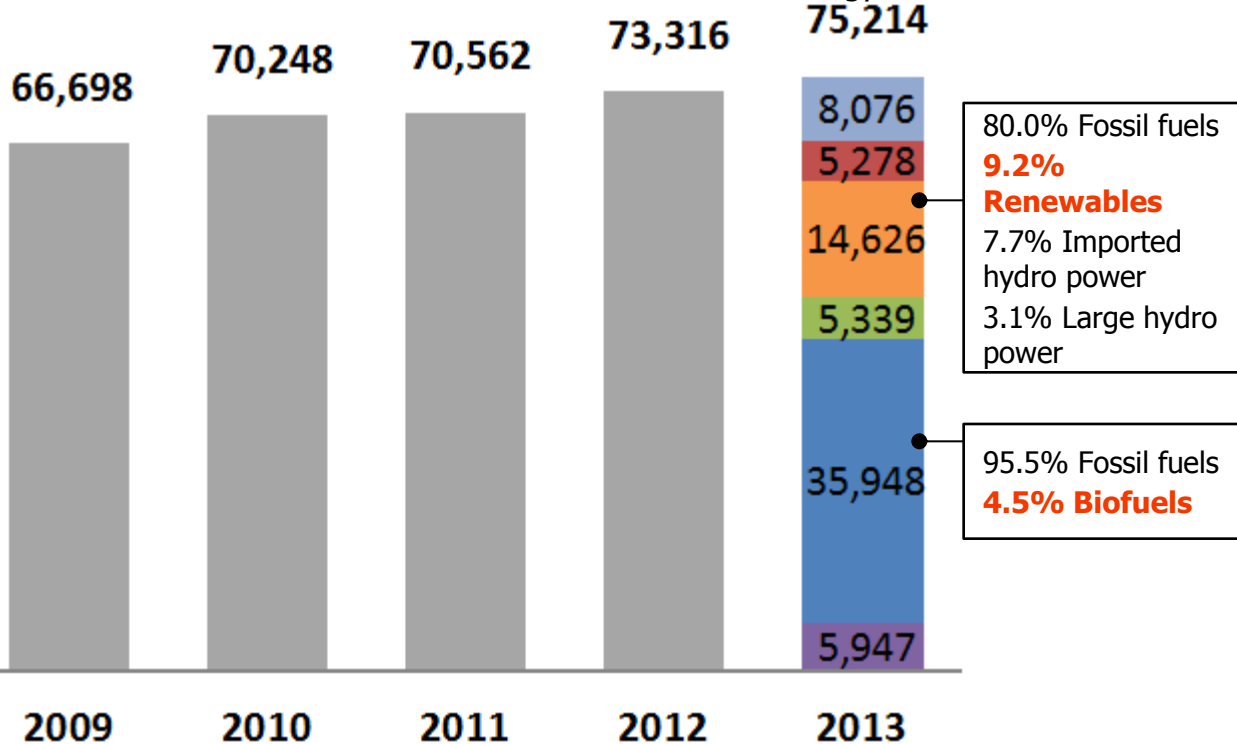
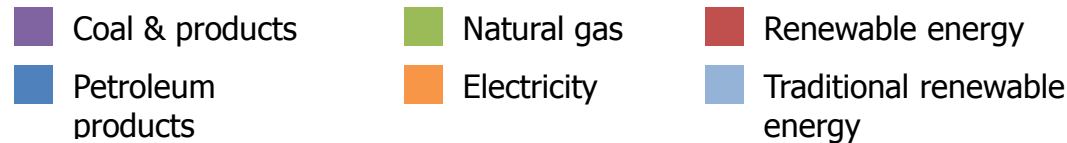


- Since 2009, the industrial sector has overtaken the transportation sector as the largest source of demand
- Commercial sector is second smallest but fastest growing
- Industry and transportation both account for ~ 36% of total energy consumption



Thailand final energy consumption, 2009-2013

Ktoe



- Since 2009, final energy consumption has been growing by ~2.4% per year
- In 2013, renewables accounted for a total of 8,232 ktoe of consumption, or ~11%
 - 5,278 ktoe direct
 - 1,612 ktoe fuel
 - 1,342 ktoe converted electricity



Import Electricity form neighbors

MYANMAR

Capacity : 39,720 MW

Souces : Ministry of Power, India

CHINA

Capacity : 694,000 MW

Sources : wikipedia.org

LAO PDR

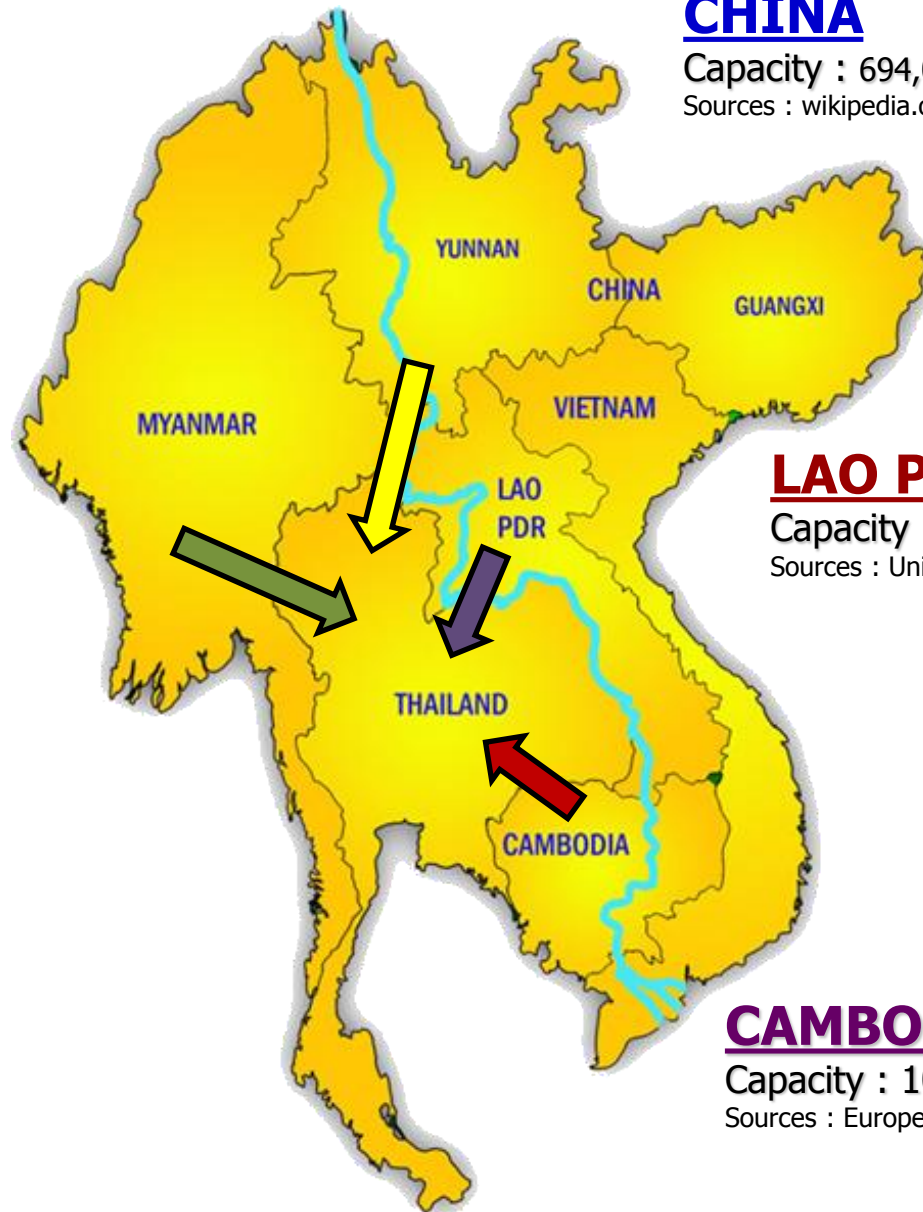
Capacity : 26,000 MW

Sources : United Nations

CAMBODIA

Capacity : 10,000 MW

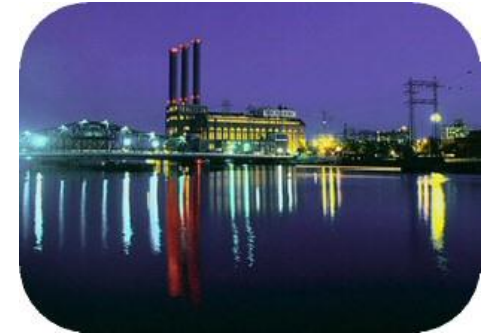
Sources : European Commission





Thailand's Energy Challenges

- ❑ Increased and fluctuated **world oil price**
- ❑ Limited **petroleum reserved**
 - needs to import 85 % of supply
- ❑ 70% of electricity supply depends on **Natural Gas**
- ❑ Lacking of **public agreement** on Energy projects
- ❑ **Energy Subsidies**
- ❑ **Green House Gas Emission** from energy sector



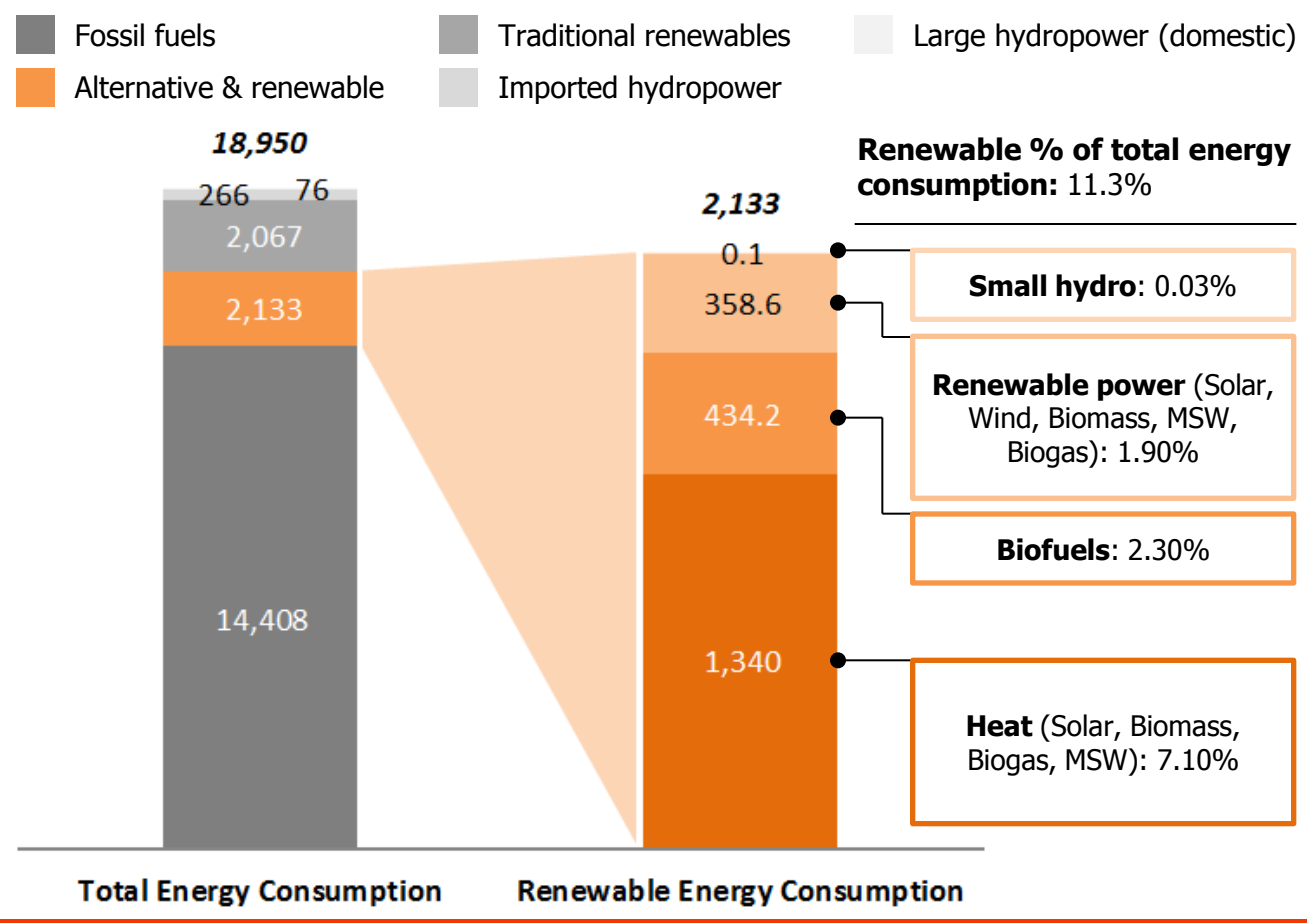
OIL SUPPLY
SECURITY



Renewable Energy Development

Thailand final energy consumption, Q1 2014

Ktoe




- In the first quarter of 2014, renewable consumption increased slightly to 11.3% of overall consumption
- Majority of renewables consumption is in the form of heat, but power and biofuels are contributing a growing share of renewable energy



The Alternative Energy Development Plan is the current roadmap for renewable energy development targets

AEDP
(2012-2021)

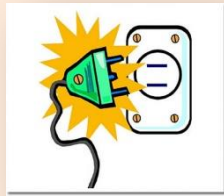


Goal: Target 25% Renewables in Total Energy Consumption by 2021

%RE of total energy consumption: 11.3%

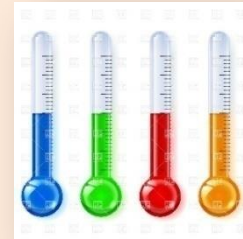
Electricity : 13,927 MW (4,416 MW)

5% (Target)
 1.75% (Current)



Heat : 9,800 ktoe (3,365 ktoe)

10% (Target)
 7.53% (Current)



Biiofuel : 19.2 mL/d (5.8 mL./d)

10% (Target)
 2.24% (Current)



RE type	Plan (MW)	Now (MW)
Solar	3,000	1,270
Wind	1,800	223
Hydro	324	143
Biogas Energy Plant	600 3,000	297 -
Biomass	4,800	2,418
MSW	400	65
New Energy	3	-

RE type	Plan (MW)	Now (MW)
Solar	100	5
Biogas	1,000	281
Biomass	8,500	3,022
MSW	200	57

RE type	Plan (mL/day)	Now (mL/day)
Ethanol	9	3
Biodiesel	7.2	2.8
BHD	3	-
CBG	1,200 n/d	-



**Potential analysis of RE resources in Thailand
And estimating potential in the future**



Analyze and Specify ratio of resource usage



Forecasting data of total energy consumption from EPPO



opportunity of RE to substitute fossil fuel



Electricity

Manage a distribution system of RE by considering area based factors such as;

- Distribution system potential
- transmission line
- RE potential in the area
- Priority of RE types (Merit order system) using Levelized Cost of Electricity Model (LCOE)

Heat

Manage RE heat production

- Using potential of fossil fuel substitution in each area

Bioenergy

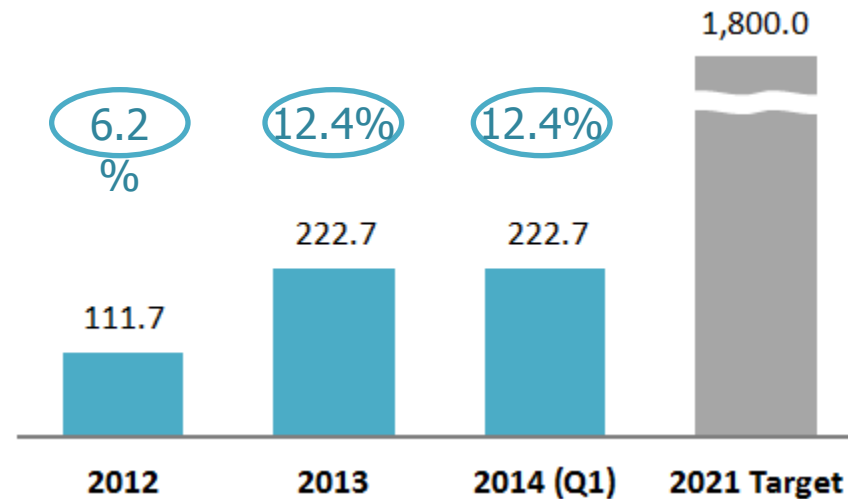
Increase bioenergy production in transportation sector (keep balance between energy production and consumption)



Current development progress

Power generation development

MW installed capacity



Development initiatives

- Promote **community scale usage**
- **Promote R&D** on wind turbine design

Sample Sites

- 2007 : 5 kw Low-speed wind turbine technology, Pathumthani
- 2010 : Wind turbine for electricity generator size 2 and 5 kW., Huasai, Nakornsrihummarat
- 2011 : Small grid-connected electric generator control system
- 2013 Study and Testing efficiency of wind turbine in producing 100% domestic electricity

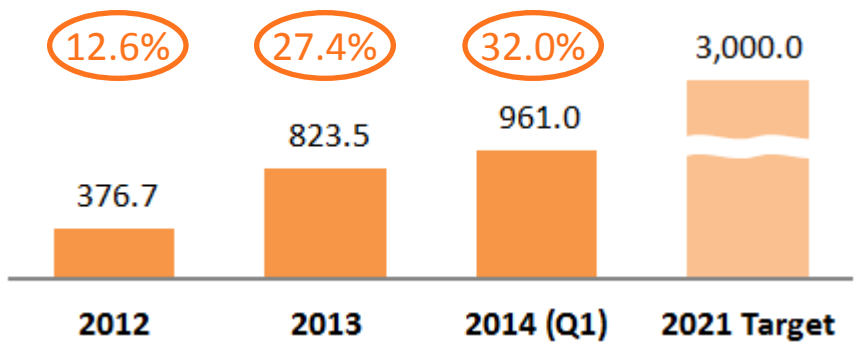


Renewable energy class detail: **Solar**

Current development progress

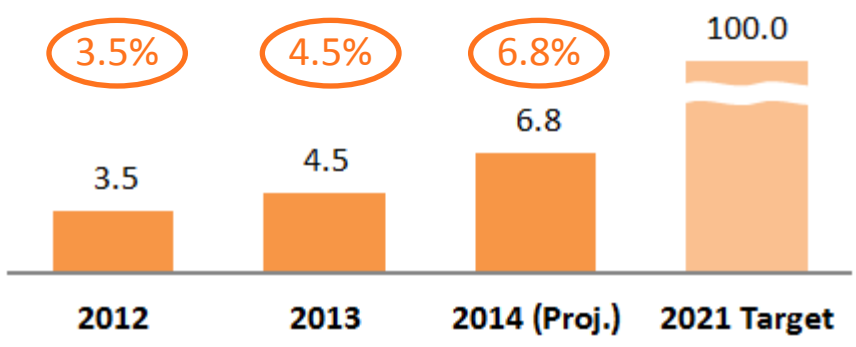
Power generation development

MW installed capacity



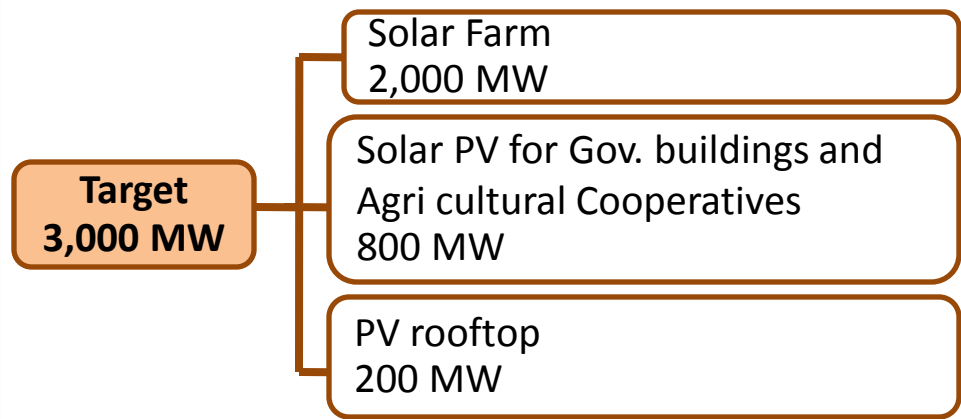
Heat development

ktoe



Development initiatives

- Promote implementation of **community/residential scale solar** system projects
- Supplant ADDER incentive system with revised **feed-in tariff (FiT)** system



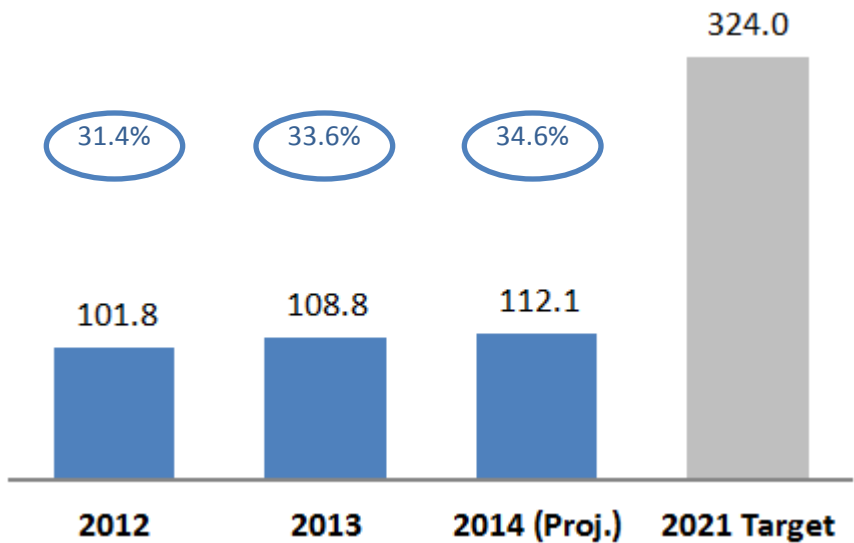
FIT Price for PV rooftop

- Household (0-10 kWp)**
 = **23.2 USCent/kWh**
- Small Enterprise (10 - 250 kWp)**
 = **21.8 USCent/kWh**
- Medium & Large Enterprise/Factory (250 – 1,000 kWp)**
 = **20.5 US cent/kWh**

Current development progress

Power generation development

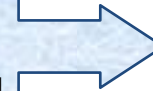
MW installed capacity



Development initiatives

- Support construction of hydropower at a **community level**

Generate hydro power at Village level



Very small power plant
 Non-electrified household (Off-Grid)

DEDE & EGAT develop small hydro power system of downstream irrigation dam

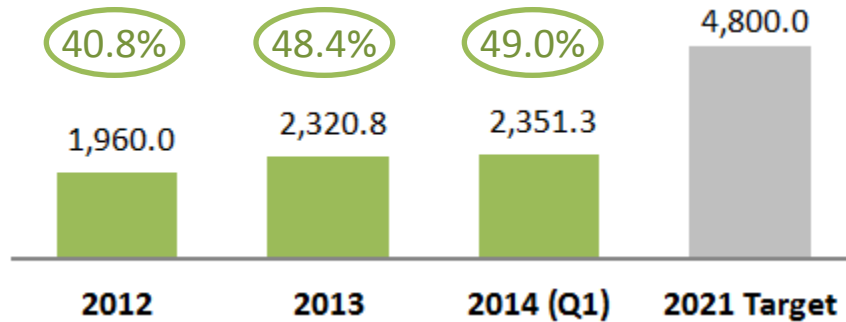
Small hydro power plant
 Local Admin Organization/people collaboration → project owner



Current development progress

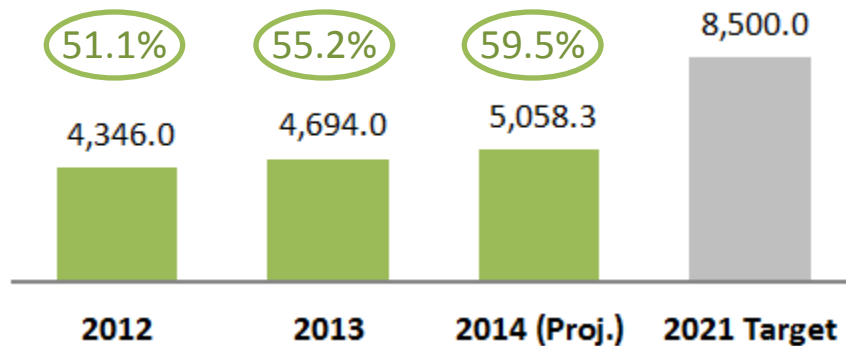
Power generation development

MW installed capacity



Heat development

ktoe



Development initiatives

- Promote **plantation of fast growing trees** that can be used as feedstock for power/heat generation
- Develop **production and standard of biomass pellets** for future biomass fuel
- Develop **advanced gasifier and gas engine technology** as well as **biomass-to-liquid (BTL)** technology
- Promote **use of high pressure boilers** to improve efficiency of power generation from biomass
- Promote Distributed Green Generation (DSG) – **community level biomass** energy
- Coordinate with EGAT to develop necessary **transmission and distribution infrastructure**

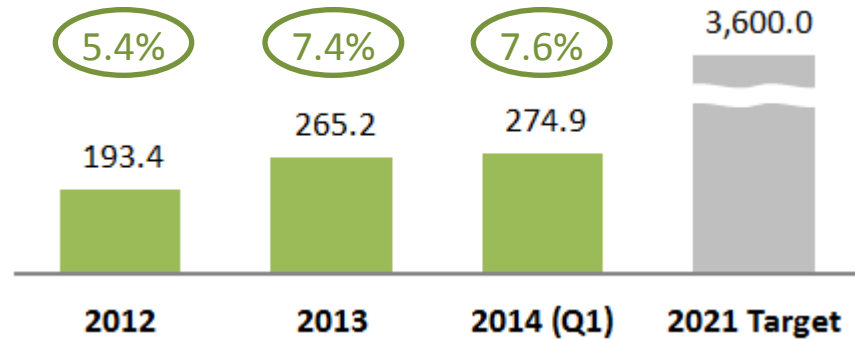


Renewable energy class detail: *Biogas*

Current development progress

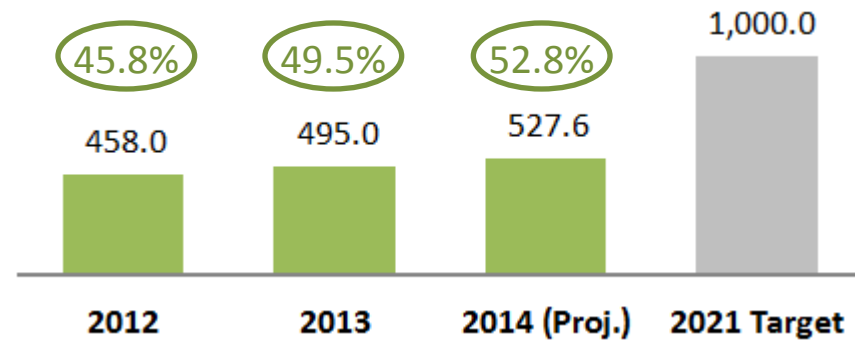
Power generation development

MW installed capacity



Heat development

ktoe



Development initiatives

- Promote and support biogas **production at a household level**
- Support **community self-management** of biogas assets
- Study biogas production from **alternative feedstock sources**
- Promote production and utilization of **compressed bio-methane gas (CBG)** from biomass and energy crops for transportation and power generation
- Study and develop **regulations for biogas safety** standards
- Conduct **public relations** to disseminate knowledge and news to help build public image of safe biogas usage



Renewable energy class detail: *New Energy*

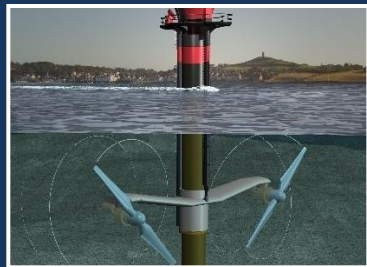
Geothermal Energy



2021 Target: 2 MW

- Develop potential map for geothermal sources & tech
- Assess feasibility in development of geothermal sources by appropriate technologies
- Evaluate cost effectiveness, environmental impact, and social impact
- Develop and adopt moderate temperature technologies

Tidal/Current Energy



2021 Target: 1 MW

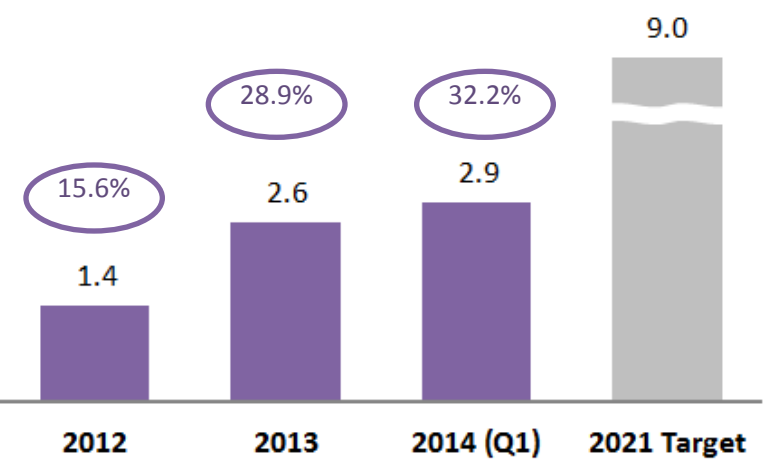
- Accelerate study on sources and technology types which may be appropriate for Thailand: expected potential areas are located around Phuket, Koh Sa Mui, and Koh Tan
- Assess development potential and readiness to develop pilot project
- Utilize pilot project data to assess further development

Renewable energy class detail: Bioethanol

Current development progress

Fuel usage development

ML/day



Development initiatives

- Continue to increase the share of "Gasohol" on the market (current share, including E10, E20, and E84 is 92%)

Bioethanol – Target 9 ML/day

Gas stations and Vehicles

Year	E20 stations	E85 stations
2008	194	-
2009	271	-
2010	542	10
2011	830	38
2012	1311	67
2013	2045	280
Q1/2014	2273	352

E20 stations are well spread over Thailand

E10 Most cars manufactured since 1995

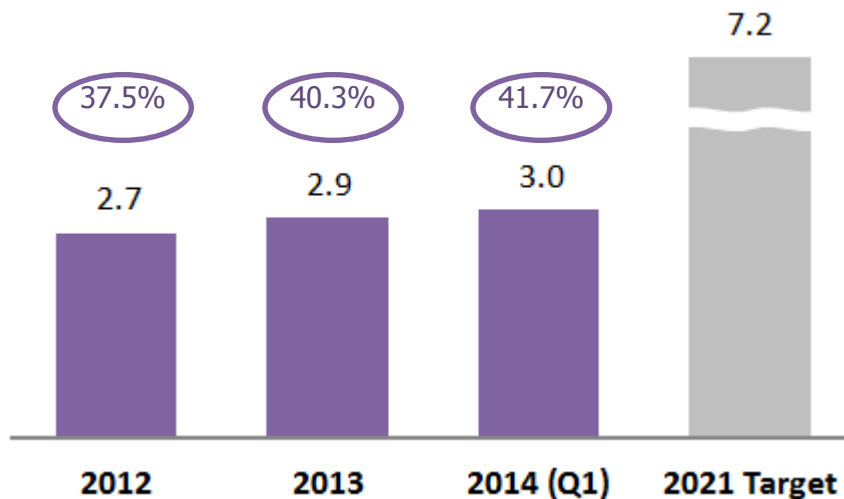
E20 Most cars manufactured since 2008

E85 All Flex fuel cars (FFV)

Current development progress

Fuel usage development

ML/day



Development initiatives

- Promote **growing palm trees in sustainable areas** not competing with food crops
- Develop **alternative energy crops** for the production of biodiesel equivalents (details on next page)
- Increase **production capacity of crude palm oil**





Renewable energy class detail: *Second generation biofuels*

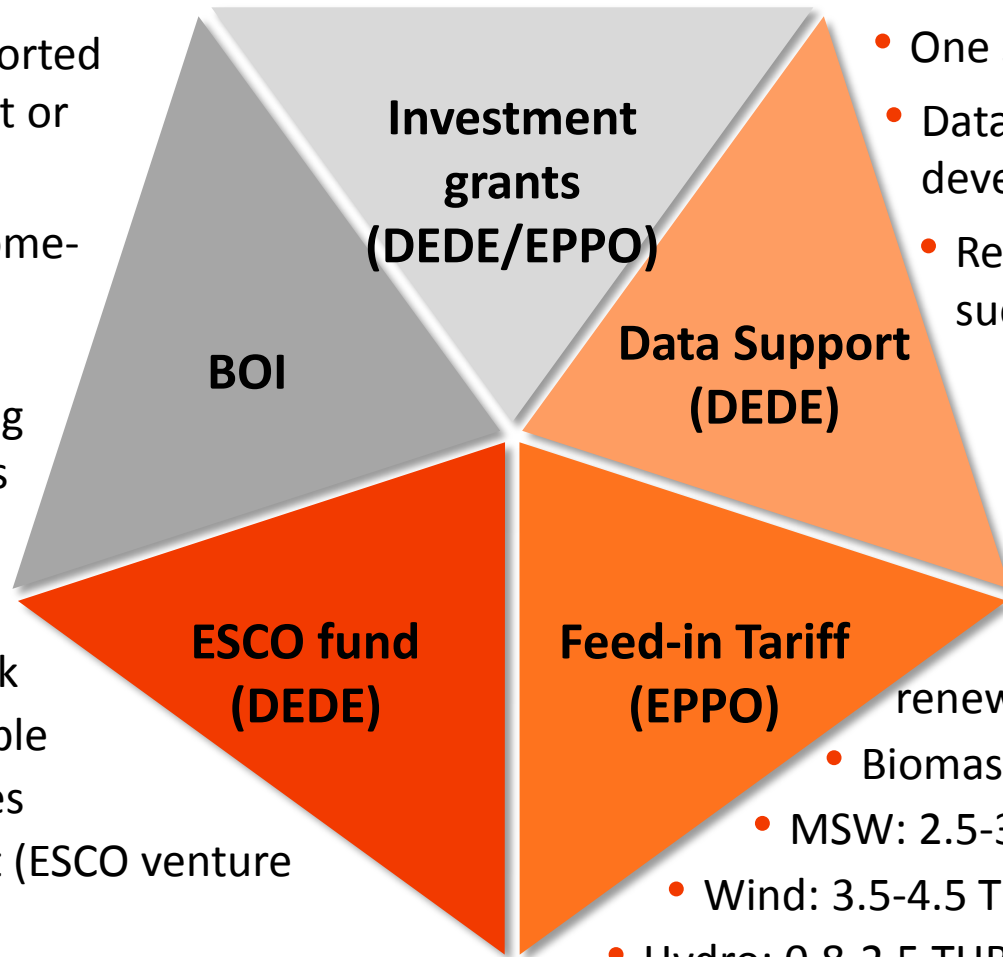




The Ministry of Energy employs several tools to incentivize renewable energy development

- Exemption of imported duty of equipment or machines
- Exemption of income-corporate taxes resulting from Selling RE or saving energy for periods up to 8 years

- Provides lower risk capital to renewable focused businesses
- Equity investment (ESCO venture capital)
- Equipment leasing
- Credit guarantee facility



- One stop service center
- Data on renewable development progress
- Resource data maps, such as solar and wind

- Premiums paid for renewable power generation
- Biomass & biogas: 0.3-0.5 THB
- MSW: 2.5-3.5 THB
- Wind: 3.5-4.5 THB
- Hydro: 0.8-2.5 THB
- Solar: 6.5 THB



ADDER premiums and Feed-in-Tariffs support economically attractive renewable development

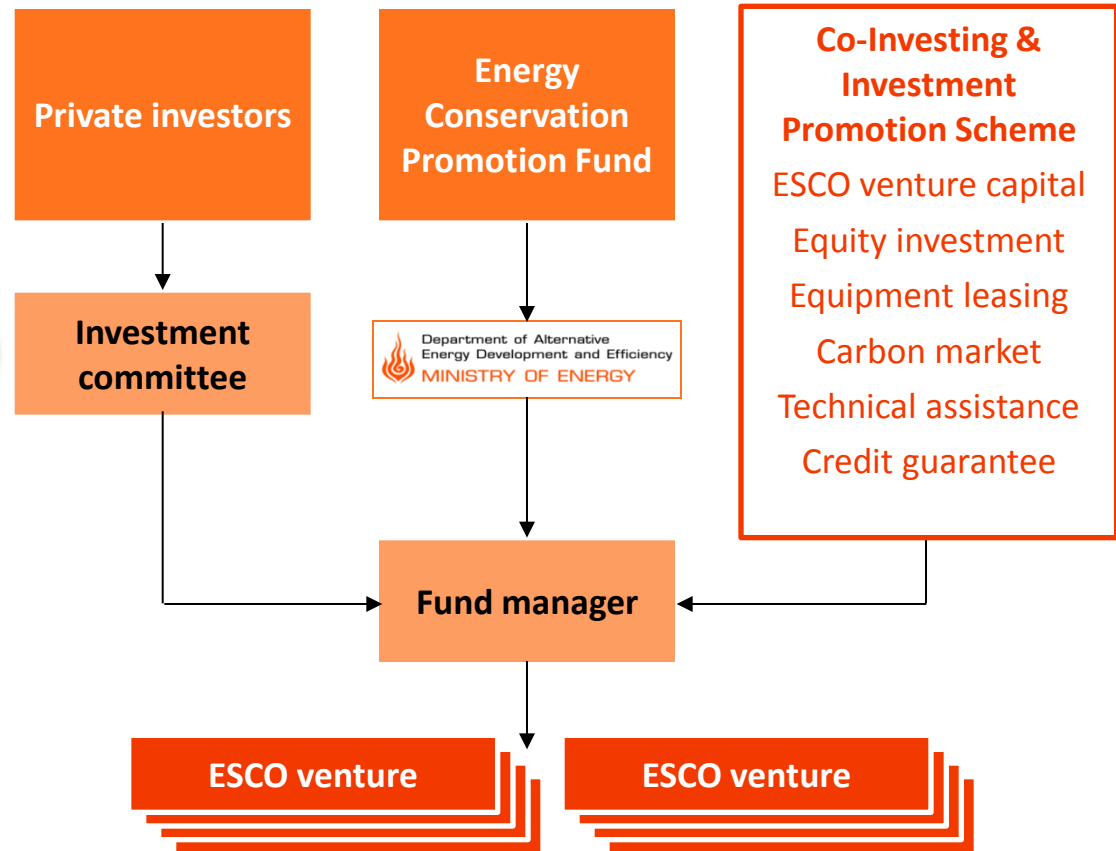
	ADDER (Baht/kWh)		ADDER (US Cents/kWh)		Special ADDER (THB/kWh)	Supporting Period (yrs)
	VSP	SPP	VSP	SPP		
Biomass up to 1 MW -> over 1 MW ->	<ul style="list-style-type: none"> 0.50 0.30 	<ul style="list-style-type: none"> Bidding Bidding 	<ul style="list-style-type: none"> 1.56 0.94 	<ul style="list-style-type: none"> Bidding Bidding 	<ul style="list-style-type: none"> 1.00 1.00 	<ul style="list-style-type: none"> 7 7
Biogas up to 1 MW -> over 1 MW ->	<ul style="list-style-type: none"> 0.50 0.30 	<ul style="list-style-type: none"> Bidding Bidding 	<ul style="list-style-type: none"> 1.56 0.94 	<ul style="list-style-type: none"> Bidding Bidding 	<ul style="list-style-type: none"> 1.00 1.00 	<ul style="list-style-type: none"> 7 7
Waste AD & LFG -> Thermal ->	<ul style="list-style-type: none"> 2.50 3.50 	<ul style="list-style-type: none"> 2.50 3.50 	<ul style="list-style-type: none"> 7.81 10.9 	<ul style="list-style-type: none"> 7.81 10.9 	<ul style="list-style-type: none"> 1.00 1.00 	<ul style="list-style-type: none"> 7 7
Wind Power up to 50 kW -> over 50 kW ->	<ul style="list-style-type: none"> 4.50 3.50 	<ul style="list-style-type: none"> 3.50 	<ul style="list-style-type: none"> 14.1 10.9 	<ul style="list-style-type: none"> 10.9 	<ul style="list-style-type: none"> 1.50 1.50 	<ul style="list-style-type: none"> 10 10
Small Hydro up to 200 kW -> 50 to 200 kW ->	<ul style="list-style-type: none"> 0.80 1.50 	<ul style="list-style-type: none"> None None 	<ul style="list-style-type: none"> 2.50 4.69 	<ul style="list-style-type: none"> None None 	<ul style="list-style-type: none"> 1.00 1.00 	<ul style="list-style-type: none"> 7 7
Solar	<ul style="list-style-type: none"> Varies – detail on next page 		<ul style="list-style-type: none"> Varies – detail on next page 		<ul style="list-style-type: none"> 1.50 	<ul style="list-style-type: none"> 25



ESCO fund lowers cost of capital and other economic barriers for renewable developers

- DEDE has also developed an ESCO fund to de-risk and encourage investment in renewable focused ventures
- Fund pools capital from the Thai government's ENCON fund with capital from private investors
- In addition to capital funding, ESCO fund provides access to low cost equipment leasing
- Thus far, the ESCO fund has invested a total of 6.1 BN THB (510 MM THB from govt., remainder from private sources) in 54 separate projects accounting for a total energy savings of 1.1 BN THB

ESCO fund structure



Introduction to Site Visit

R.P.M. Farm and Feed Co.,Ltd

- Animal feed producers , Livestock Production, Further Processing and Trading
- Construct CMU-CD-(Chiang Mai University Channel Digester) for producing biogas 1,000 cubic meter from livestock wastewater
- Biogas production capacity 600 cubic meter per day
- Electric production capacity 9,240 kwh per month
- CBG 384 kg per day



Showcase "Mae Kam Pong"



Mae Kam Pong Electric Project

- National Policy in 1980 , aims to extend the use of electricity in rural area
 - 1,300 m. than MSL with 23.5 sq.km.
 - located far from grid system distribution
 - In 1982 , DEDE started micro hydro project
 - site 1 = 20 kw
 - site 2 = 20 kw
- " Small water resource =
The cheapest energy resource "

✓ Community Participation => Share holders cooperative

Community

Provide Labour

Construction Material =>
Locally available ex. sand, gravel,
wood etc.

DEDE

Budget

Design /Technical Assistance
=> Generating equipment
=> advise, monitor civil work
=> organize cooperatives

After
Construction

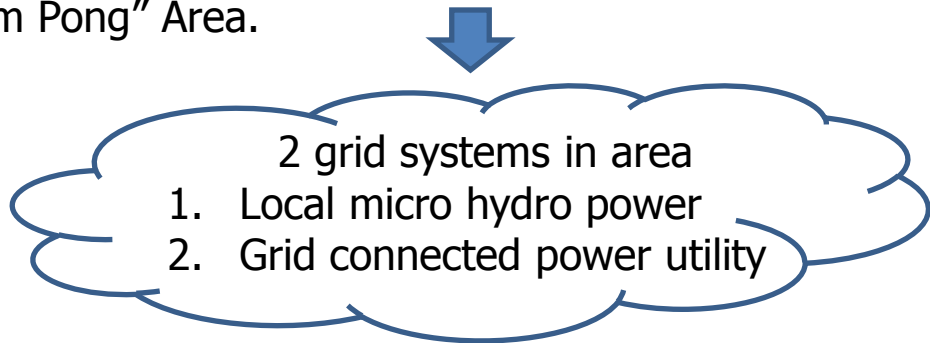
Transfer Ownership
to Community

O & M

Showcase "Mae Kam Pong"



- ## Mae Kam Pong Electric Project
- In 1994-2003 => increase capacity in the area to site 3 with 40 kw
 - Managed by local cooperatives => one time charge payment
 - In 1995 , Electricity from PEA grid system came into "Mae Kam Pong" Area.



Micro Hydro Power still operate

=> without interruption

- ✓ Strong unity of people in community
- ✓ Managing system
- ✓ Local rules & regulations
- ✓ Maintenance / Advise from DEDE



Thank you for your attention