BADAN PENGKAJIAN DAN PENERAPAN TEKNOLOGI (BPPT)

Iloilo, 27-30 November 2018

Indonesian Road Map to Marine Energy: Status and Prospective

On: **The East Asian Seas Congress, Iloilo Convention Center, Philippines**

BIDANG TEKNOLOGI INDUSTRI RANCANG BANGUN DAN REKAYASA

BY: ERWANDI

CENTER OF TECHNOLOGY FOR MARITIME INDUSTRIAL ENGINEERING

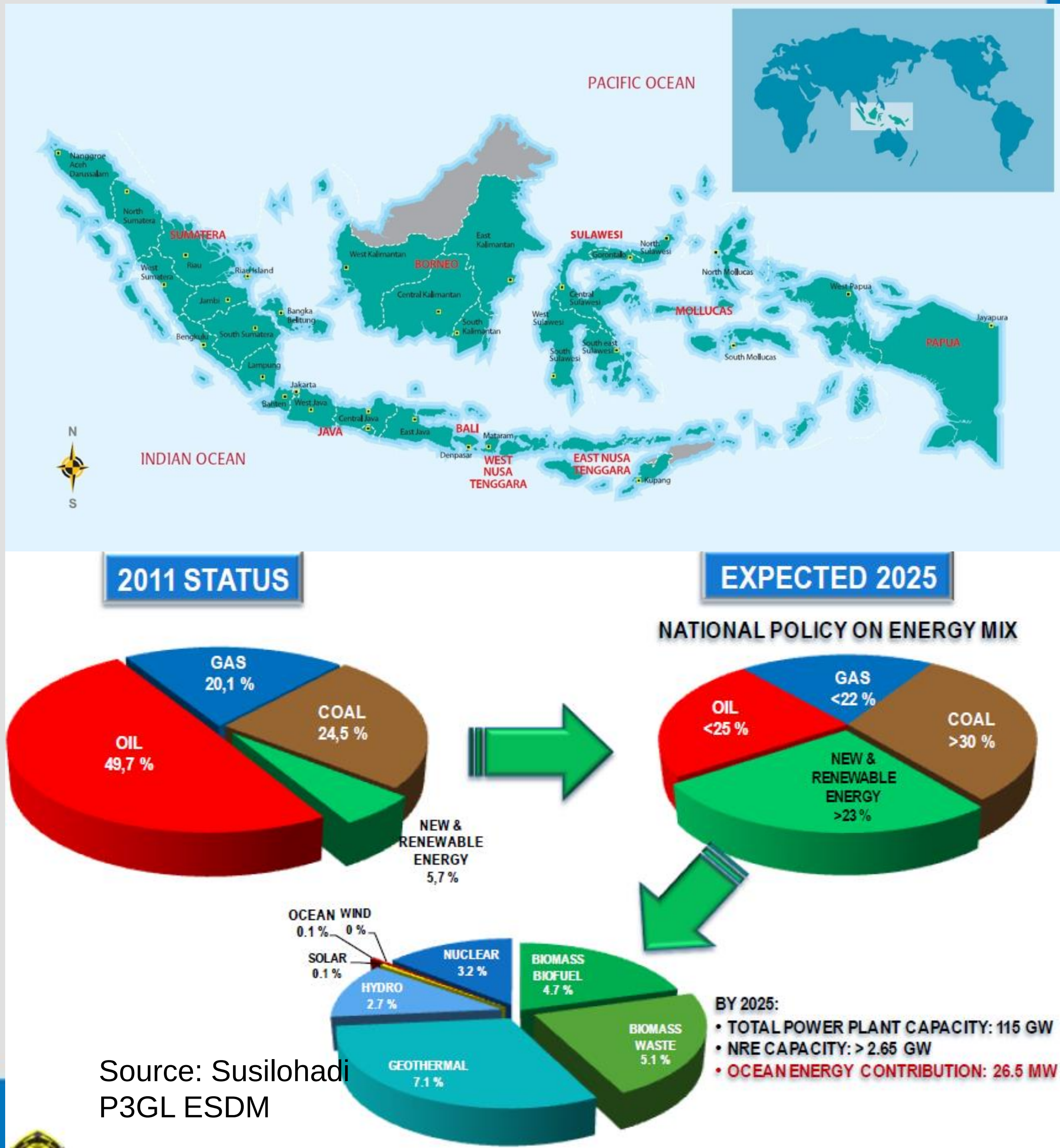
AGENCY FOR THE ASSESSMENT AND APPLICATION OF TECHNOLOGY

Outline

1. **Introduction:** National Energy Mix Policy, about BPPT and 2 labs
2. **BPPT Experience on ORE Mapping, Research, Engineering, and Prototyping**
3. **BPPT Recommendations:** Case Study of UNIDO Project, Tidal Bridge, and Recommendations to Government

Indonesia dan National Energy Mix Policy

1. The supply energy of many Islands depend on oil and coal.
2. Price and transportation become the main problem especially for east Indonesia.
3. The government policies : the islands should utilize their own local energy resources.
4. Need a new concept to develop the local energy resources.
5. Government Regulation about Policy of National Energy Mix, (PP no. 79, 2014) and the roadmap of the development of ocean energy resources.

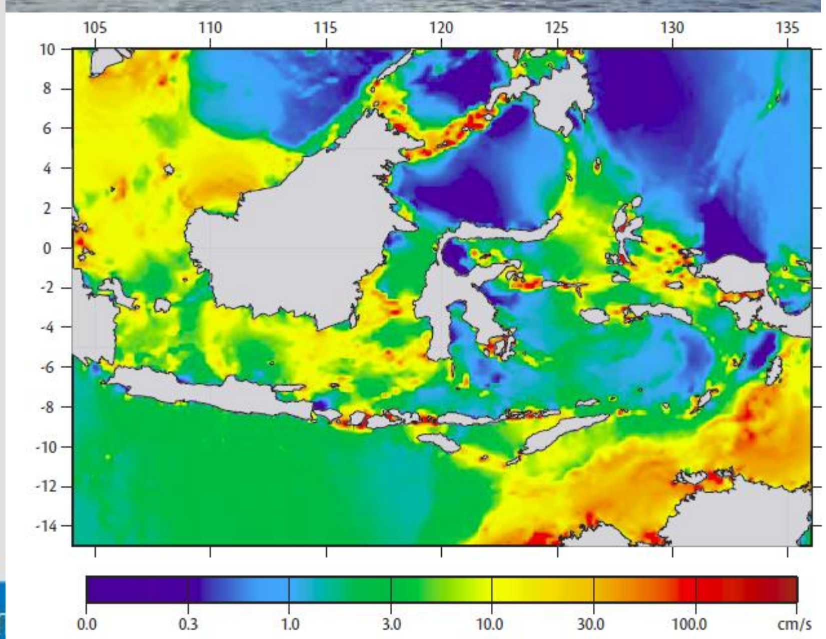


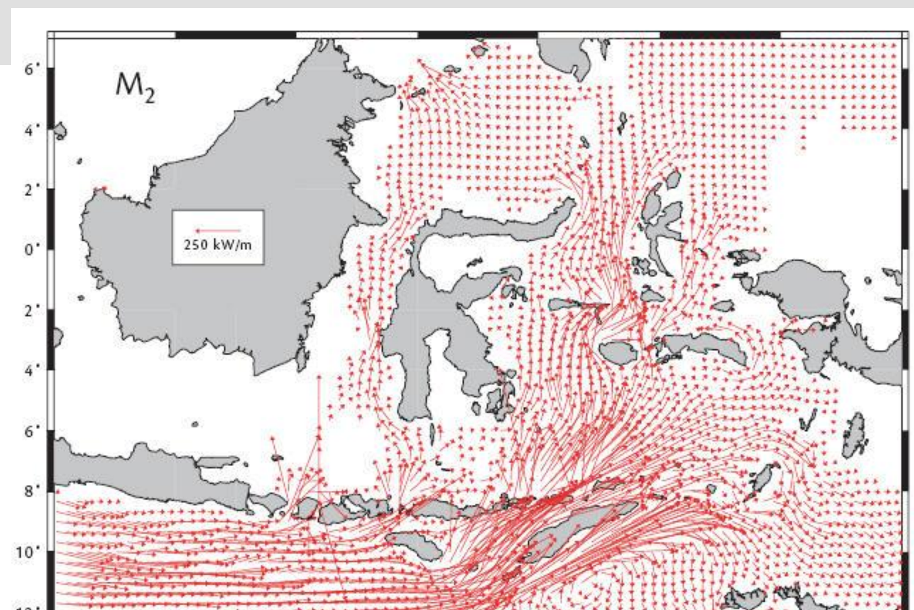
Source: Susilohadi
P3GL ESDM

Marine Current Potencies

- Marine current is the source of hydro-kinetic energy.
- The current will be accelerated when passing the straits.
- Predictability
- Since 2004 BPPT had assignment for assessing the ORE Technology (Marine Current and Wave)

Marine Current at Larantuka Strait





Source: Ray et.al. (2005): A Brief Overview of Tides in the Indonesia Seas

BPPT ORGANIZATIONAL STRUCTURE

BPPT

BADAN PENGKAJIAN DAN PENERAPAN TEKNOLOGI (BPPT)

Chairman
Dr. Ir. Unggul Priyanto, MSc

Inspectorate

Principal Secretariate

Deputy for Technology Policy Assessment

- Center For Assessment Of Technology Innovation Policy
- Center For Assessment Of Technology Difusion Policy
- Center For Assessment Of Comptetitiveness Improvement Policy
- Center Of Technology Audit
- Center For Technology Incubator

Deputy for Natural Resource development Technology

- Center Of Natural Resources Inventory Technology
- Center Of Mineral Resources Technology
- Center Of Land Region And Disaster Mitigation Technology
- Center Of Environmental Technology
- Center For Marine Survey
- Center For Environtmental Technology
- Center For Weather Modification Technology

Deputy for Agroindustrial Technology and Biotechnology

- Center Of Agricultural Prodction Technology
- Center Of Agroindustrial Technology
- Center Of Bioindustrial Technology
- Center Of Pharmaceutical Ad Medical Technology
- Center For Biotechnology
- Center For Starch Technology

Deputy for information Energy and material technology

- Center Of Information And Communication Technology
- Center Of Energy Resources Developent Technology
- Center Of Energy Consservation And Conservation Technology
- Center Of Material Technology
- Center For Design Engineering And Technology System
- Center For Science And Technology Network
- Center For Polymer Technology
- Center For Energy Technology
- Center For Ceramic And Porcelain Art And Technology Development

Deputy for Industrial Technology, Design and Engineering

- Center Of Technology For Maritime Industrial Engineering:
  - Laboratory of Technology for Port Insfrastructure and Coastal Dynamics
  - Laboratory of Hydrodynamics Technology
- Center Of Technology For Manufacturing Industry
- Center Of Technology For Security And Defense Industry
- Center Of Technology For Transportation Industry And Transportation System
- Laboratory For Thermodynamics Motor And Propulsion
- Laboratory For Machine tools Production Techniques And Automation Technology
- National Laboratory For Material Strength
- Netional Laboratory For Aero-gas Dynamics And Vibration

BPPT Engineering

Center of Technology for Maritime Industrial Engineering (PTRIM)

Center of Technology for Maritime Industrial Engineering (PTRIM)

- *Research Program Office in Jakarta/Serpong*
- *Laboratory of Technology for Ports Infrastructure and Coastal Dynamics (BTIPDP) in Jogjakarta*
- *Laboratory of Hydrodynamics Technology(BTH) in Surabaya*

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RANCANG BANGUN DAN REKAYASA

BPPT LABORATORY FACILITY:

LABORATORY OF HYDRODYNAMICS TECHNOLOGY - SURABAYA

BTH

Balai Teknologi Hidrodinamika

- ***Towing Tank***

Length 235.4 m, width 11 m , and depth 5.5 m
For testing of ship powering

- **Manuveuring & Ocean Engineering basin**

Length 105 m, width 36 m deep bas. 2.5 m , shallow bas. 1.5 m.
Kolam ini digunakan untuk pengujian manover dan stabilitas kapal

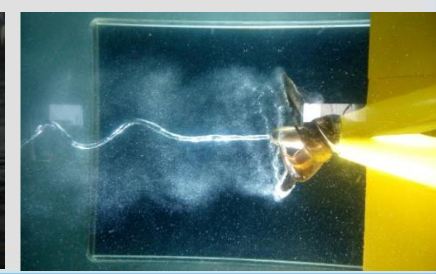
- **Cavitation Tunnel**

Test section length 3 m, width 85 x 85 cm









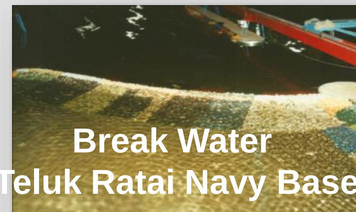
Pengujian Power, Stabilitas dan Manoeuver Kapal

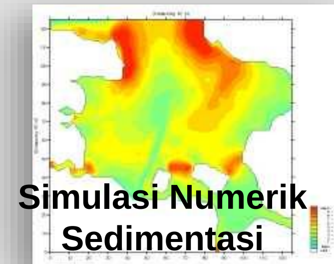
BTIPDP

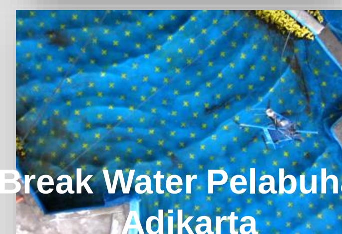
Laboratory of Technology for Ports Infrastructure and Coastal Dynamics

1. Physical Test Laboratory :

- *Wave Basin*
- *Wave Flume*

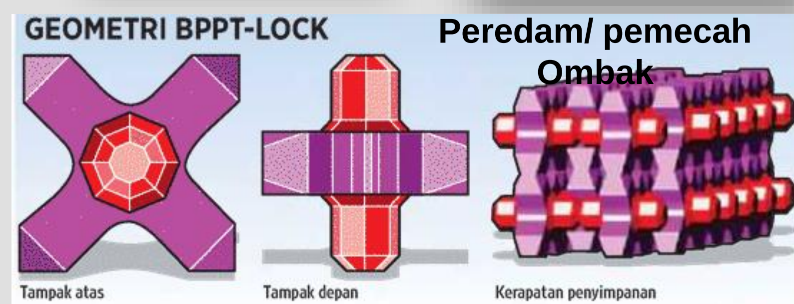






2. Numerical/mathematical model simulation:

- *2D Modelling of Coastal Waters and Seas*
- *3D Modelling of Coastal Waters and Seas*



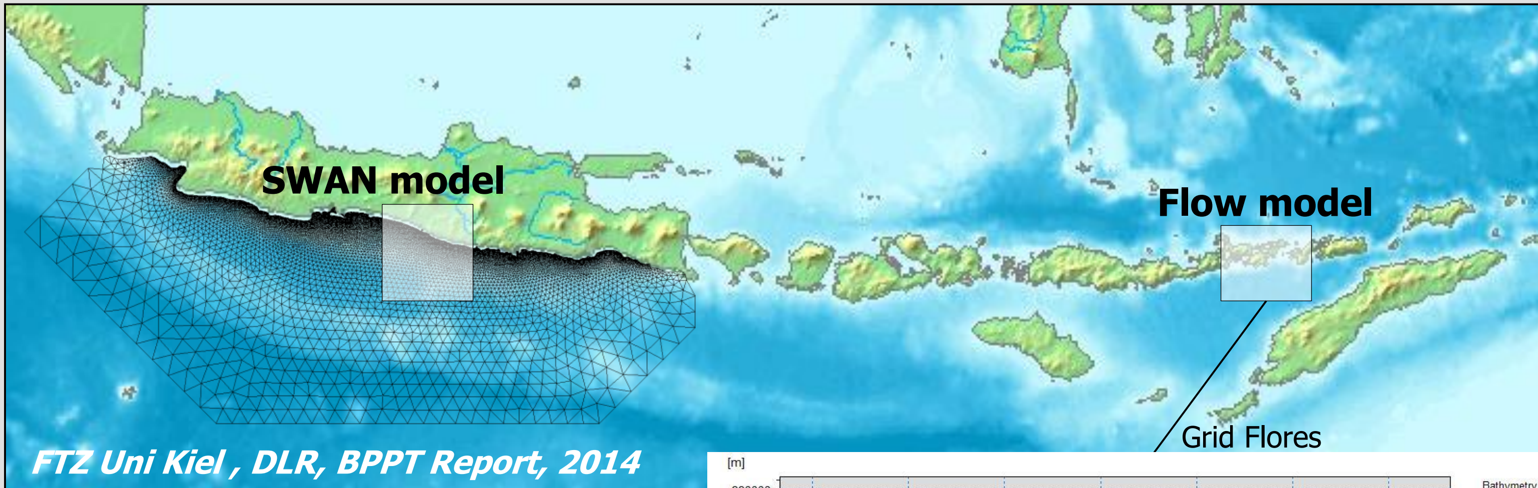
BPPT EXPERIENCES ON
OCEAN RENEWABLE ENERGY DEVELOPMENT

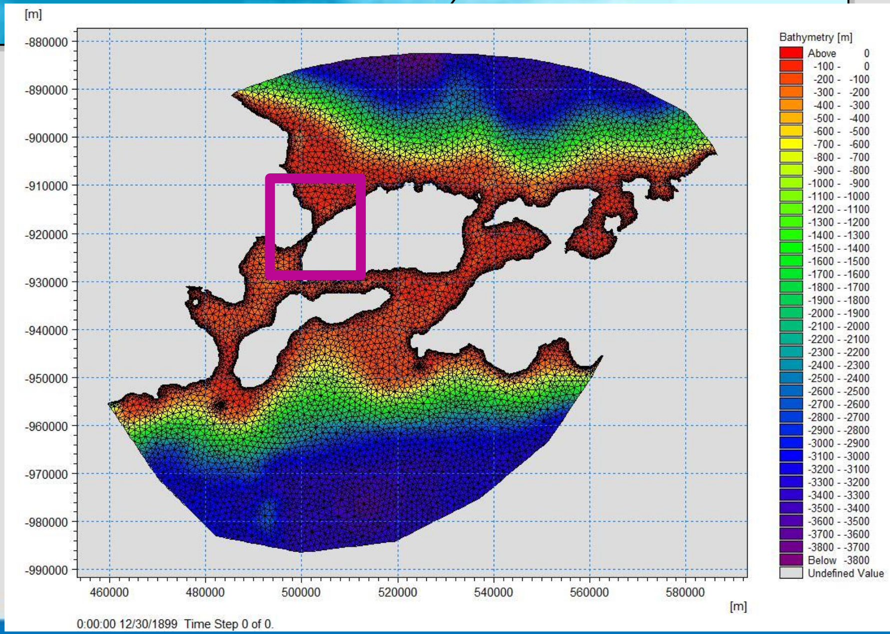
ORE Potential site Survey

SPICE-3 Observation

1. Wave @ Baron Site and
2. Tide Gauge @ Larantuka Str

Methods (2- Ocean Models)





SWAN –*Simulating Wave Nearshore*

Flow Model – 2DDI Hydrodynamic Model (MIKE-21 by DHI)

Baron Site

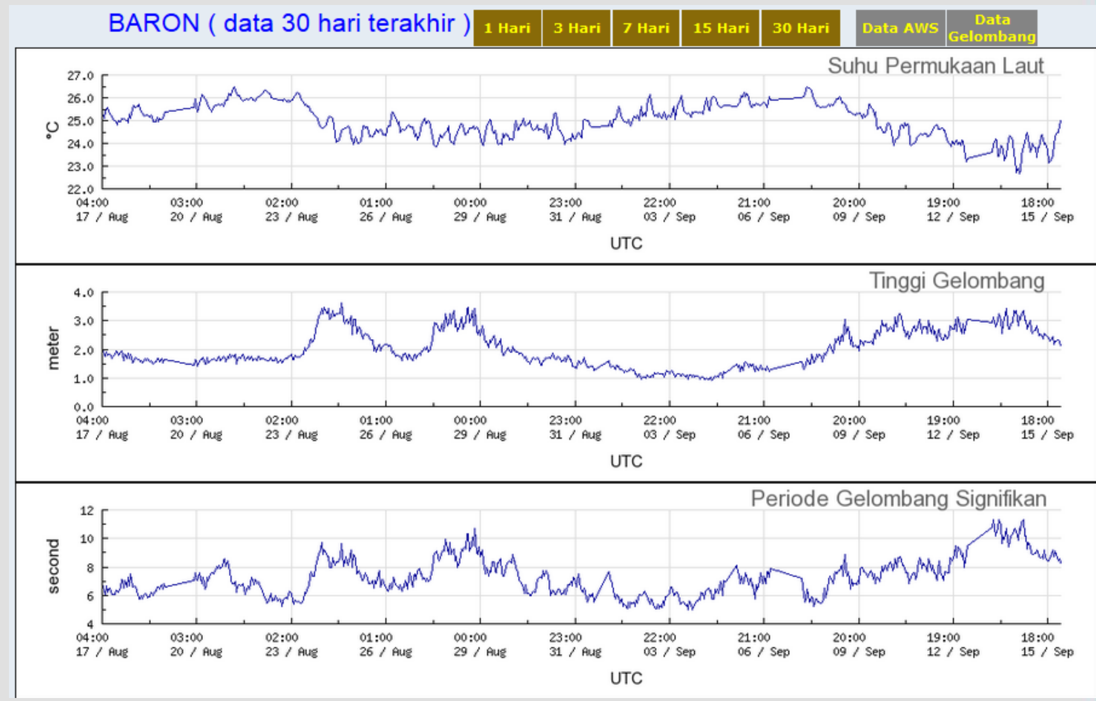
(Wave measurement)

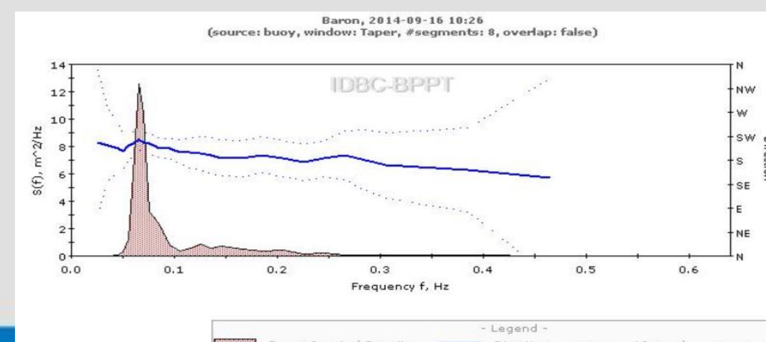
Wave Observation

(SPICE III, Topic 6, Potential ORE)

R&D Activities → Measuring Campaigns: May – Sept 2014

Data was made available on-line & realtime at: http://bpptbuoy.info/pdbi/metocean/





Swell dominant at f ~ 0.07Hz or T = ~12-13 sec

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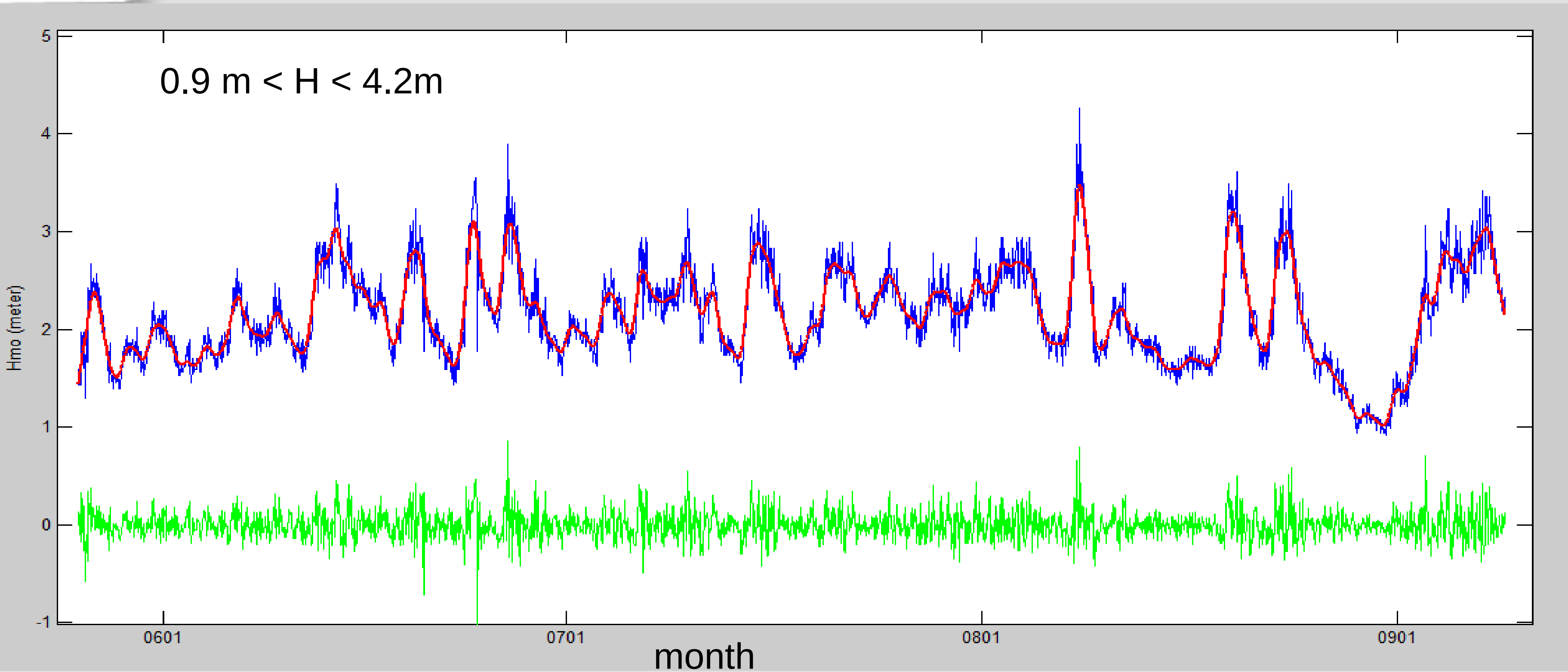
Low Pass Filter Wave energy

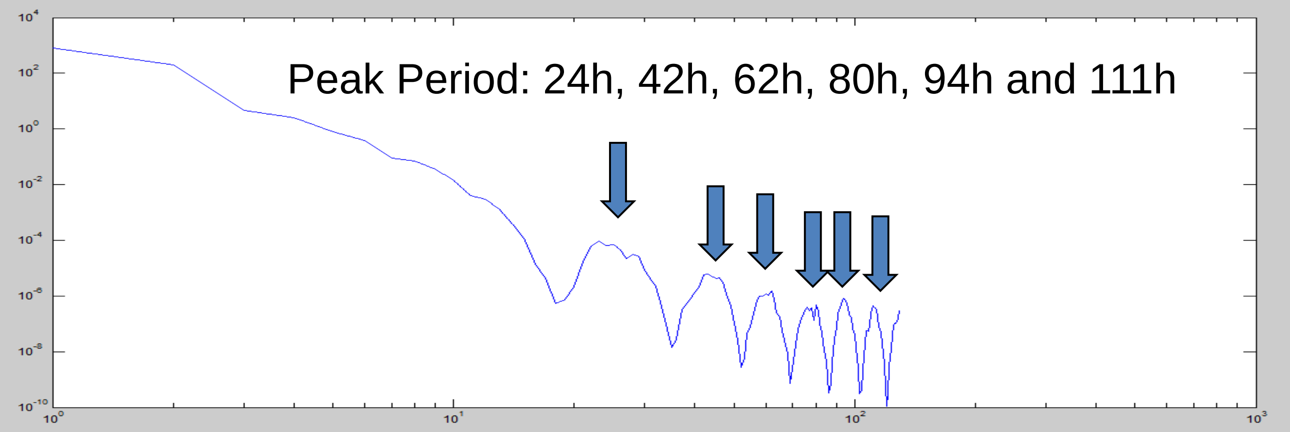
Recording 25/5/2014 – 16/ 9/2014 @ Baron Site



Raw Data

Low Freq

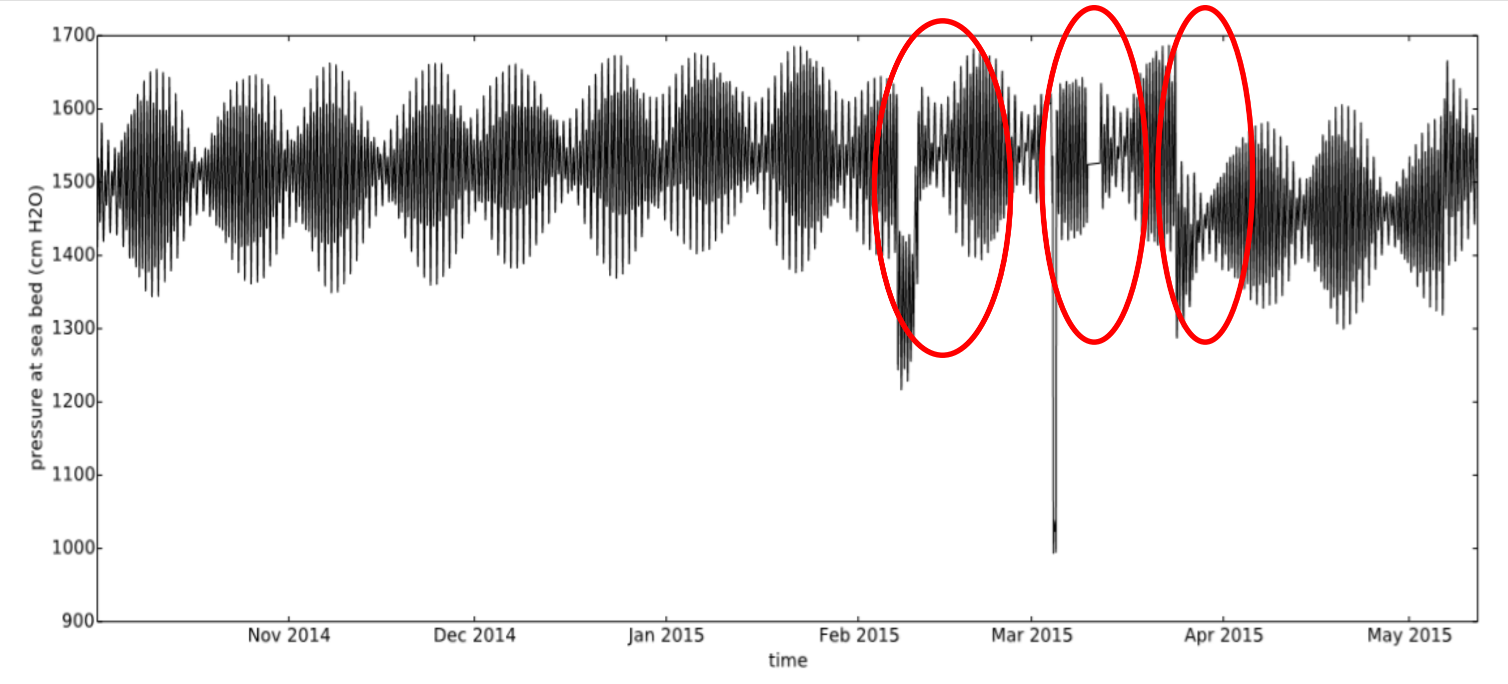
High Frek



Larantuka Site

(Tide n Met Observation)

Tide elevation (observation) at Larantuka

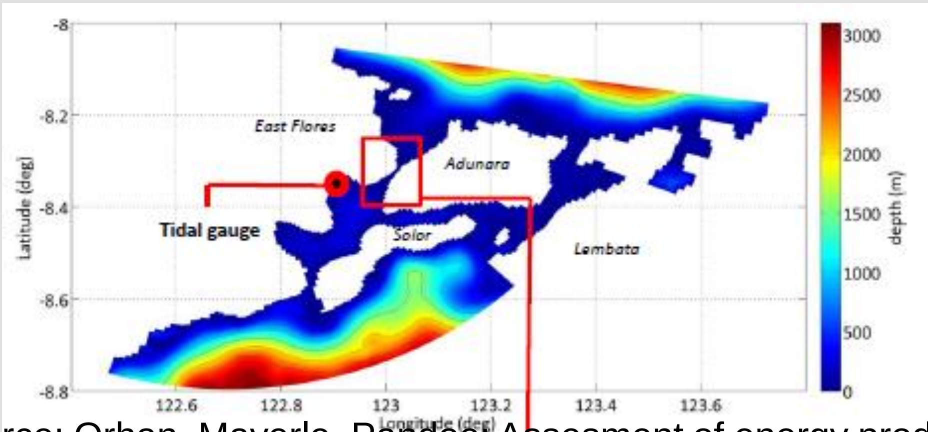


Several disturbance on the measurement due to:

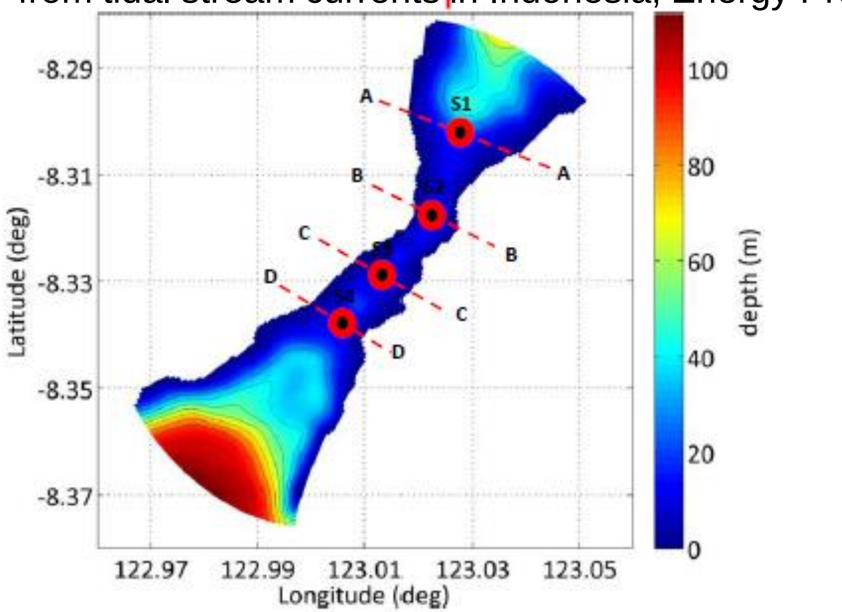
- 8 months continuous tide observation
- Shifting the sensor
- Relocation Observation site

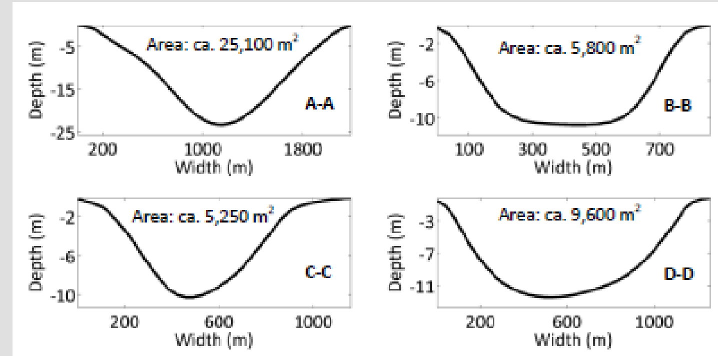
Larantuka

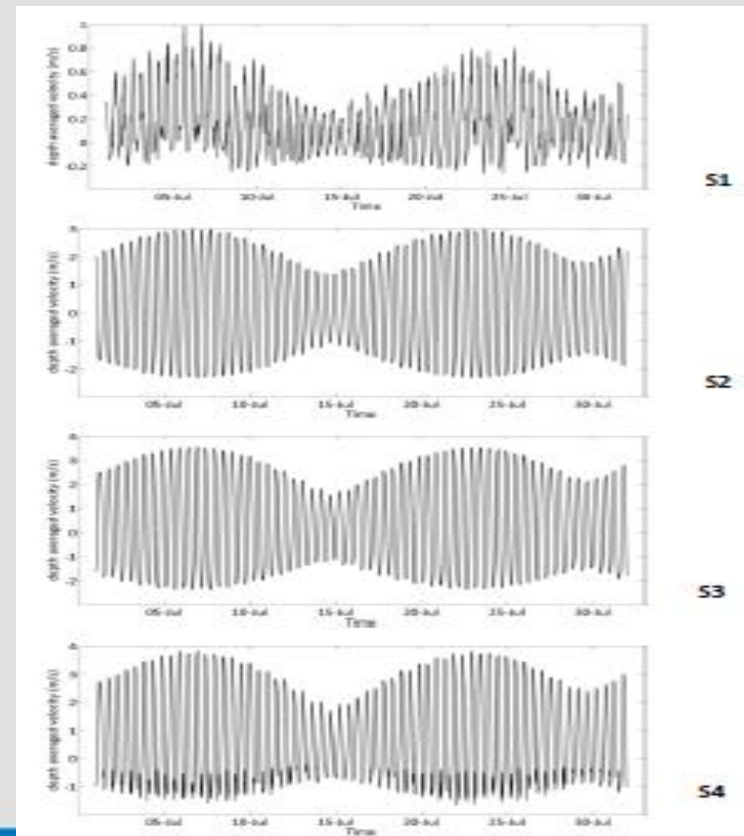
❑Bathymetri



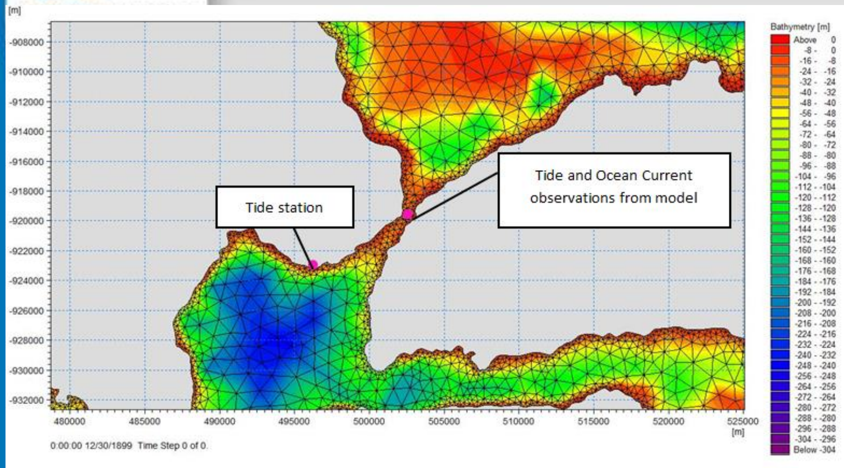
Source: Orhan, Mayerle, Pandoe: Assesment of energy production potential from tidal stream currents in Indonesia, Energy Procedia, 2015



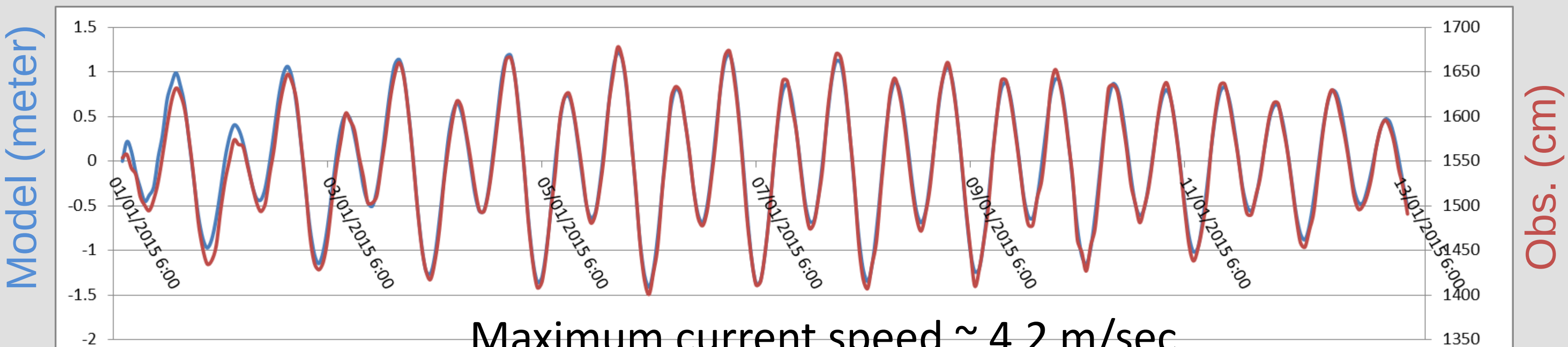




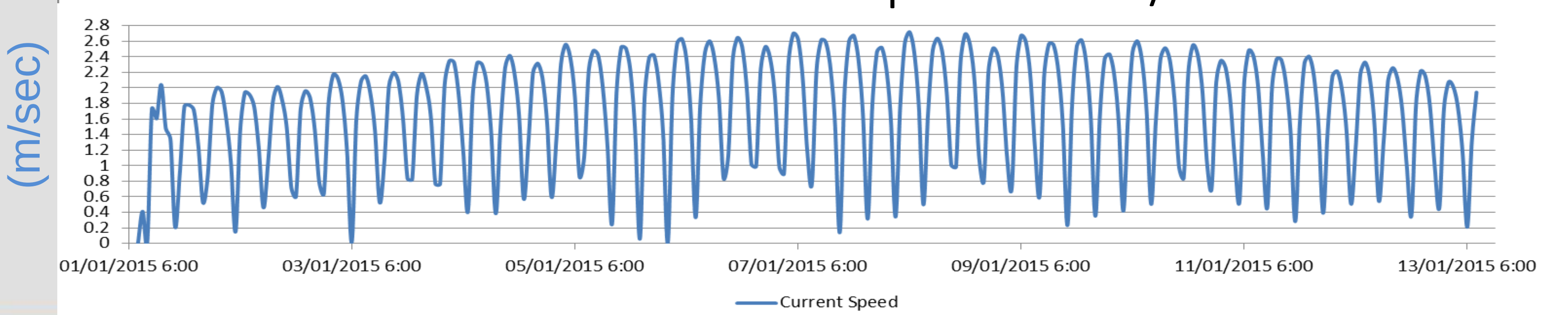
Marine Current energy @ Larantuka



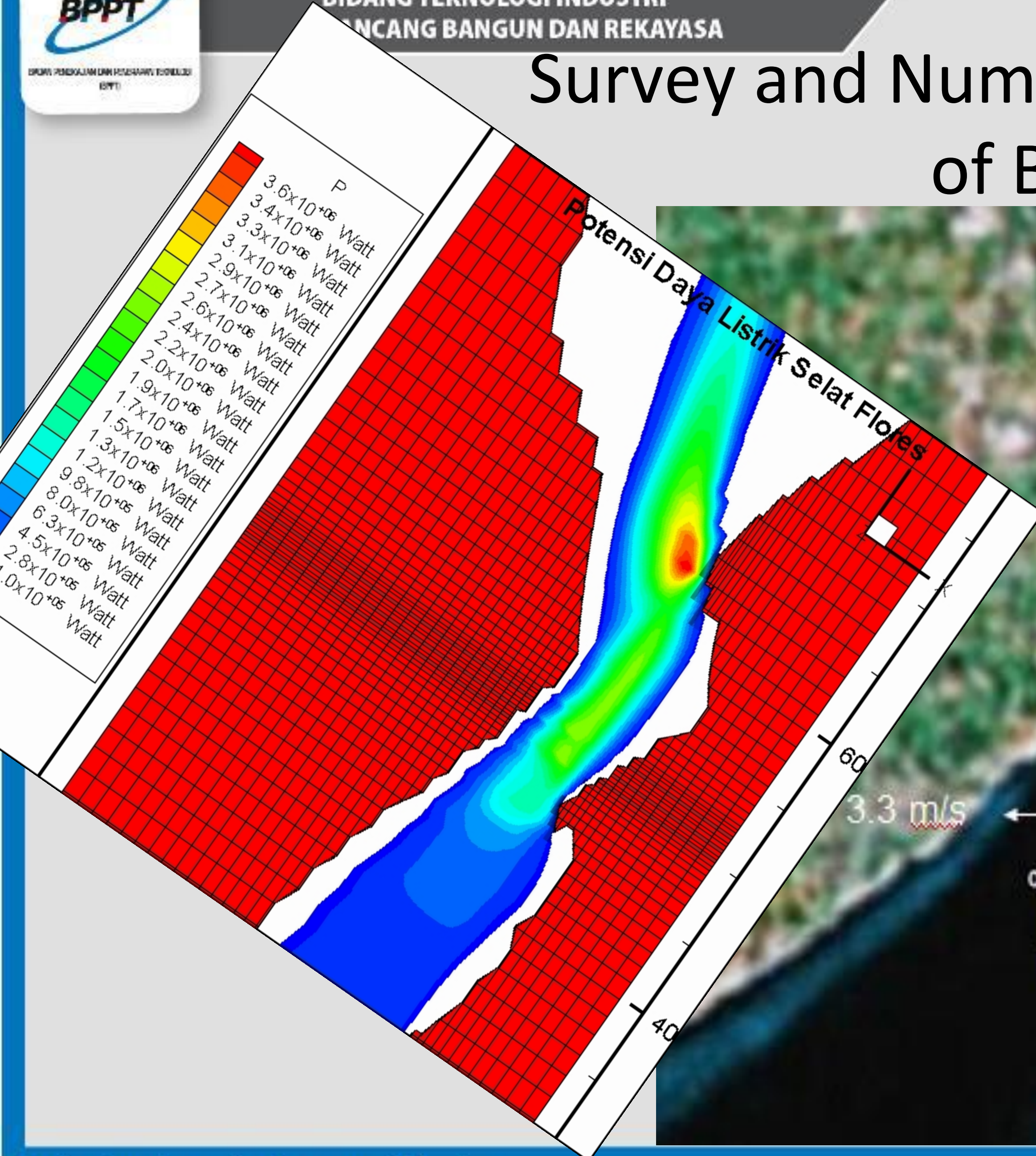
- A good correlation between tide elevation model and observation
- Current speed in *'bottle neck'* of the channel > 1 m/sec in *mean period of neap* and *spring tides*

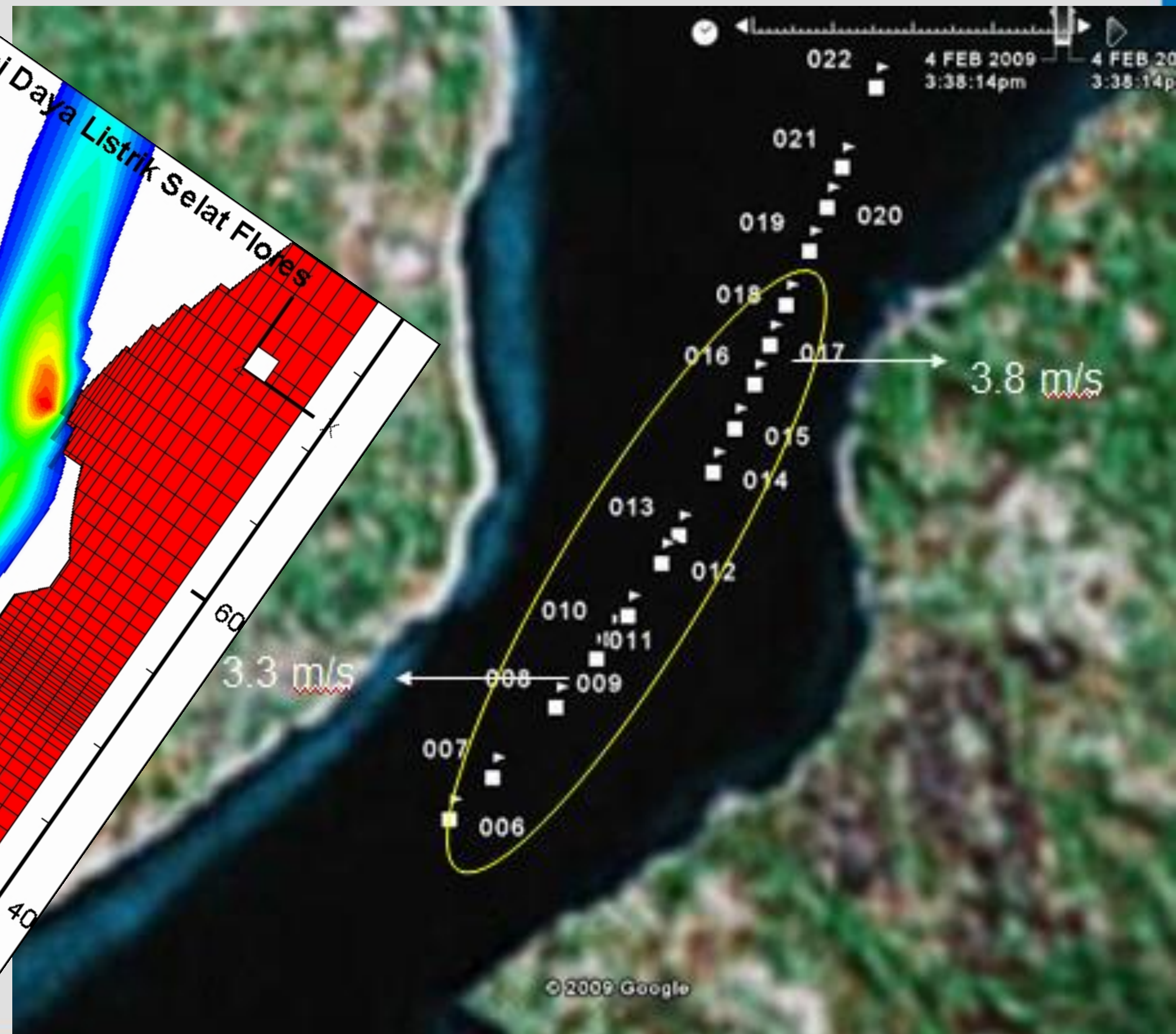


Maximum current speed ~ 4.2 m/sec



Survey and Numerical Prediction of BTH 2008





Research, Engineering, & Prototyping

Wave Energy Converter Research

OWC BTIPDP

Wave Dragon BTH

Wave –Current Rotor BTH

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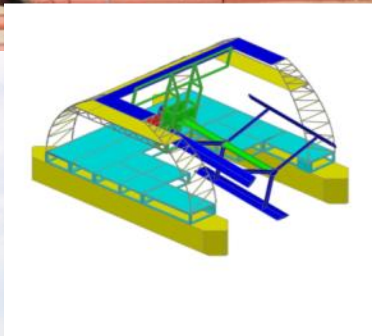
RANCANG BANGUN DAN REKAYAS

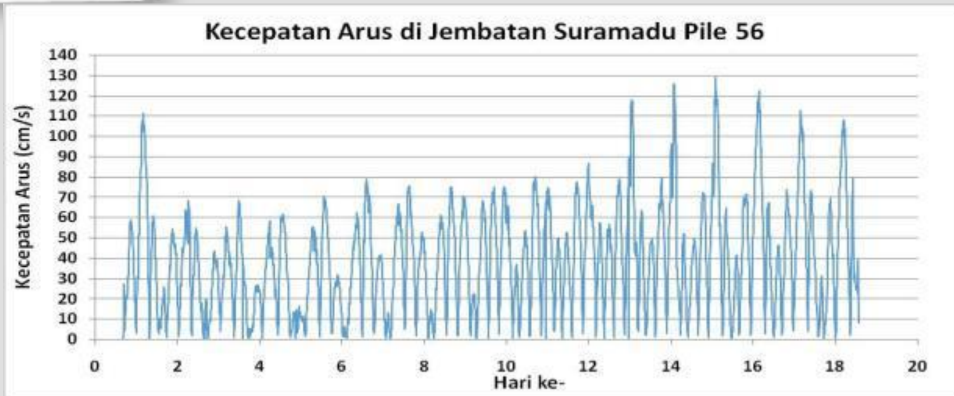
BPPT Prototype Testing 2011

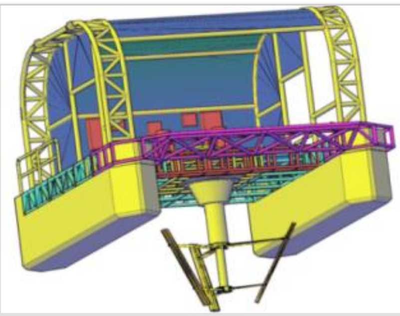
10 kW BPPT, Larantuka Strait

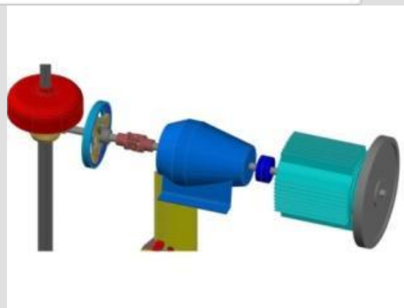


http://www.youtube.com/user/erw4ndi

10 kW Prototype Testing at Low Speed Current Suramadu Bridge Pile 56 2013



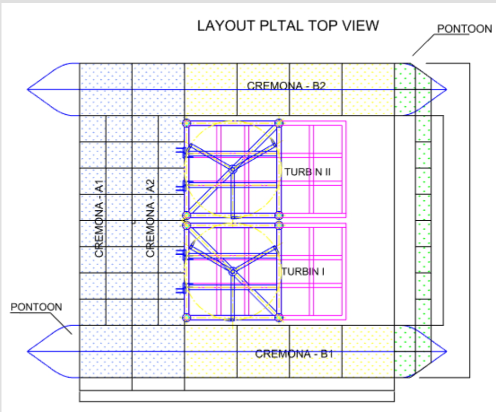




http://www.youtube.com/user/erw4ndi

Twin-Turbine Prototype 10 kW Suramadu Bridge

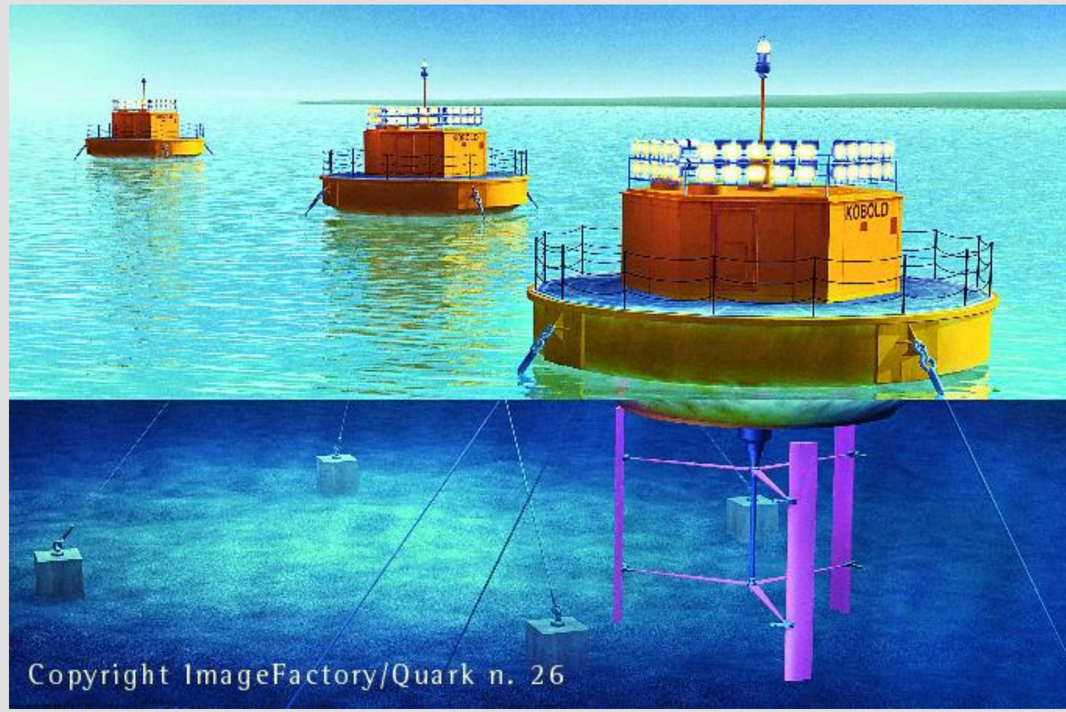
Funded by Balitbang KKP (2014-2015 Development) & Ristek Dikti (2016 Endurance Test)



BPPT RECOMMENDATIONS

Case Study of UNIDO Project

Source : Wörlen and Erwandi, Independent Evaluation Promotion and Transfer of Marine Current Exploitation Technology in China and South East Asia (UNIDO 2015)

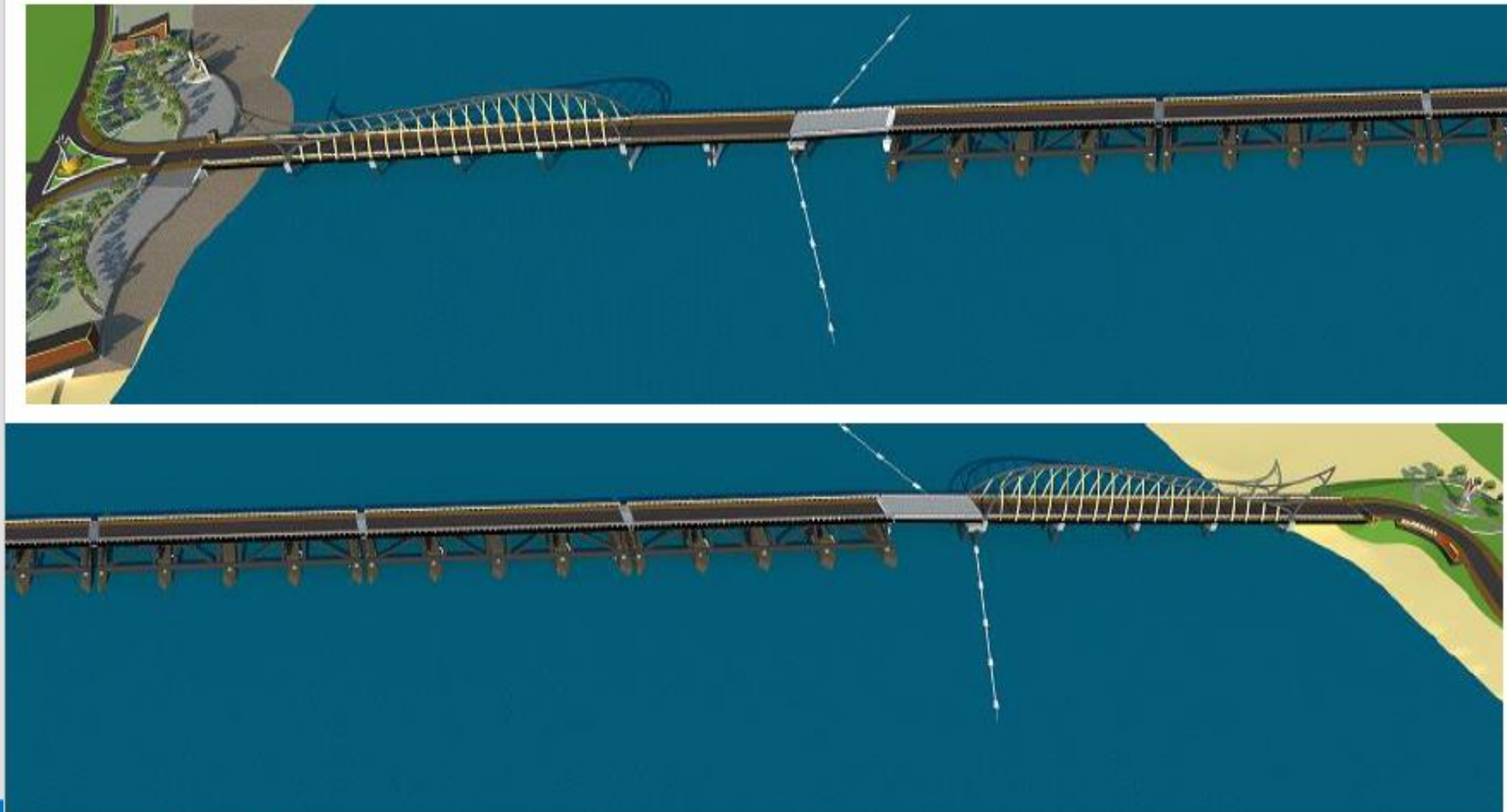


In 2008 UNIDO Project ENERMAR (Ponte di Archimede) collaborated with Ministry of Research and Technology, and Walinusa Energi: Kobold Nusa at Alas Strait

Kobold at East Lombok Island

Concept of Pancasila Palmerah Tidal Bridge at Larantuka Strait, East Flores Regency

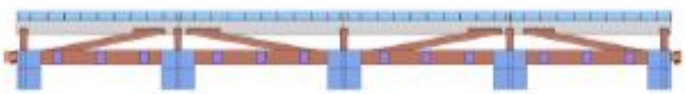
Palmerah Tidal Bridge overview



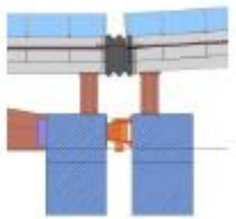
TIDAL BRIDGE

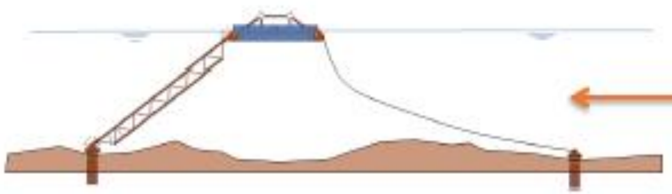
Basic functions Tidal Bridge

Bridging
- Floating elements
- Main supporting structure
- Possibilty for water transport



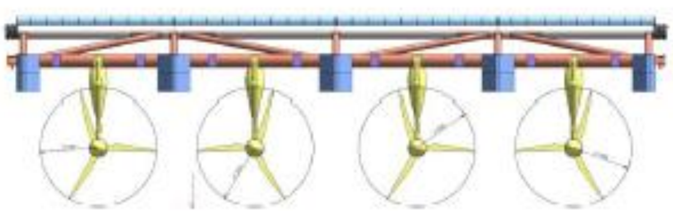
Connections
- Connection between floating elements
- Able to take axial and radial loads
- Able to take continous movements.

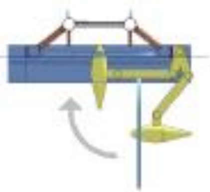




Anchoring
- To keep the floating elements in position
- Able to follow the movements of tide and currents.

Land fall
- Connection between floating elements and fixed structures
- Able to follow movements in height





Produce
- Tidal Energy converters (turbines)
- Electrical system

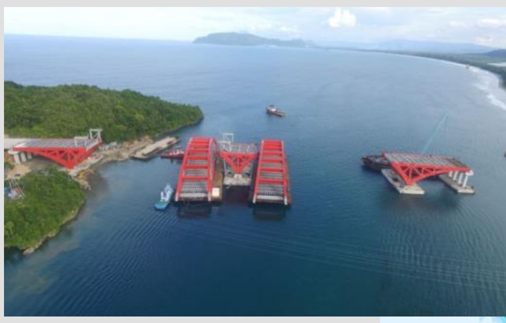
Need regulation discretion !

Special Economic Zones

Recommendations

1. **Long Terms**
   Development of Maritime Cluster Industries at Sulawesi / Ambon / Kupang

2. **Short Terms**
   Building special ships for transport, erection, and maintenance.



Holtekamp Bridge Papua was build at PT. PAL shipyard Surabaya

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