

INDONESIA RENEWABLE ENERGY

**NEW AND RENEWABLE ENERGY TECHNOLOGIES
EXPERT GROUP (EGNRET) MEETING 41**

**Beijing, P.R. China
16-17 October, 2013**



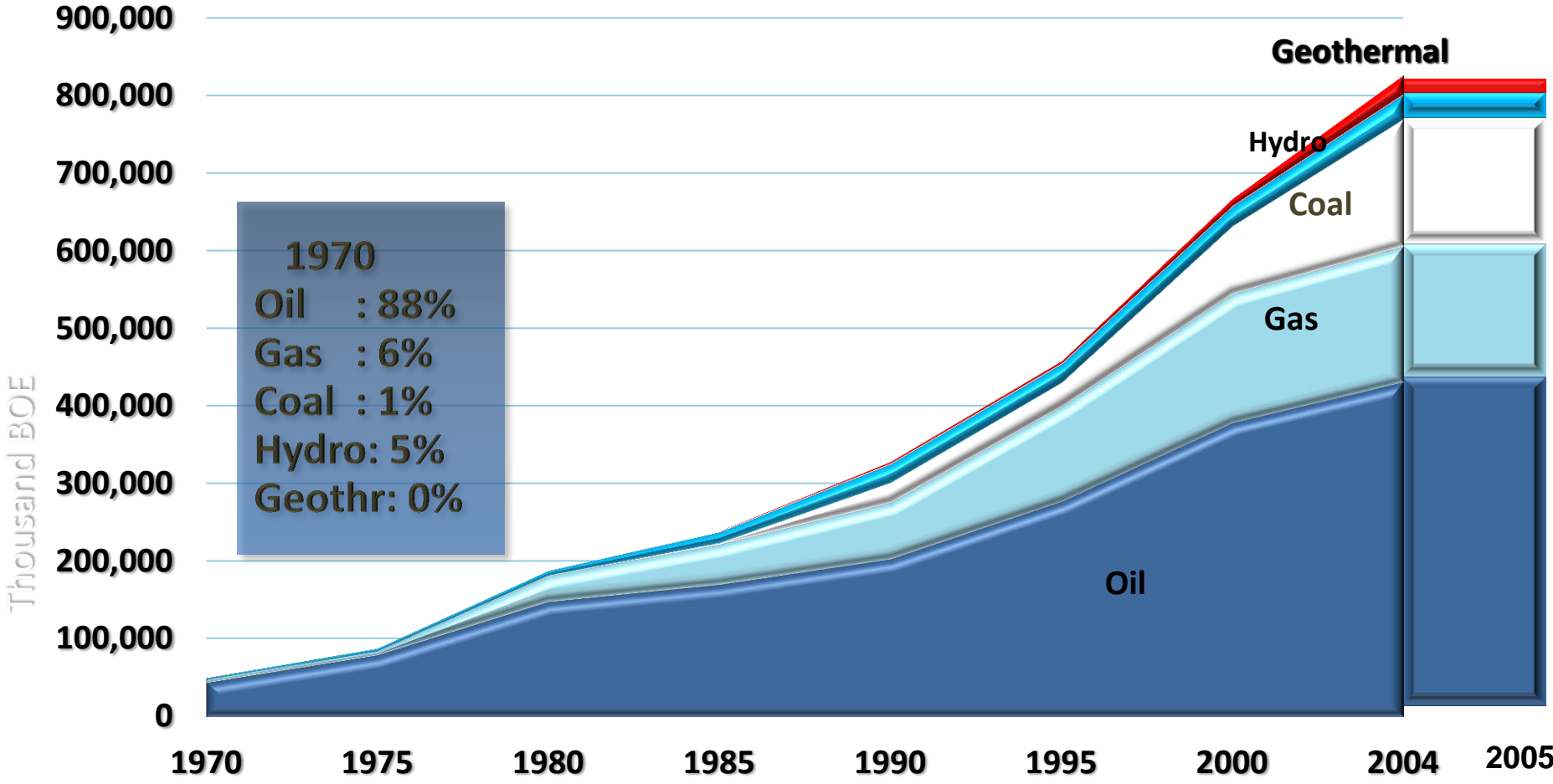
**R & D Center For Electricity, New-
Renewable Energy and Energy
Conservation**

**MINISTRY OF ENERGY AND MINERAL
RESOURCES REPUBLIC OF
INDONESIA**

CURRENT ENERGY SITUATION

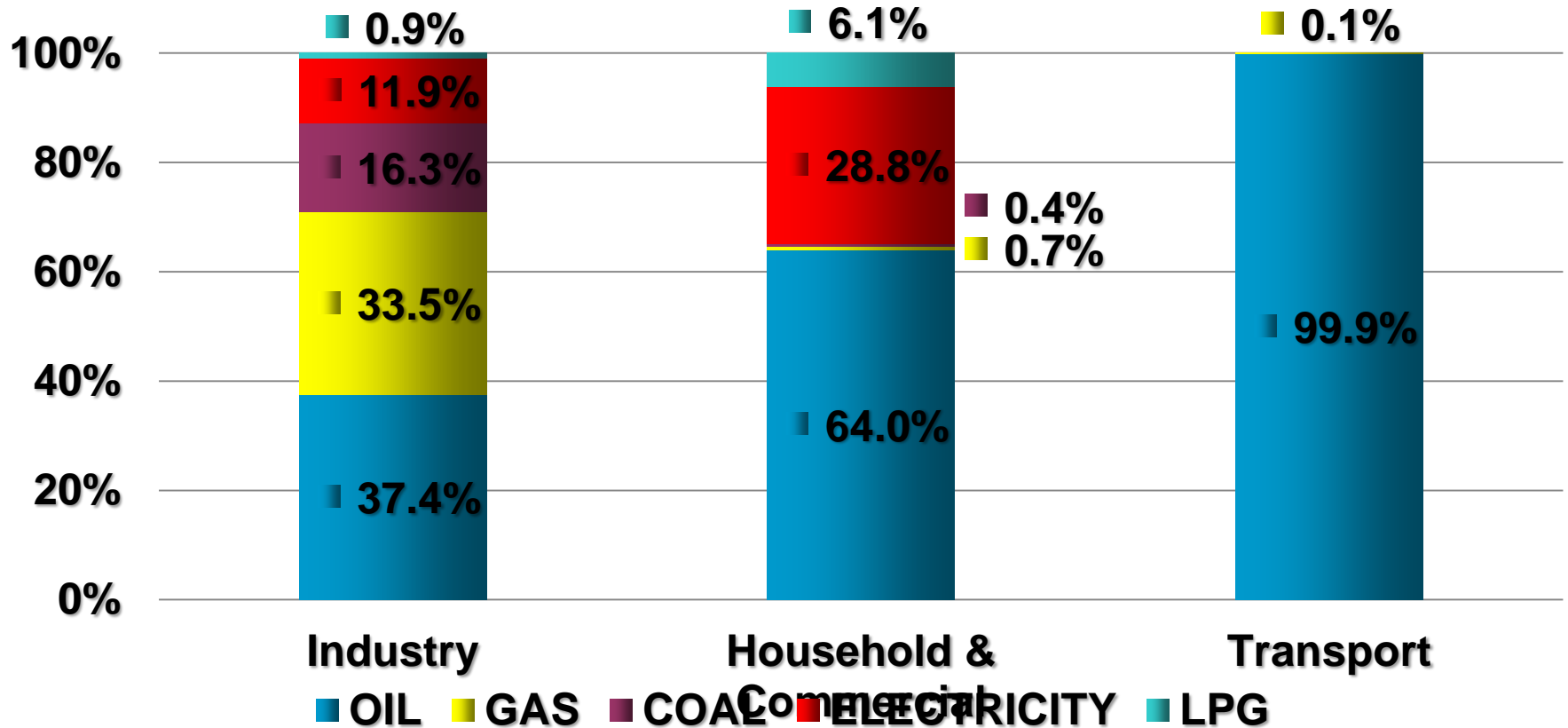
- Oil Domination
 - Oil still dominates primary energy sources in Indonesia (about 52% of primary energy mix)
- Fuel Subsidies
 - GOI has provided fuel subsidies to provide cheaper fuel price. Reduction of fuel subsidies has been gradually applied since 2004, but not yet completely removed. In 2005, the subsidies cost nearly \$10 billion or 3.5% of GDP
- Growth of energy consumption in period of 1970-2005 is $\pm 8.5\%$ per year, however, the community access to the energy still low

Growth of Primary Energy Demand (Thousand BOE)



- Growth of Energy Consumption 1970-2005 + 8,5 %/year
- Oil still has dominant role

Share of Final Energy Consumption by Fuel type (2005)



Share of Final Energy Consumption by sector :

Industry	: (38.5%)
Household & Commercial	: (23.5%)
Transportation	: (38.0%)

RENEWABLE ENERGY RESOURCES

- Hydro;
Hydro energy that spread out in the country is estimated to have total capacity more than 75 GW
- Geothermal;
Over 252 areas has been identified (small - intermediate enthalpy about 30,000 MWe and high enthalpy about 27,000 MWe)**
- Wind;
Some direct measurements and model-based estimates have been done. At windy area the annual average wind speed reach 7 m/s at 50m height***

Sources: * DJLPE; ** PERTAMINA; *** LAPAN, P3TKEBT

RENEWABLE ENERGY RESOURCES

- Solar;
The intensity of solar energy 4-5.7 kWh/m²/d
- Ocean;
Straits in Eastern Indonesia have high speed current (1-3 m/s),
some locations have tidal potential up to 4m^{**}
- Biomass;
Annual agriculture/forestry waste (~ 50 GW)^{***}

Sources: * P3TKEBT; ** PPGL; *** DJLPE

SOME RESEARCH & DEVELOPMENT ACTIVITIES FOR NON-FOSSIL ENERGY AT MINISTRY OF ENERGY AND MINERAL RESOURCES

- Model project of Micro hydro
- Demonstration project of Stabilized and Advanced Grid-Connection Photovoltaic
- Model project of biogas from dung in rural area
- Bio ethanol from industrial waste
- Fuel cell for power generation
- Microalgae as a feedstock for biodiesel
- Biomass Gasification (lead to cellulosic bio fuel)
- Medium scale of Wind Turbine (100 kW)
- Study on Geothermal Reservoir
- Ocean Current power plant

MODEL PROJECT OF MICROHYDRO POWER PLANT



Run-off-river MHPP at water fall creek, Garut, West Java, cap. of 165 kW



Run-off-river MHPP at irrigation system, Subang, West Java, cap. of 100 kW

BIOMASS GASIFICATION, BIOETHANOL AND BIOGAS



FUEL CELL AS DISTRIBUTED POWER GENERATION

- Applicability for Indonesia
 - Distributed Power Generator is suitable for archipelago country
 - Small capacity power generation can be used for housing/small industries
 - Hydrogen can be obtained from RE such as Wind or PV which its availability is intermittent
- Current Development
 - PEM FC is under development by many institutes
 - MEA is mostly component that under studies

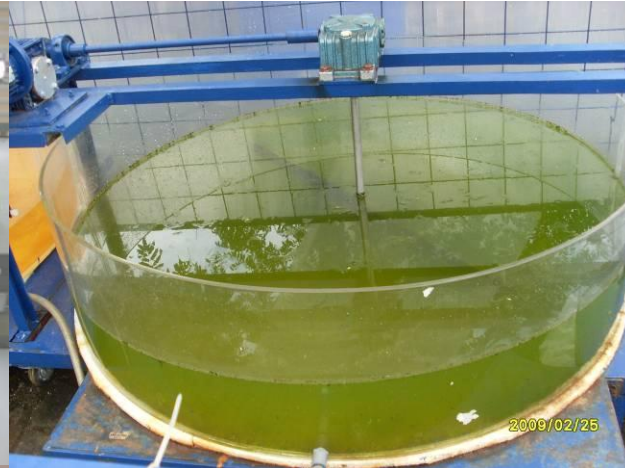
Facility for fabricating small scale PEMFC (reducing catalyst by applying sputtering technique)



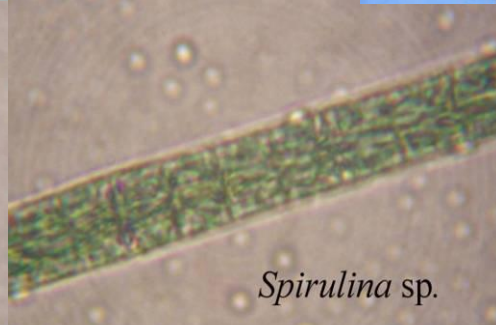
Micro Algae as Biodiesel Feedstock

- Applicability for Indonesia
 - Archipelago country with the length of coastal area reach to 80,000 km
 - Tropical climate, with high sunlight exposure and relatively constant temperatures for the whole year
 - Microalgae variety is abundant in Indonesian waters
- Current Development
 - Hundreds of species have been assessed
 - Some strains show promising properties
 - Small scale project is underway

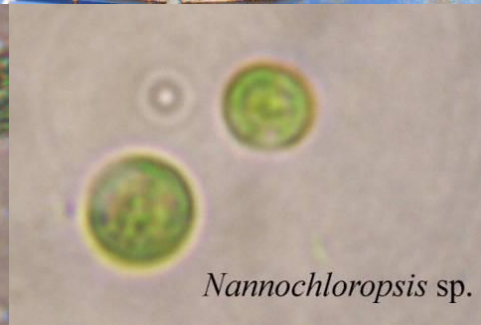
Microalga: species, culture and the oil



Dunaliella tertiolectra - IFREMER



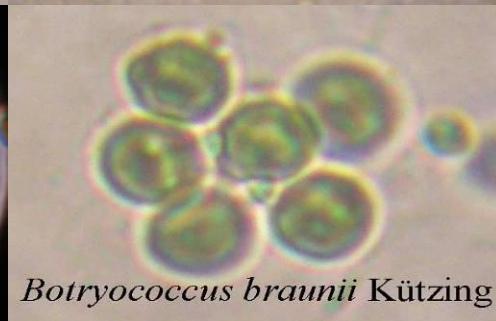
Spirulina sp.



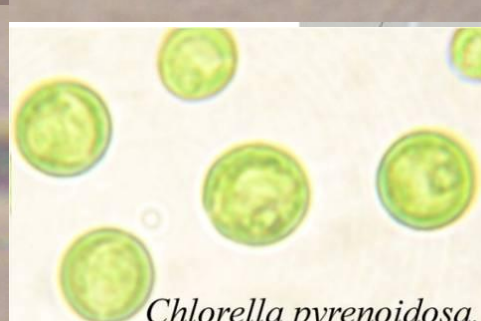
Nannochloropsis sp.



Tetraselmis sp.



Botryococcus braunii Kützing



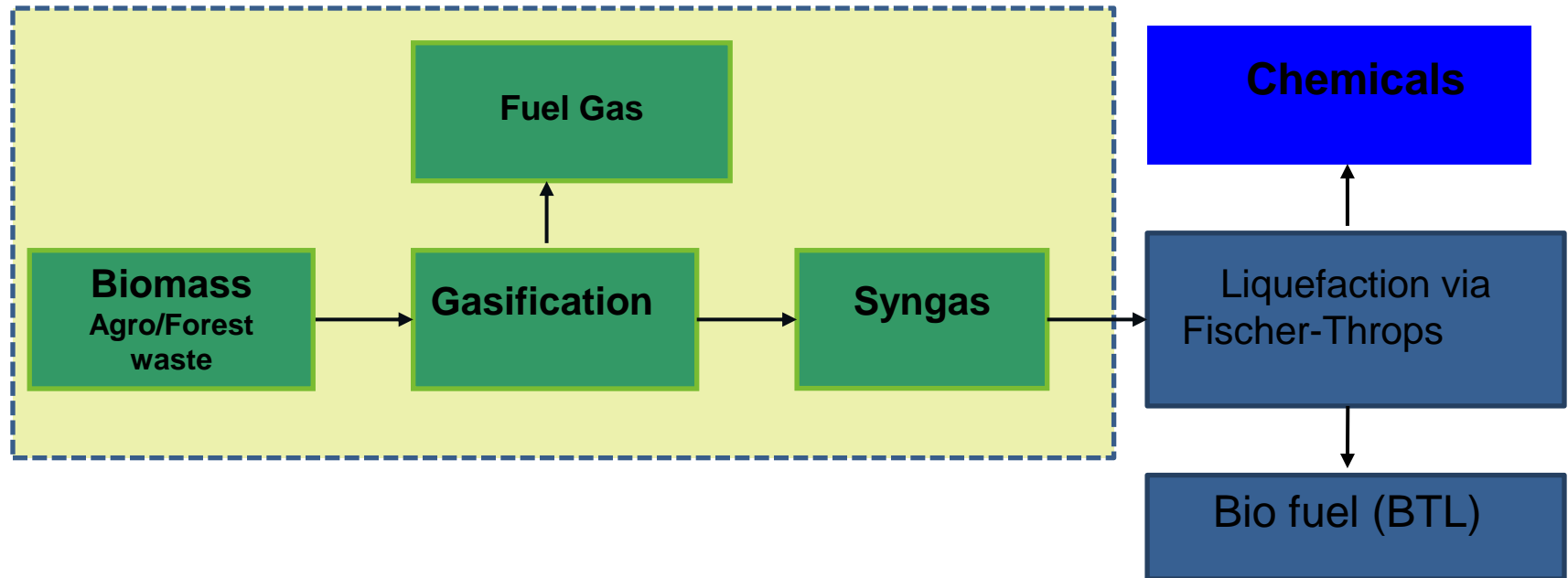
Chlorella pyrenoidosa.



THERMAL PROCESS FOR CELLULOSIC BIOFUEL

- Applicability for Indonesia
 - Most of agriculture/forest waste has not been optimal utilized and its capacity is huge
 - Utilization of biomass for energy mostly using direct combustion technology
- Current Development
 - Industrial scale of biomass gasification using fluidized bed is not yet applied
 - The application of biomass gasification typically using downdraft/updraft reactor
 - Fischer Throps process has been studied at laboratory scale

Cellulosic Biofuel Production

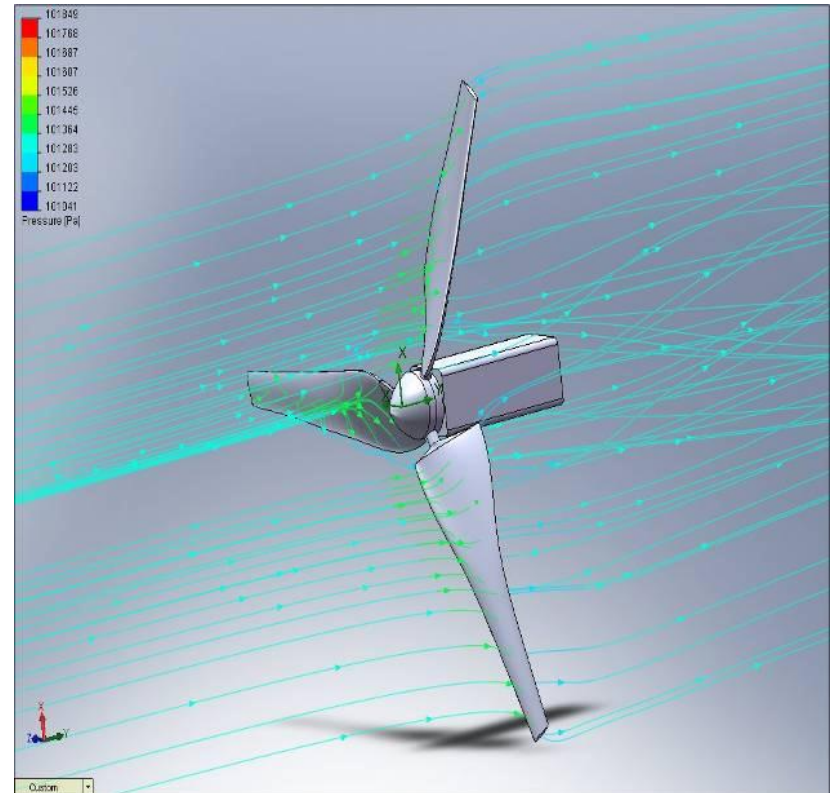
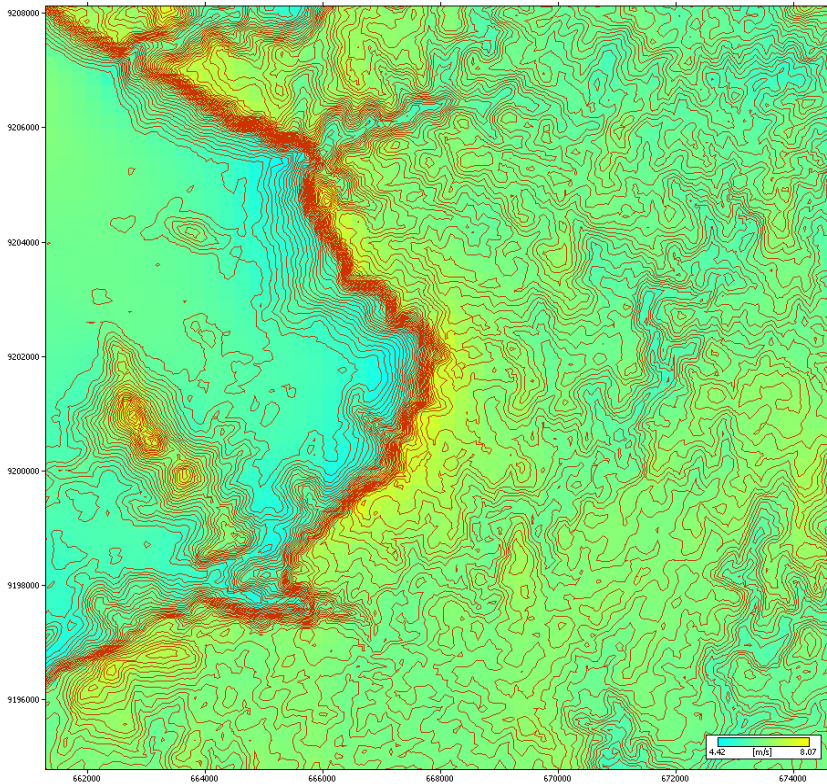


- The study on small scale biomass gasification using fluidized bed reactor is underway

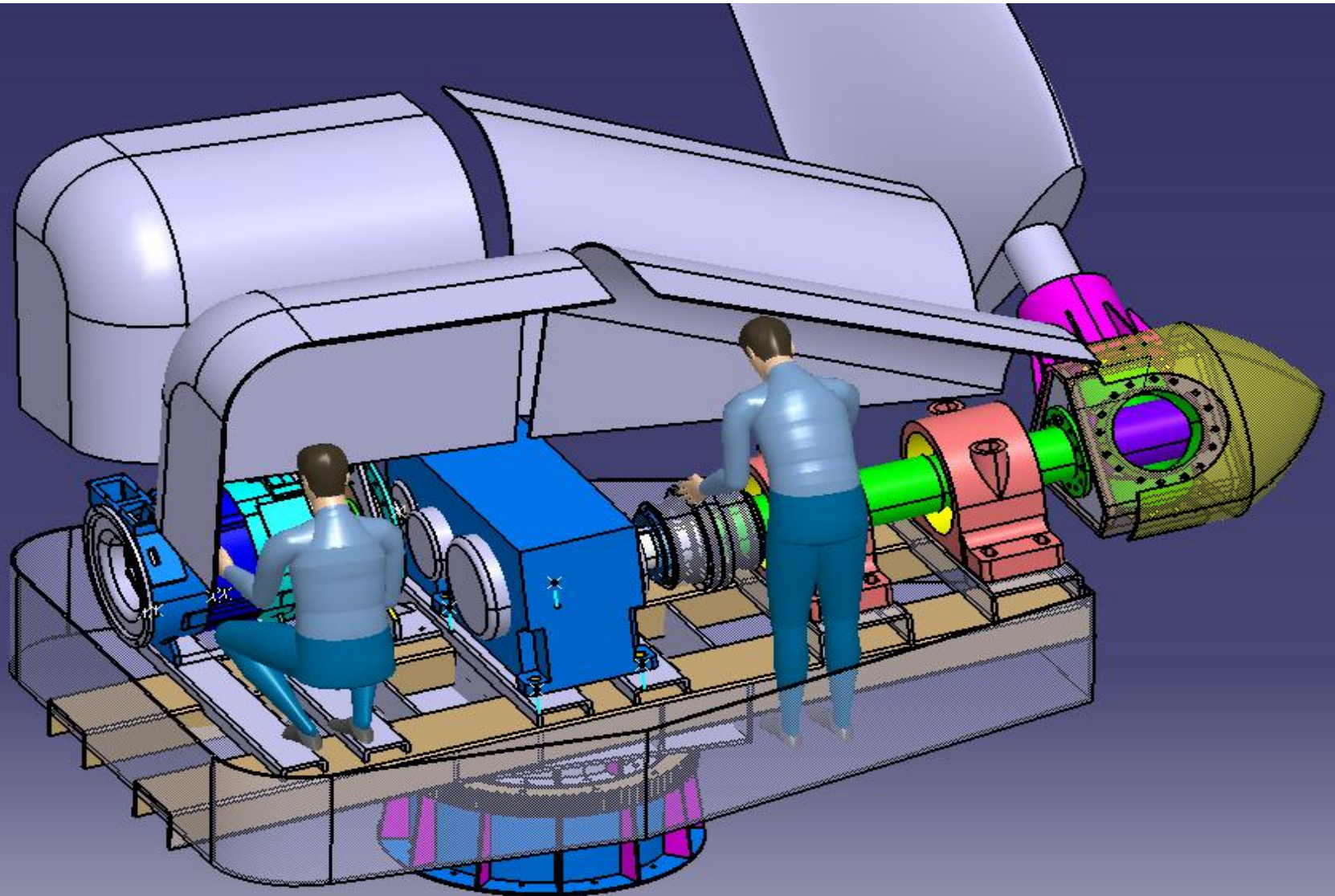
WIND ENERGY POWER PLANT

- Applicability for Indonesia
 - Archipelago country and many remote area needs distributed power generator
 - Some areas has annual rated speed over 5 m/s
 - Very small utilized, difficulties to adopt existing technology
- Current Development
 - Small capacity (<10kW) has been developed
 - 100 kW wind turbine using induction generator is under development
 - Manufacture of medium-large scale of blade is conducted at National aero craft industry facility

Map of wind grid sources at West Java, and development of 100 kW Wind turbine



WIND TURBINE CONCEPTUAL DESIGN



WIND TURBINE PILOT PLANT 100 kW



Small Scale Geothermal Energy Development (< 10 MW)

- Applicability for Indonesia
 - Hundreds of geothermal site is identified as low-intermediate enthalpy, none is utilized as small power plant
 - The sites spread out in the country, suitable for small grid in islands outside Java
- Current Development
 - A few of early investigation has been done
 - High cost on the activities become a barrier for further investigation

- Proposed site of study
Banten Province

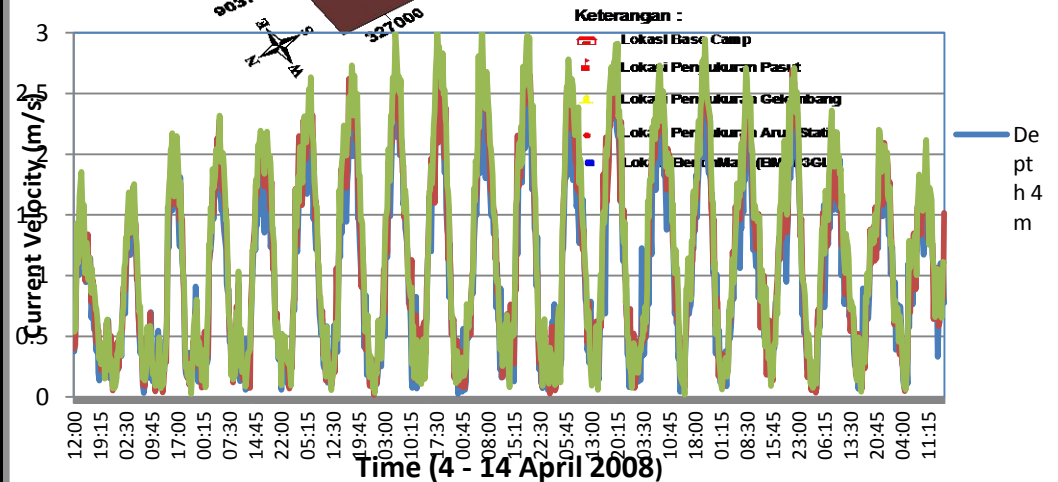
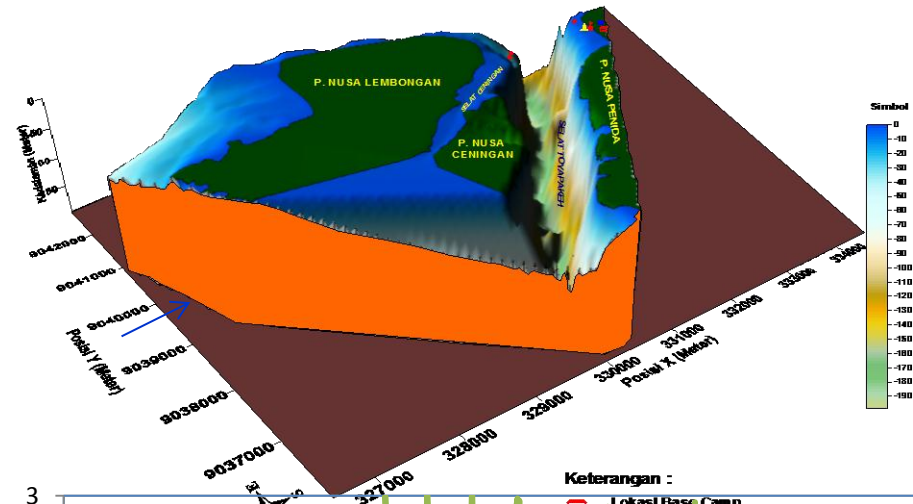
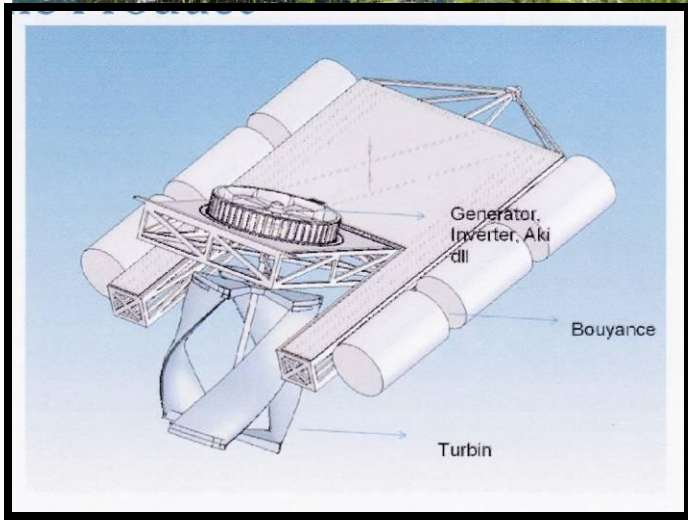
- Potential indication:

Based on geological, geochemistry and geophysics data and manifestation on the surface, it is possible to have heat accumulation zone that forms geothermal zone under the surface. It is predicted geothermal reservoir zone is located at > 1000m under the ground with capacity of 61 MWe

OCEAN CURRENT POWER PLANT

- Applicability for Indonesia
 - Archipelago country which has more than thousand islands, potential for ocean energy (wave, tidal or current)
 - many straits that potential for ocean current plant
 - The sites spread out in the country, suitable for small grid in islands outside Java
- Current Development
 - A few of early investigation has been done
 - High cost on the activities become a barrier for further investigation

Study on ocean current at Bali province



CLOSING

- ❑ Oil production tends to decline
- ❑ Acceleration of alternative energy development need to be immediate performed as one measure to achieve national energy security
- ❑ High up-front capital cost is a main challenge for renewable energy development in many developing countries like Indonesia
- ❑ Technological aspects has important role to answer the challenges in renewable energy development

THANKYOU

www.p3tkebt.esdm.go.id