Climate Change & Renewable Energy

Fundamental of Renewable Energy

3 – 4 Febuari 2020

Cawangan Kejuruteraan Elektrik

Schedule

HARI/MASA	8.00 Pagi - 8.30 Pagi	8.30 Pagi – 10.30 Pagi	10.30- 11.00 Pagi	11.00 Pagi - 12.00 T/hari	1.00 - 2.30 Petang	2.30 Petang - 4.30 Petang
SELASA 29/01/2019	PENDAFTARAN PESERTA	Climate change & Renewable energy	MINUM PAGI	Solar Photovoltaic (PV) & Solar thermal	MAKAN TENGAHARI	Wind Energy, Biomass
RABU 30/01/2019		Hydro power		i) Geothermal & Wave Energy ii) Energy storage system iii) Exercise		Exercise & Field Training

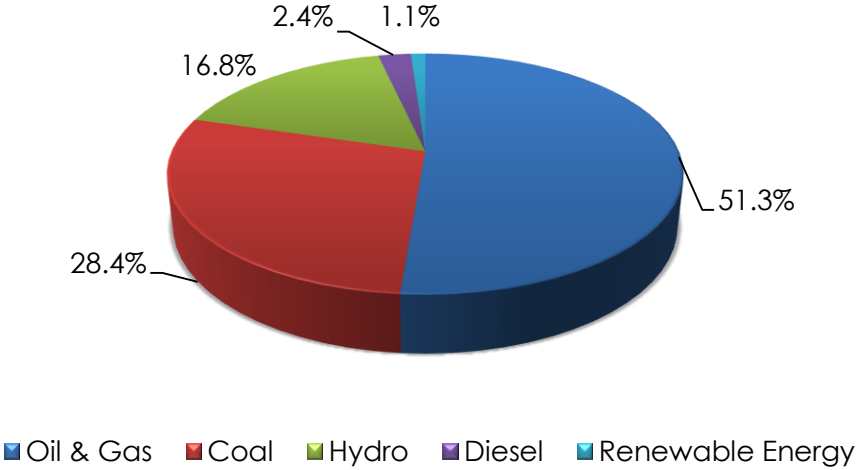
QUIZ #1

What is your motivation to attend this course?

(In 3 – 5 words)

Energy Resources

- The world energy demand is still dependent on fossil fuel base energy generation
  - Gas & oil
  - Coal
  - Diesel



Resources	Capacity (MW)			
	Peninsular	Sabah	Sarawak	Total
Oil and gas	11,988.4	1,034.2	608	13,630.6
Coal	7,056.0	-	480	7,536.0
Hydro	1,899.1	76.9	2,496	4,472.0
Diesel	-	487.3	163	650.3
Other renewable energy	234.2	52.0	-	286.2
Total installed capacity	21,177.7	1,650.4	3,747	26,575.1

Source : Energy Commission of Malaysia, KeTTHA, SEDA

Energy Emission Overview

- Every day we damage our climate by using fossil fuels for energy & transport
- Malaysia emitted 208 mill. tonnes of CO_2 or 7.1 tonnes per capita in 2009
- Projected total emissions – 285.73 mill tonnes CO_2 (2020). Largest emitting sector – electricity generation (43.4%)

Source : Energy Revolution, Greenpeace

Global Issues

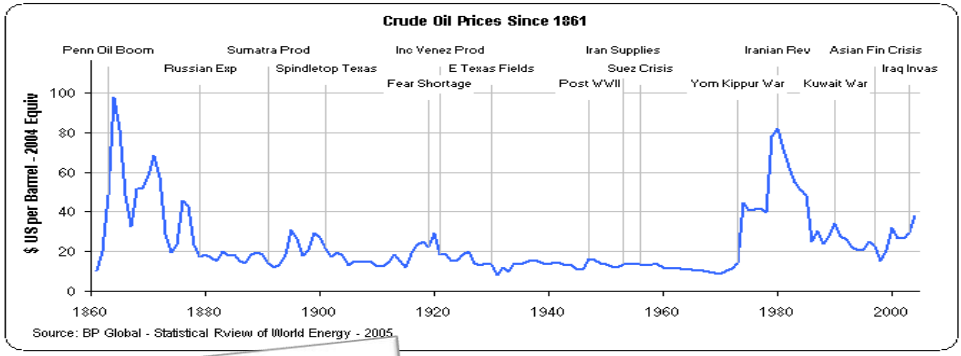
- Fossil fuel based energy will be depleted by time

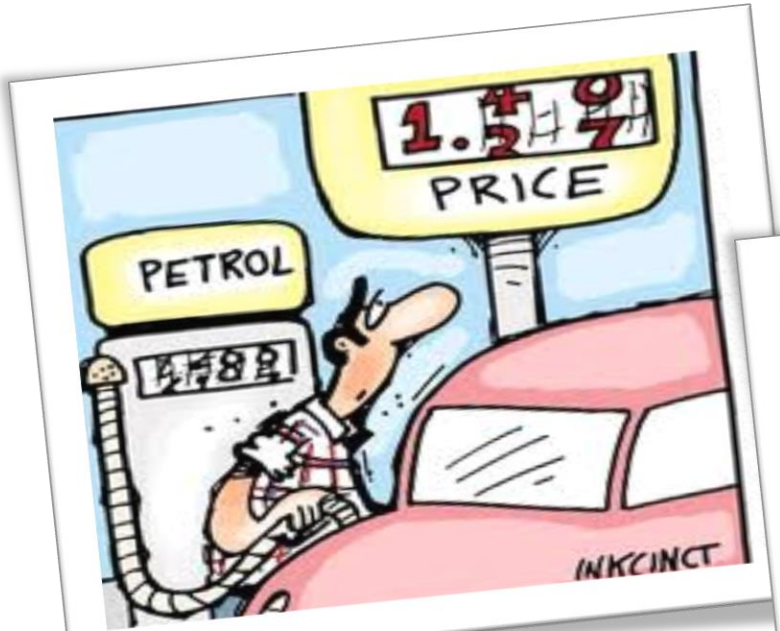
  - **Malaysia's energy reserve**

    - Oil reserve of three billion barrels. Crude oil production 750,000 barrel/day
    - Natural gas produced 80,000 barrels/day, with 2.12 trillion cubic meter reserves
    - The current reserve amount for oil may last for 19 years & natural gas for 33 years

Global Issues

- Fluctuation of global oil price





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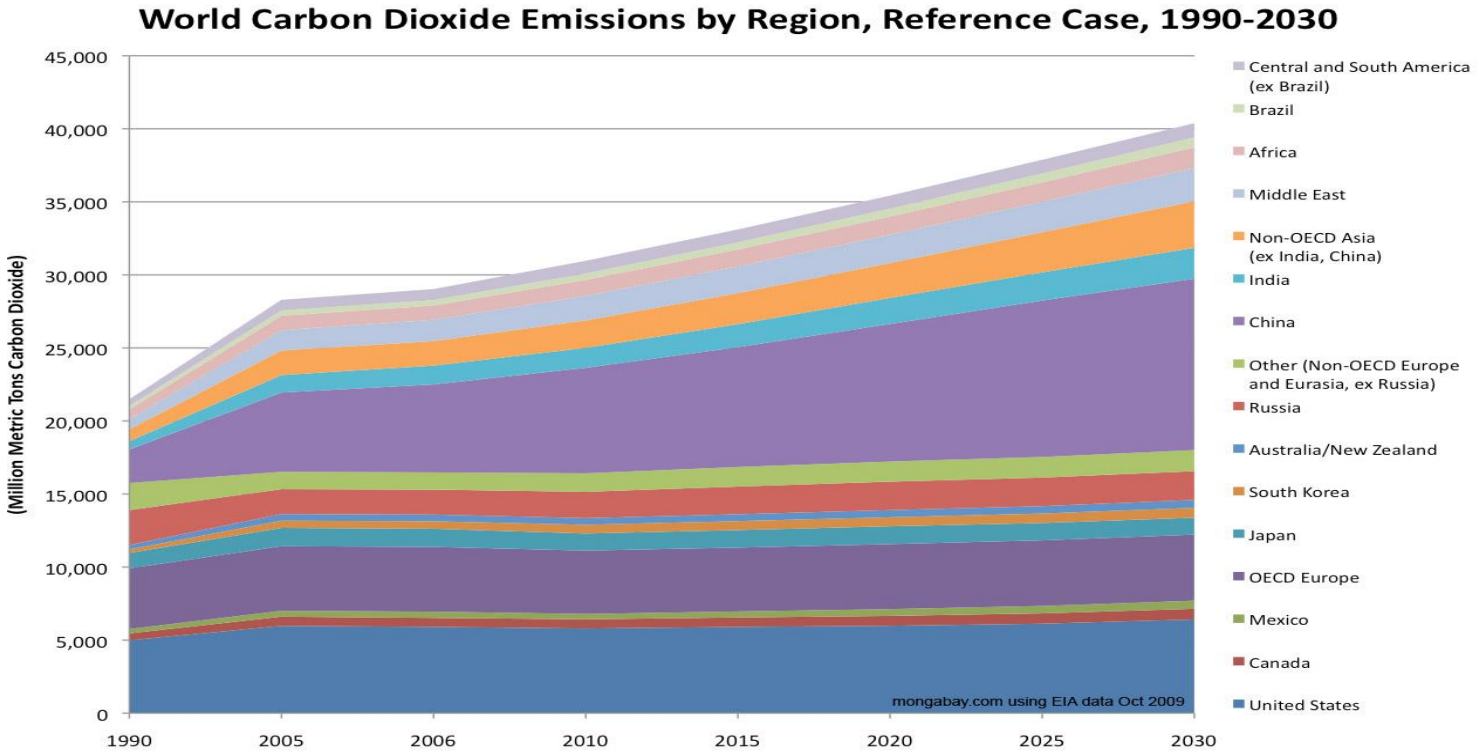
Global Issues

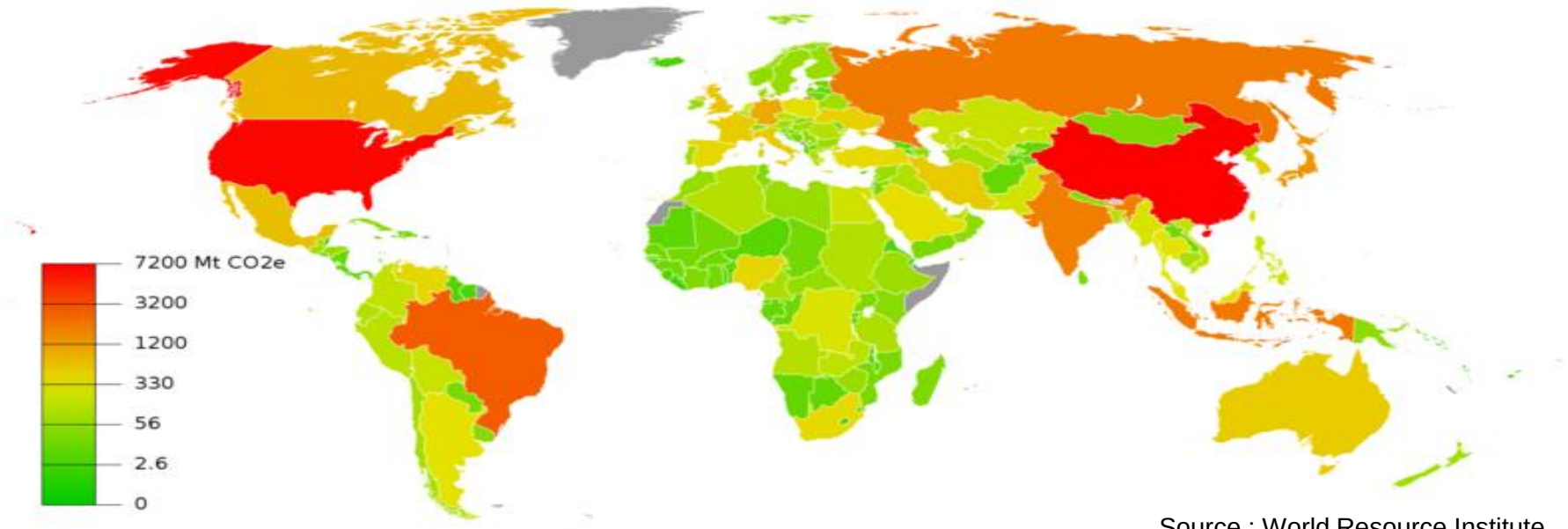
- World population growth requires more energy
- Environmental pollution

Environmental Effect

- Green House Gasses
  - Global warming & climate change



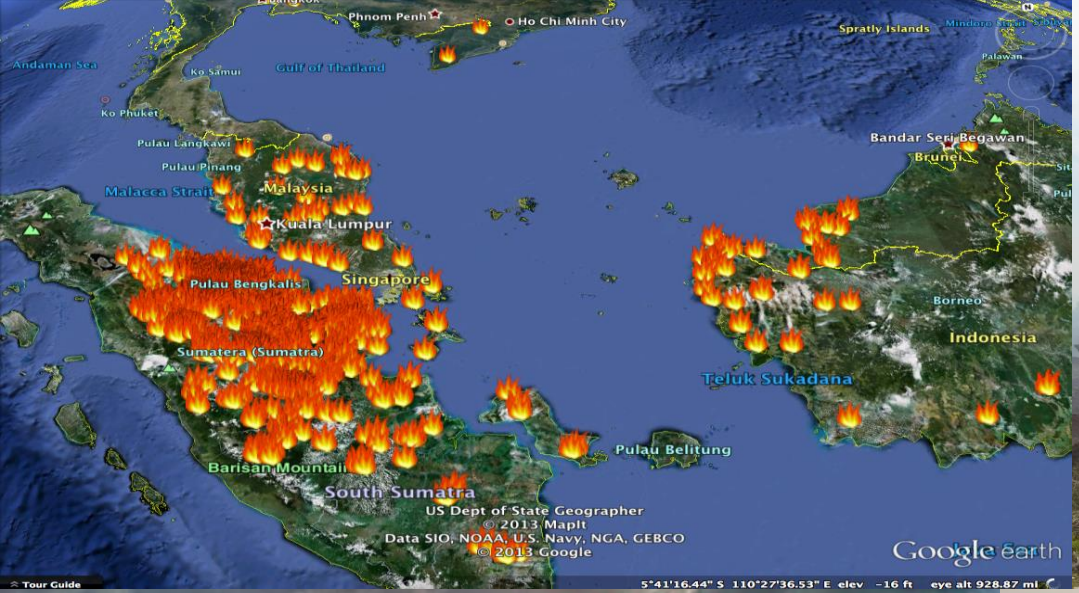
Annual CO_2 emission (2005) including land use



Source : World Resource Institute
World Bank

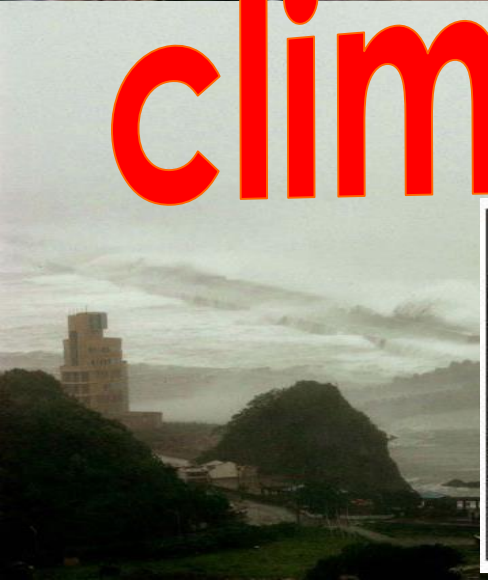
Malaysia

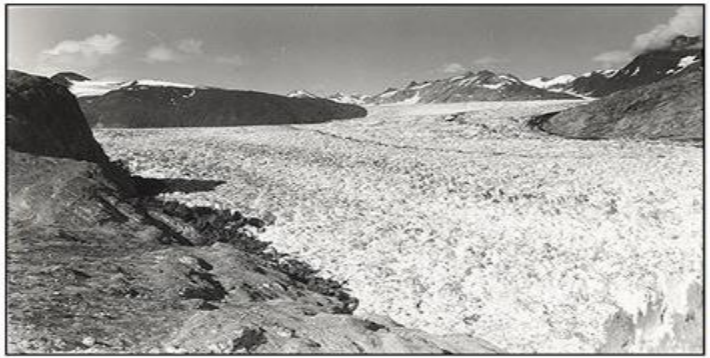
- Annual CO2 emission (2008) = 208,267,000 metric tons (0.7% of world emission)
- Annual CO2 emission per capita (2009) = 7.1 metric tons per capita (not including land use)


Phnom Penh
Ho Chi Minh City
Spratly Islands
Andaman Sea
Ko Samui
Gulf of Thailand
Palawan
Ko Phuket
Pulau Langkawi
Bandar Seri Begawan
Brunei
Pulau Pinang
Malaysia
Malacca Strait
Kuala Lumpur
Singapore
Pulau Bengkalis
Borneo
Indonesia
Sumatera (Sumatra)
Teluk Sukadana
Pulau Belitung
Barisan Mountains
South Sumatra
US Dept of State Geographer
© 2013 MapIt
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Google
Google earth
Tour Guide
5°41'16.44" S 110°27'36.53" E elev -16 ft eye alt 928.87 mi


DIMANAKAH INSAN
DIKALA BUMI DINODAI
FOTO BY SANI996

climate change !!!





The earth needs to be healed….

- Sustainable energy is the answer…

RENEWABLE ENERGY

ENERGY EFFICIENCY

Definition of Renewable Energy

Renewable Energy (RE) is any form of primary energy from recurring and non-depleting indigenous resources such as agricultural produce, hydro-power, solar, wind, solid-waste, etc.

Biomass

Wind Energy

Hydro

Biogas

Geothermal

Solar PV

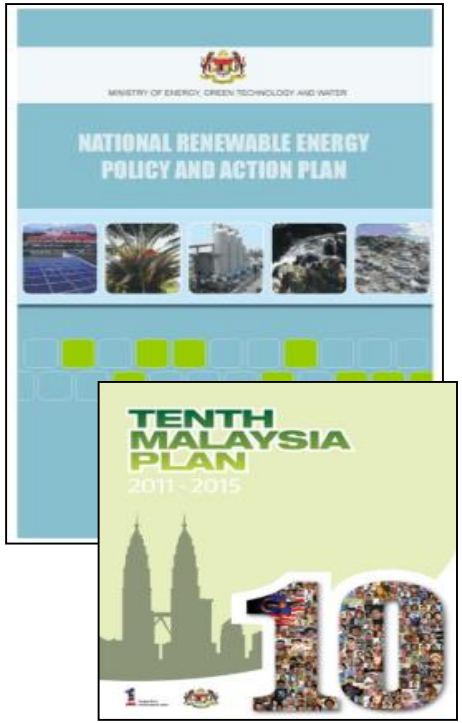
Renewable Energy in Malaysia

Development of Energy Policies in Malaysia

- National Petroleum Policy (1975)
- National Energy Policy (1979)
- National Depletion Policy (1980)
- 4-Fuel Diversification Policy (1981)
- 5-Fuel Policy (2001)
- **RE Policy and Action Plan (2010)**

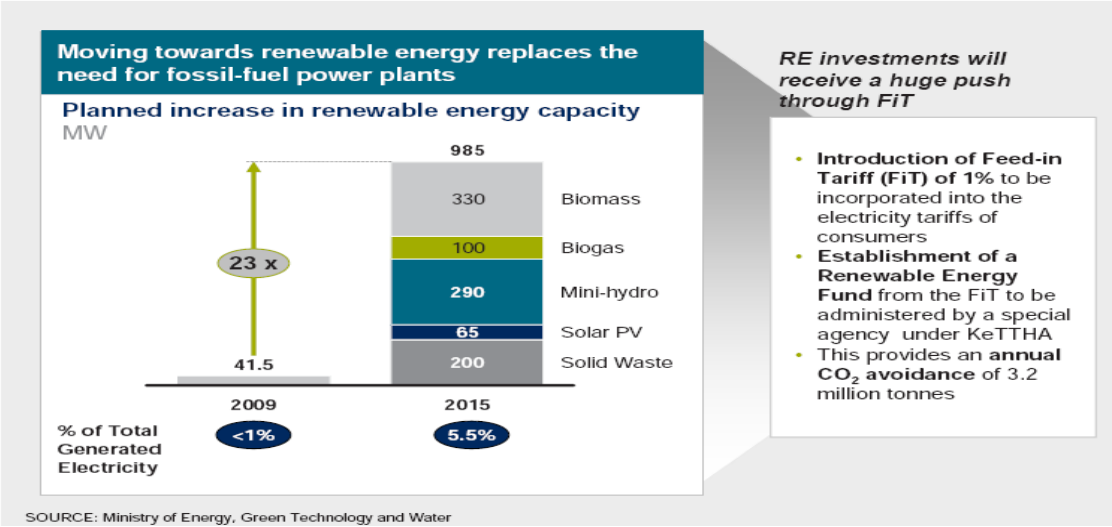
Renewable Energy in Malaysia…cont'd

➢ Renewable Energy: Government Policies



2nd April 2010: National Renewable Energy Policy & Action Plan approved
10th Jun 2010: 10th Malaysia Plan (chapter 6)
15th Oct 2010: National Budget 2011 (paragraph 34)
25th Oct 2010: Economic Transformation Programme (chapter 6)

Renewable energy will increase from <1% in 2009 to 5.5% of Malaysia's total electricity generated by 2015



SOURCE: Ministry of Energy, Green Technology and Water

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Renewable Energy in Malaysia…cont'd

National RE Targets

Year	Cumulative RE Capacity	RE Power Mix	Cumulative CO_2 avoided
2015	985 MW	5.5%	11.1 mt
2020	2,080 MW	11%	42.2 mt
2030	4,000 MW	17%	145.1 mt

Note: RE capacity achievements are dependent on the size of RE fund

- Assumptions:
  - Feed-in Tariff (FiT) implemented

Feed-in Tariff Rates

Technology / Source	FiT Duration	Range of FiT Rates (RM/kWh)	Annual Degression
Biomass (palm oil waste, agro based)	16	0.27 – 0.35	0.5%
Biogas (palm oil waste, agro based, farming)	16	0.28 – 0.35	0.5%
Mini Hydro	21	0.23 – 0.24	0%
Solar PV	21	0.85 – 1.78	8%
Solid waste & Sewage	16	0.37 – 0.45	1.8%

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POLISI TEKNOLOGI HIJAU NEGARA

Kebergantungan kepada bahan api fosil akan dikurangkan melalui peningkatan sumbangan tenaga boleh baharu (renewable) dalam penjanaan elektrik.

Tun Mahathir Mohamad
Perdana Menteri
Kajian Separuh Penggal RMK-11
Oktober 2018

Kerajaan yakin mencapai sasaran 20 peratus janaan elektrik daripada sumber tenaga diperbaharui (RE), bersamaan 3,991 megawatt (MW), dalam masa tujuh tahun akan datang melalui pelbagai inisiatif, program dan dasar.

YB Yeo Bee Yin
Menteri Tenaga, Teknologi, Sains, Alam Sekitar & Perubahan Iklim
November 2018

POLISI TEKNOLOGI HIJAU NEGARA

2011 — Feed In Tariff

- Tarif untuk solar PV
  2013 – RM0.68 – RM1.1316/kWh
  ** Degression rate 8% setahun*

2016 — Net Energy Metering (NEM)

- Konsep *Net billing*
- *Self consumed*, lebihan penjanaan tenaga dijual ke pihak utiliti pada kadar tarif belian tenaga
- Contoh:
  Tarif B = RM0.509/kWh
  ** Rate telah disemak semula tahun 2018*

2018 — Supply Agreement for Renewable Energy (SARE)

- *Self consumed*,
- Tarif penjanaan tenaga daripada solar PV rendah daripada tarif grid utiliti
- Contoh:
  Grid = RM0.509/kWh
  Solar = RM0.43/kWh

End of 1st session….