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MEMO 2003 MARINE ENVIRONMENT AND RENEWABLE ENERGY

MASTER OF SCIENCE (MECHANICAL ENGINEERING)

SHIP TECHNOLOGY / OFFSHORE TECHNOLOGY

UTM 2021

FARAH ELLYZA HASHIM, PhD.



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SYNOPSIS



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This course is designed to give students an understanding of the science of marine environment particularly waves and tides, and how this affects efforts to exploit energy from these resources. Students will first be introduced to fundamentals of oceanography and marine meteorology. It explains the fluid physical characteristics and movement on the earth surface. As such, the student will have a clear understanding of the weather that results from the interaction between the atmosphere and the sea surface. Student will then learn on marine environmental issues related to ship and offshore structure. This course also introduces the main forms of marine renewable energy particularly wind, wave and tidal, focusing on the technology and resource assessment associated with each.



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LESSON PLAN (WEEK)



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01

Introduction

02

Atmospheric
pressure and
wind

03

Waves and
Tides

04

Oceanic
Circulation

05

Climatology
and Weather
System

06

Weather
Observation
and
Forecasting

07

Climate
Change

09

Marine
Renewable
Energy

10

Wave and
Wind Energy

11

Tidal Energy

12

Development
Appraisal

13

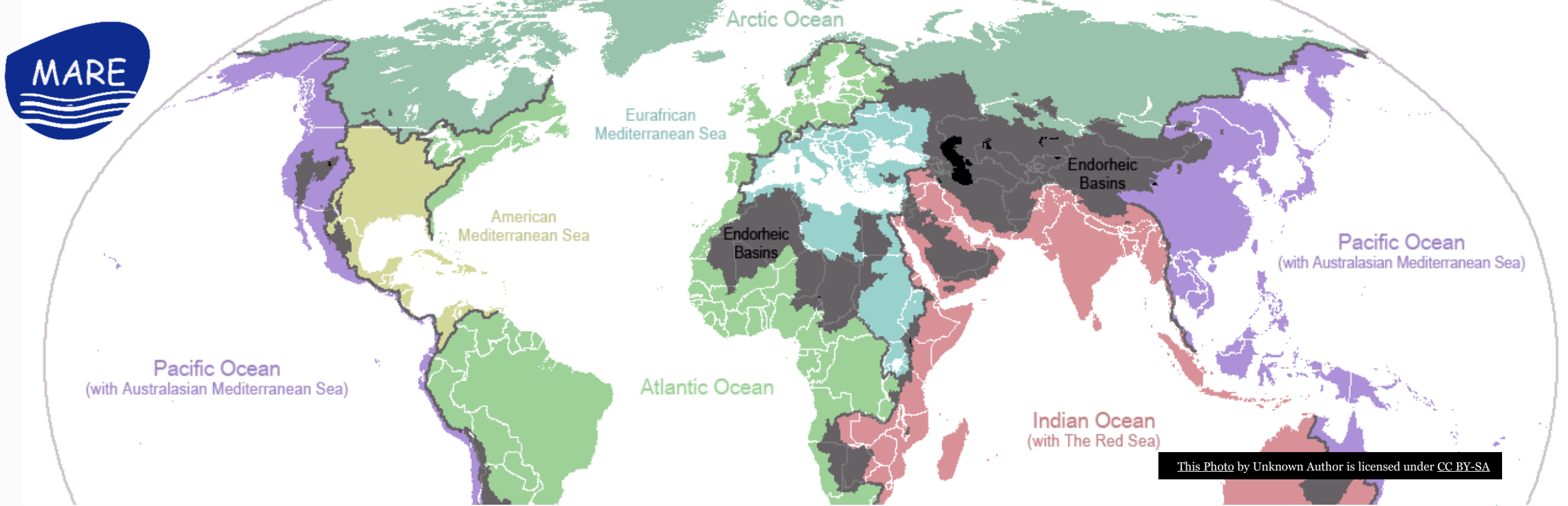
Resource
Assessment

14

Case Studies

15

Revision
Week



OCEANOGRAPHY AND MARINE ENVIRONMENT



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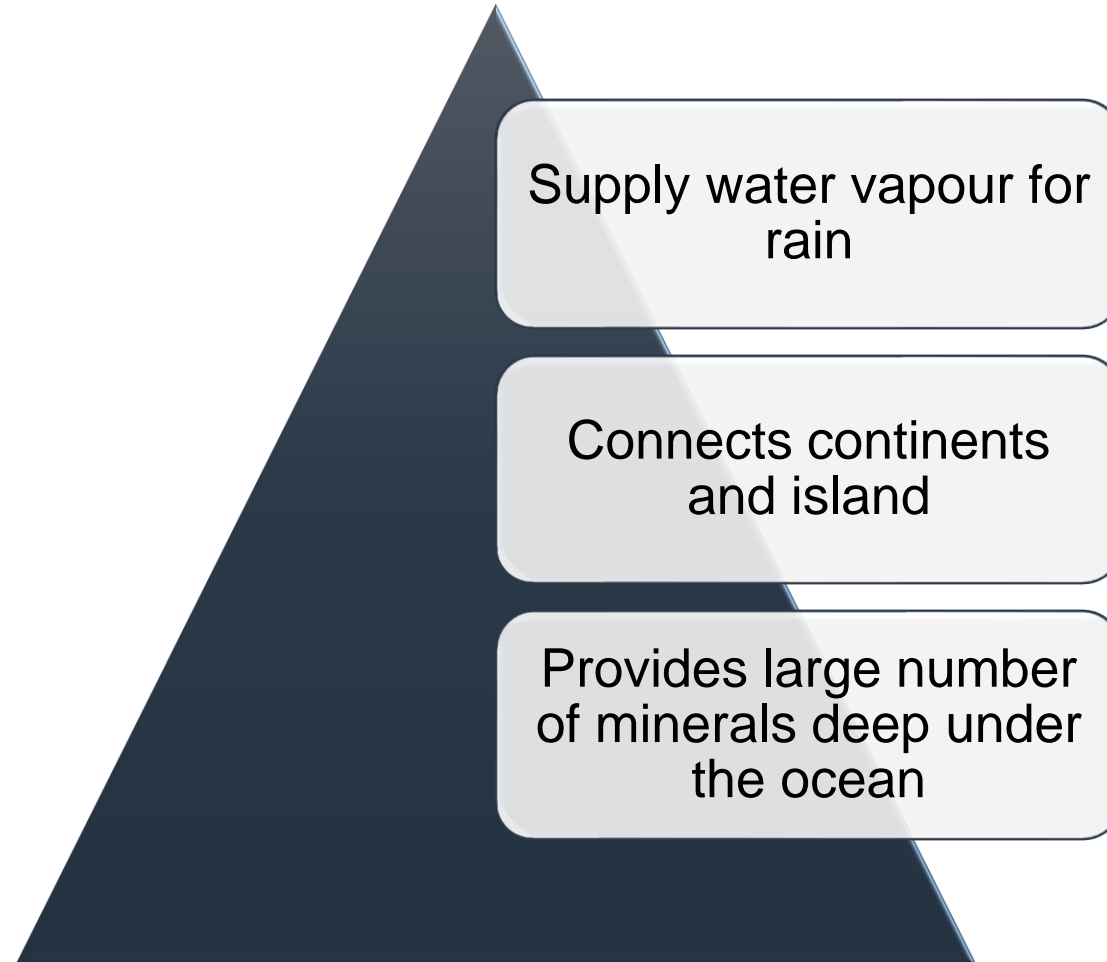
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ROLE OF OCEAN

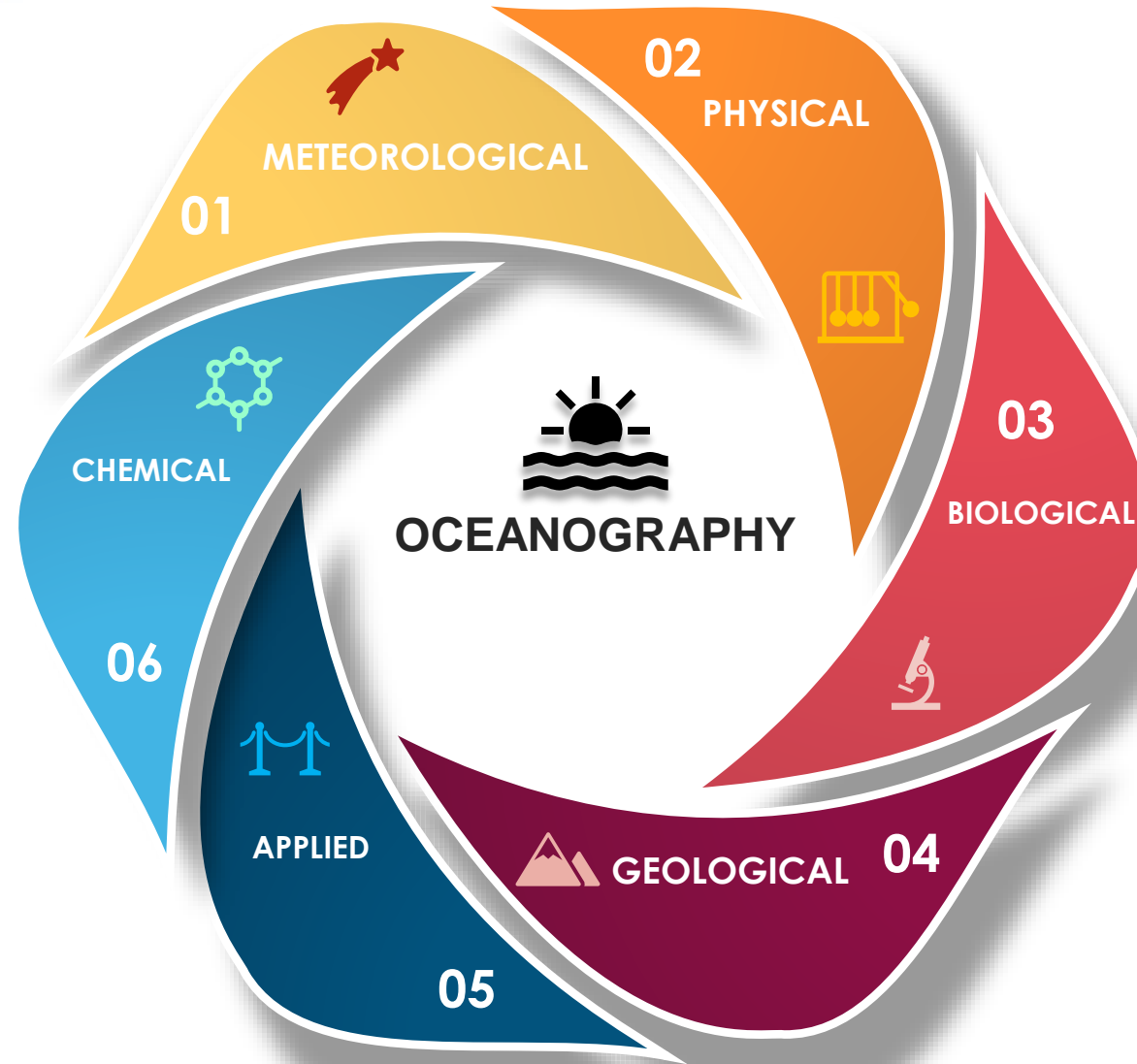




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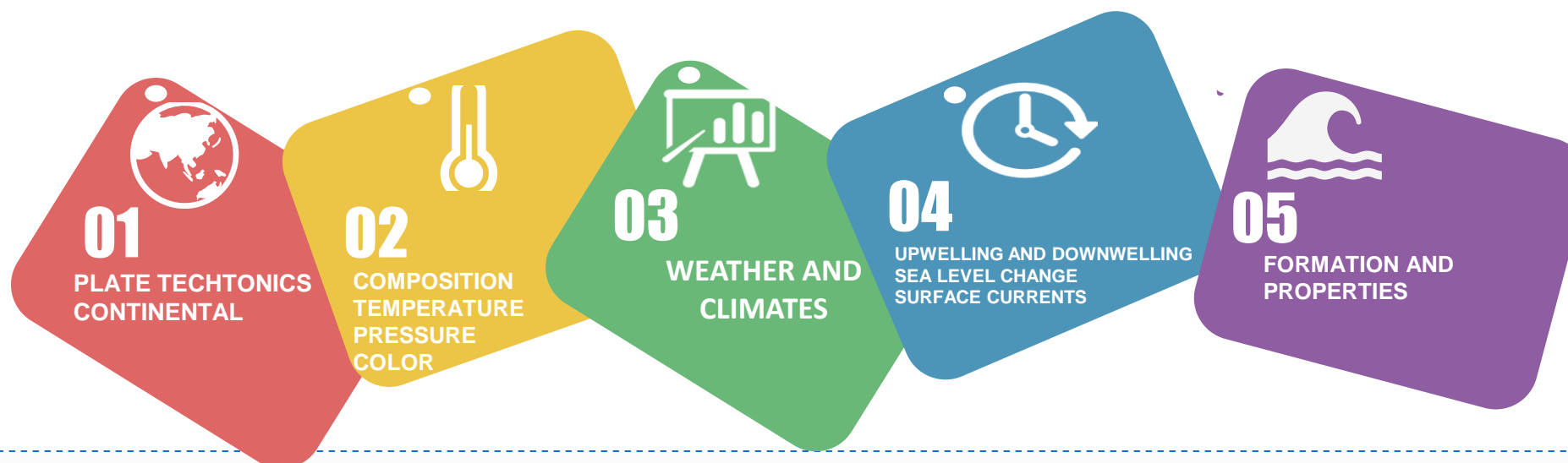


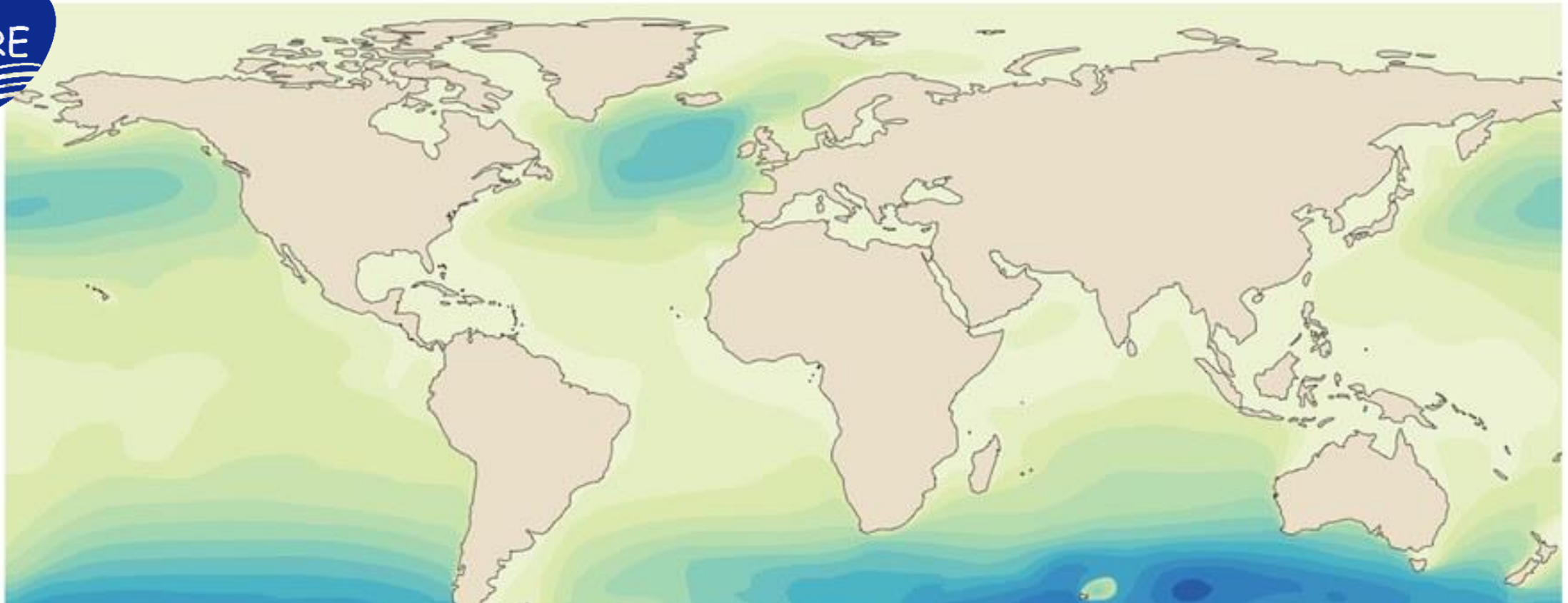
MARINE ENVIRONMENT



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RENEWABLE ENERGY

5 15 25 35 45 55 65 75 85 95 105 115 125
Mean power in Kilowatt per metre

Source: Cornett, 2008



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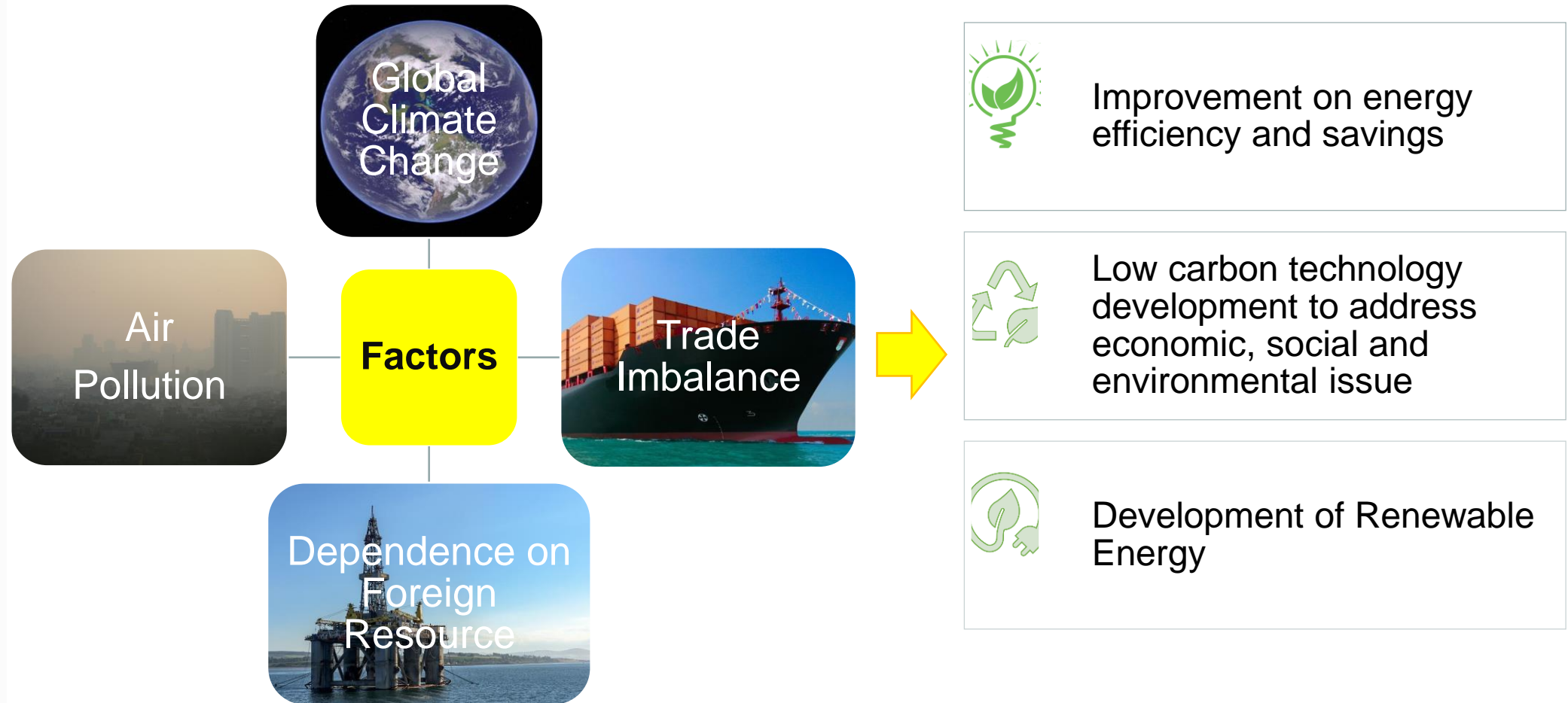
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Introduction





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Why Renewable Energy?



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1

HELPS ENVIRONMENT —

Renewable energy reduces the devastating impact of fossil fuels on local ecosystems



2

BENEFITS ECONOMY —

Renewable energy can bring stability to energy prices by increasing the number of sources of energy used to meet demand.



3

PROVIDES SECURITY —

Multiple energy sources can also provide reliability because if production dips in natural gas, other energy sources, like solar, wind, and hydro, can pick up the slack.



5

IMPROVES PUBLIC HEALTH —

Air and water pollution produced by coal and natural gas production aren't emitted by clean energy technologies.

4

SUPPORTS JOB GROWTH —

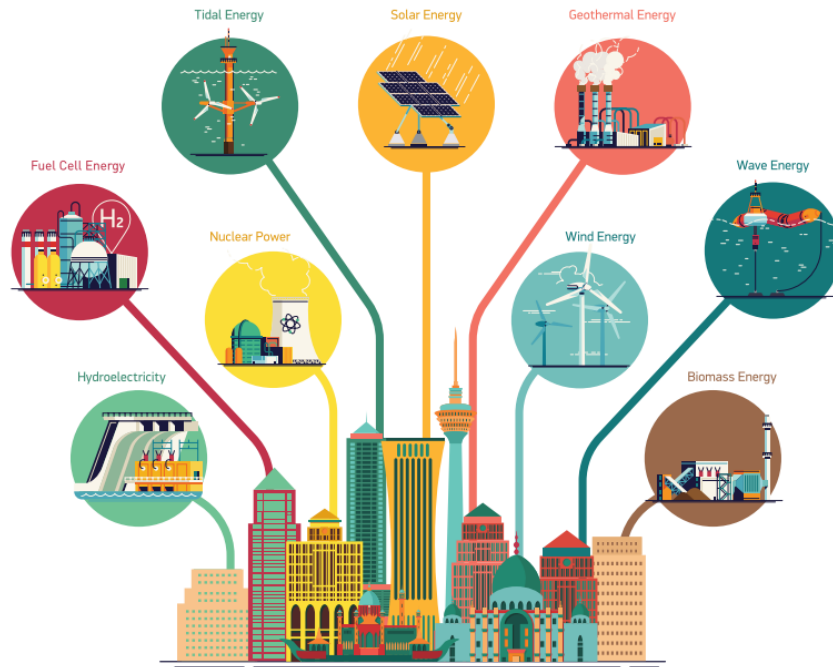
Renewable energy is labor intensive and can provide a significant amount of job growth.



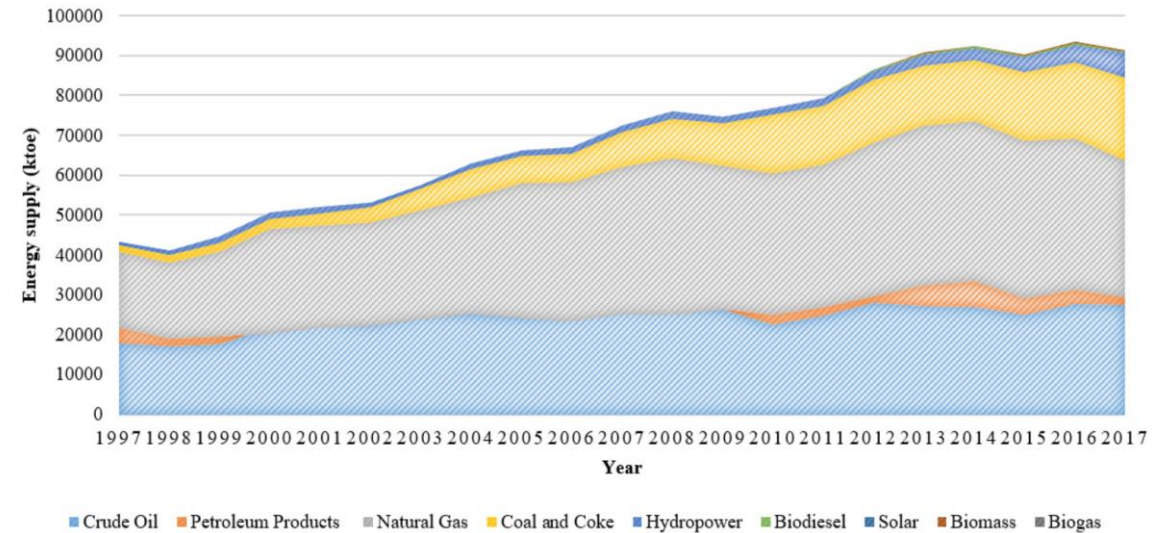
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CARBON FREE ENERGY: ROADMAP FOR MALAYSIA



Renewable Energy In Malaysia



Increasing demand of energy supply in Malaysia over 20 years
(1997-2017). (Energy Commission, 2017)

- National Green Technology Policy (2009)
- National Renewable Energy Policy and Action Plan (2010)
 - New Energy Policy (2010)
 - Renewable Energy Act (2011)
- National Biomass Strategy 2020 (2011)



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Types of Renewable Energy Sources



①

Hydropower



Gravitational potential energy of water converted into electrical energy through a hydraulic turbine

②

Wind Energy



Kinetic energy of wind converted into electricity by wind turbines

③

Solar Energy



The sun's energy turned into electricity heat energy by solar panels/solar heaters

④

Biomass



Energy obtained from plant & animal remains; e.g, burning wood produces heat energy

⑤

Geothermal Energy



Heat energy trapped underneath the earth's crust converted into electricity by steam turbines

⑥

Ocean Energy



Oceanic thermal and tidal energy converted into electricity by turbines and other systems

⑦

Hydrogen



Hydrogen's potential chemical energy converted into electricity by Hydrogen fuel cells



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Picture credit <https://www.sciencefacts.net/types-of-renewable-energy.html>



Ocean Tides

- Potential energy associated with tides can be harnessed by building barrage or other forms of turbine-equipped construction across an estuary



Ocean Waves

- Kinetic and potential associated with ocean waves can be harnessed using modular technologies



Marine Current

- Kinetic energy associated with tidal (marine) currents can be harnessed using modular systems



Temperature Gradient

- Thermal energy due to temperature gradient between sea surface and deep water can be harnessed using different Ocean Thermal Energy Conversion (OTEC) processes



Salinity Gradient

- At the mouths of rivers where fresh water mixes with salt water, energy associated with the salinity gradient can be harnessed using a pressure retarded reverse osmosis process and associated conversion technologies

OCEAN RENEWABLE RESOURCES





Potential positive and negative outcomes of renewable energy development



a

**Positive
outcomes**



Reduced impacts from
climate change



Improved air quality
and human health

b

**Negative
outcomes**



Reduced biodiversity due
to land-use change



Reduced local land rights



Reduced water evaporation
from floating solar



Increased greenhouse gas
emissions from land-use change



Increased agricultural yields
from agricultural solar



Increased threats to
cultural heritage



Coastal protection from
wave energy



Increased mining of
rare earth metals

THANK YOU

farahellyza@utm.my