EGAT

Disruptive Technology and Climate Change

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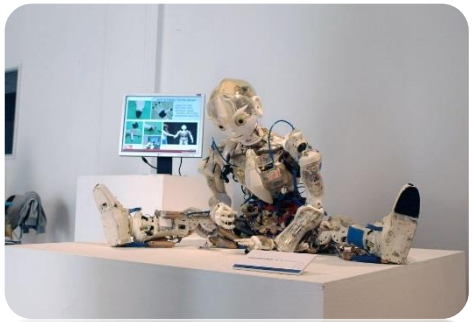
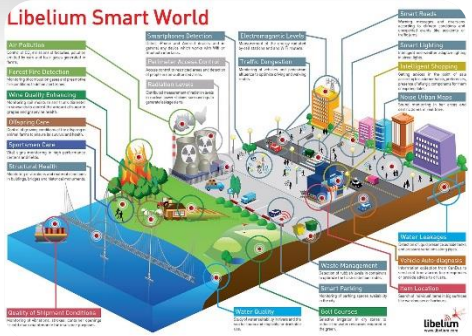
Malaysia

Outline

- Disruptive Technology
- Climate Change
- ASEAN: Case of Thailand
- Electricity Generating Authority of Thailand: EGAT
- Conclusion

❖ Disruptive Technologies



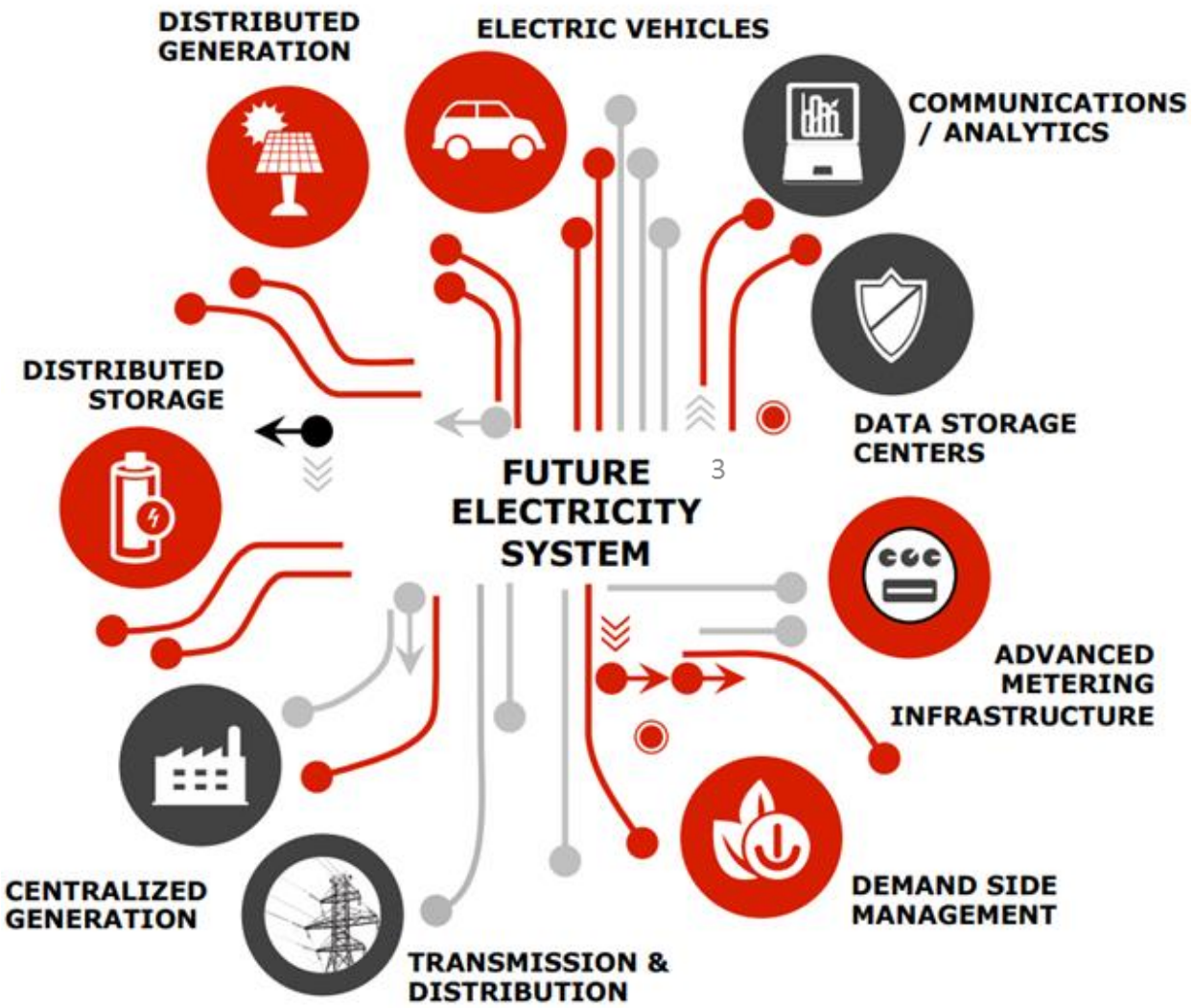


❖ Twelve Potentially Economically Disruptive Technologies

Mobile Internet	Increasingly inexpensive and capable mobile computing devices and Internet connectivity
Automation of knowledge work	Intelligent software systems that can perform knowledge work tasks involving unstructured commands and subtle judgments
The Internet of Things	Networks of low-cost sensors and actuators for data collection, monitoring decision making, and process optimization
Cloud technology	Use of computer hardware and software resources delivered over a network or the Internet, often as a service
Advanced robotics	Increasingly capable robots with enhanced senses, dexterity, and intelligence used to automate tasks or augment humans
Autonomous and near-autonomous vehicles	Vehicles that can navigate and operate with reduced or no human intervention
Next-generation genomics	Fast, low-cost gene sequencing, advanced big data analytics, and synthetic biology ("writing" DNA)
Energy storage	Devices or systems that store energy for later use, including batteries
3D printing	Additive manufacturing techniques to create objects by printing layers of material based on digital models
Advanced materials	Materials designed to have superior characteristics (e.g., strength, weight, conductivity) or functionality
Advanced oil and gas exploration and recovery	Exploration and recovery techniques that make extraction of unconventional oil and gas economical
Renewable energy	Generation of electricity from renewable sources with reduced harmful climate impact

SOURCE: Mc Kinsey Global Institute analysis

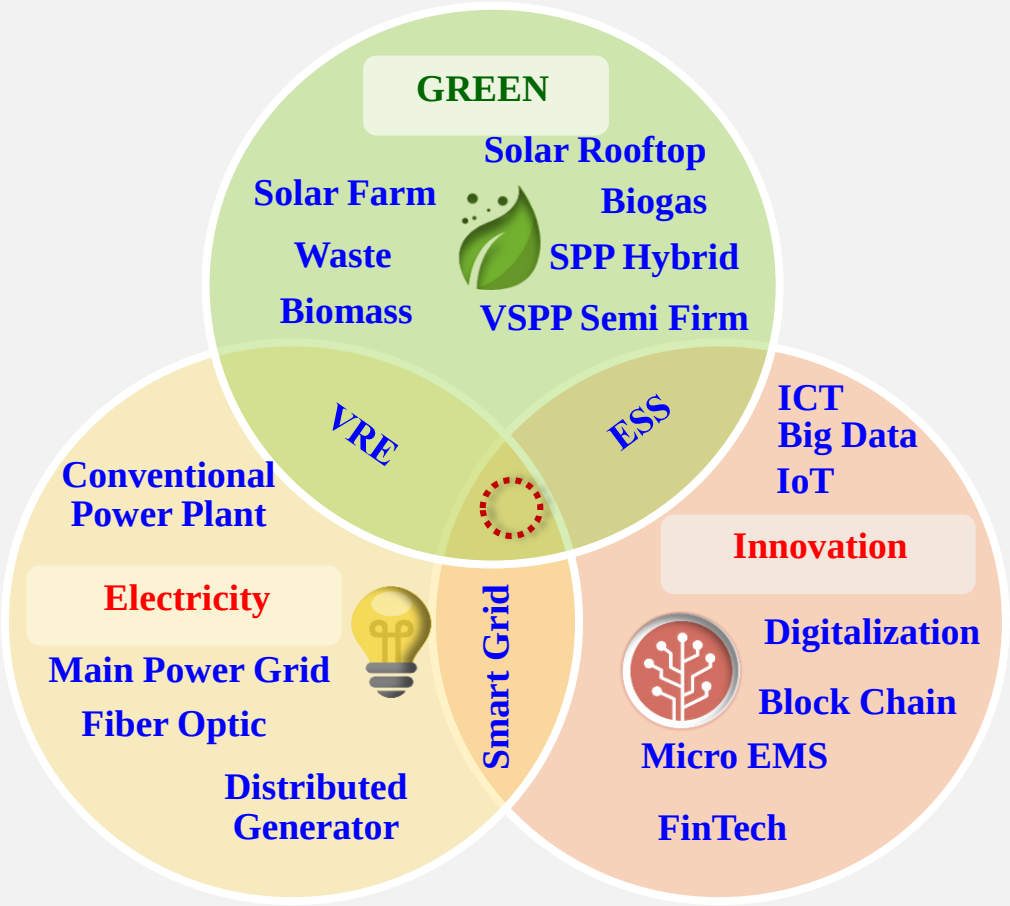
Energy Disruptive Era



SOURCE: World Economic Forum 2017

The Changing of Utility Role

Present → **Future**



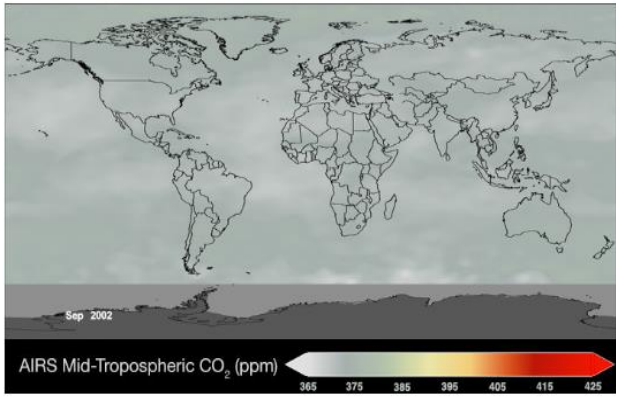
❖ Climate Change

❖ Climate Change

Average Ambient Temperature

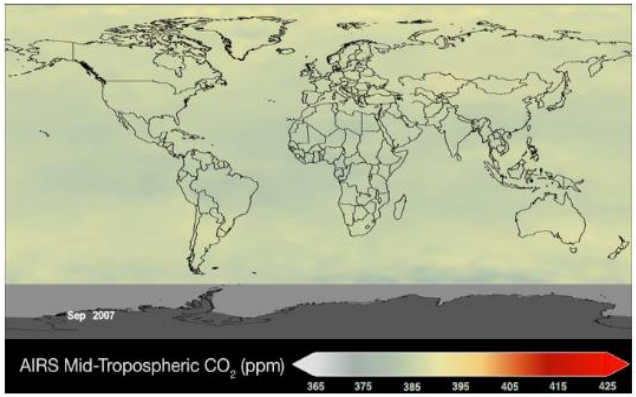
TIME SERIES: 2002-2016
Data source: Atmospheric Infrared Sounder (AIRS).
Credit: NASA

SEPTEMBER
2002



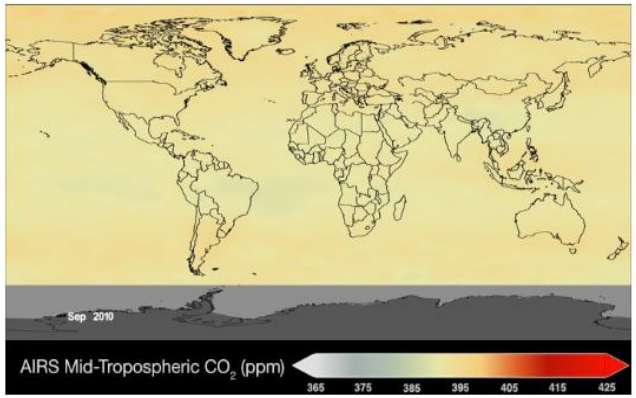
TIME SERIES: 2002-2016
Data source: Atmospheric Infrared Sounder (AIRS).
Credit: NASA

SEPTEMBER
2007



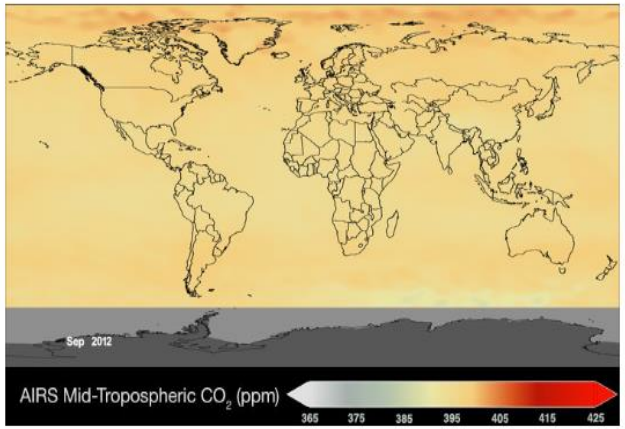
TIME SERIES: 2002-2016
Data source: Atmospheric Infrared Sounder (AIRS).
Credit: NASA

SEPTEMBER
2010



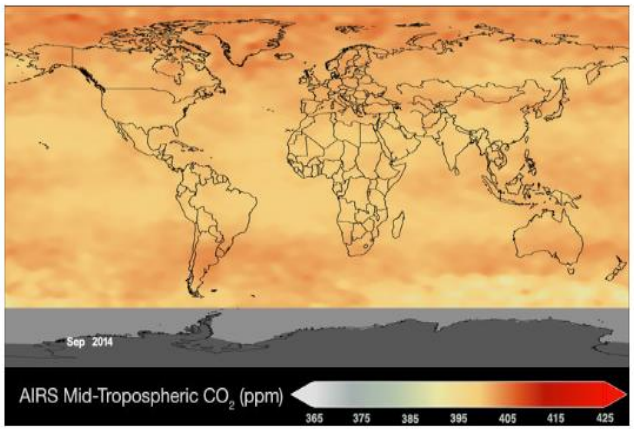
TIME SERIES: 2002-2016
Data source: Atmospheric Infrared Sounder (AIRS).
Credit: NASA

SEPTEMBER
2012



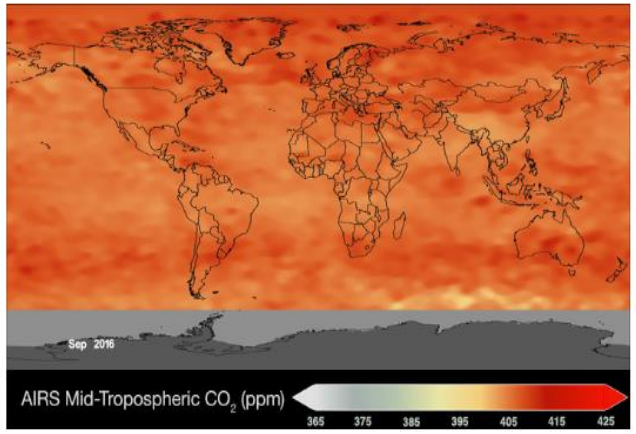
TIME SERIES: 2002-2016
Data source: Atmospheric Infrared Sounder (AIRS).
Credit: NASA

SEPTEMBER
2014

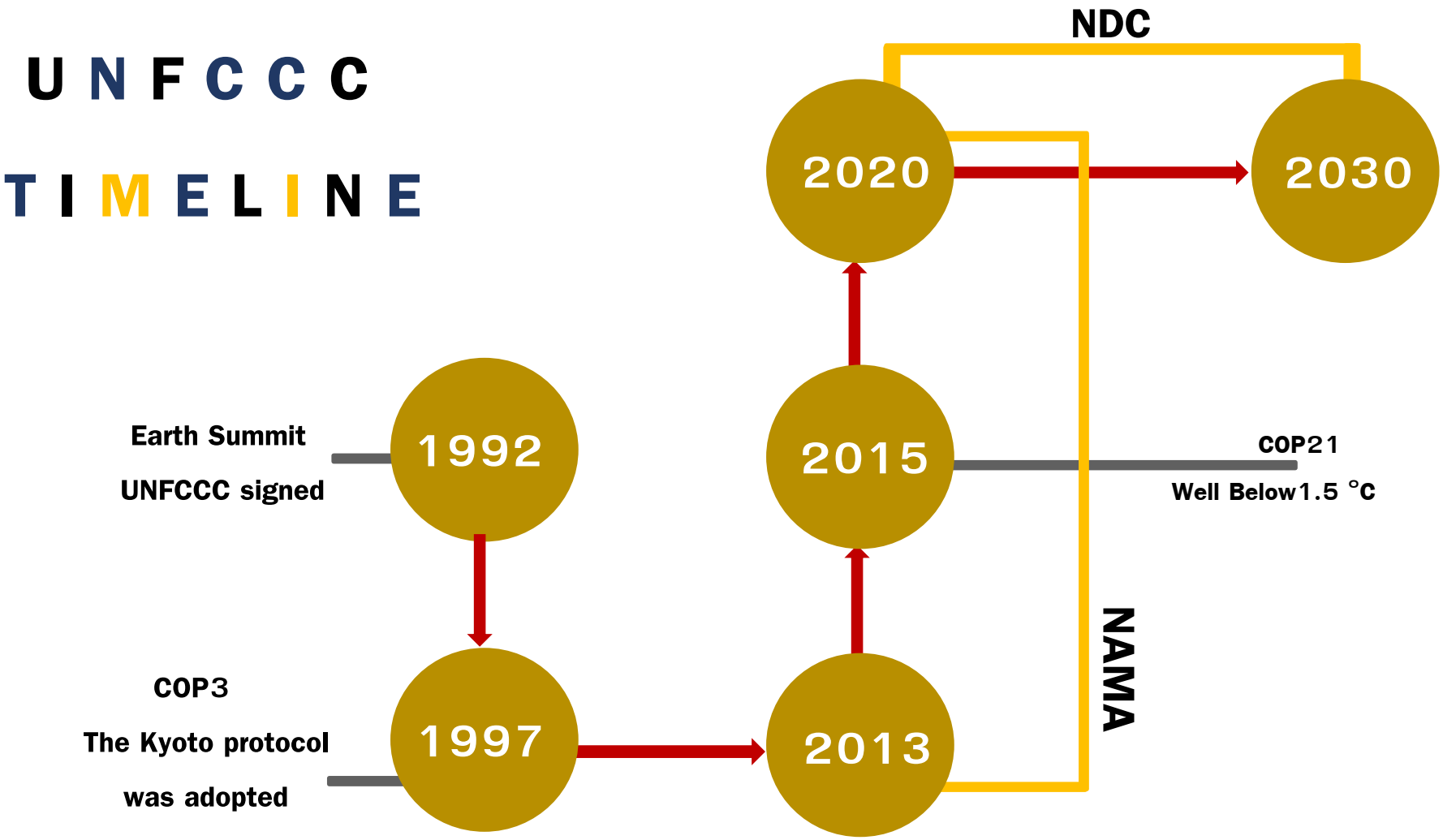


TIME SERIES: 2002-2016
Data source: Atmospheric Infrared Sounder (AIRS).
Credit: NASA

SEPTEMBER
2016



United nation Framework Convention on Climate Change : UNFCCC

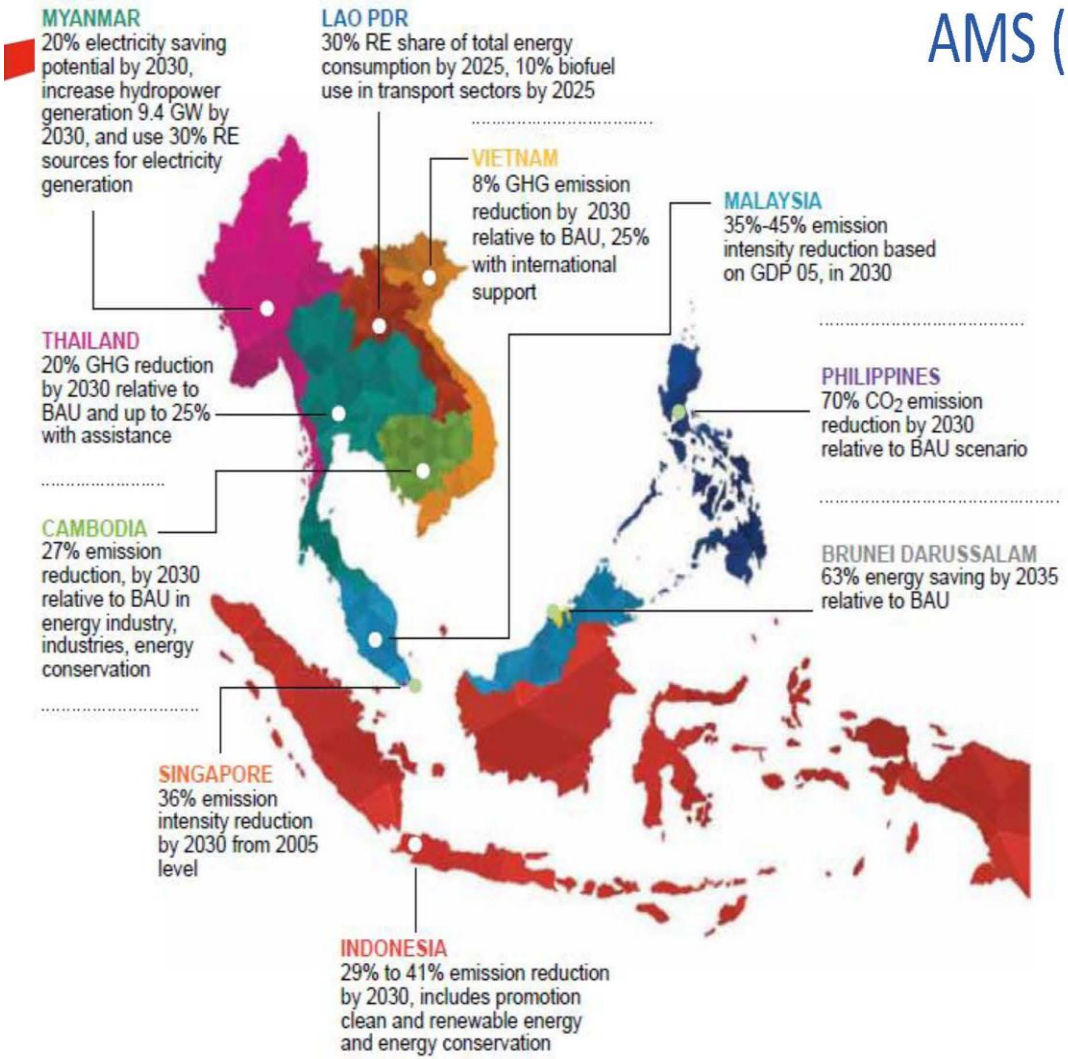


ASEAN's Commitment to Climate Change Mitigation

At Global Level: Paris Agreement

- All the ASEAN's Countries have ratified the Paris Agreement
- Conveyed ASEAN Joint Statement to the United Nations Climate Action Summit 2019, 23 Sep. 2019, New York

AMS (I)NDC Targets



- *At regional level, ASEAN itself does not define specific value on regional commitment for carbon-dioxide (CO_2) emission reduction.*
- *However, the direction of APAEC 2016-2025, is leading to a significant CO_2 emissions reduction in the region.*

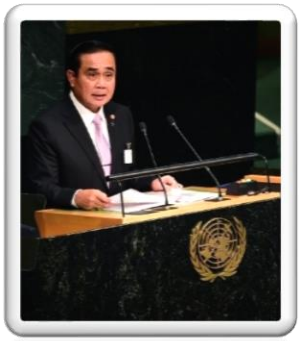
❖ Case of Thailand: Targets

❖ National Appropriate Mitigation Actions

"Thailand will endeavor, on a voluntary basis, to reduce its GHG emissions in the range of 7 to 2 0 percent below the Business as Usual (BAU) in energy and transportation sectors in 2020, subject to the level of international support provided […]"

Coverage : RE | EE | Bio-fuels | Transport

❖ Nationally Determined Contributions



"Thailand intends to reduce its greenhouse gas emissions by 20 percent from the projected business-as-usual (BAU) level by 2030. The level of contribution could increase up to 25 percent, subject to adequate and enhanced [support] through a balanced and ambitious global agreement […]"

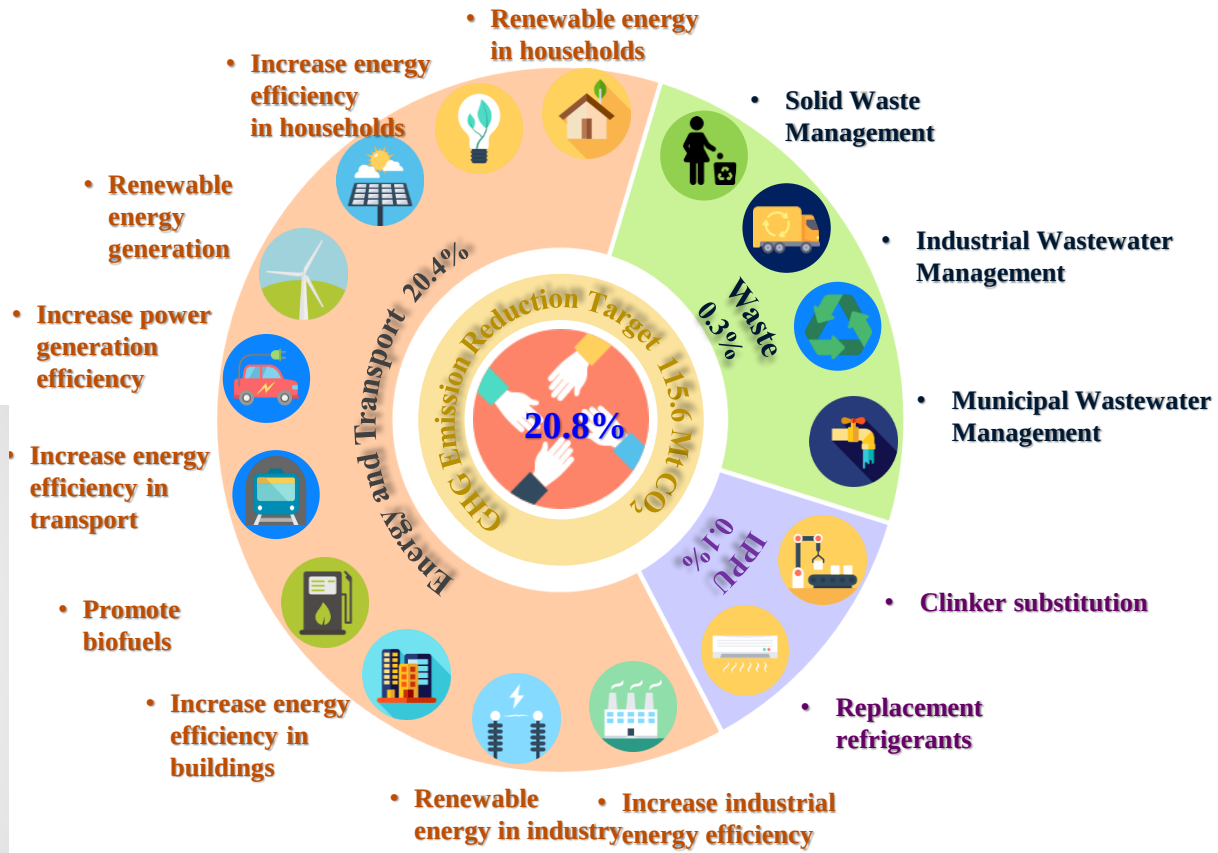
Coverage : Economy-wide

Inclusion of LULUCF will be decided later

Thailand's Nationally Determined Contribution Roadmap

Primary plans supporting implementation of NDC Roadmap

- Energy Efficiency Plan 2015-2036
- Alternative Energy Development Plan 2015-2036
- Power Development Plan 2015-2036
- Smart Grid Development Plan 2015-2036
- Environmentally Sustainable Transport System Plan 2013-2030
- National Industrial Development Master Plan 2012-2031
- Environmental Quality Management Plan 2017-2021
- Implementation under the Montreal Protocol



EGAT Business

Generation

To generate electricity by more than 47 power plants located in different parts of the country.

Installed Generating Capacity **15,789.58** MW

Transmission

To solely operate the transmission system. (Main voltage levels 500, 230, 132, and 115 kV.)

Transmission Line Length **34,553.851** Circuit-Kilometers

Power Purchase

To purchase bulk electricity from IPPs and SPPs and from neighboring countries, i.e. Lao PDR and Malaysia.

Contract Capacity **27,582.92** MW

Affiliates

To invest in electricity generation and energy-related businesses in the following 5 affiliates.

EGAT's Investment **34,290.40** Million Baht

Ref. EGAT Annual Report 2018

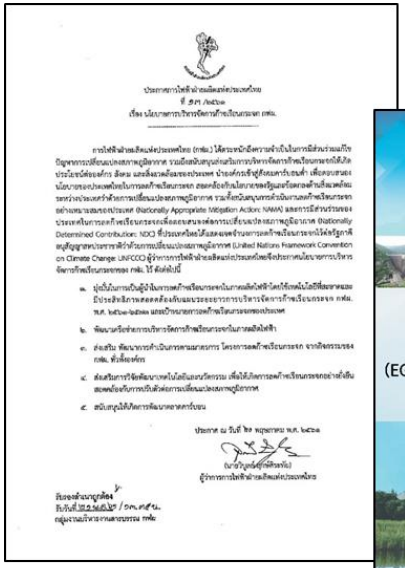
EGAT's GHG Reduction Target

NAMA (A.D.2020)

4 $MtCO_2e$

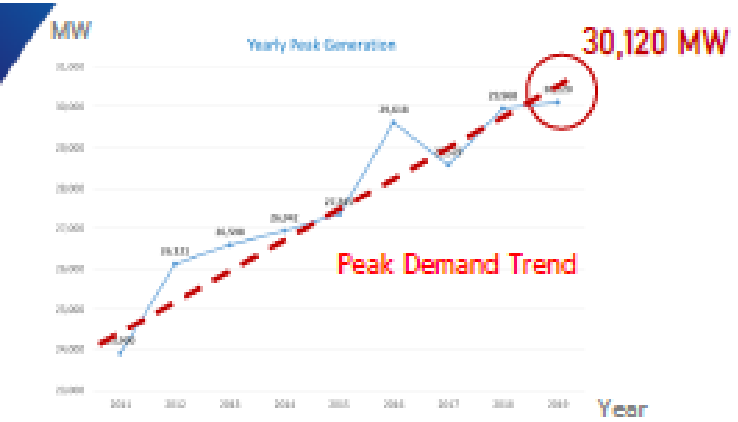
NDC (A.D.2030)

10 $MtCO_2e$

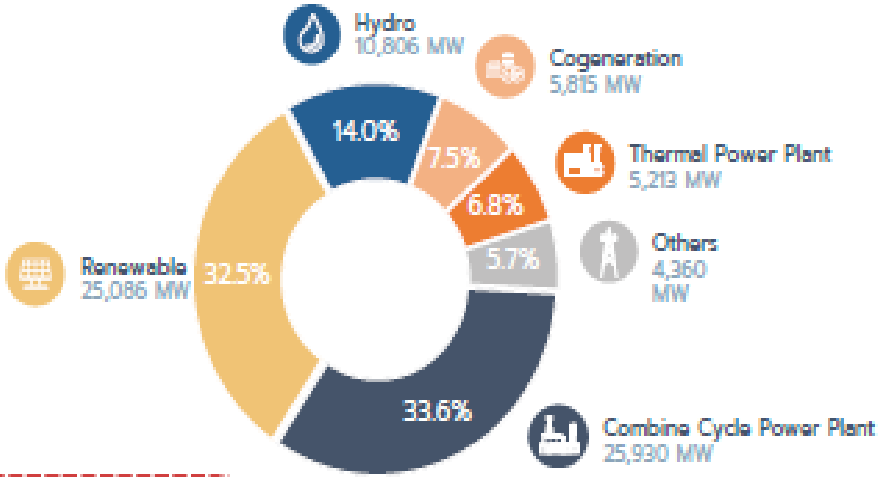


❖ Case of Thailand: PDP2018

Thailand Power Development Plan (PDP 2018)



On April 24, 2019, 8.29 p.m., the overall peak demand of power system was 30,120 MW



RE Development Plan
(During 2018 – 2037)

Biomass	3,376
Biogas	546
Solar	10,000
Wind	1,485
Waste	94
Hydro-Floating Solar (EGAT)	2,725
TOTAL	18,176

Total Capacity

77,211 MW

new RE target of 30% in 2037

❖ Hydro-Floating Solar Hybrid Project

Hydro-Floating Solar Hybrid Project

EGAT's Multipurpose Dam

9 Dams

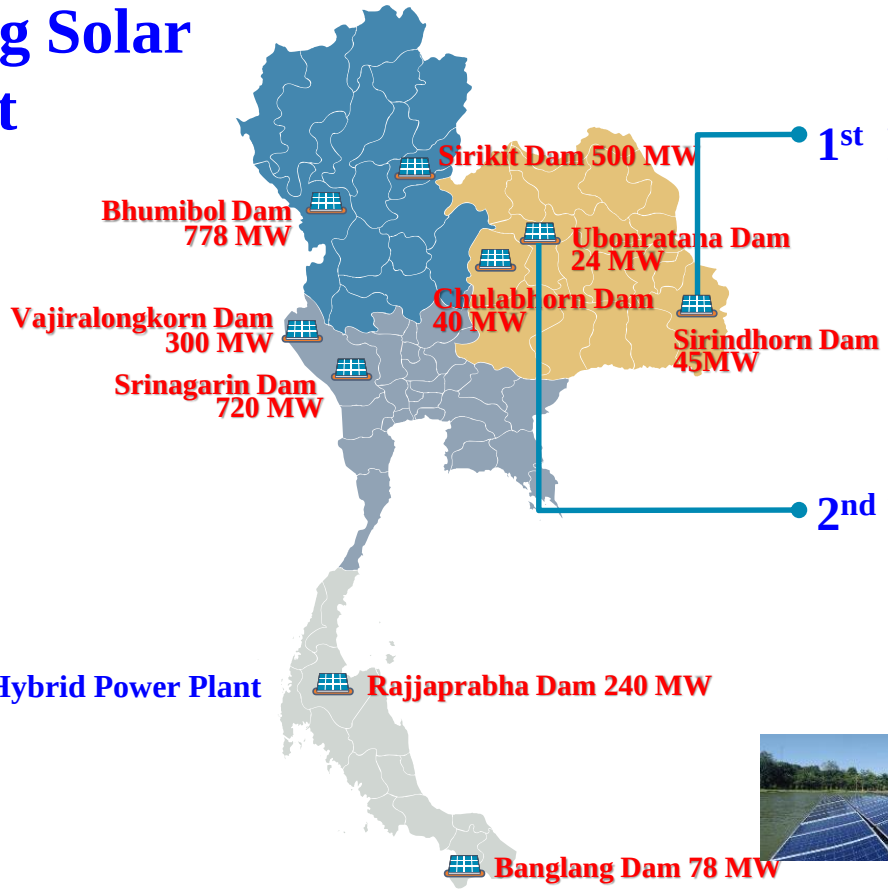
30% of Water Surface Area

43.6 km^2

Capacity of Floating Solar Hybrid Power Plant

2,725 MW

During 2018-2037 (PDP 2018)



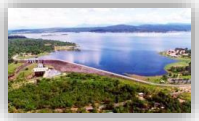
1st Project

Capacity 45 MW
Water Surface Area 0.72 sq.km.
Capacity Factor 18.74 %
Commercial Operation Date 2020

2nd Project

Contracted Capacity 24 MW
Water Surface Area 0.04 sq.km.
Capacity Factor 18.59%
Commercial Operation Date 2023

EGAT's Multipurpose Dams






	Sirindhorn Dam	Ubonratana Dam	Bhumibol Dam	Srinagarin Dam	Vajiralongkorn Dam	Chulabhorn Dam
Capacity: Hydro	**36 MW**	**25.20 MW**	**779.20 MW (1)**	**720 MW (2)**	**300 MW (3)**	**40 MW**
Capacity: Solar	45 MW	24 MW	778 MW	720 MW	300 MW	40 MW
Water Surface Area	270.54 km2	449.64km2	270.08 km2	389.10 km2	350.24 km2	11.95 km2
Installation Area	0.72 km2	0.29 km2	9.16 km2	8.64 km2	3.6 km2	0.48 km2
% Installation Area	0.27%	0.06%	3.39%	2.22%	1.03%	4.02%
Reduce CO_2 Emission (25years)	1,186,914.50 tons	359,234.59 tons	11,036,741.42 tons	9,726,812.41 tons	3,847,781.49 tons	1,069,145.70 tons
Reduce Evaporation (25years)	11,520,976.75 million m3	5,487,080.50 million m3	252,500,321.00 million m3	274,603,011.00 million m3	114,417,920.00 million m3	15,182,524.28 million m3



	Banglang Dam	Rajjaprabha Dam	Sirikit Dam
Capacity: Hydro	**84 MW**	**240 MW (4)**	**500 MW (5)**
Capacity: Solar	**78 MW**	**240 MW**	**500 MW**
Water Surface Area	**52.59 km2**	**174.21 km2**	**241.03 km2**
Installation Area	**0.94 km2**	**2.88 km2**	**6 km2**
% Installation Area	**1.79%**	**1.65%**	**2.49%**
Reduce CO_2 Emission (25years)	**1,905,279.02 tons**	**5,732,823.56 tons**	**13,271,957.46 tons**
Reduce Evaporation (25 years)	**22,950,203.08 million m3**	**70,768,986.16 million m3**	**162,928,388.99 million m3**

Note

1.Bhumibol Dam: 3 Phases
#1. 158 MW. (2026) #2. 300 MW. (2030) #3. 320 MW (2033)

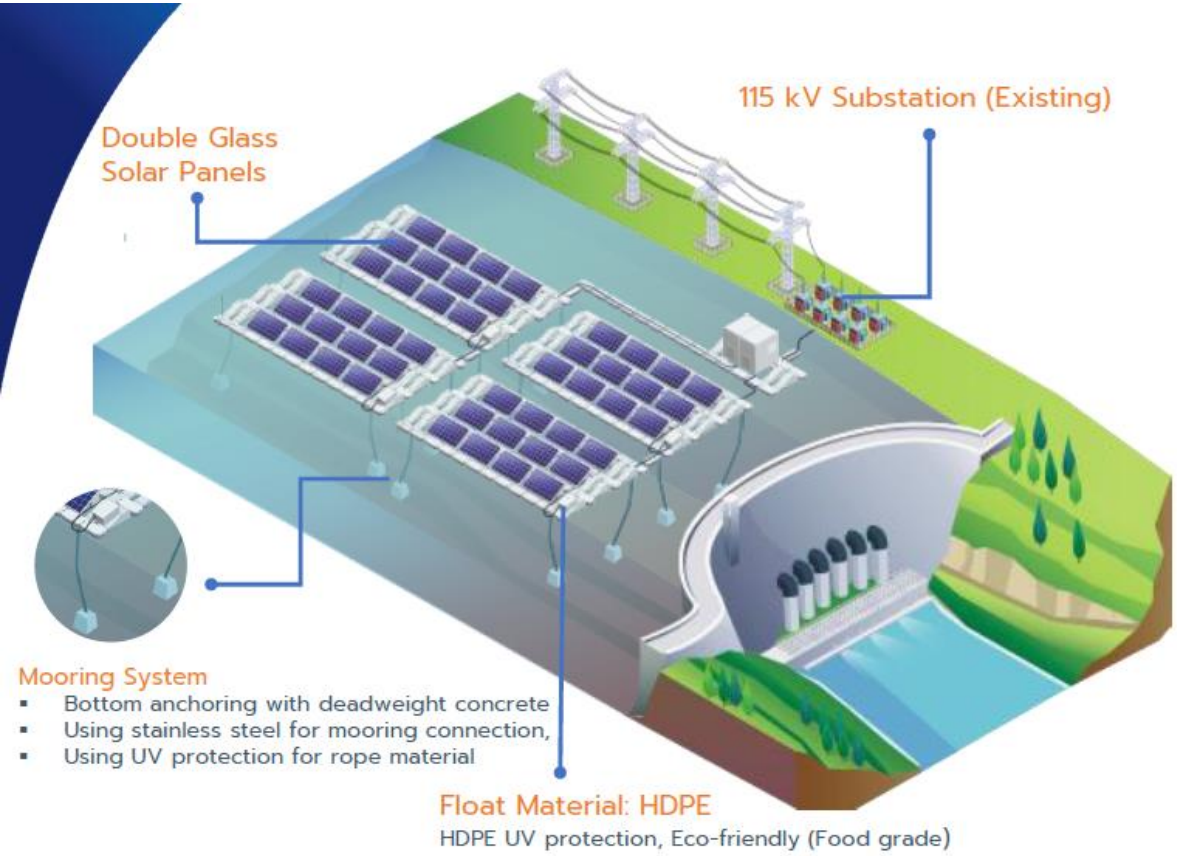
2.Srinagarin Dam: 3 Phases
#1. 140 MW. (2026) #2. 280 MW. (2029) #3. 300 MW (2032)

3.Vajiralongkorn Dam: 2 Phases
#1. 50 MW. (2027)#2. 250 MW. (2031)

4.Rajjaprabha Dam: 2 Phases
#1. 140 MW. (2034) #2. 100 MW. (2036)

5.Sirikit Dam: 2 Phases
#1. 325 MW. (2035) #2. 175 MW. (2037)

The 1st Pilot Hydro-Floating Solar Hybrid Project



1st Pilot Project @Sirindhorn Dam)
- Construction : 12 Months
- Plant Lifetime: 25 Years
- Capacity
  - ❑ Hydro: 36 MW / Solar: 45 MW
- Power Output Controlled by EMS (Energy Management System)

Dam Profile
- Type of Dam: Earth Core Rock Fill
- Depth: approximately: 30 m. Water level validation: 7.3 m.
- Wind speed: 150 km/hr

Benefits
- More Flexible Generation more power and longer period.
- More Reliable on the power grid: regulate the variability and uncertainty.
- Reduce water evaporation (10,222 m3/yr./MW.) depend on location
- Reduce CO2 (0.546 tons/1,000 kwh)

❖ Conclusion

- RE is another great example of Disruptive Technology by transition of changing from fossil fuels to RE.
- The large power plants will be decreased and RE will be spread out everywhere and large transmission lines will be replaced by micro grid and smart grid.
- Climate Change is an important global problem that changes the components of global atmosphere directly and indirectly.
- ASEAN countries are the member of UNFCCC, Thailand has expressed intention to reduce GHG emissions 115.6 MtCO2eq in 2030. EGAT has set the target to reduce GHG by 10 MtCO2eq in 2030.
- The challenge of PDP2018 (2018-2037) principles of Energy Security, Ecology and Economy, RE will increased in 30 %. EGAT will support RE 2,725 MW.

EGAT
Power for Thai Happiness

Innovate Power Solutions for a Better Life

Thank You