Development of Distributed Energy and New Energy Technology in Thailand

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Alternative Energy Situation

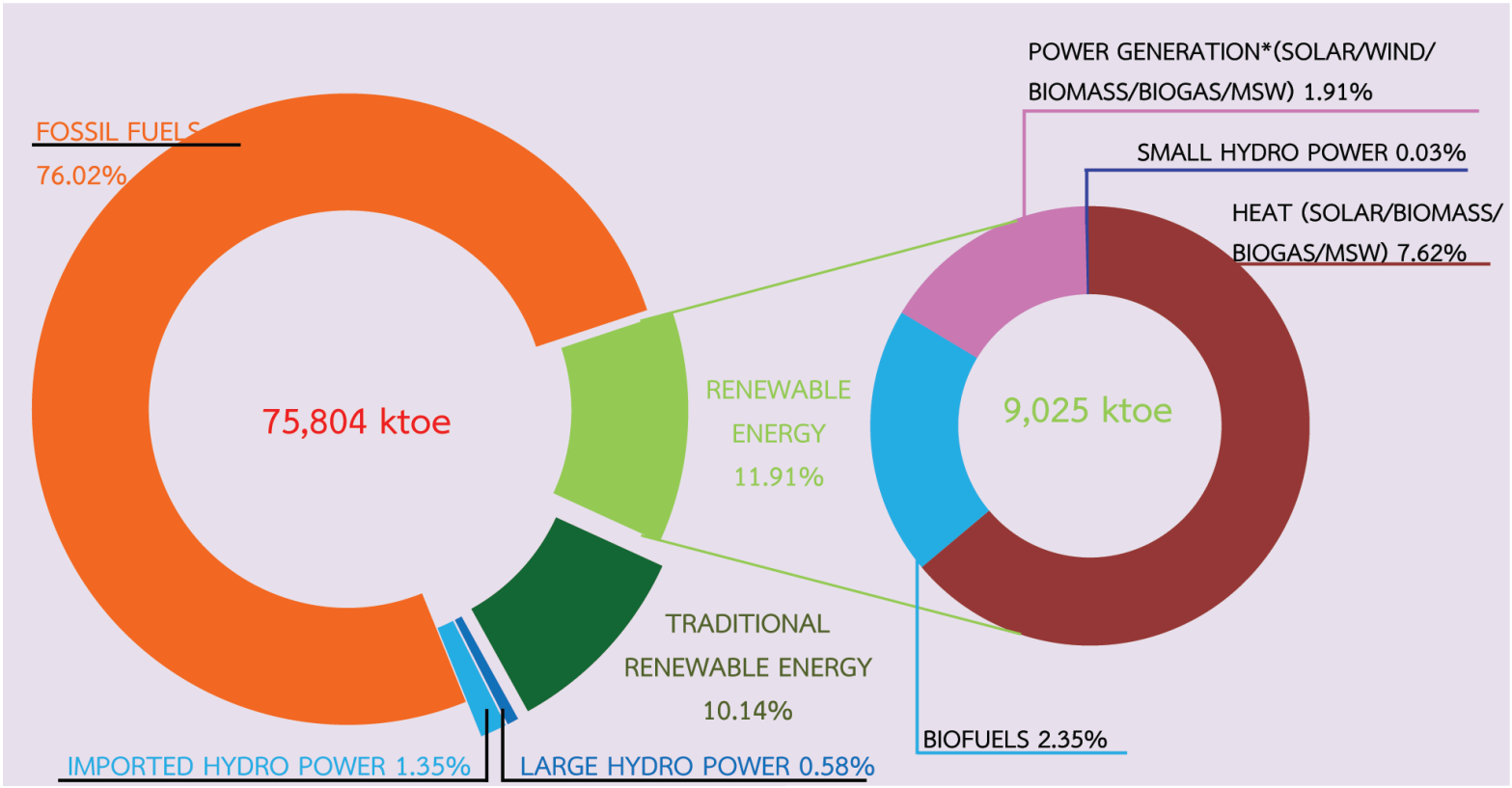
Alternative Energy Situation in Thailand

Final Alternative Energy Consumption 2010 - 2014

Alternative Energy Situation in Thailand

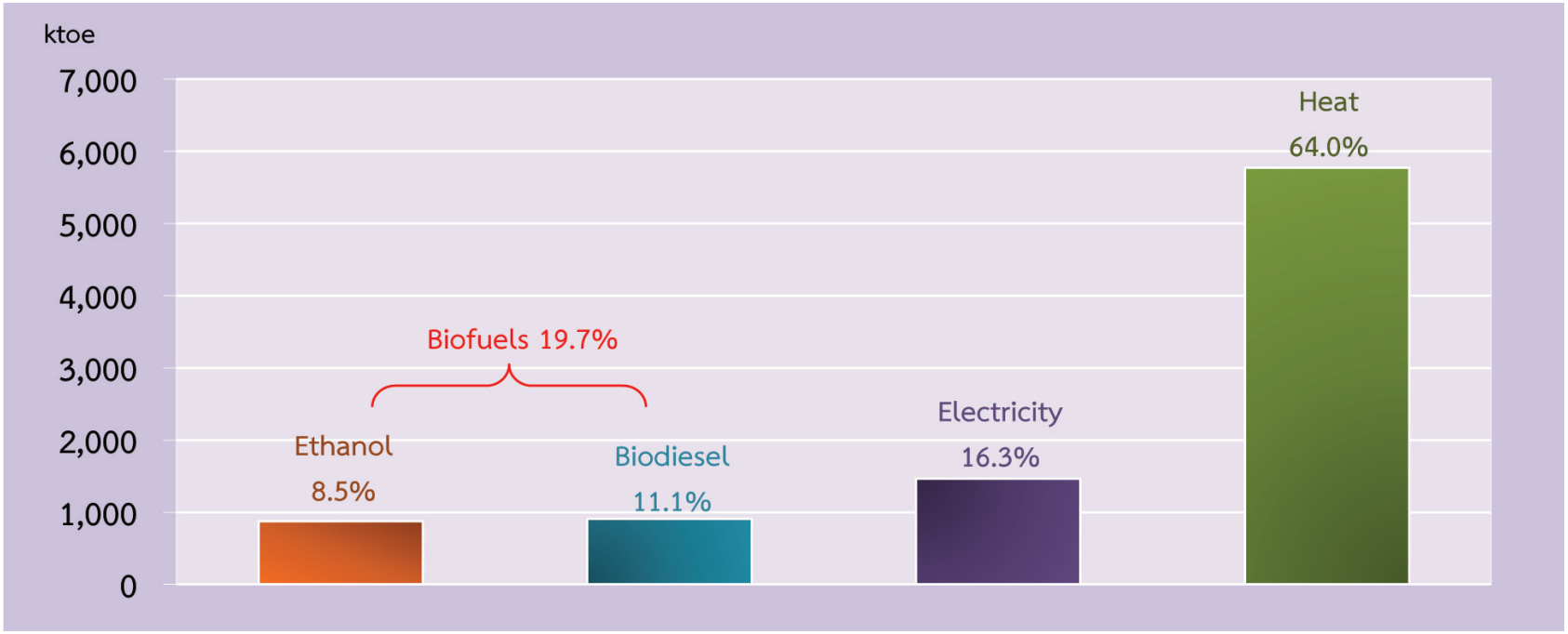
Final Energy Consumption 2014

Final Alternative Energy Consumption 2014



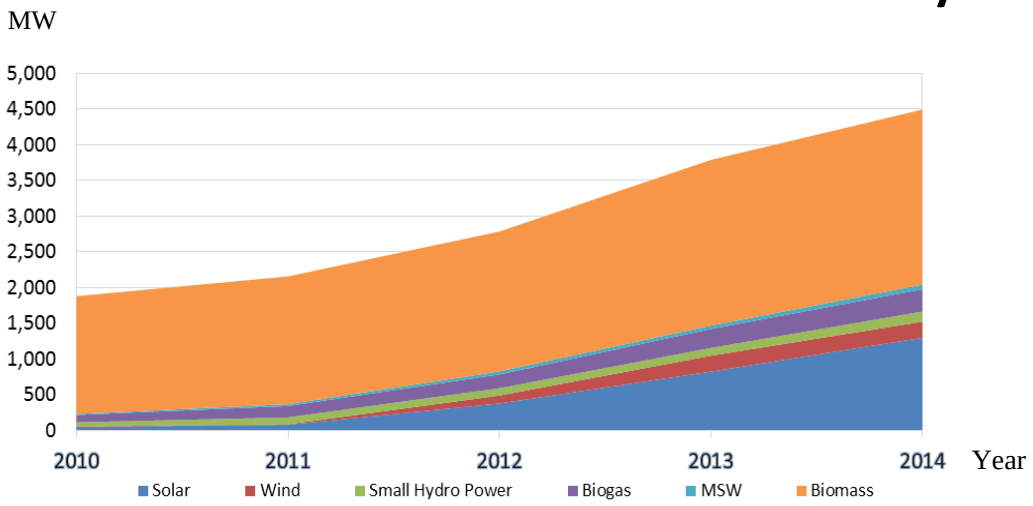
Alternative Energy Situation in Thailand

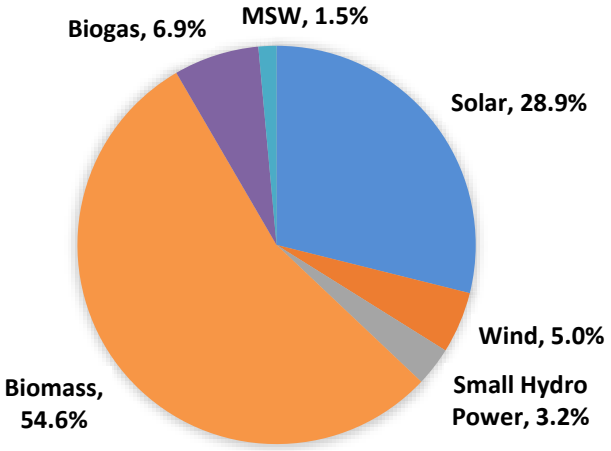
Alternative Energy Consumption 2014



Alternative Energy Situation in Thailand

Electricity

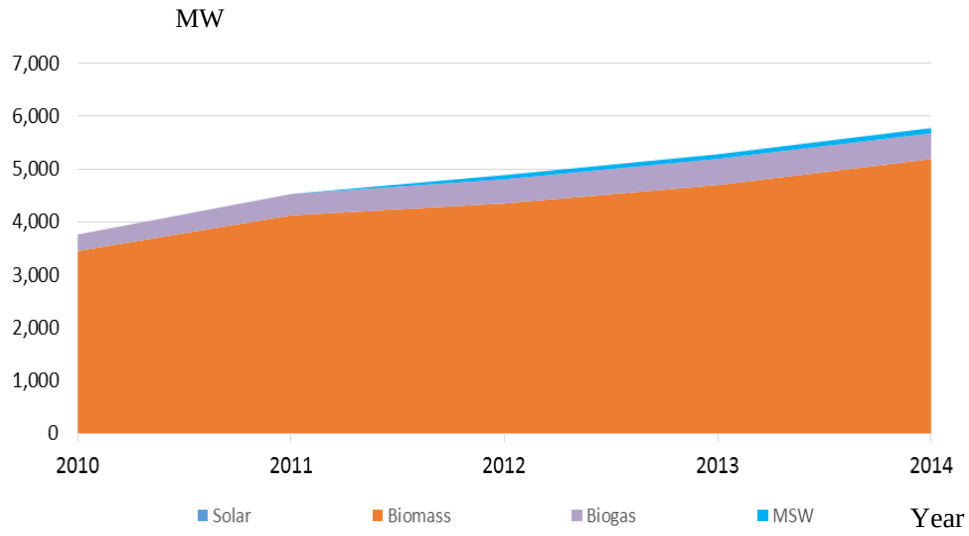


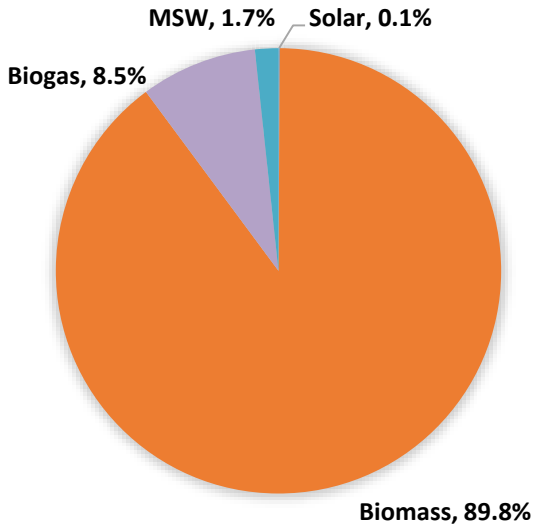


Alternative Energy	Installed Capacity (MW)					Growth rate(%)
	2010	2011	2012	2013	2014	2013-2014
Solar	48.6	78.7	376.7	823.5	1298.5	57.7
Wind	5.6	7.3	111.7	222.7	224.5	0.8
Small Hydro Power	58.9	95.7	101.8	108.8	142	30.5
Biogas	103.4	159.2	193.4	265.7	311.5	17.2
MSW	13.1	25.5	42.7	47.5	65.7	38.3
Biomass	1,650.2	1,790.2	1,959.9	2,320.8	2,451.8	5.6
Total	1,879.8	2,156.6	2,786.2	3,789.0	4,494.0	18.6

Alternative Energy Situation in Thailand

Heat

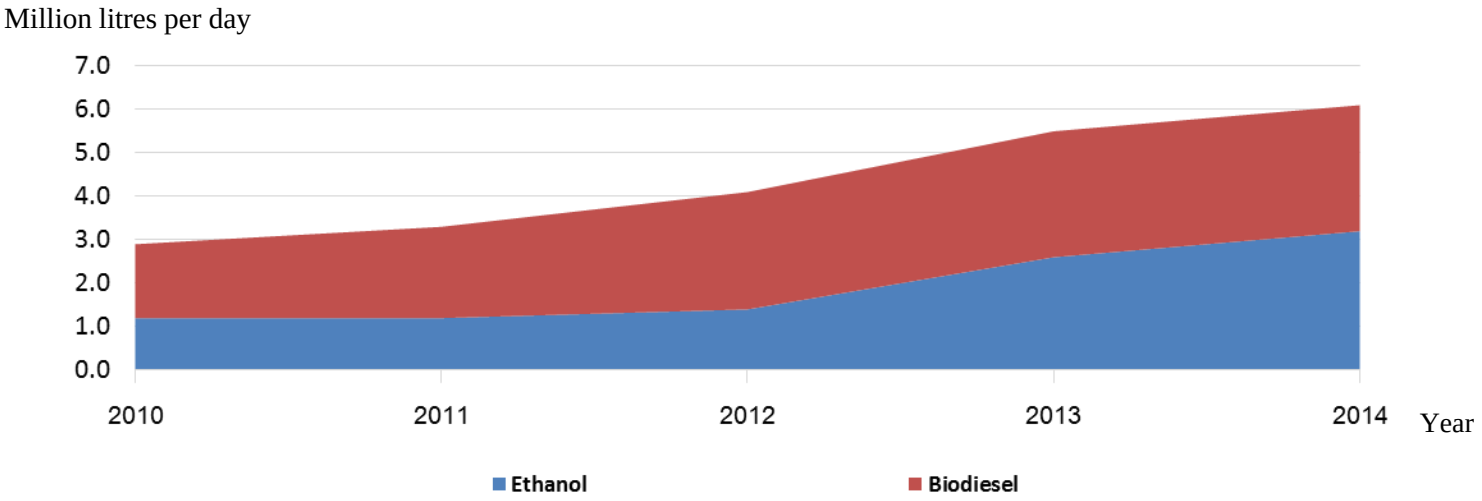




Alternative Energy	Heat (ktoe)					Growth rate(%)
	2010	2011	2012	2013	2014	2013-2014
Solar	1.8	2.0	4.0	4.5	5.1	12.8
Biomass	3,449	4,123	4,346	4,694	5,184	10.4
Biogas	311	402	458	495	488	1.4
MSW	1.1	1.7	78	85	98	15.3
Total	3,763	4,529	4,886	5,279	5,775	9.4

Alternative Energy Situation in Thailand

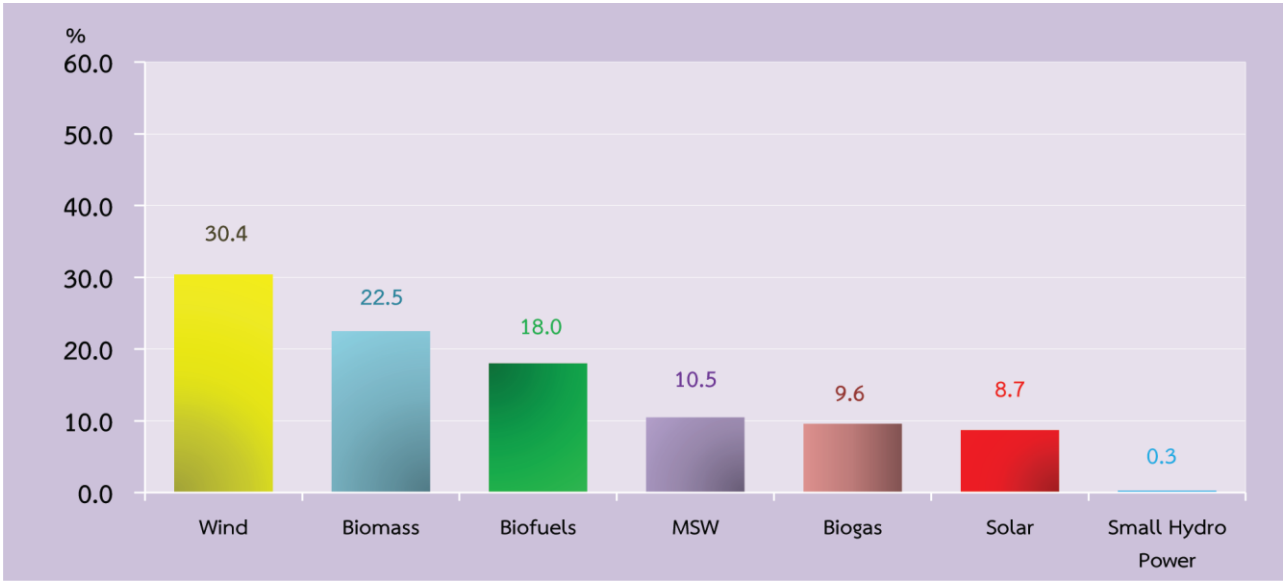
Biofuels



Alternative Energy	Biofuels (million litres per day)					Growth rate(%)
	2010	2011	2012	2013	2014	2013-2014
Ethanol	1.2	1.2	1.4	2.6	3.2	23.1
Biodiesel	1.7	2.1	2.7	2.9	2.9	-
Total	2.9	3.3	4.1	5.5	6.1	10.91

Alternative Energy Situation in Thailand

Alternative Energy investment 2014



Alternative Energy Investment	Solar Energy	Wind Energy	Small Hydro Power	Biomass	Biogas	MSW	Biofuels	Total
Investment (million Baht)	7,319	25,720	238	19,062	8,096	8,916	15,237	84,588

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Alternative Energy Development Plan (AEDP 2015-2036)

Energy Policy

Thailand's Energy Policies

General Prayuth Chan O-cha
Prime Minister

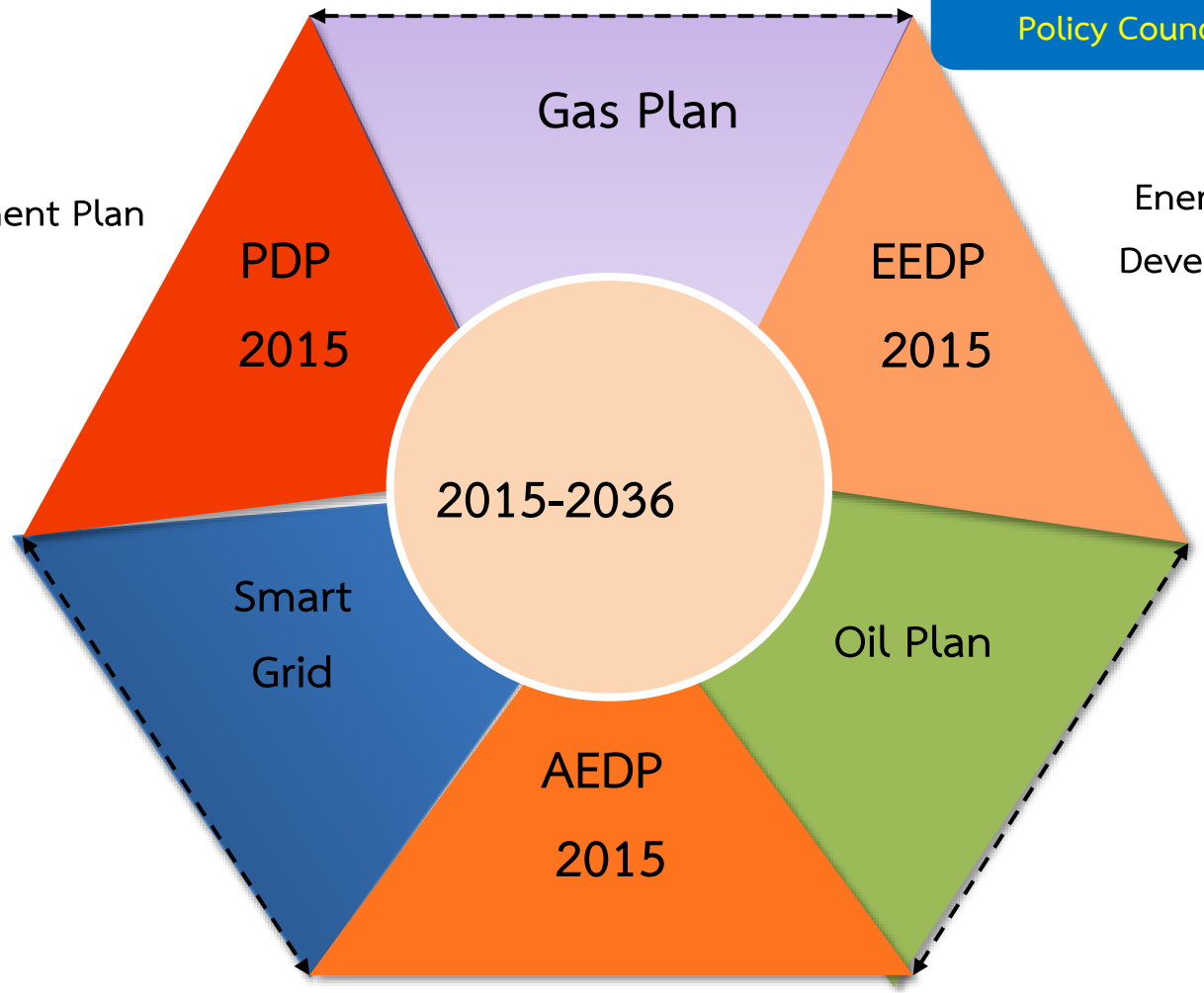
✓ Secure Thailand Energy supply
- Exploration and production of natural gas and crude oil both in the sea and on land
- More new power plant by government agencies and private organizations
- Increase the use of renewable energy
- International energy development cooperation

✓ Fair Energy Pricing
- Energy price restructure
- Appropriate tax between different types of oil

✓ Energy conservation
- More efficient use of energy
- Awareness of consumer

AEDP 2015-2036

Resolution of National Energy Policy Council (15/08/2014)



Power Development Plan

Energy Efficiency Development Plan

Alternative Energy Development Plan

Initial concepts for AEDP 2015-2036

1) **Promotion on power generation from MSW, biomass and biogas, to benefit both farmer and community.**

- MSW 500 MW
- Biomass
  - 2,500 MW from biomass potential at present
  - 1,500 MW from increased agricultural area, due to zoning policy (Ministry of Agriculture)

2) **Set up target of the provincial RE development** by zoning of electricity demand and RE potential

3) **Power generation from solar and wind** if the investment cost will be able to compete with power generation using Natural Gas

4) **Incentives** by using the competitive bidding, and promote the utilization by energy consumption reduction (Net Metering or Self-Consumption)

Initial concepts for AEDP 2015

Study for the potential of domestic RE source (Power/Heat/Biofuel) and forecast the quantity of RE in future

Analyze and appoint the share of RE for power, heat and biofuel at present and future

Total energy used prediction from EPPO's model

Opportunity for using RE replace fossil

Power

Provide RE for power generation by the potential of transmission line of PEA's substation by the consideration of:

1) RE potential of each area
2) Priority of RE by merit order, using "Levelized Cost of Electricity (LCOE) model"

Heat

Provide RE for heat generation by the potential of fossil fuel replacement/target group

Biofuel

Increase amount of biofuel production instead of fuel oil in transportation sector, by considerate the equilibrium of production and utilization

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Alternative Energy Development Plan: AEDP2015

Fuel	2014 (MW)	Target 2036 (MW)
1. MSW	65.72	500.00
2. Industrial waste	-	50.00
3.Biomass	2,451.82	5,570.00
4. Biogas from wastewater/manure	311.50	600.00
5. Biogas from energy crops	-	680.00
6. Wind	224.47	3,002.00
7. Small Hydro	142.01	376.00
8. Hydro	-	2,906.40
9. Solar	1,298.51	6,000.00
Sum	**4,494.00**	**19,684.40**

*2014 not include Hydro

Fuel	2014 (ktoe)	2036 (ktoe)
1. MSW	**98.1**	**495.00**
2. Biomass	**5,184.00**	**22,100.00**
3. Biogas	**488.10**	**1,283.00**
4. Solar	**5.12**	**1,200.00**
5. Heat from others (Ex. Geothermal, Oil from used tire)	**-**	**10.00**
Sum	**5,775.00**	**25,088.00**

Fuel	2014 (M Liter/d)	2036 (M liter/d)	2036 (ktoe)
1. Biodiesel	**2.89**	**14.00**	**4,404.82**
2. Ethanol	**3.21**	**11.30**	**2,103.5 0**
3.Pyrolysis oil	**-**	**0.53**	**170.87**
4. CBG (Compressed Biogas)	**-**	**4,800.00**	**2,023.24**
5. RE from others (Ex. Bio-oil, Hydrogen)	**-**		**10.00**
Sum	**6.10**		**8,712.43**

Target RE = 30% of total energy consumption

*2014 =11.9%

Electricity

5,588.24 ktoe
(4.27%)

Electricity ratio from RE of total electricity consumption
20%

Heat

25,088.00 ktoe
(19.15%)

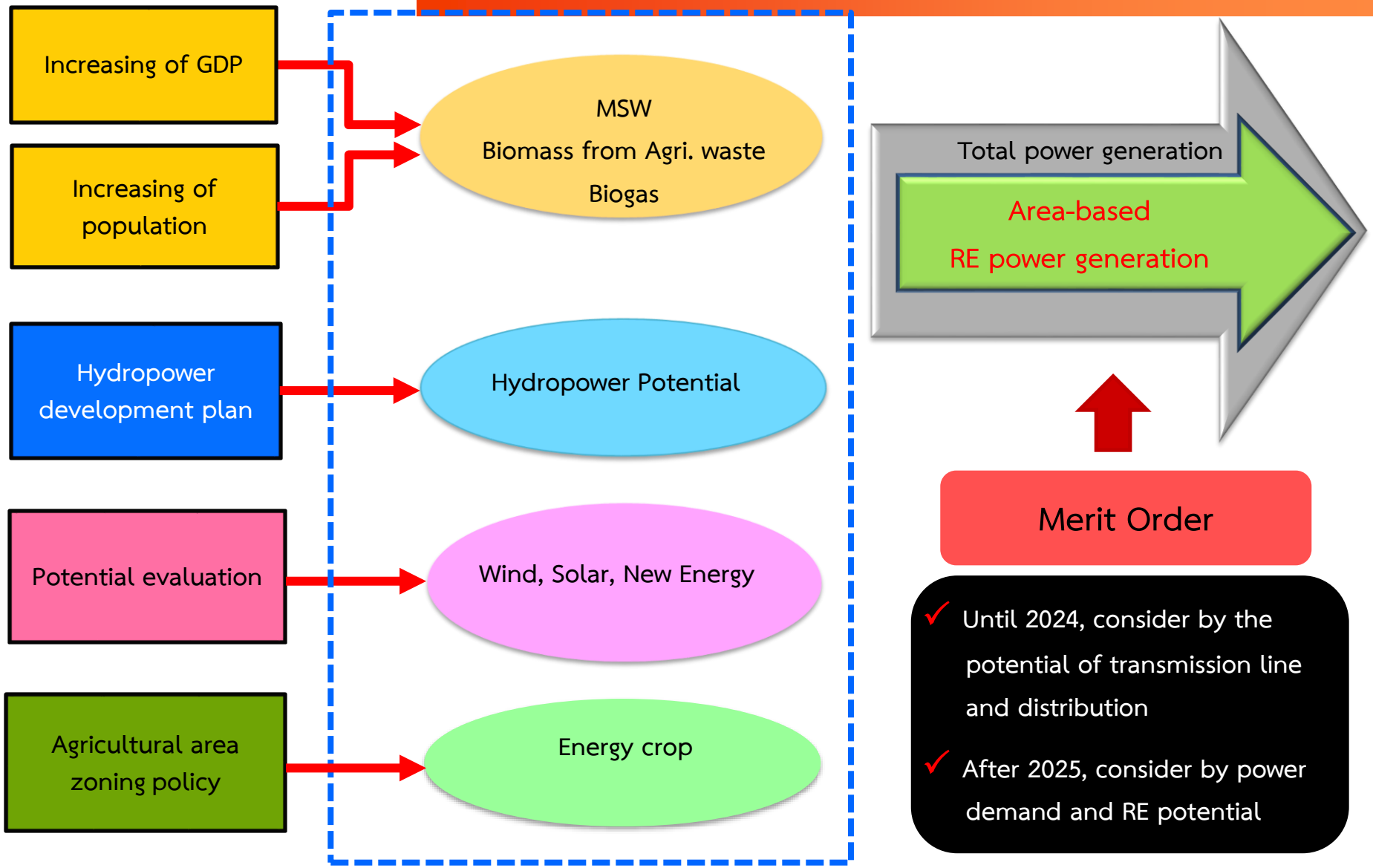
Heat ratio from RE of total thermal consumption
36.67%

Biofuel

8,712.43 ktoe
(6.65%)

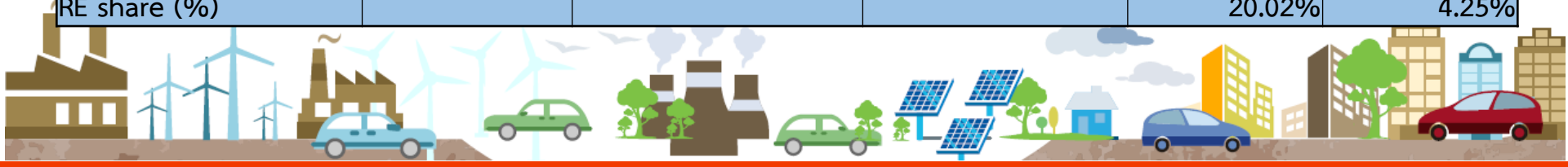
Biofuel ratio from RE of total biofuel consumption
25.04%

Concepts for prediction of power production potential

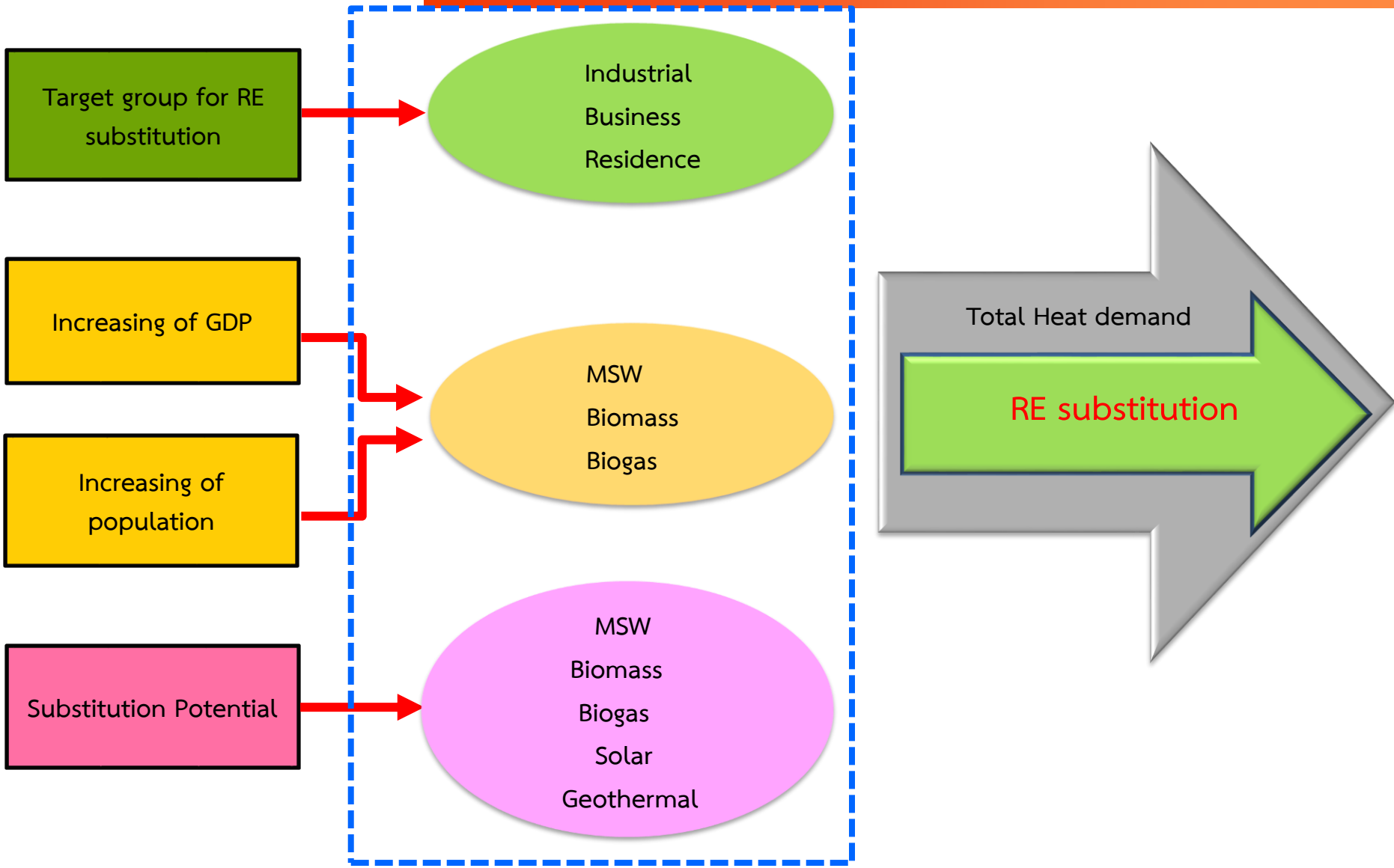


RE potential for power generation

Energy Type	Total Potential	At present (2014)	Remaining Potential	Target in 2036	Energy in 2036
Power	MW	MW	MW	MW	GWh
1. MSW	697.01	65.7	631.31	501.00	3,072.13
2. Biomass	8,492.01	2,451.8	6,040.21	5,570.00	34,155.24
3. Biogas	657.58	311.5	346.08	600.00	3,679.20
4. Biogas (Energy crop)	4,287.05	-	4,287.05	680.00	4,646.30
5. Small Hyfropower	410.00	142.0	268.00	376.00	1,350.44
6. Wind	14,141.00	224.5	13,916.50	3,002.00	4,733.55
7. Solar	42,356.67	1,298.5	41,058.17	6,000.00	8,409.60
8. Large Hydropower	2,906.00	2,906.0	-	2,906.00	5,235.00
Total	73,947.32	7,400.0	66,547.32	19,635.00	65,281.46
Final Energy Consumption (ktoe)				326,119.00	131,000.00
RE share (%)				20.02%	4.25%



Concepts for prediction of heat production



Target groups of heat generation promotion

Industrial Sector

- Large Industry
- Community Enterprise
- SMEs

- Biomass
- Biogas
- MSW
- Solar (Hot Water+Drying)
- Geothermal

Business Sector

- Hotel
- Hospital
- Department Store
- Business Office

- Solar (Hot Water, PV-Air Conditioning)

Residence

- House
- Village, Community

- Biomass
- Biogas
- Solar (Hot Water, PV-Air Conditioning)

RE potential for heat generation

Energy Type	Total Potential	At present (Sep.2014)	Remaining Potential	Target in 2036
Heat	ktoe	ktoe	ktoe	ktoe
1. MSW	200.00	98.03	101.97	200.00
2. Biomass	15,368.31	5,153.00	10,215.31	15,000.00
3. Biogas	1,000.00	496.13	503.87	1,000.00
4. Solar	1,255.91	4.89	1,251.02	1,200.00
5. Other Alternative Energy	361.00	-	361.00	100.00
Total	18,185.22	5,752.05	12,433.17	17,500.00
Final Energy Consumption (ktoe)				131,000.00
RE share (%)				13.36%

RE utilization for heat generation

Utilize RE instead of coal, oil and natural gas in an industrial sector, or heat applications

- Biogas : Generate biogas from waste water/ or industrial waste, and use as fuel in production line
- Biomass : Use for direct combustion or biomass pellet in the industrial's boiler
- MSW : Transform to RDF of pellet
- Solar: : Use solar collector to rise up water temperature, and use for boiler's feed water or other applications

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Biofuel – Target and Concepts

DEMAND

Goals

Substitute fossil fuel with domestic biofuel

Jan.-Sep. 2014	2579 BAU	2579 EE
22×10^6 l/d	33×10^6 l/d	?

ที่มา: สนพ.

Maximum blending in car and motorbike 85%

ม.ค. – ก.ย. 2557	2579 BAU	2579 EE
58×10^6 l/d	95×10^6 l/d	?

ที่มา: สนพ.

FAME Biodiesel can substitute diesel 7%

BHD Biodiesel can substitute diesel 20%

SUPPLY

Goals

Increase value for domestic agricultural products

Gasoline substitution - Ethanol

1. Sugar cane and sugar strategy (2014 – 2036)

Increase sugar cane crop area from 10 million rai to 16 million rai within 2036

2. Cassava and product strategy (2014 - 2036)

Increase product per rai from 3.5 ton/rai to 7 ton/rai in 2036

Ref: Office of Agricultural Economy

Diesel substitution – Biodiesel (FAME) and high level biodiesel BHD

Palm Oil strategy (2015-2036)

Increase oil palm crop area from 4.2 million rai to 7.5 million rai within 2036

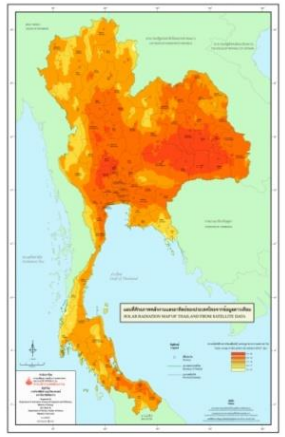
Ref: Office of Agricultural Economy

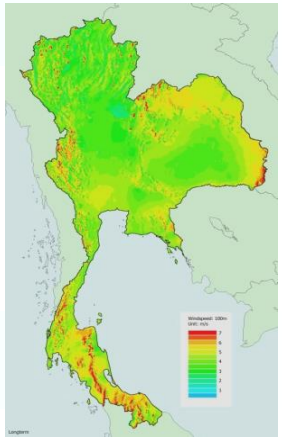
Promotion guidelines

Data and Information Support

Energy Potential

- Wind energy potential map and electronics database
- Solar energy potential map
- Biomass/Biogas/MSW potential database





Prototype Demonstration

- Large scale wind turbine
- On-shore and valley small scale wind turbine
- Standard biogas system
- Standard solar drying system

Study and development on new energy

- Cost reduction for advanced biofuel production (2^{nd}/3^{rd} Gen.)
- Research and develop for raw materials and technologies for the 2^{nd} generation biofuel (biofuel from biomass)
- Follow up the 3^{rd} generation biofuel (biofuel from algae)

Policy Incentives

Contact and discuss with relate organizations

Ministry of Agriculture and Cooperatives

1. Raw material development
2. Zoning of agricultural area
3. Energy plant Contact farming

Ministry of Transport

1. High efficiency energy saving in transportation
2. Clear and continuous biofuel promotion policy
3. Automobile industrial promotion

Ministry of Industry

1. Biofuel plant

Feed in Tariff (FiT)

Installed Capacity (MW)	FiT (THB/kWh)			Supporting Period (years)	FiT Premium (THB/kWh)	
	FiT_F	$FiT_{V,2560}$	FiT[(1)]		Biobased Fuel (for the first 8 years)	special Southern zones[(2)] (for project lifetime)
1) Waste-to-Energy						
Existing Capacity ≤ 1 MW	3.13	3.21	6.34	20	0.70	0.50
Existing Capacity > 1-3 MW	2.61	3.21	5.82	20	0.70	0.50
Existing Capacity > 3 MW	2.39	2.69	5.08	20	0.70	0.50
2) Landfill organic waste	5.60	-	5.60	10	-	0.50
3) Biomass						
Existing Capacity ≤ 1 MW	3.13	2.21	5.34	20	0.50	0.50
Existing Capacity > 1-3 MW	2.61	2.21	4.82	20	0.40	0.50
Existing Capacity > 3 MW	2.39	1.85	4.24	20	0.30	0.50
4) Biogas (wastewater/manure)	3.76	-	3.76	20	0.50	0.50
5) Biogas (energy crops)	2.79	2.55	5.34	20	0.50	0.50
6) Small hydro						
Existing Capacity ≤ 200 kW	4.90	-	4.90	20	-	0.50
7) Wind	6.06	-	6.06	20	-	0.50

Renewable Energy Development Barriers

1. Protests by communities, especially biomass power plants;
2. Limitation of grid connection due to inadequate capacity of transmission lines;
3. License delay and long process for getting power purchase concession;
4. Obstruction by laws or regulations;
5. Lack of support from financial institutions;
6. Changes in government policy.

Renewable Energy Project

Solar Energy

Solar Farm

0.630 MWp Solar Farm, Ekarat Engineering PCL.,Pracheenburee.
(COD done in 2010).

0.55 MWp x 10 = 5.5 MWp, Thai Solar Plant Group, Saraburi.
(COD done in 2012)

0.55 MWp x 10 = 5.5 MWp, Thai Solar Plant Group, Saraburi.
(COD done in 2012)

1.0 MWp, Chiangrai North Wood Co., Ltd. , Lampang.
(COD done in May 2012)

1.0 MWp, PP Solar Power Co., Ltd. , Nongkhai.
(to COD, End 2012)

Solar Rooftop

Solar Energy

TPVA

Cells and Modules Manufacturers in Thailand

Company	Product	Capacity (MW)	Machine	Investment Cost (Million Baht)	Production Year	Location
Solartron Plc.	Cryst. Si Cells	75	Japan	3,000	2013	Nakornraschasrima
	Cryst. Si Modules	75	germany	500	2004	Nakornraschasrima
Bangkok Solar	A-Si Cells/Modules	5	Hungary	500	2004	Chaseongsao
	A-Si Cells/Modules	10	USA	1,300	2007	Chaseongsao
	A-Si Cells/Modules	15	USA	2,000	Dec-07	Chaseongsao
Sharp (Thailand)	Cryst. Si Modules	7	Japan		2005	Nakornpathom
Thai Agencies	Cryst. Si Modules	5	Japan	50	2005	Ayudthaya
	A-Si Modules	5	Japan	50	2005	Ayudthaya
Ekarat Solar	Cryst. Si Modules	15	Japan	100	2005	Chaseongsao
	Cryst. Si Cells	25	Germany	1,500	2006	Rayong
Full Solar	Cryst. Si Modules				2014	
*****	Cryst. Si Modules				2015	
Total		237		9,000		

Solar Energy

TPVA

Inverter Manufacturers in Thailand

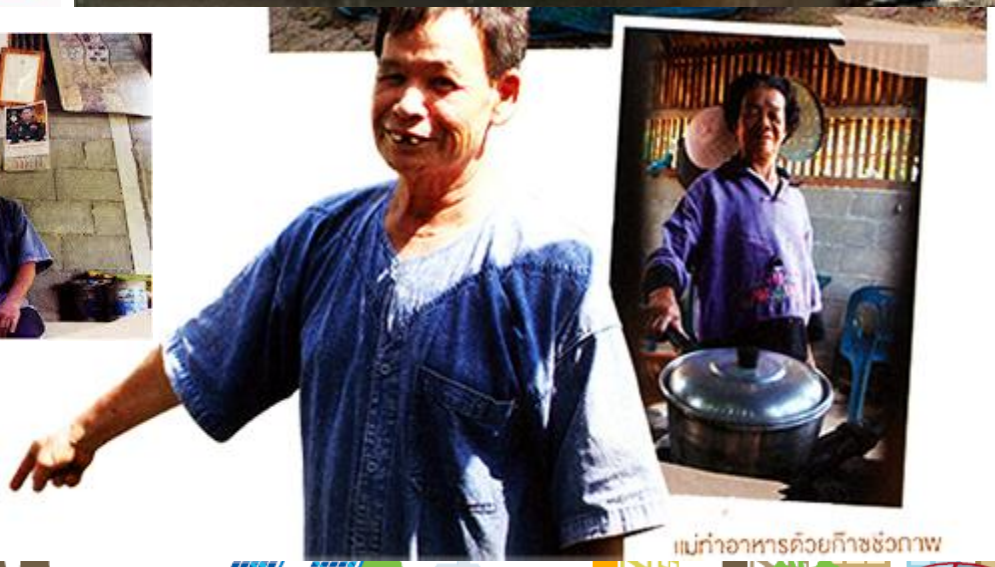
Brand	Original Technology
1. Leonics	Thailand
2. Delta Electronics	Taiwan, Germany
3. Tabuchi	Japan

Wind Energy

Nakhon ratchasima: 90x2.3 MW

Biogas Energy

Biogas in Community



Thank you for Your attention

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