ERC FORUM

2023

Thailand Energy Transition

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Thailand Long-term GHG Emission Development Strategy

THAILAND

2030 : NDC 40%

2050 : Carbon Neutrality

2065 : Net Zero Emission

2022

COP27 SHARM EL-SHEIKH EGYPT 2022

2021

COP26

COP26

Paris Agreement

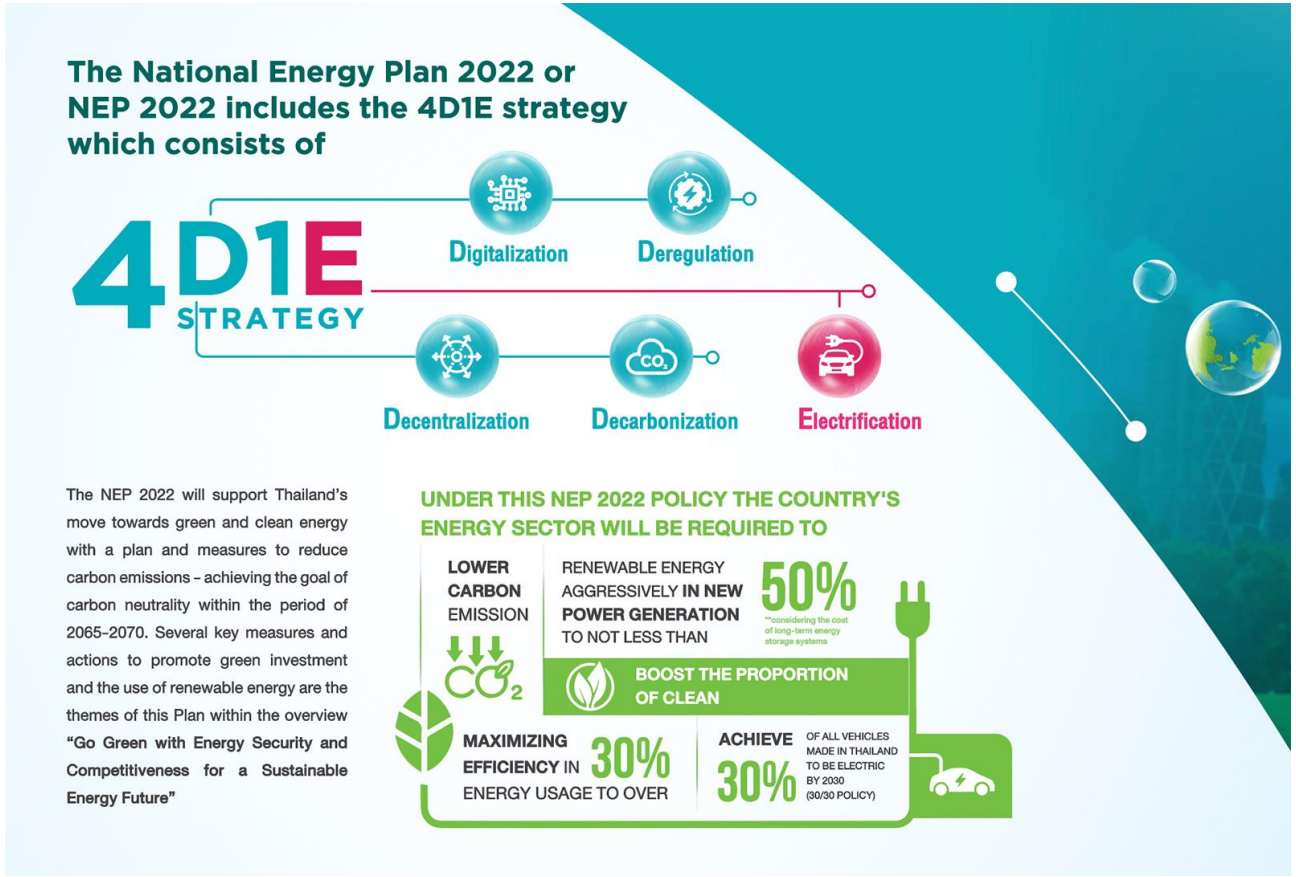
2016

COP21 PARIS2015 UN CLIMATE CHANGE CONFERENCE COP21·CMP11

2015

Energy Transition in Thailand

New National Energy Plan (being drafted)



https://www.asew-expo.com/2022/en/index.asp

Utilization of Biofuel and Green Hydrogen from Biobased

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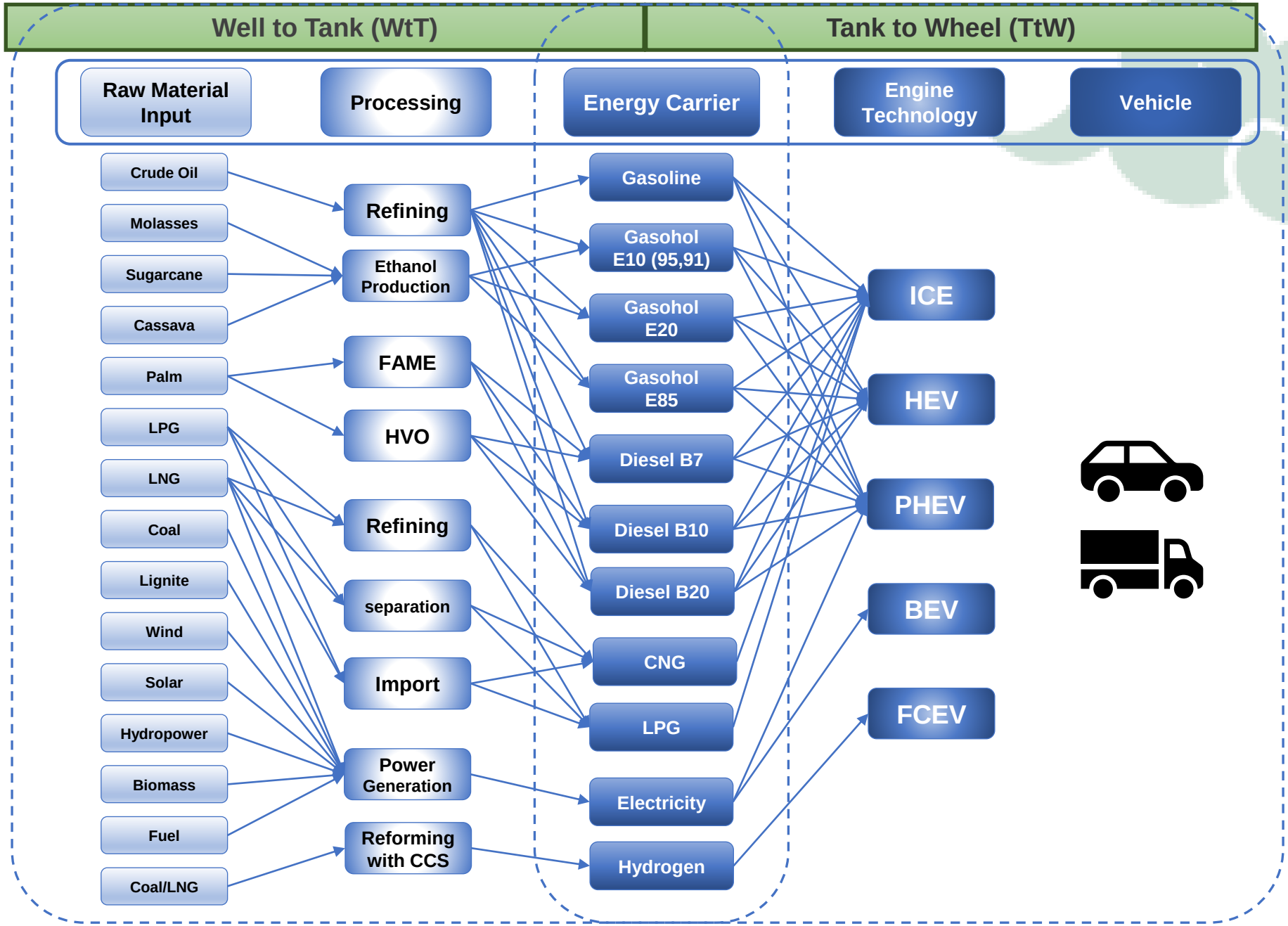
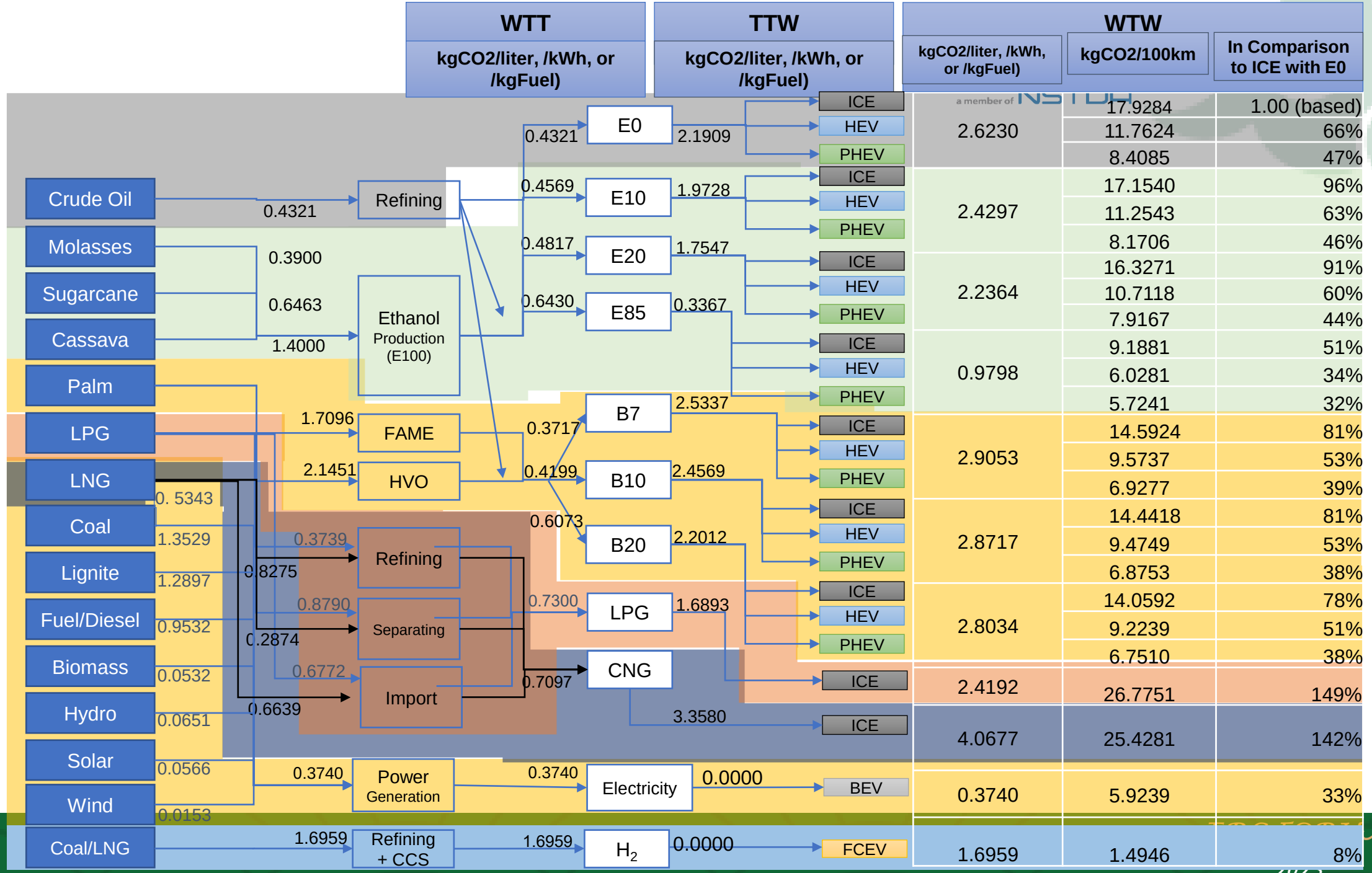
2023

Comparison of Carbon Emission in Thai Transportation



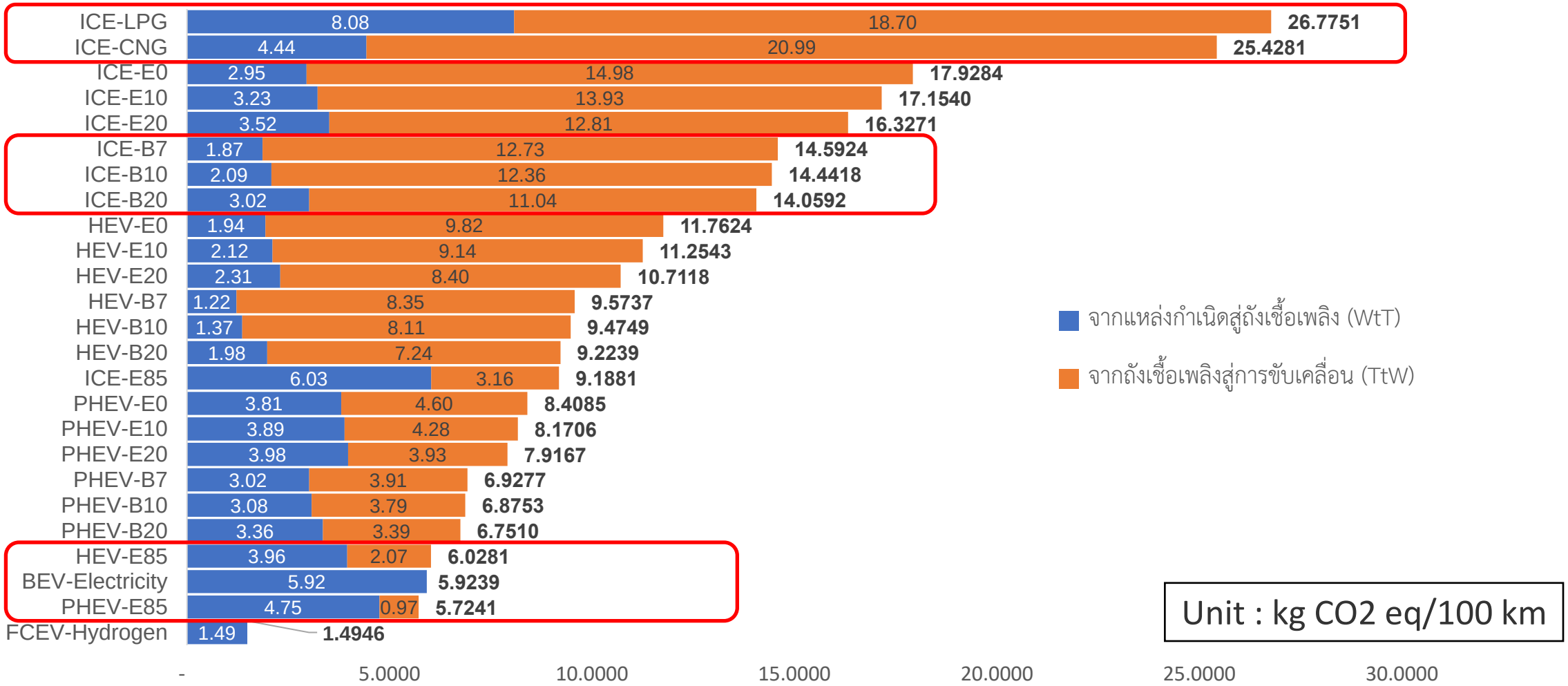
Ref: BCG Economy Model Subcommittee in Energy, Materials and Biorefinery

Compare GHGs



WTT kgCO2/liter, /kWh, or /kgFuel)	TTW kgCO2/liter, /kWh, or /kgFuel)	WTW kgCO2/liter, /kWh, or /kgFuel)	WTW kgCO2/100km	WTW In Comparison to ICE with E0
0.4321	E0 2.1909	2.6230	17.9284	1.00 (based)
			11.7624	66%
			8.4085	47%
0.4569	E10 1.9728	2.4297	17.1540	96%
			11.2543	63%
			8.1706	46%
0.4817	E20 1.7547	2.2364	16.3271	91%
			10.7118	60%
			7.9167	44%
0.6430	E85 0.3367	0.9798	9.1881	51%
			6.0281	34%
			5.7241	32%
0.3717	B7 2.5337	2.9053	14.5924	81%
			9.5737	53%
			6.9277	39%
0.4199	B10 2.4569	2.8717	14.4418	81%
			9.4749	53%
			6.8753	38%
0.6073	B20 2.2012	2.8034	14.0592	78%
			9.2239	51%
			6.7510	38%
0.7300	LPG 1.6893	2.4192	26.7751	149%
0.7097	CNG 3.3580	4.0677	25.4281	142%
0.3740	Electricity 0.0000	0.3740	5.9239	33%
1.6959	H_2 0.0000	1.6959	1.4946	8%

Comparison of GHGs emission for Well-to-Wheel



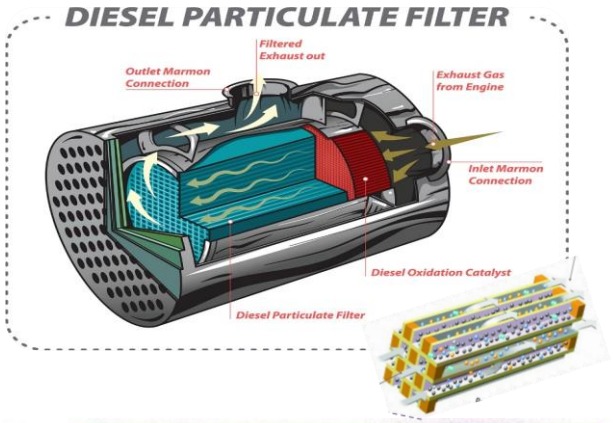
Unit : kg CO2 eq/100 km

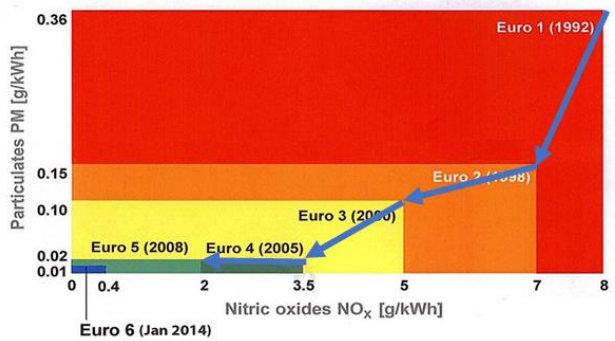
Ref: BCG Economy Model Subcommittee in Energy, Materials and Biorefinery

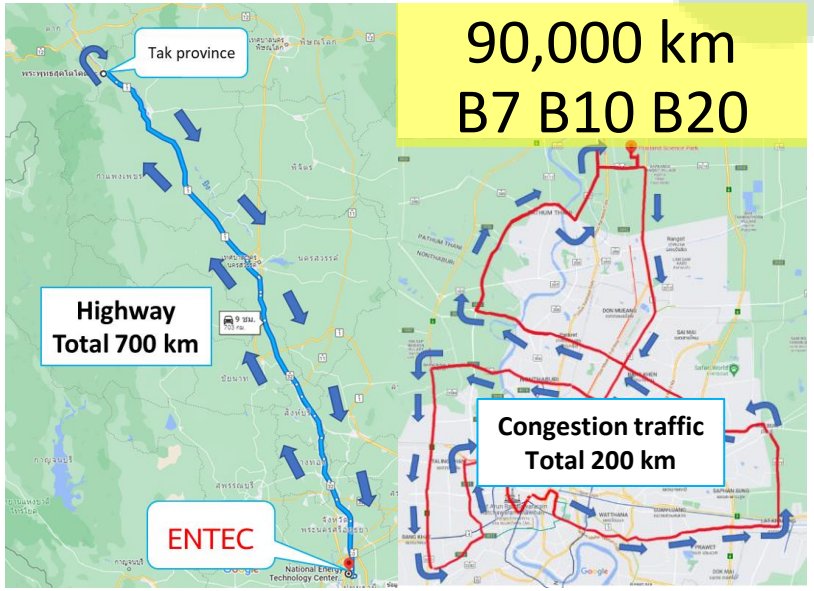
Demonstration on the Use of Biodiesel in Light Duty Vehicles with Certified EURO5 Emission Standard

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

ENTEC
a member of NSTDA





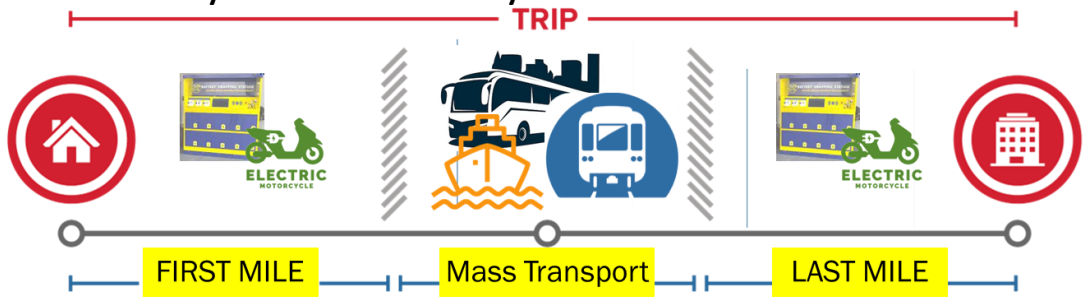


1. LDV-Diesel with EURO5 emission certified can use EURO5 diesel fuel with B7, B10, and B20 by 90,000 km. No deterioration / degradation found in vehicle performance, wear, and exhaust treatment system.
2. Tightening vehicle emission standard couple with fuel standard improvement can help greatly reduce vehicle exhaust emissions.
3. Increasing biodiesel fraction can reduce PM pollution for new vehicle with high emission certified (EURO5) and older on-road diesel vehicles (EURO4 and older). Higher biodiesel blend should be promoted along with pushing higher biodiesel standard – H-FAME.

Mainstreaming Electric Mobility 2 and 3 Wheelers in Thailand

“Promotion of E-Motorcycle as Public Taxi-Riders in Thailand”

- Connect first/last mile transport between home or workplace and mass transport system
- Extend a limit of driving range with battery swapping station
- Demonstrate the use in real road conditions and real climate of Thailand as-well-as collect energy consumption data
- Test the legal requirements for registering electric motorcycles as motorcycle taxis

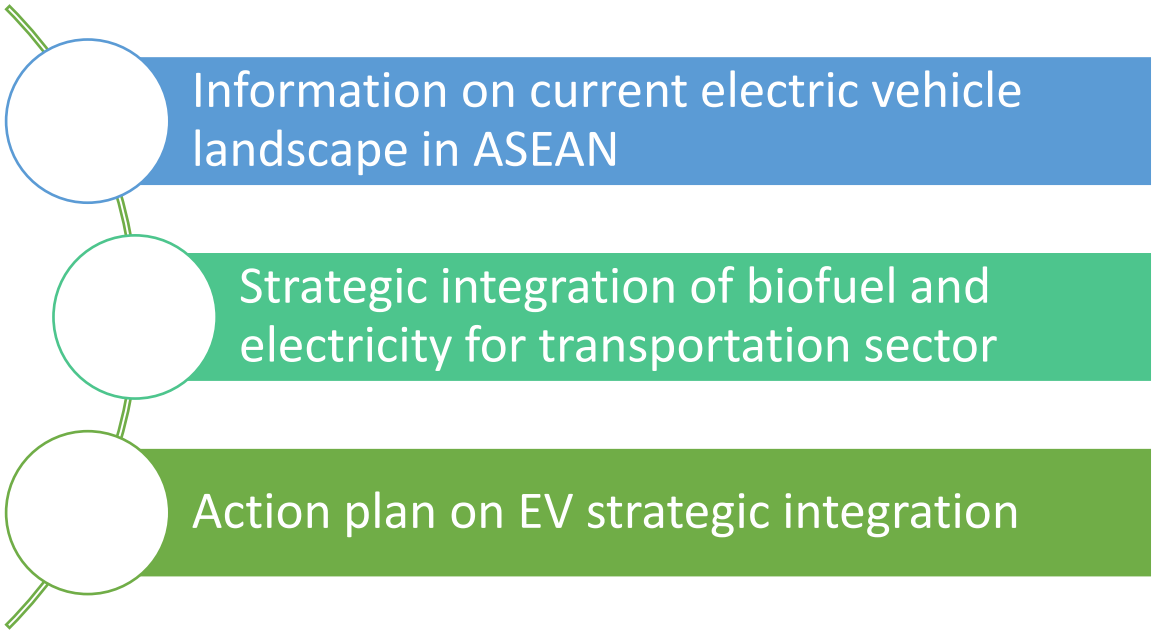


ASEAN ROK project

Strategic Integration of Electric Vehicle into ASEAN Biofuel Roadmap

- **Proponents:** NSTDA-ACE*
- **Duration | Requested budget:** 3 years (15 Nov 2021 – 14 Nov 2024)
- **Objectives**
  - To establish policy dialogue on EV for strategic integration into biofuel for energy mix in transportation section across AMS
  - To conduct scenario analysis reflecting strategic integration of EV and biofuel-powered vehicle through Focus Group Discussion (FGD) with relevant government officials
- **Supporting bodies**
  - Ministry of Trade, Industry and Energy (MOTIE)
  - Asian Federation of Electric Vehicle Associations (AFEVA): Electric Vehicle Association of Malaysia | the Philippines | Singapore | Thailand (EVAM | EVAP | EVAS | EVAT),
  - International Energy Agency: Hybrid & Electric Vehicle Technology Collaboration Programme (IEA-HEV)

Project Output



Why Hydrogen

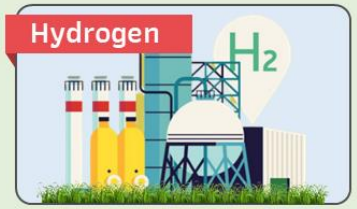
Current State

Energy

CO_2

$$C_xH_y + O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

Future State



1 H Hydrogen 1.008

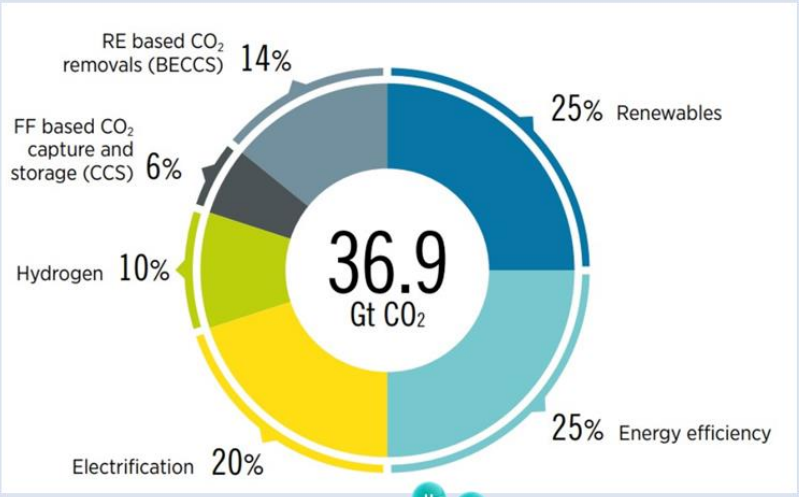
Energy

H_2O

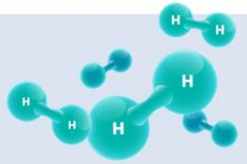
$$2H_2 + O_2 \rightarrow 2H_2O$$

H_2

Hydrogen one of six technology for decarbonization



Source: IRENA

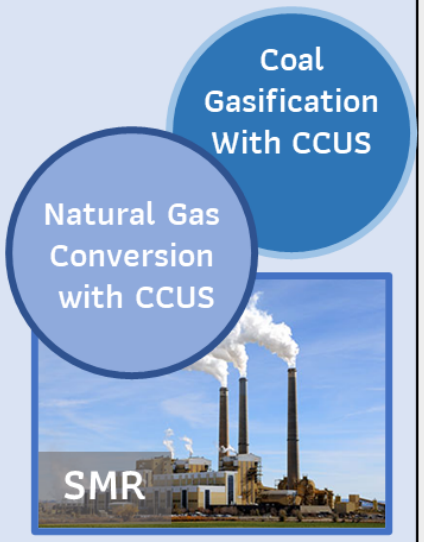


Hydrogen Production

Terminology	Technology	Feedstock	GHG footprint
White	By-product	Mixed	N/A
Green	Electrolysis	Renewable energy	Minimal
Pink	Electrolysis	Nuclear	Minimal
Yellow	Electrolysis	Mixed grid energy	Medium
Blue	Gasification + CCUS	Natural gas	Low
Turquoise	Pyrolysis	Natural gas	Solid carbon
Grey	thermochemical	Natural gas	Medium-high
Brown	thermochemical	Brown coal (lignite)	High
Black	thermochemical	Black coal	High

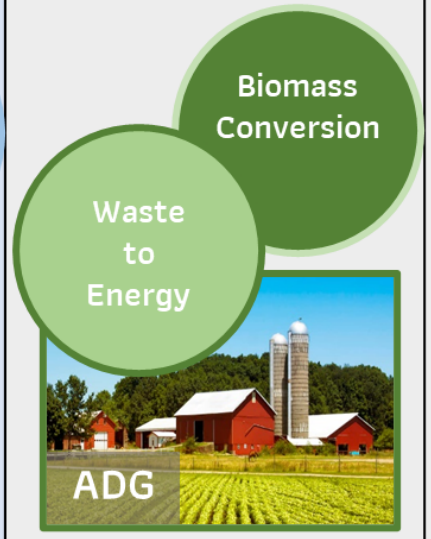
FOSSIL RESOURCES

- Low-cost, large-scale hydrogen production with CCUS
- New options include byproduct production, such as solid carbon



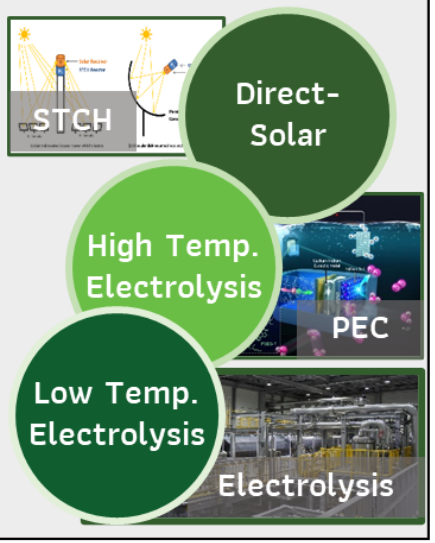
BIOMASS/WASTE

- Options include biogas reforming and fermentation of waste streams
- Byproduct benefits include clean water, electricity, and chemicals

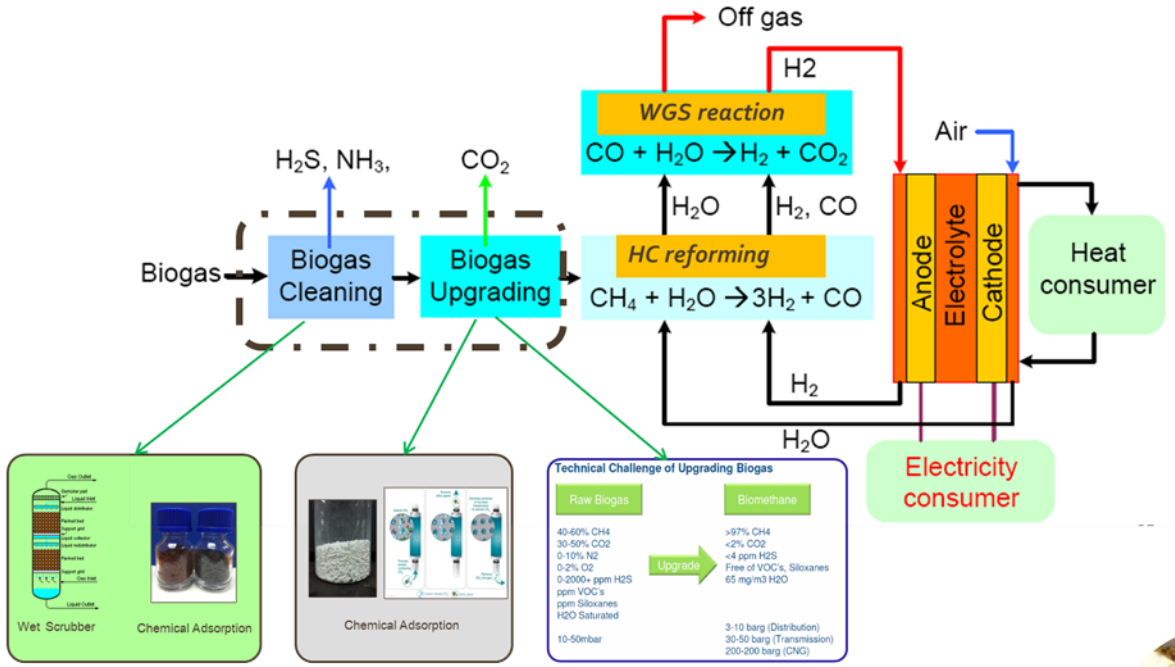


H_2O SPLITTING

- Electrolyzes can be grid-tied, or directly coupled with renewables
- New direct water-spitting technologies offer longer-term options

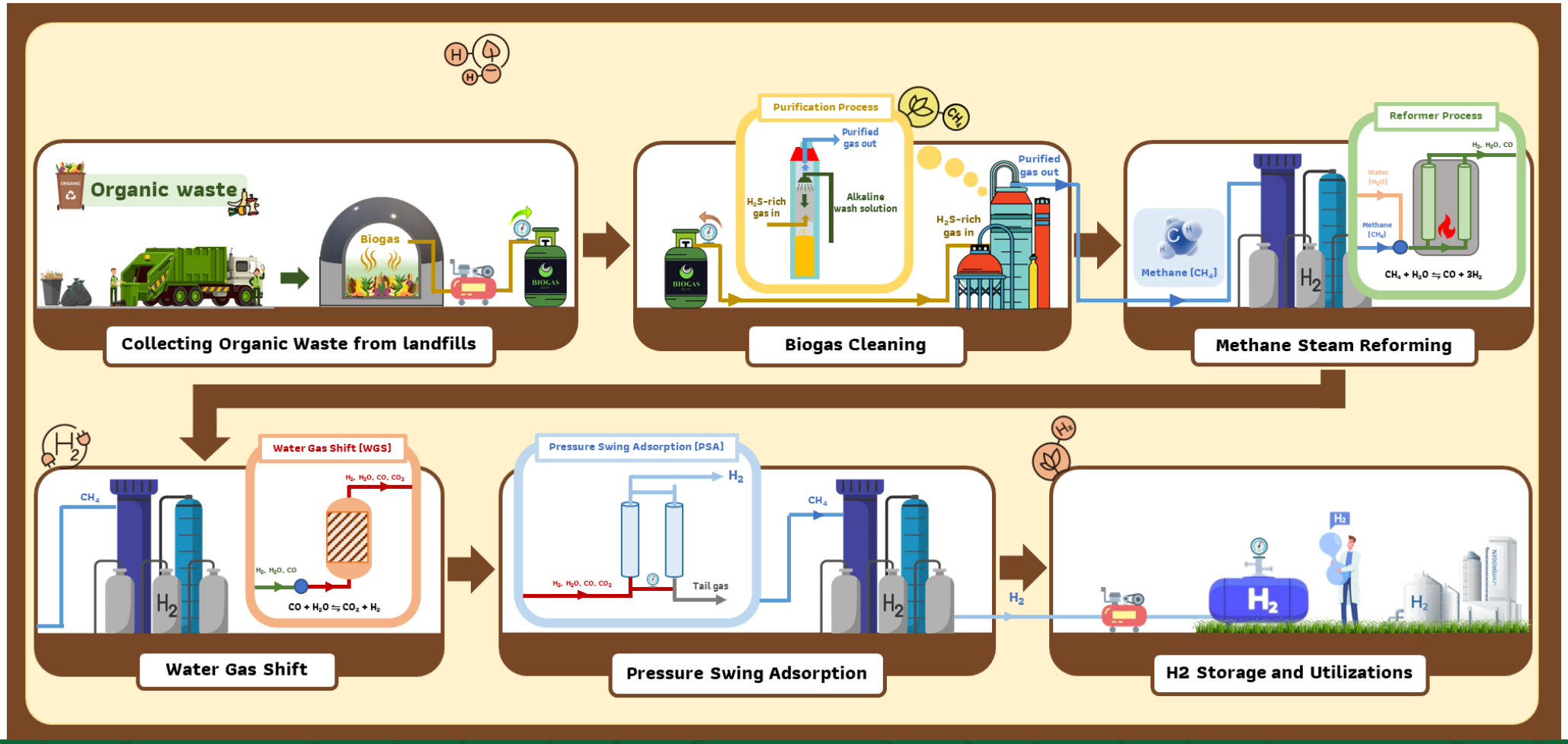


H_2 from Biomass/Biogas



- Biomass is an **abundant domestic resource**
- Biomass/Biogas **"recycles" carbon dioxide**
- Waste to energy
- CH_4 is 28 times Global warming potential than CO_2

H_2 Production Using Biogas from Municipal Waste



Concluding Remarks

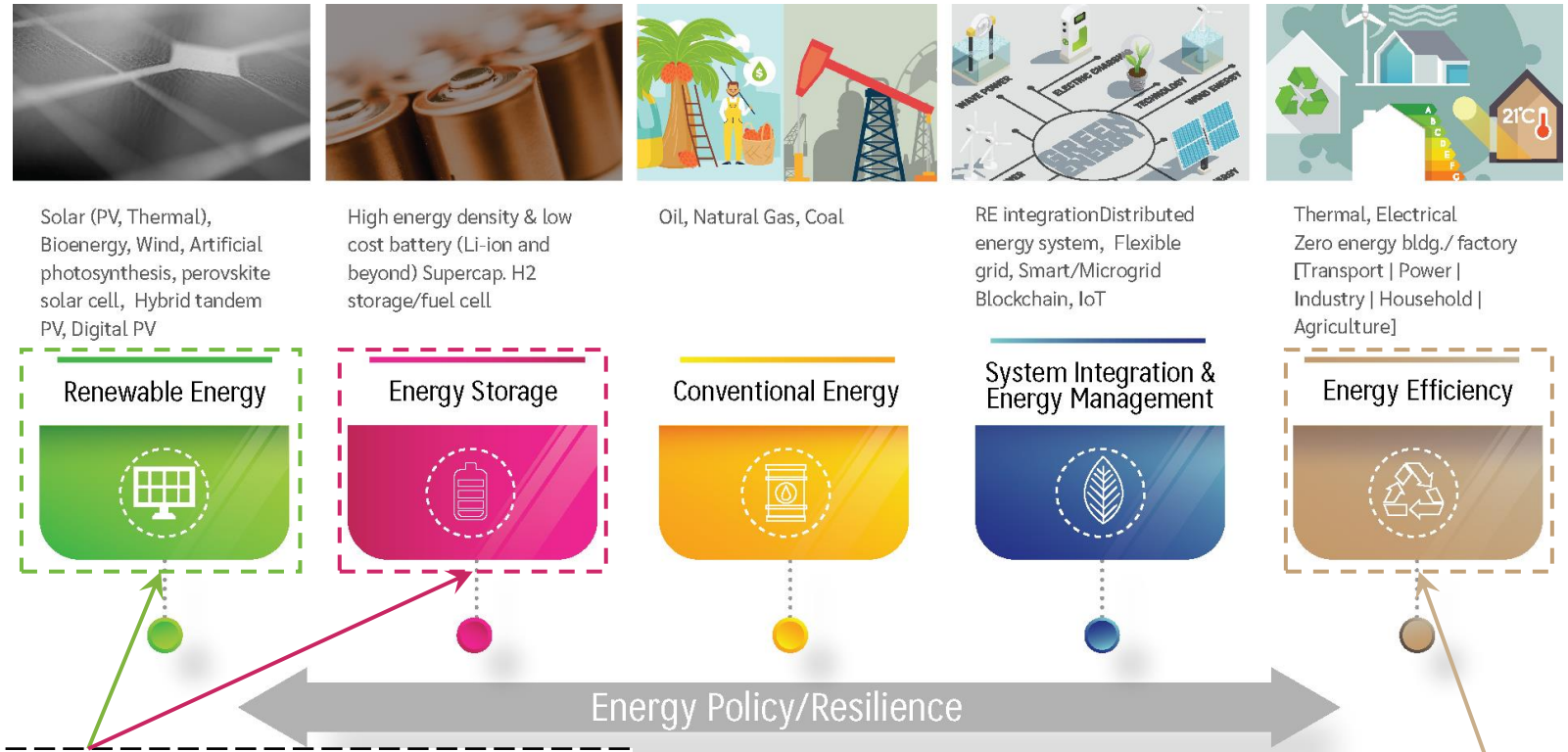
The world is moving towards carbon neutrality by promoting clean energy, increasing energy efficiency, and promoting EV.

Financial incentives, e.g., carbon credit, tax exemption, are used to induce investment in energy transition.

Thailand also aims to achieve energy transition by: RE > 50%, EE > 30%, EV 30@30, and 4D1E.

ENTEC conducts research to support energy transition in Thailand, e.g., solar application and management, biofuel, battery, e-bike demonstration, and EV policy study.

ENTEC Research Pillars to Support Carbon Neutrality



Research on PV applications, modeling and forecasting, biofuel, battery, and green hydrogen to support increase of renewable energy

EV demonstration and EV policy study to support EV promotion

Thank You

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