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

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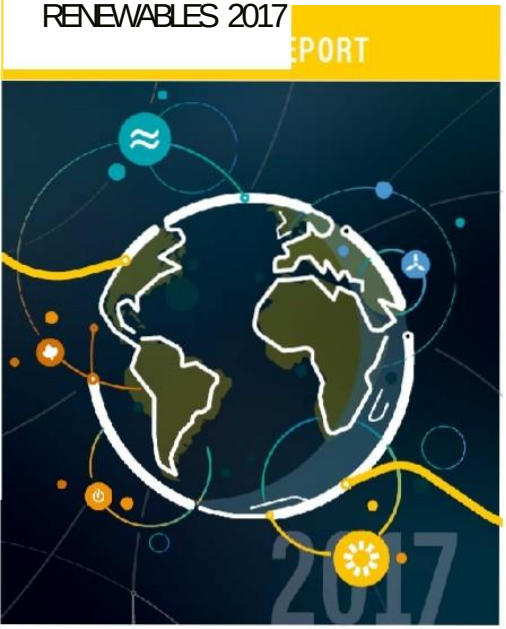
Vice Chairman, Renewable Energy Industry Club,

Federation of Thai Industry

REN21

RENEWABLES 2017



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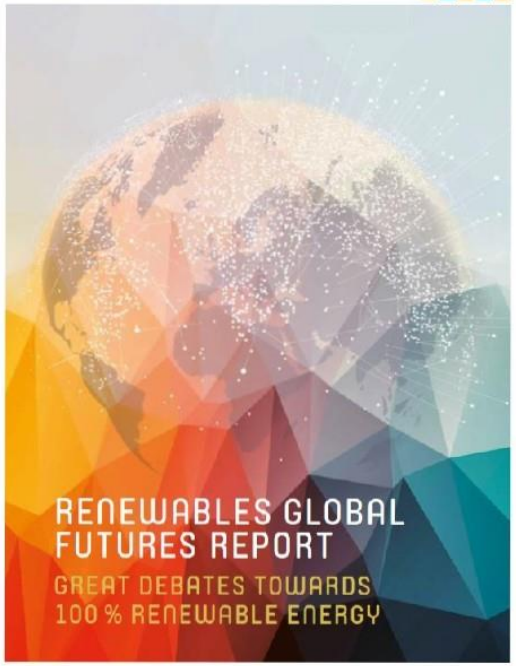

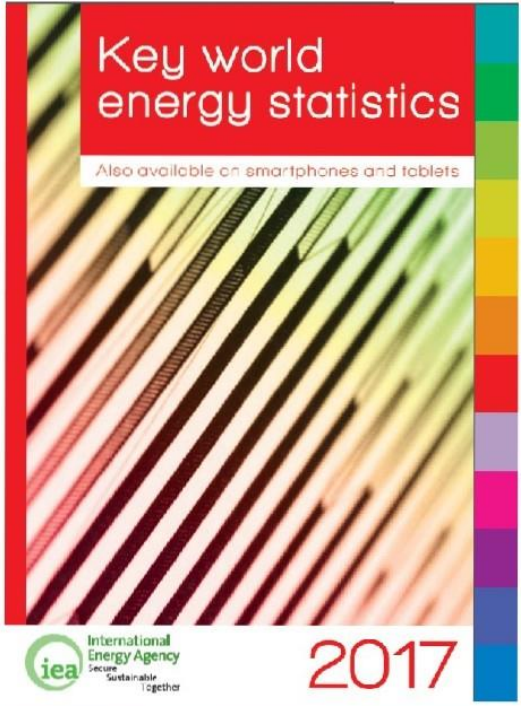

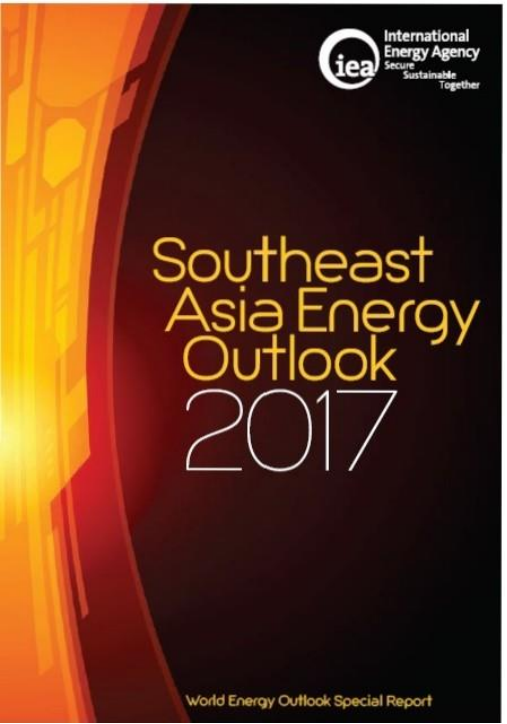

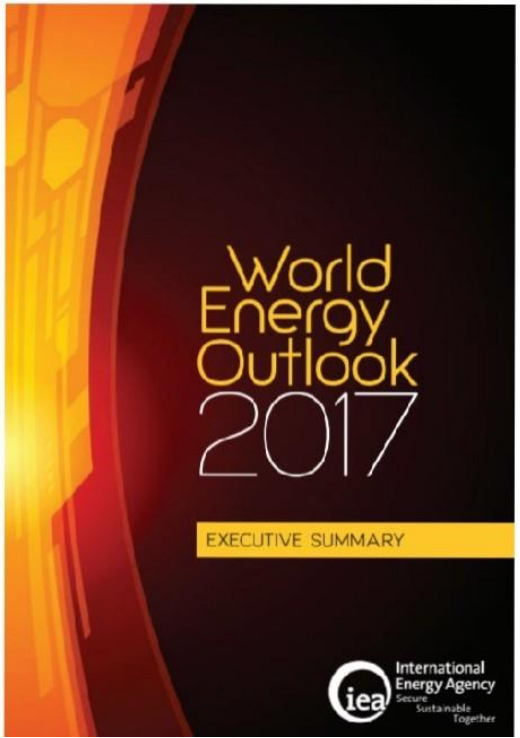

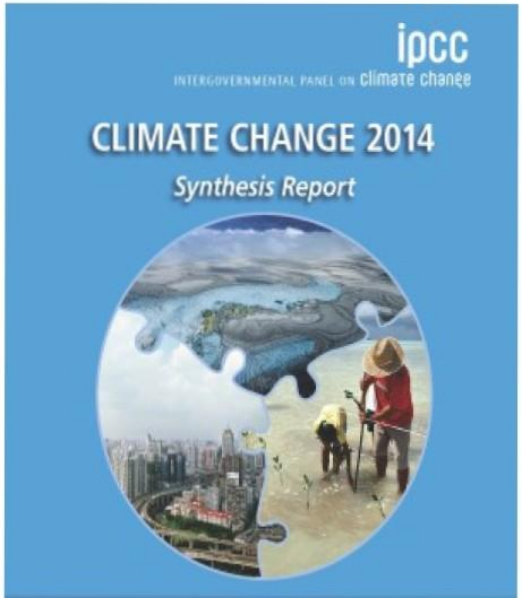

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Global Energy Potential

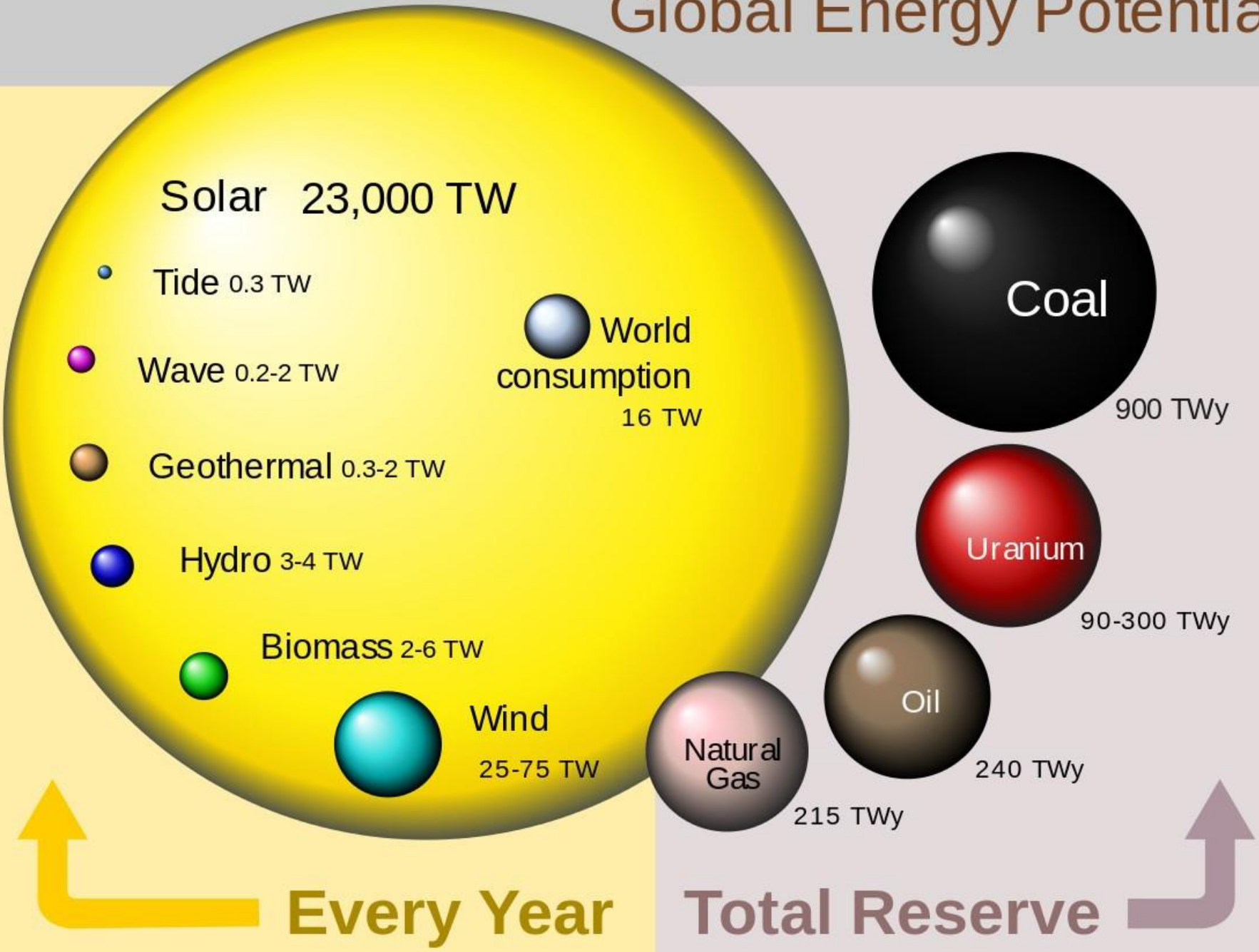
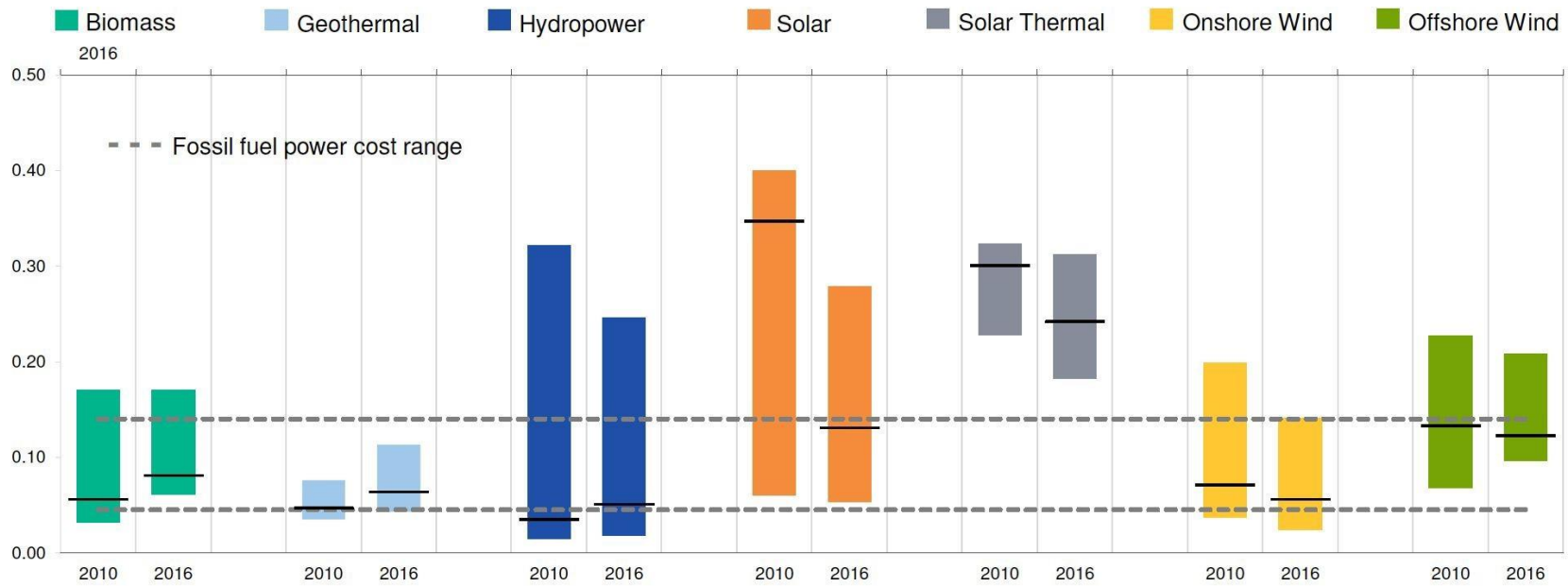


Exhibit 3

The cost of renewable energy technologies has become competitive with fossil fuels

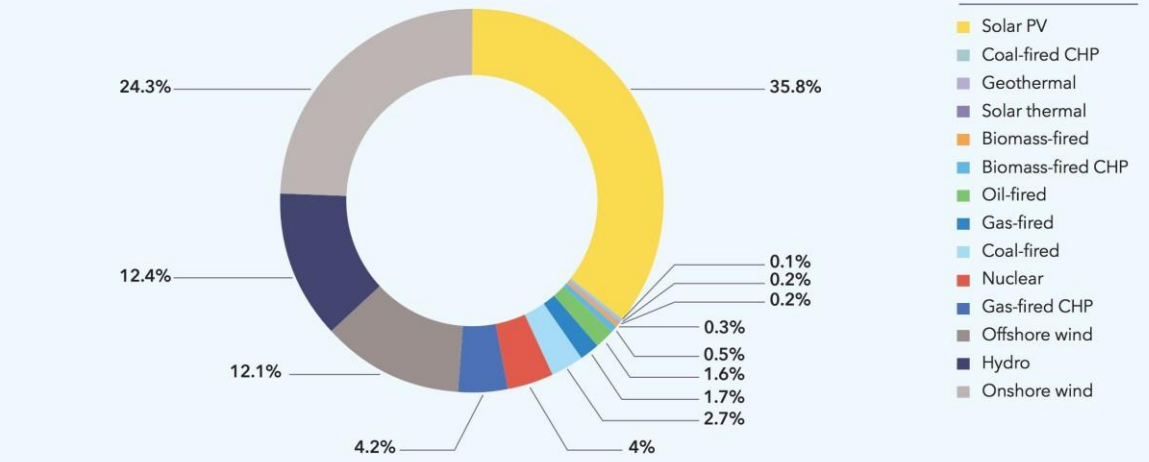
Levelised cost of electricity from renewable energy, 2016 USD per kWh



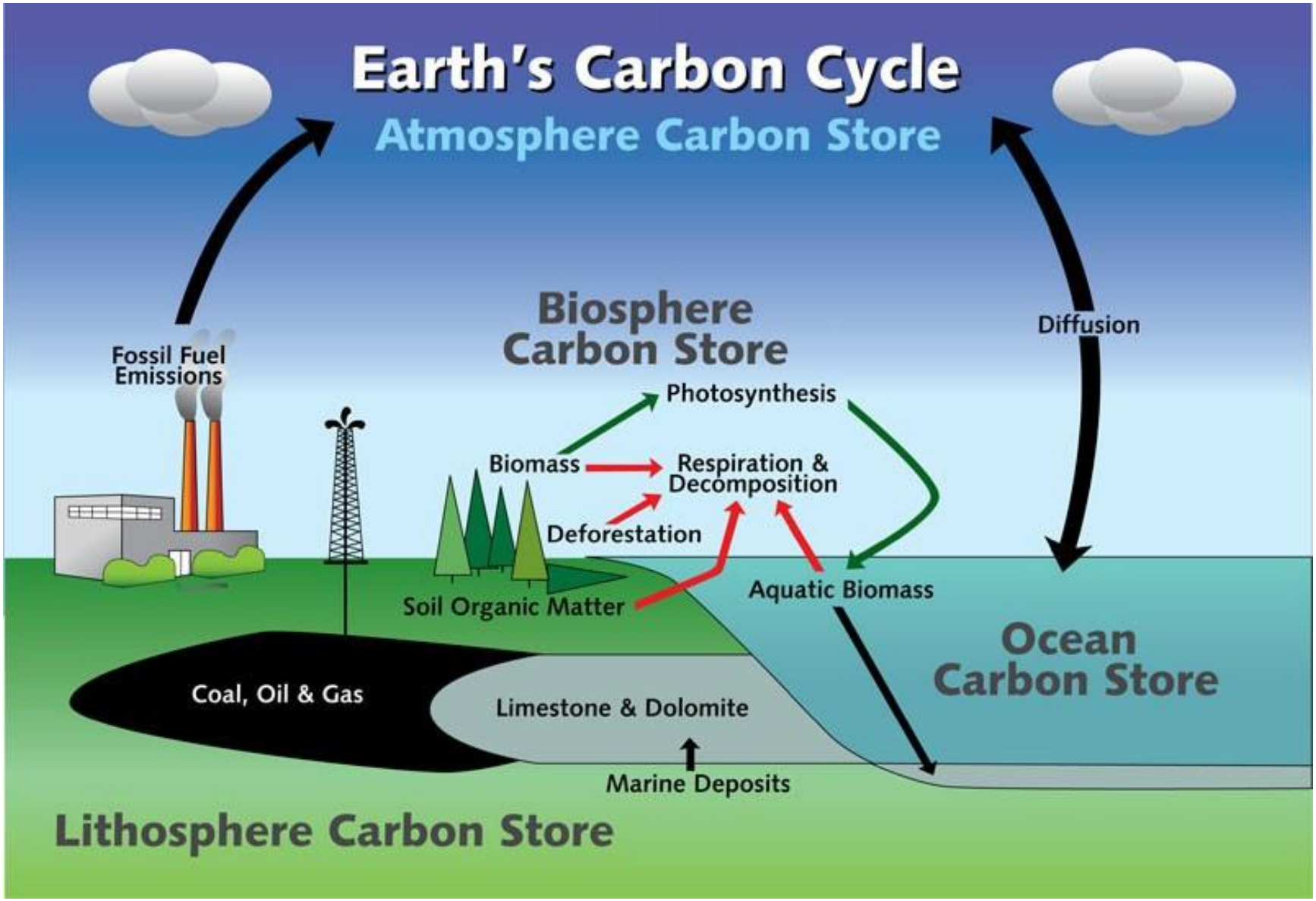
Note: The bars represent the min-max range in LCOE, and the black lines are the average. All costs are in 2016 USD. Weighted Average Cost of Capital is 7.5% for OECD and China and 10% for Rest of World. Preliminary data for 2016.

Source: IRENA's Renewable Cost Database

GLOBAL ELECTRICITY PRODUCTION IN 2050 (FIGURE 3-3)

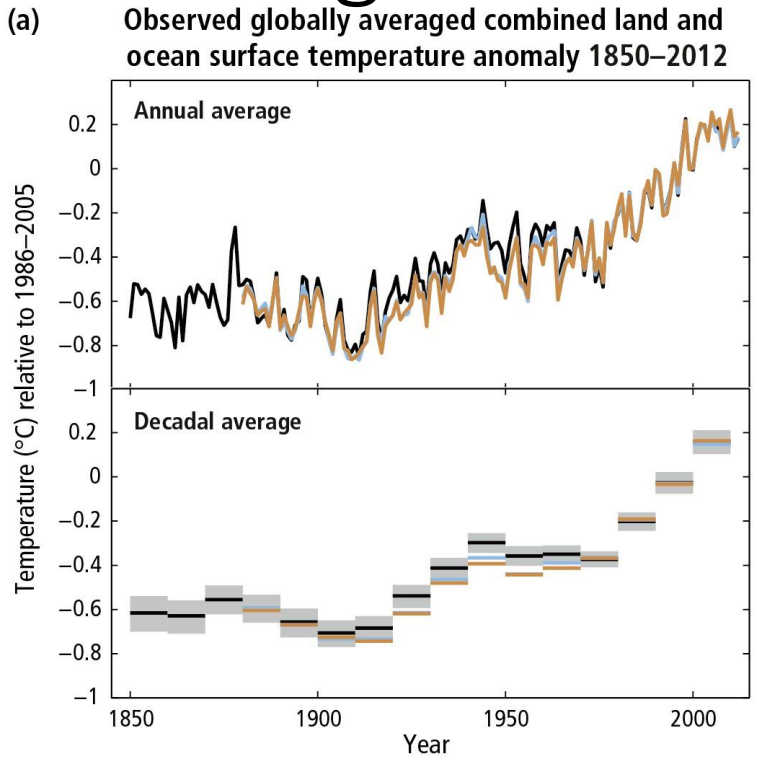


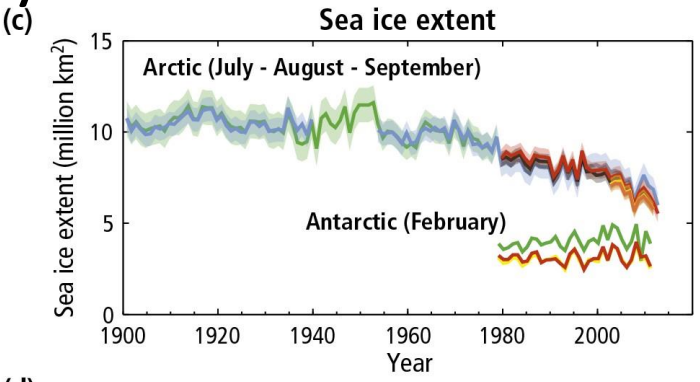
Carbon Cycle Diagram from the IPCC

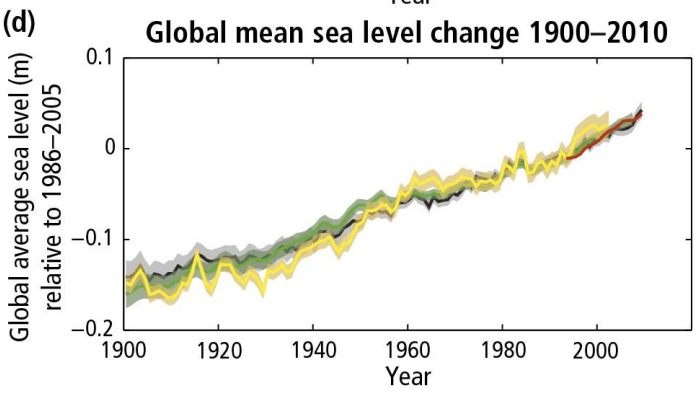


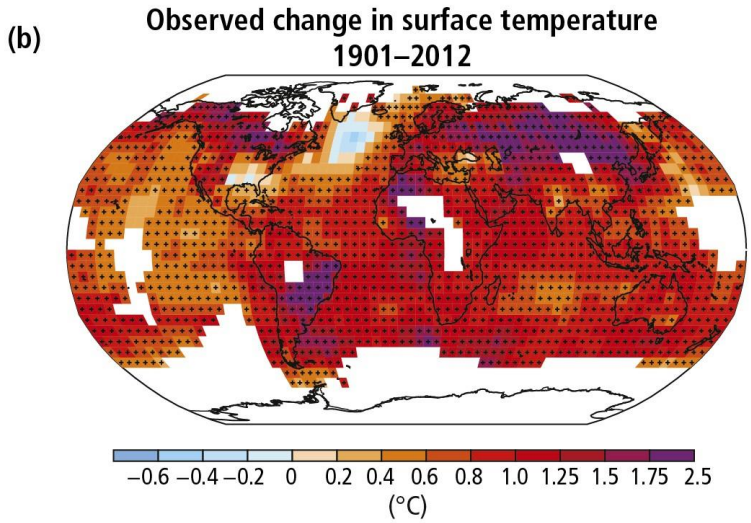
Credit to NYS Department of Environmental Conservation

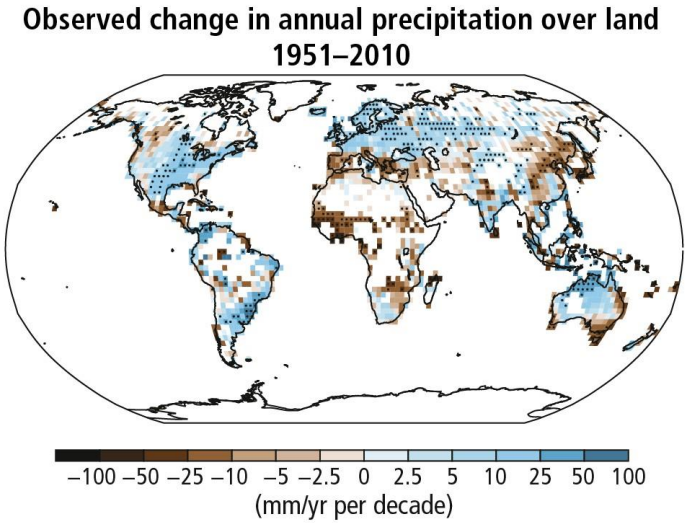
Climate Change in Reality







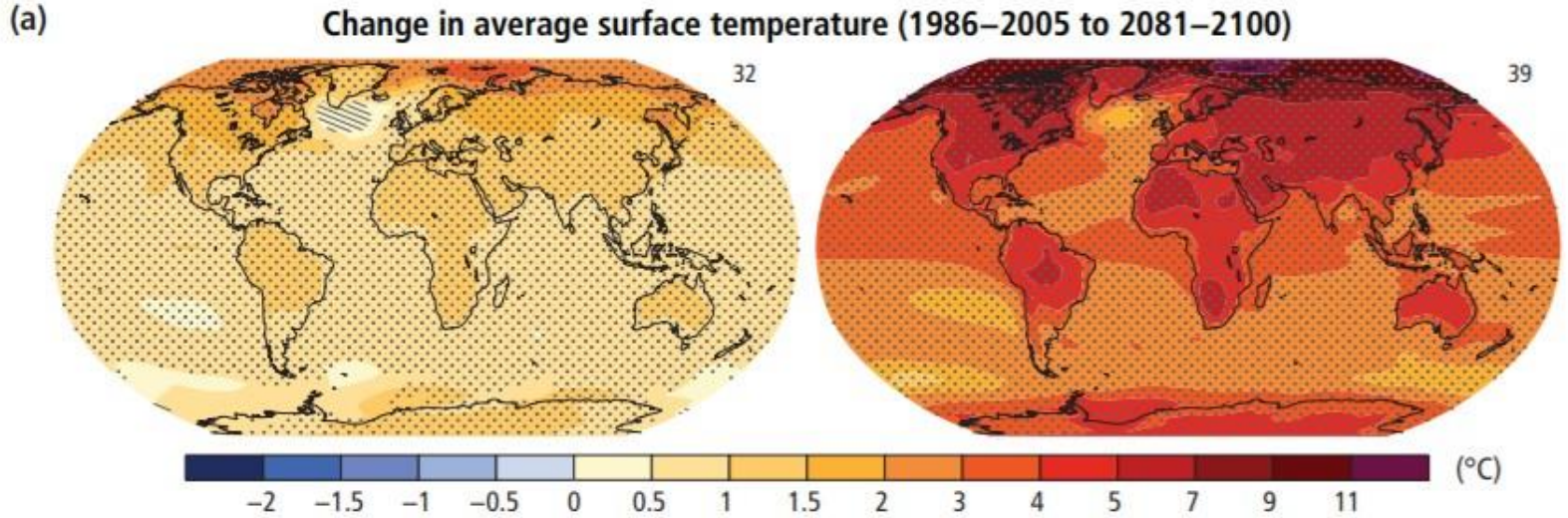


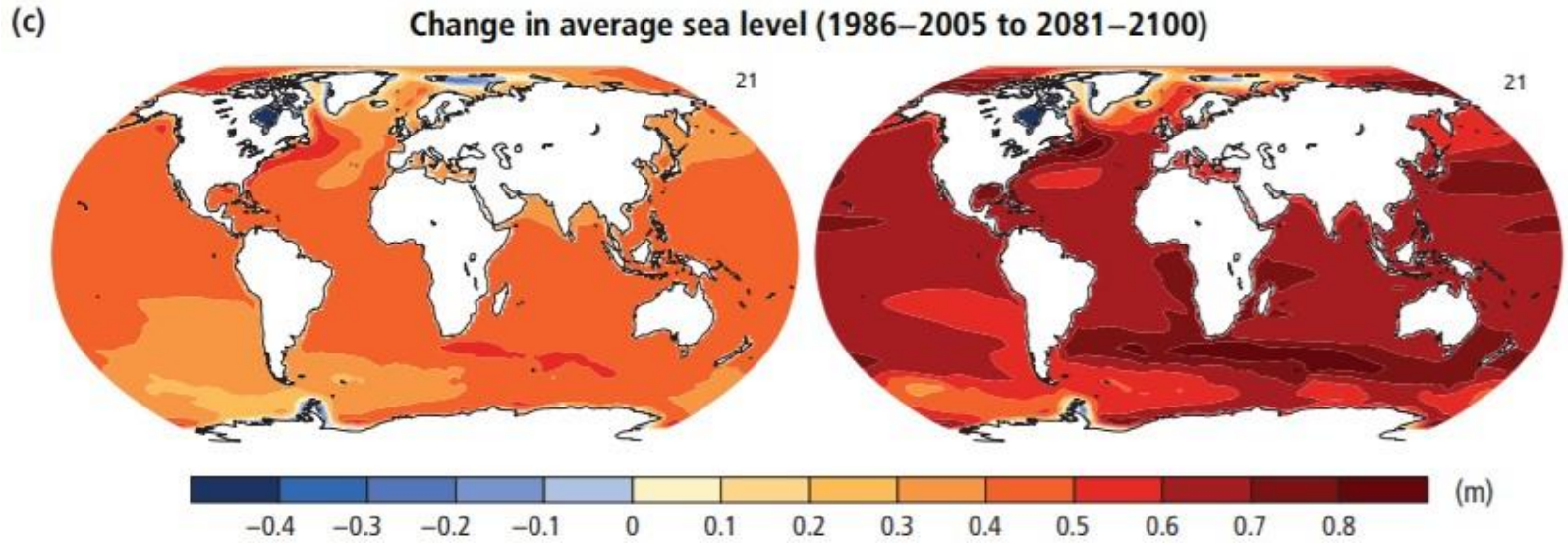


It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise

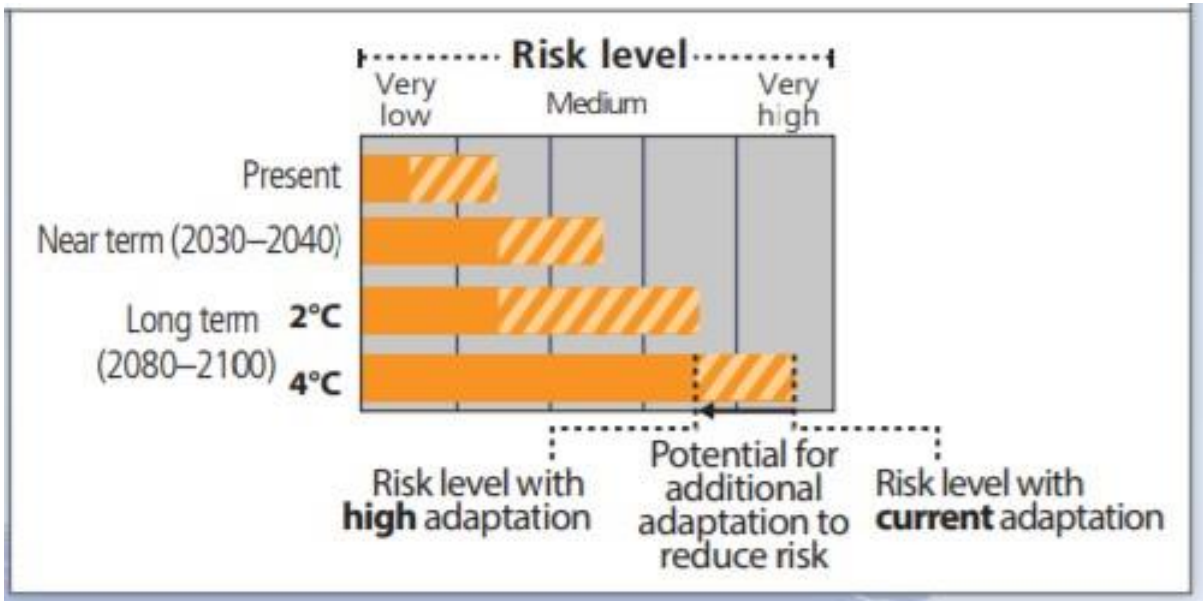
Best Case

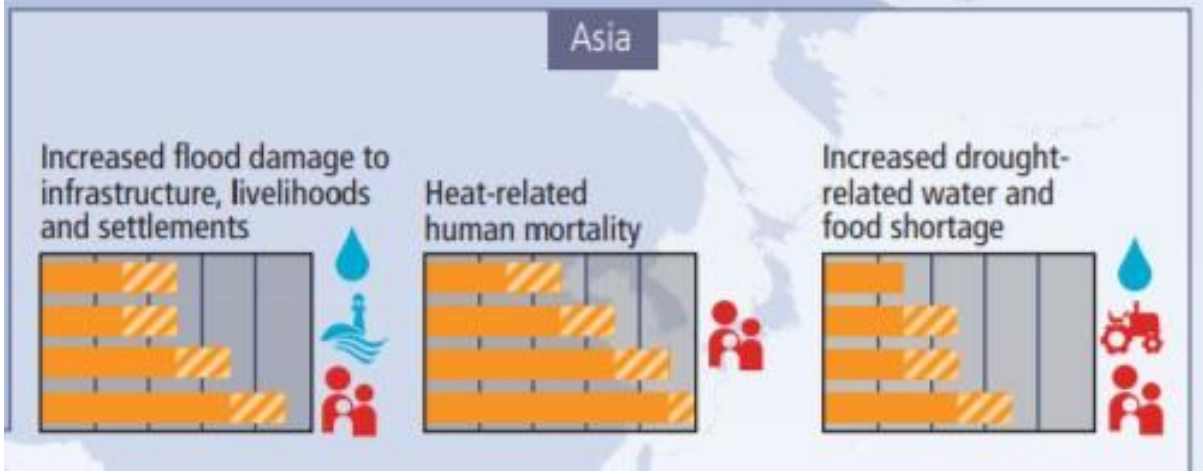
Base Line

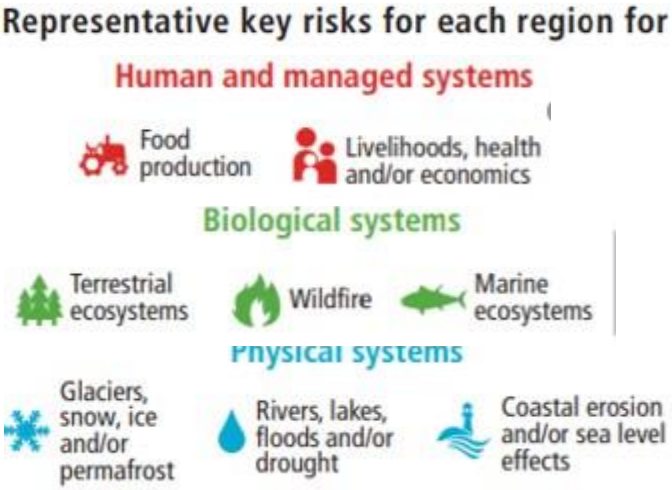




Climate Change Key Risks and Potential for Risk Reduction







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

Development Period

- High Cost of Technology
- Initial stage of business lack of knowledge & experience
- New for Finance Institute and high unknown on risk mitigation
- *Strong government support policy with high subsidy program together with EE Act & Encon Fund*

High Growth Period

- Cost of Technology reduction rate a lot faster than PPA tariff Structure
- Very High competitive to acquire PPA
- High transaction on buying and selling the project
- Low barrier of entry of new prayer
- Plenty of high qualified RE&EE Finance Institute and Investor available in Thailand

??? Period

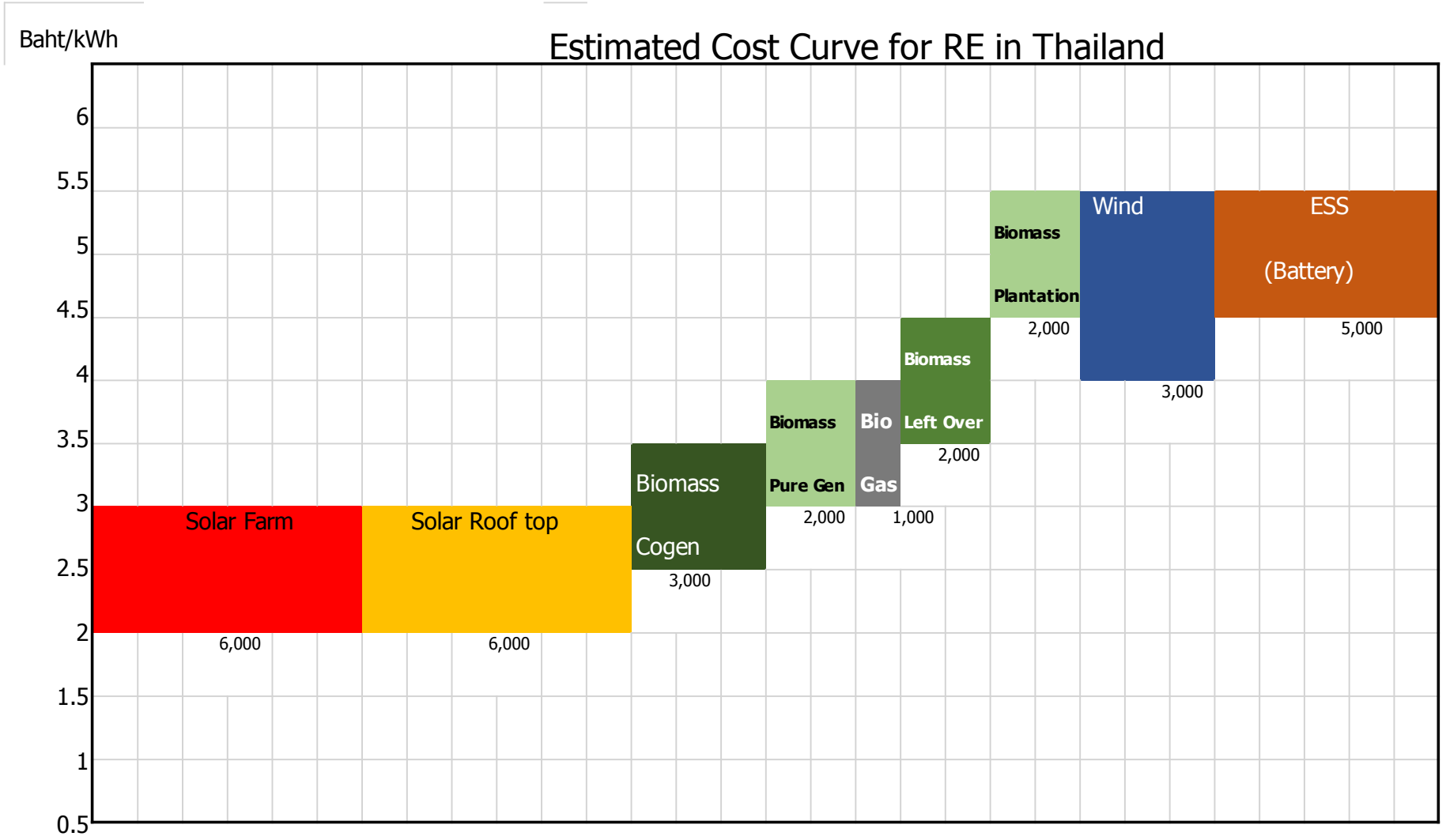
- Limitation of the transmission system capacity
- PPA acquiring through Draw Lots or Bidding System
- A lot more developer from SET
- *Very high uncertainty from Country EE & RE Policy*

Renewable Energy Expenses

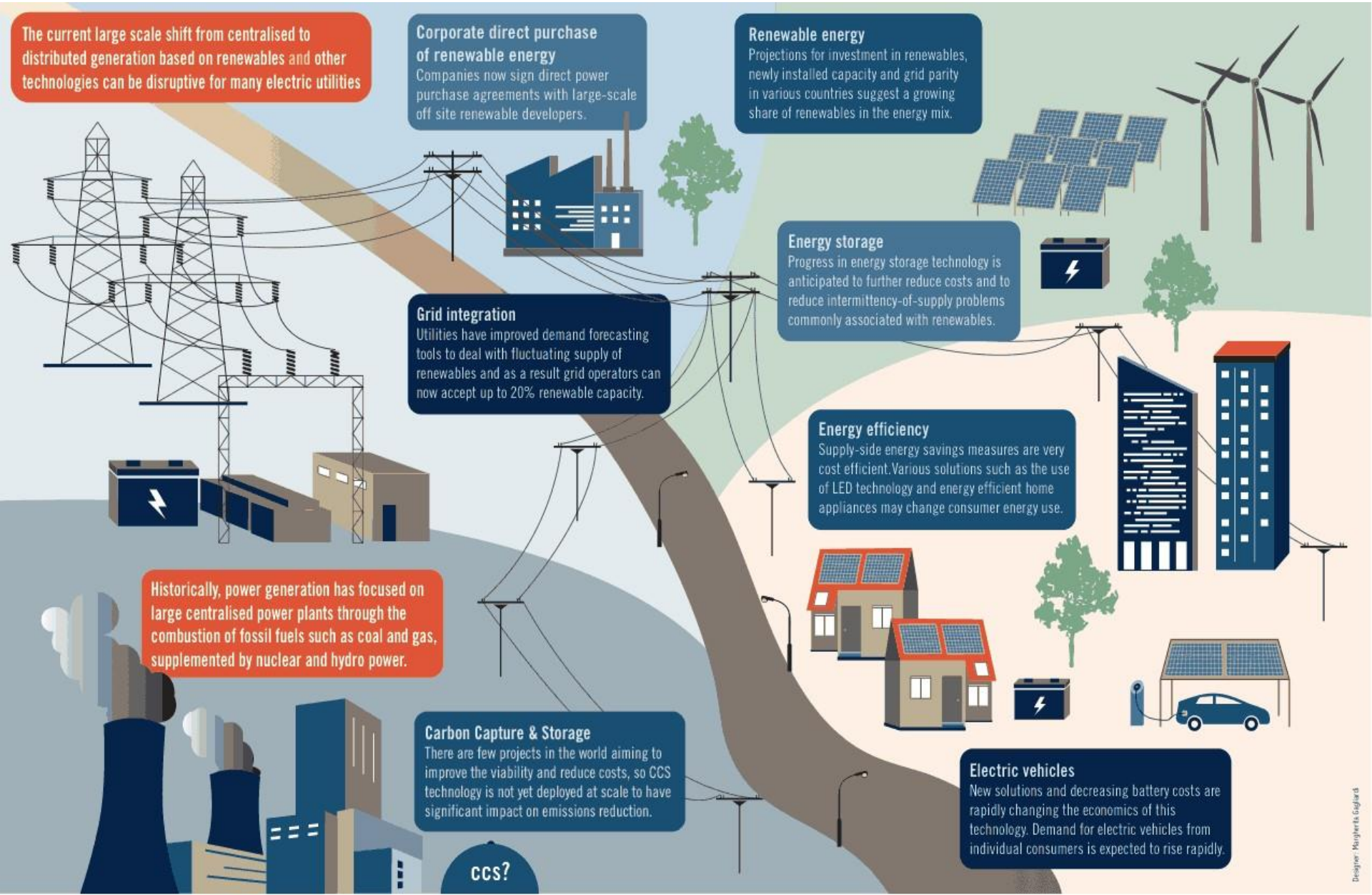
Forex 34.5 Baht/USD

Item	Categories	Investment (USD/kW)	Operating Expenditure (cent/kWH)	Unit (MWH/20yr/MW)	Tariff (baht/kWH)	Unit (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 Eff. (Heat Rate 14,500 kj/kwh)**	2,029	5.80	160,000	3.00	160,000
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



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**