





International Conference On Inclusive Science, Technology and Innovation Policies for Promoting the Transfer of New and Emerging Technologies in Water and Energy Sectors Date: 27 November 2018

Venue: Pullman Bangkok King Power Hotel, Bangkok, Thailand

Development of Renewable Energy in Thailand

Private Sector Perspectives

Mr. Arthit Vechakij Vice Chairman, Renewable Energy Industry Club, Federation of Thai Industry







Southeast Asia Energy Outlook 2017



RENEWABLES GLOBAL FUTURES REPORT

GREAT DEBATES TOWARDS 100 % RENEWABLE ENERGY



EXECUTIVE SUMMARY



Key world energy statistics

Also available on smartphones and tablets



INTERGOVERNMENTAL PANEL ON Climate change

CLIMATE CHANGE 2014

Synthesis Report



S" [TI-U] S fi(POIT (IF NU AITH ASSUWSCI UFOIT OF **HE** INJtAGO(IbMI,b"(AI "-LO **I**WMAfi CM**AFE**)



Global Energy Potential

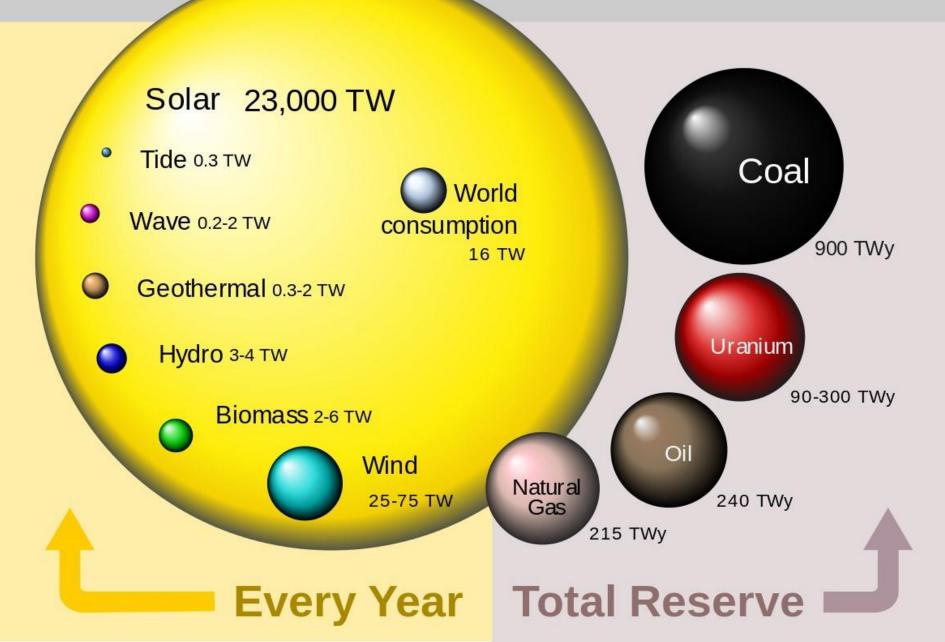
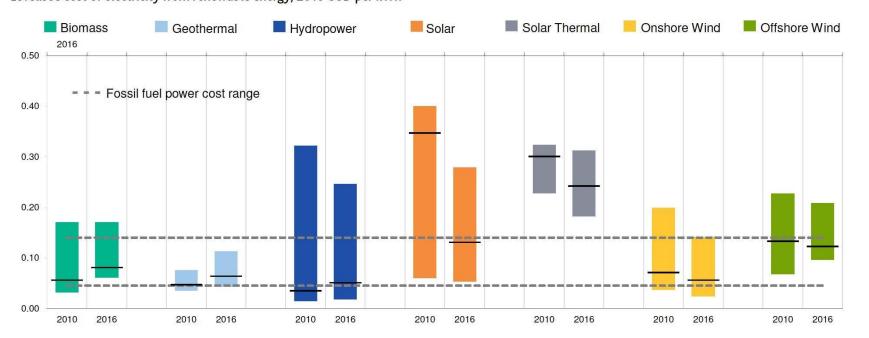


Exhibit 3

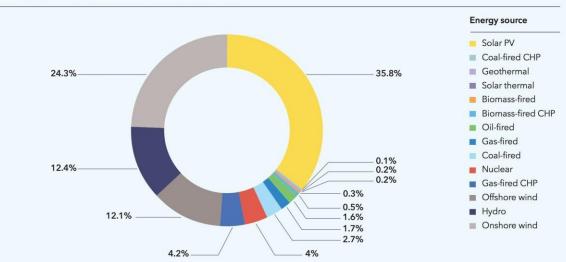
The cost of renewable energy technologies has become competitive with fossil fuels Levelised cost of electricity from renewable energy, 2016 USD per kWh



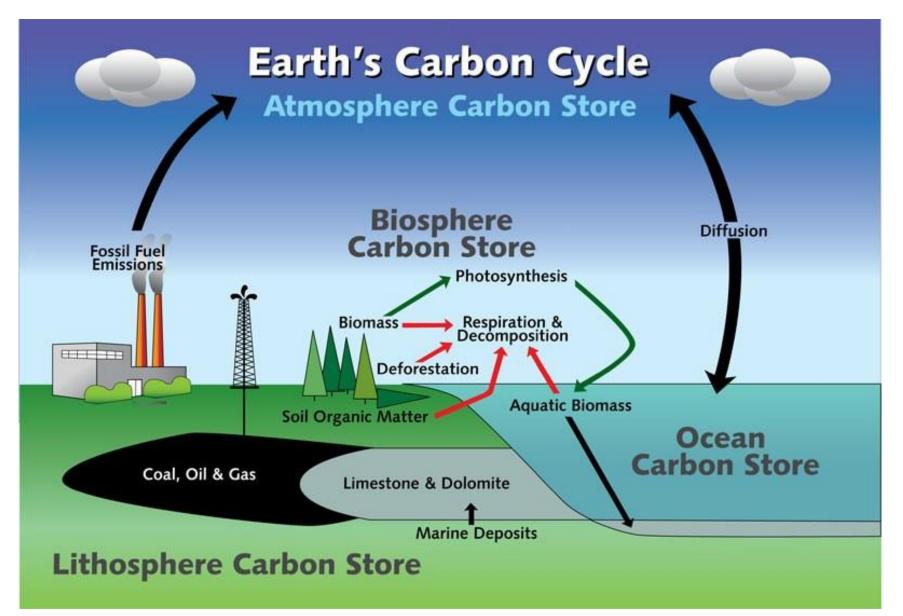
Note: The bars represent the min-max range in LCOE, and the black lines are the average. All costs are in 2016 USD. Weighted Average Cost of Capital is 7.5% for OECD and China and 10% for Rest of World. Preliminary data for 2016.

Source: IRENA's Renewable Cost Database

GLOBAL ELECTRICITY PRODUCTION IN 2050 (FIGURE 3-3)



Carbon Cycle Diagram from the IPCC

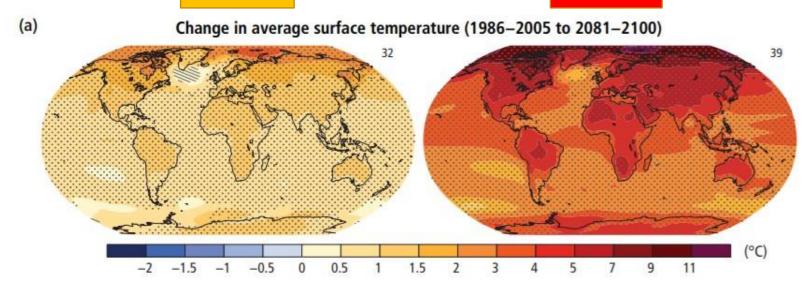


Climate Change in Reality Observed globally averaged combined land and (a) Sea ice extent (Č) 15 ocean surface temperature anomaly 1850–2012 Sea ice extent (million km²) Arctic (July - August - September) Annual average 0.2 10 0 Temperature (°C) relative to 1986-2005 -0.2 Antarctic (Februar 5 -0.4-0.6 1920 1960 2000 1900 1940 1980 -0.8 Year (d) -1 Global mean sea level change 1900-2010 **Decadal** average 0.1 Global average sea level (m) relative to 1986–2005 0.2 0 0 -0.2 -0.4 -0.6 -0.1 -0.8 -1 -01960 1900 1950 2000 1900 1920 1940 1980 2000 1850 Year Year Observed change in annual precipitation over land **Observed change in surface temperature** (b) (e) 1901-2012 1951-2010 0.2 0.4 0.6 0.8 1.0 1.25 1.5 1.75 2.5 -100 -50 -25 -10 -5 -2.5 0 2.5 5 10 25 50 100 -0.6 -0.4 -0.2 0 (°C) (mm/yr per decade)

It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise

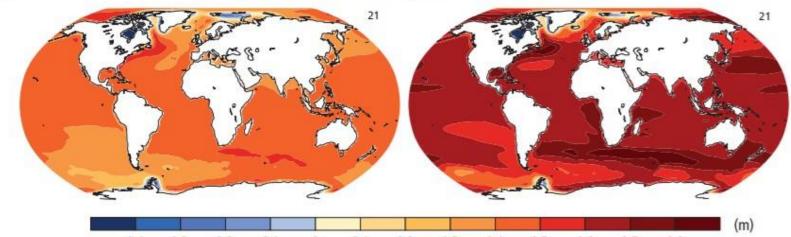
Best Case

Base Line



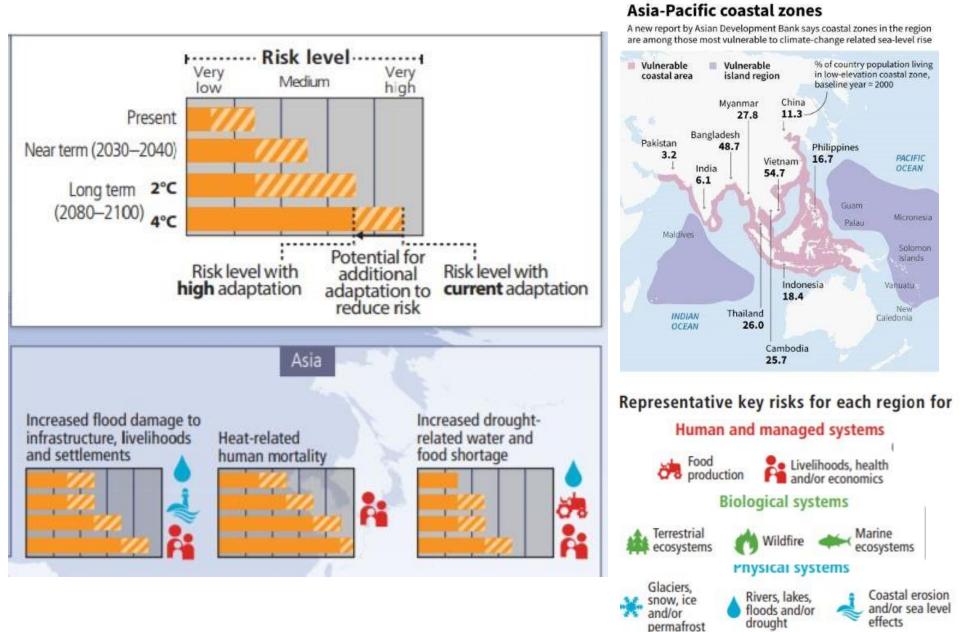
(c)

Change in average sea level (1986-2005 to 2081-2100)



-0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

Climate Change Key Risks and Potential for Risk Reduction



list of Impacts of Climate Change

shifting seasons that affect planting and growing periods;

extreme heat, droughts, increased aridity and water shortages that reduce or wipe out yields;

erratic rainfall that makes farm planning difficult if not impossible;

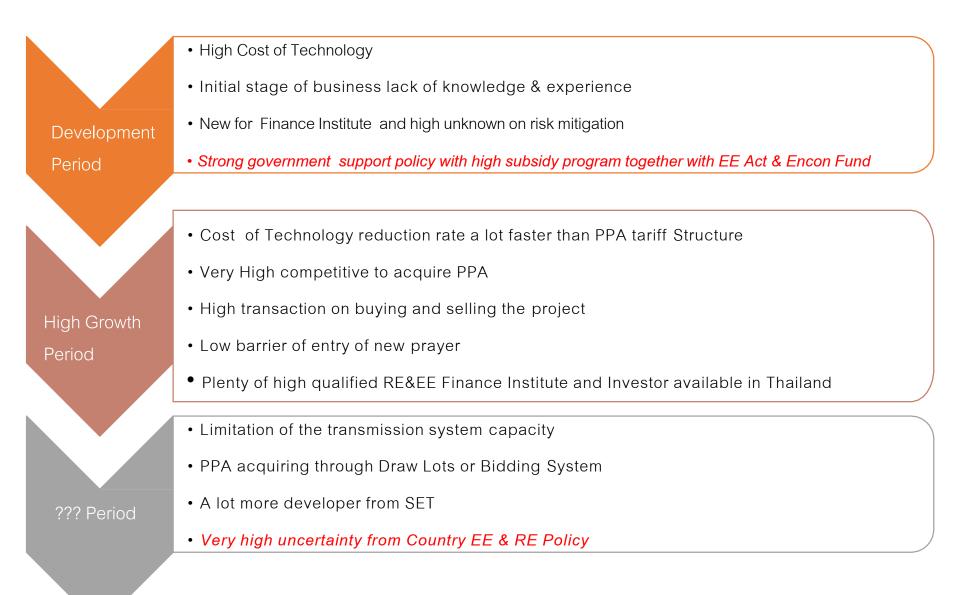
storms, floods and landslides that destroy crops, livestock and homes;

rising sea levels that salinate farm land;

increased human, plant and livestock diseases;

and lowered productivity of livestock, including fisheries.

Thailand Renewable Energy Business Development

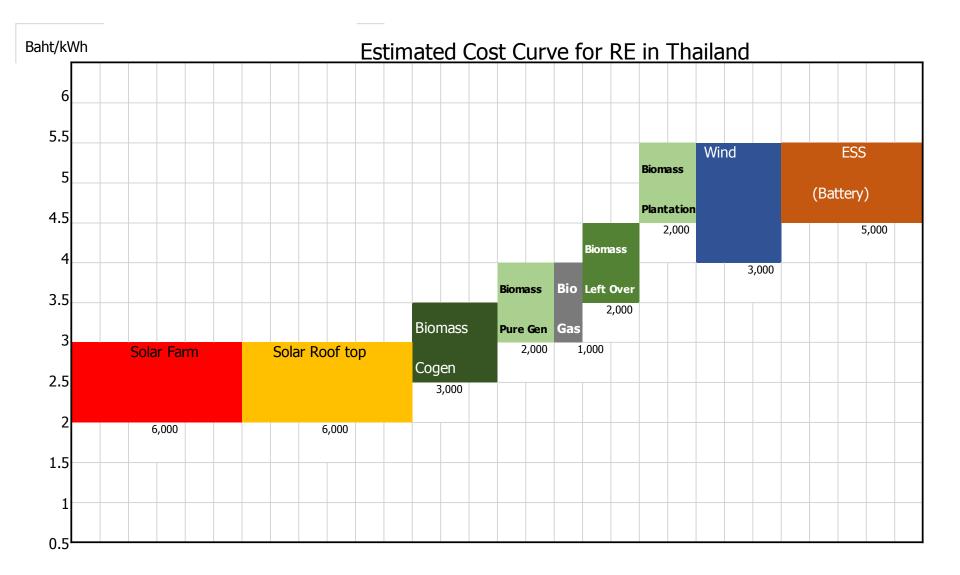


Renewable Energy Expenses

Forex 34.5 Baht/USD

ltem	Categories	Investment	Operating	Unit	Tariff	Unit
		(USD/kW)	Expenditure (cent/kWH)	(MWH/20yr/MW)	(baht/kWH)	(MWH/20yr/MW)
1	Solar					
	1.1 Solar Farm < 5MW	793	1.59	28,382	2.40	28,382
	1.2 Utility Solar Farm > 50MW	793	0.87	28,382	2.10	28,382
	1.3 Solar Roof (Housing)	1,449	0.00	28,382	3.60	28,382
	1.4 Solar Roof (Industry 1 MW)	793	1.59	28,382	2.40	28,382
	1.5 Solar Floating	909	1.45	28,382	2.60	28,382
2	2.1 Biogas from Waste Water > 3 MW	2,029	3.77	130,000	2.80	130,000
	2.2 Biogas from Waste Water < 3 MW	2,899	3.77	130,000	3.30	130,000
3	MSW to Energy (RDF Combustion)	3,768	3.48	144,000	3.30	144,000
4	Biomass 10 MW WoodChip High	2,029	5.80	160,000	3.00	160,000
	Eff. (Heat Rate 14,500 kj/kwh)					
5	Large Scale Wind Farm	1,942	2.90	55,125	3.30	55,125

Thailand RE Estimate Current LCOE @ 10% DR



Utilities and their business models face a growing number of liabilities

The current large scale shift from centralised to distributed generation based on renewables and other technologies can be disruptive for many electric utilities Corporate direct purchase of renewable energy Companies now sign direct power purchase agreements with large-scale off site renewable developers.



Projections for investment in renewables, newly installed capacity and grid parity in various countries suggest a growing share of renewables in the energy mix.

Grid integration

Utilities have improved demand forecasting tools to deal with fluctuating supply of renewables and as a result grid operators can now accept up to 20% renewable capacity.

Historically, power generation has focused on large centralised power plants through the combustion of fossil fuels such as coal and gas, supplemented by nuclear and hydro power.

Carbon Capture & Storage

ccs?

There are few projects in the world aiming to improve the viability and reduce costs, so CCS technology is not yet deployed at scale to have significant impact on emissions reduction.

Energy storage

Progress in energy storage technology is anticipated to further reduce costs and to reduce intermittency-of-supply problems commonly associated with renewables.

4

Energy efficiency

Supply-side energy savings measures are very cost efficient. Various solutions such as the use of LED technology and energy efficient home appliances may change consumer energy use.

Electric vehicles

New solutions and decreasing battery costs are rapidly changing the economics of this technology. Demand for electric vehicles from individual consumers is expected to rise rapidly.

RE Policies from Private Sector Perspectives

The policy of RE PPA pricing not to effect to people must also be aware about social economy, social revenue and environment and energy security

Proper ratio of fuel mix must be seriously considered by country policy maker

PPA selection program must be clear and crystal process & with good governance

Must provide highly support on B to B or Private PPA with clear and simple regulation , such as, 3rd access policy, etc.

Carbon Trading Scheme should be applied

ESS Pilot Project must be implemented on the Grid Distribution Level, such as, Peak Shaving Application under Public Private Participation Program

Energy Efficiency Policies from Private Sector Perspectives

- 1. Energy Efficiency Country Information Management
- 2. EE Technology Trend
- 3. Energy Management Information System / IOT
- 4. Distributed Generation / Smart Grid / Cogeneration
- 5. Virtual Factory Process Improvement
- 6. ESCO for Public Sector