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INDONESIA'S ALGAE-BASED BIOFUEL RESOURCE POTENTIAL

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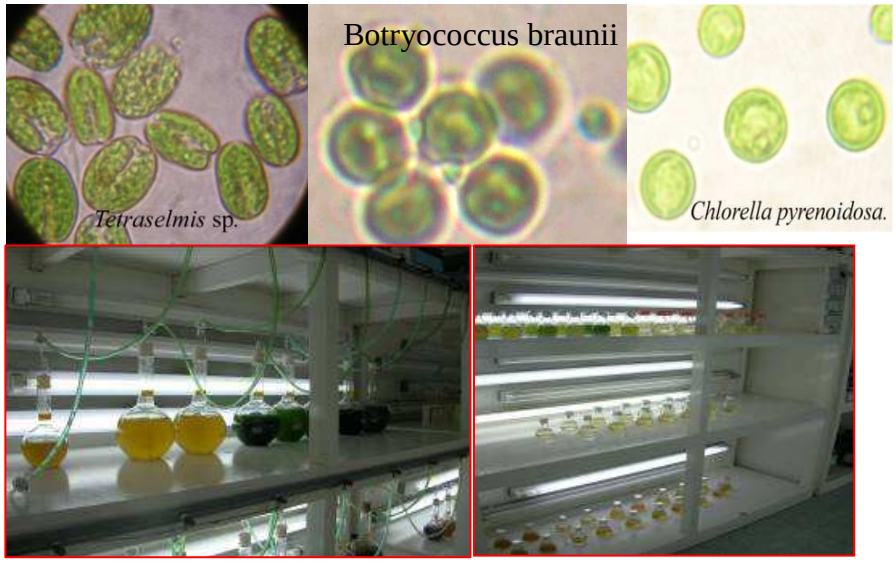
APPLICABILITY IN INDONESIA

- Archipelago country with the length of coastal area more than 80,000 km
- Tropical climate, with high sunlight exposure and relatively constant temperatures in the whole year
- Abundant microalgae varieties (fresh/brackish water, marine)
- Availability of other resources: CO_2, land, water

Suitable conditions for microalgae

MICROALGAE VARIETIES

- Potential of 24 marine microalgae species as biofuels resources is under investigation
- More than 500 samples of microalgae from fresh/brackish water from different areas have been analyzed
- *Nannochloropsis sp., Chlorella sp., Tetraselmis sp., Botryococcus braunii sp.,* typical microalgae that gain interest to be investigated as possible resource of biodiesel



MASS CULTURE

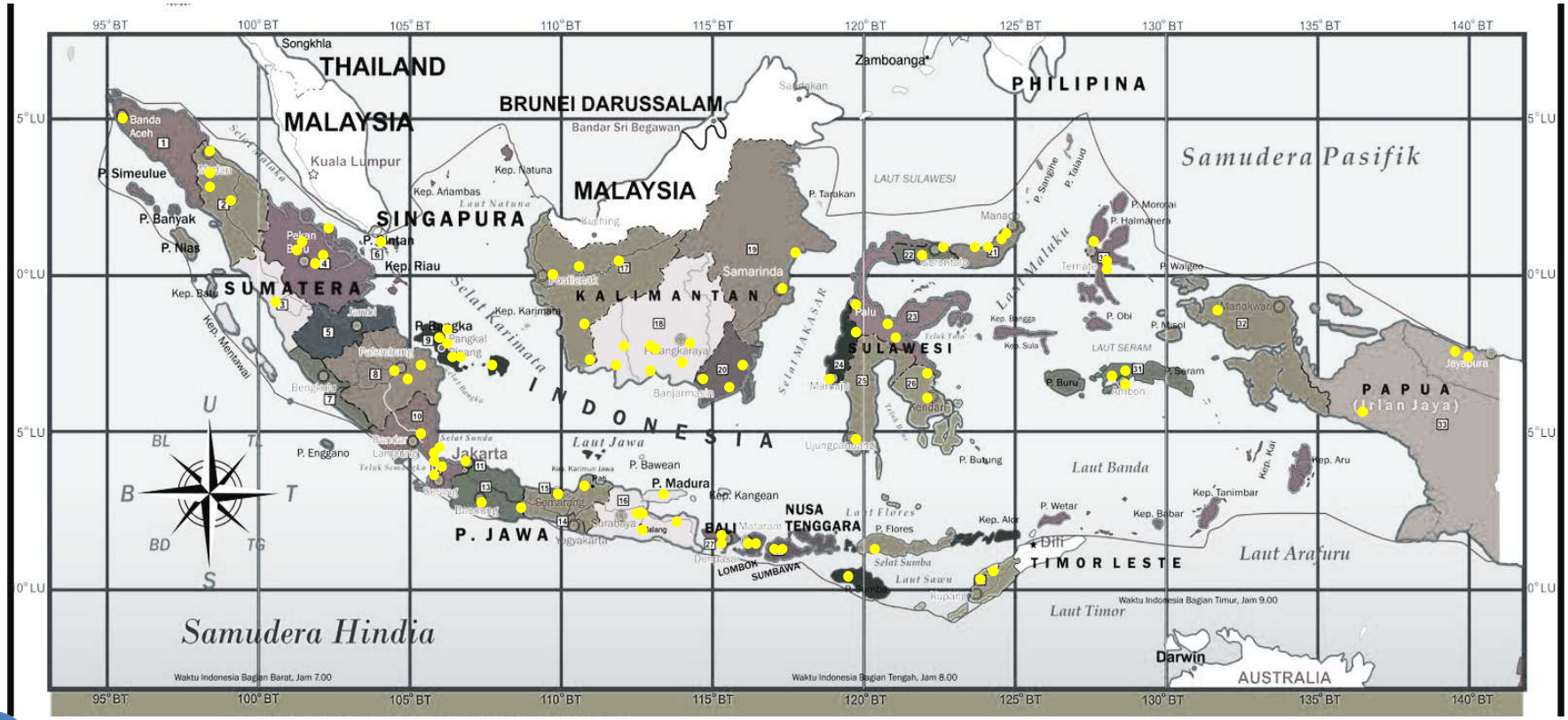
- Marine microalgae culture is well established especially in hatchery industries. Usually cultured in open deep concrete ponds
- Fresh/brackish water microalgae used for waste water treatment and other purposes, mostly cultured in inland areas with shallow ponds
- Basic technologies are applied by traditional farmers in hatchery industries, while mass culture in photo bioreactors is not popular.

Nannochloropsis oculata culture at Research Institute for Marine Culture Gondol-Bali, Ministry of Marine Affairs and Fisheries

Chaetoceros sp (diatom) culture at Research Institute for Marine Culture Gondol-Bali, Ministry of Marine Affairs and Fisheries

CO_2 RESOURCES (Power Plants)

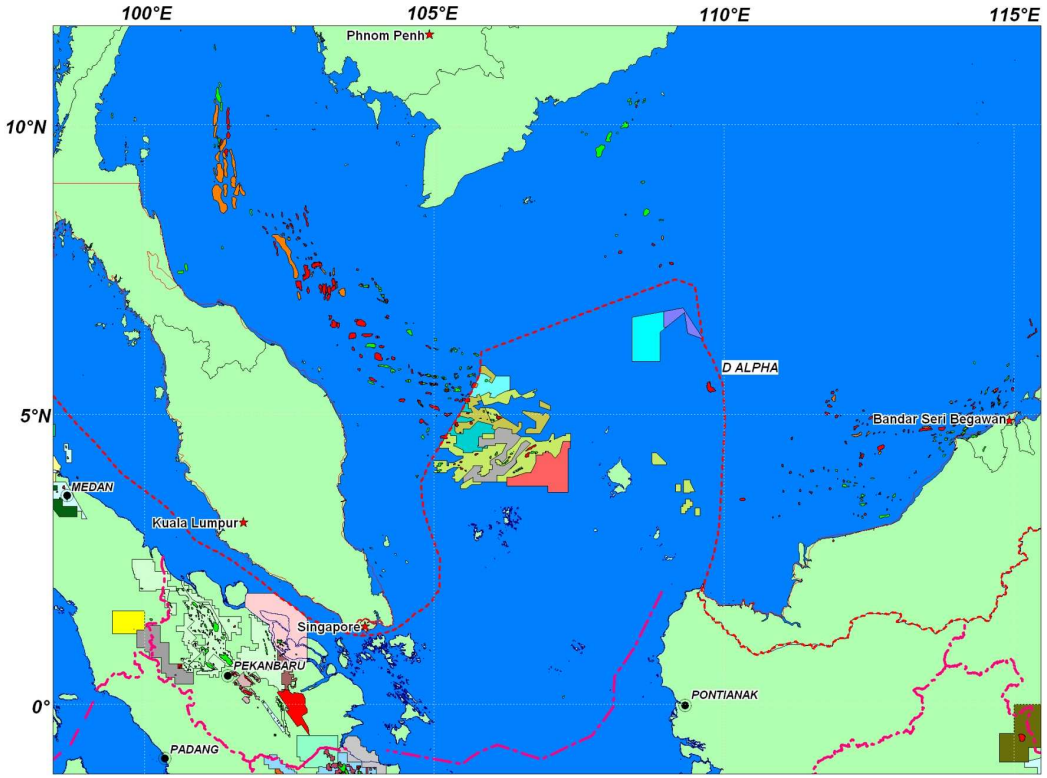
- Coal power plants (existings/on-going projects) located accross the country
- In 2009, national CO_2 emission from power generation reached 116 Mill Mton*.



* ICCSR (Indonesia Climate Change sectoral Roadmap

CO_2 RESOURCES (Oil/Gas Field)

- Natural gas/ associated gas may contain high amount of CO_2
- CO_2 content in natural gas from Natuna gas field is estimated to be 70% (or 72 mill.ton per year



SUITABLE PARAMETER FOR MARINE MICROALGAE PRODUCTION

Parameters	Range	Optima	Indonesia
Temperature (C)	20 - 32	27 – 29	28-30 (sea water)
Salinity (ppt)	12 – 40	30-31	30-33 (sea water)
Light intensity (lux)	1000 – 10,000	2.500 – 5,000	
Light : dark, (hours)		24 : 0 (maximum)	12:12 (coastal area)
pH	7 - 9	8.2 – 8.7	8.2-8.4 (sea water)

WATER/LAND RESOURCES

- In case deep concrete ponds is used for marine /brackish microalgae culture, the amount of water and land required is estimated below, with assumptions that yield of oil extraction can reach 30%

- Better system production design is expected to reduce the water needs significantly

Microalgae type	Oil Prod. [Ton/y]	Fresh sea water [Ton/y]	Fresh water [Ton/y]	Land for ponds [m2]
Marine	**1000**	**2,200,000**	**-**	**120,000**
Brackish	**1000**	**1,500,000**	**700,000**	**120,000**

CLOSING

- Marine microalgae has better potential to be developed in Indonesia compare to freshwater type, in terms of CO_2, water and land resources
- Indonesia has long experience in marine microalgae culture for hatchery
- Indonesia ‘s climate and its geographic is favorable to develop low cost production system of microalgae-based biofuel
- In recent years, the research works on microalgae for biofuel especially for lipid production has gained more interests.

THANK YOU