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Coupling ocean energy with other RE sources

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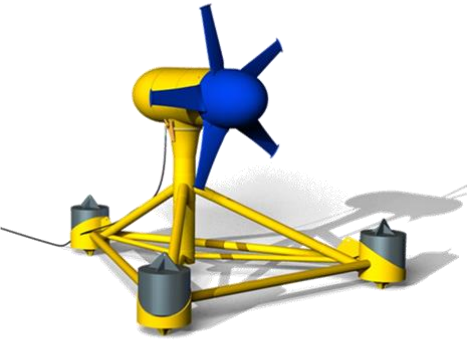
16th of October 2019

PROJECT DESCRIPTION

Scope & stakeholders

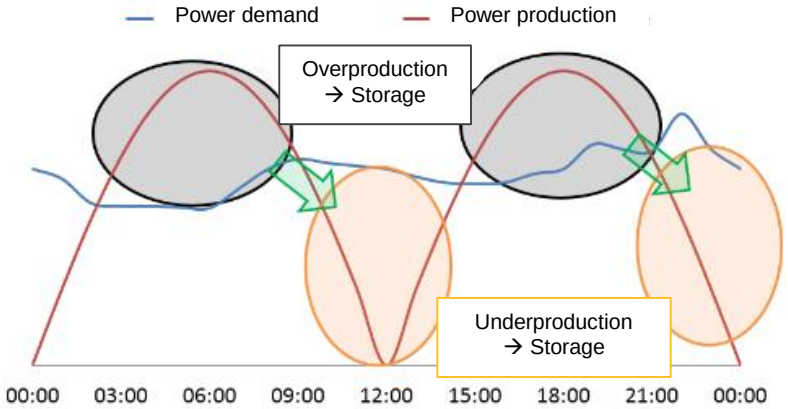
- Innovative initiative aiming to develop the **Philippines' and the ASEAN region's first commercial ocean power plant** deploying **tidal in-stream turbines** in San Bernardino Strait
- Development by H&WB and SABELLA, MoU with PNOC RC
- **1.5 MW ocean power plant** off Capul island, on one of the 3 concession areas granted by the Philippine Department of Energy in 2013 to H&WB
- **3 x D18-1000 turbines** connected to the grid through 3 export cables



PROJECT DESCRIPTION

How tidal energy can become the baseload of the grid?

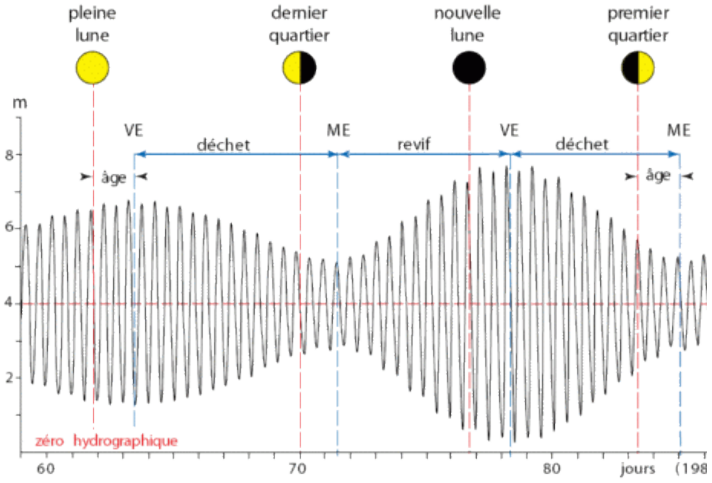
- Both long-term and short-term variability in power production handled by an **energy storage system** (onshore batteries)
- Improve grid stability and demand-supply balance

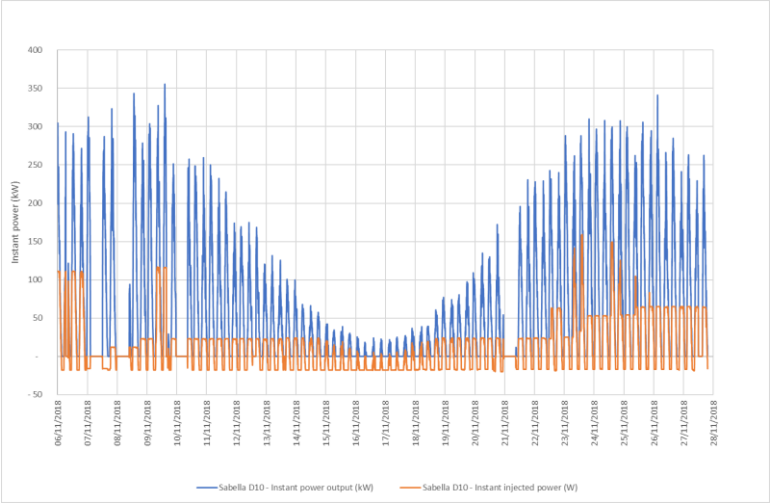


PROJECT DESCRIPTION

How tidal energy can become the baseload of the grid?

➜ Ongoing study to couple the baseload provided by the tidal turbines (predictable) with the power production of **other renewable energy sources (e.g. solar or wind)**





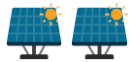
PROJECT DESCRIPTION

Scope & stakeholders

Tidal turbines

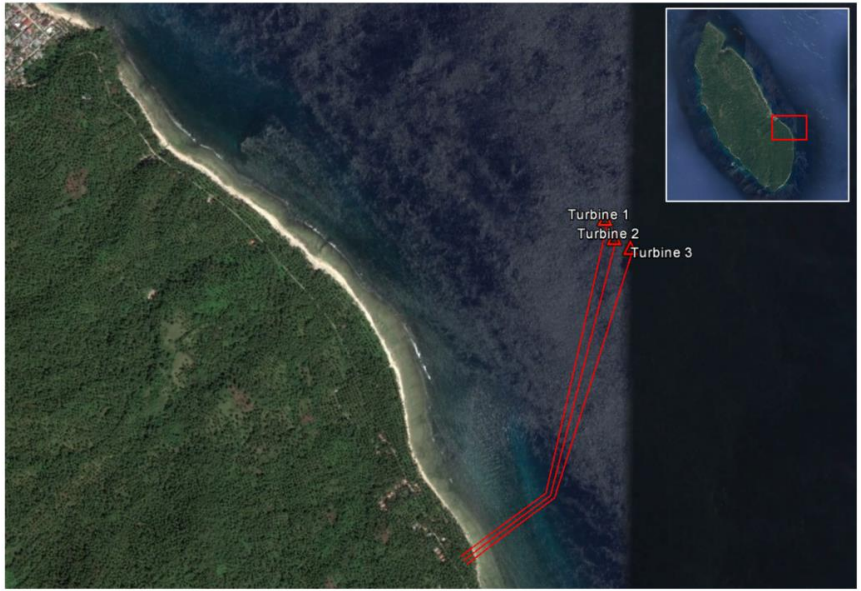
Energy storage system

Solar panels



Municipality of Capul:

- 12 barangays
- 14,000 residents
- Richly endowed with fisheries and aquatic resources
- But does not have enough electricity for the town to thrive
- Off-grid network
- Peak demand in 2018: 300 kW
- Powered by polluting and costly Diesel generators



3 x D18-1000 turbines

- 18m rotor diameter, 1000 kW rated power
- Power production: **2.8 GWh/year**

Solar PV

- Ongoing studies

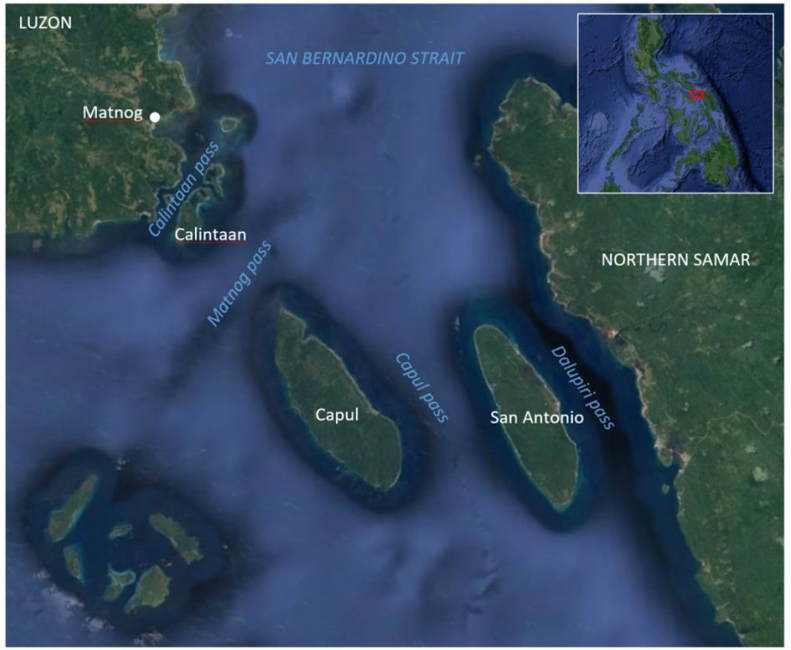
Energy storage system

- Battery Lithium-Ion, capacity TBD

PROJECT DESCRIPTION

Location: San Bernardino Strait

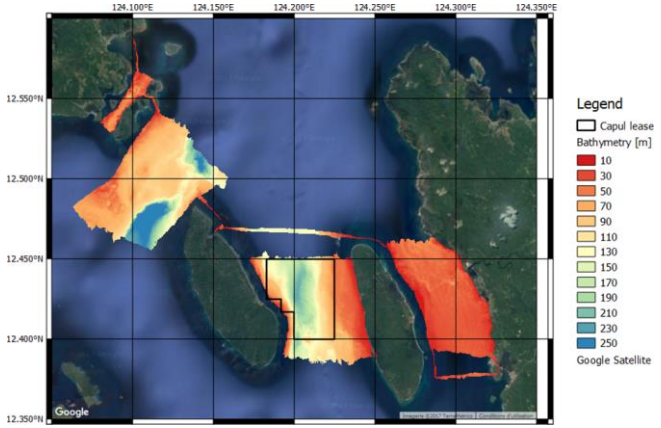
- Four channels separating the islands of Luzon, Calintaan, Capul, San Antonio and Samar
- Strong influence from the **Indonesian Throughflow**
- **Semidiurnal with a diurnal inequality** tidal regime
- Current speeds **over 3 m/s** during spring tides



RESOURCE ASSESSMENT

In situ measurements

- Preliminary resource characterization study (2015)
- **ADCP deployments** (2015) in the three concession areas
- **High-resolution bathymetric survey** (2016) in the four passes, using a Multi-Beam Echosounder

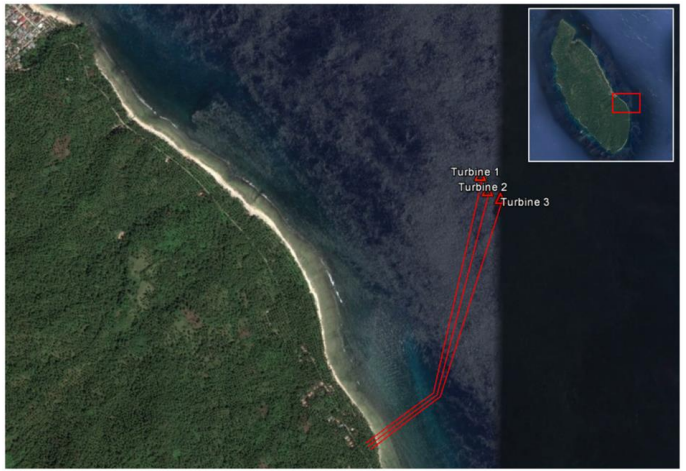


Necessary inputs for the numerical model and the site selection for the 1st phase of the project

RESOURCE ASSESSMENT

Lay-out

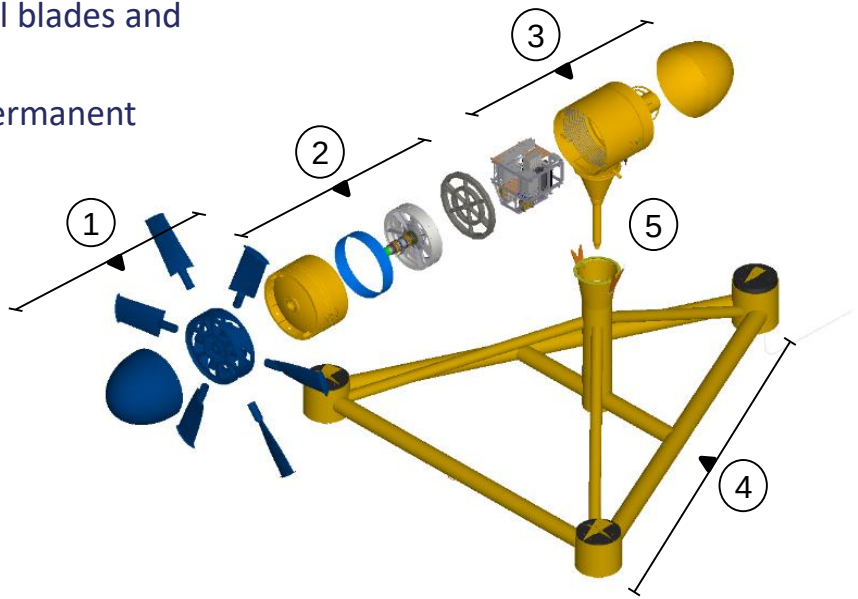
- Selection of Capul based on the **energy density and technico-economical criteria**
- Criteria used for the lay-out :
  - Bathymetric limits
  - Flatness of the seabed
  - Minimum axial and longitudinal spacing
  - Landfall constraints



PRELIMINARY FRONT-END ENGINEERING

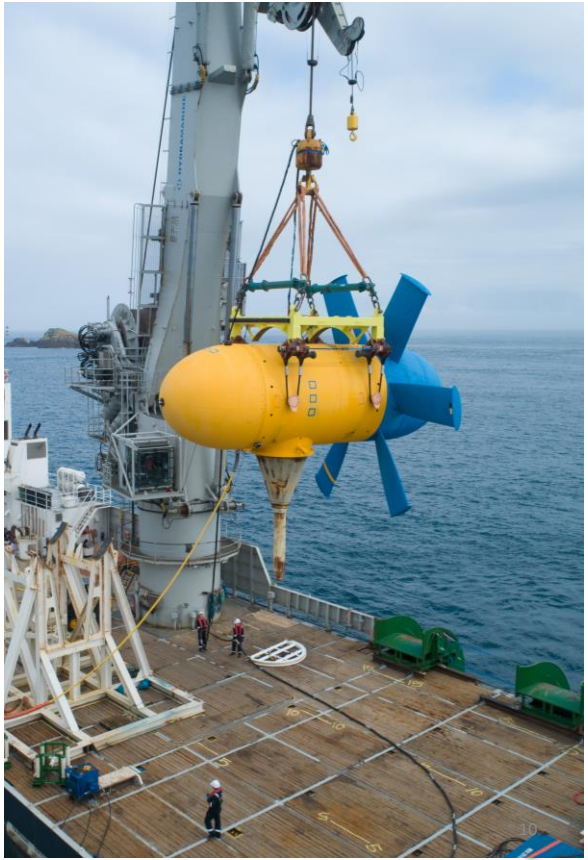
Fundamental technological principles & tidal power plant architecture

- **Simplicity & Ruggedness**: referent choices
  1. Horizontal axis rotor with fixed symmetrical blades and no yaw drive
  2. Direct drive synchronous generator with permanent magnets
  3. In-board conversion / transformation
  4. Gravity-based tripod foundation
  5. Modularity
- Capul **power plant architecture**
  - 18m rotor diameter
  - 3 x 1000 kW rated power output
  - 3 x 7.5 kV export cables
  - PV array and energy storage



UPCOMING PROJECT DEVELOPMENT PHASES

- **Permitting and environmental impact study**
- **Financial closing**
- **Detailed engineering**
- **Procurement**
  - **Local content**: possibility to build some of the subparts locally, like the support structure.
  - **Strategic components** like the nacelle should be built by suppliers with a previous experience in tidal technology development, so as to benefit from lessons learnt (learning by doing emerging industry)
- **Installation**
- **Grid connection / commissioning**



Project financing

How to get this pilot project funded?

30% equity – Sabella and H&WB
Other prospective partners are being considered (MOU with PNOC-RC in 2016)

70% debt-financing
To be provided by banks, or multilateral institutions
ADB, DBP, IRENA-ADFD

ADB

DBP

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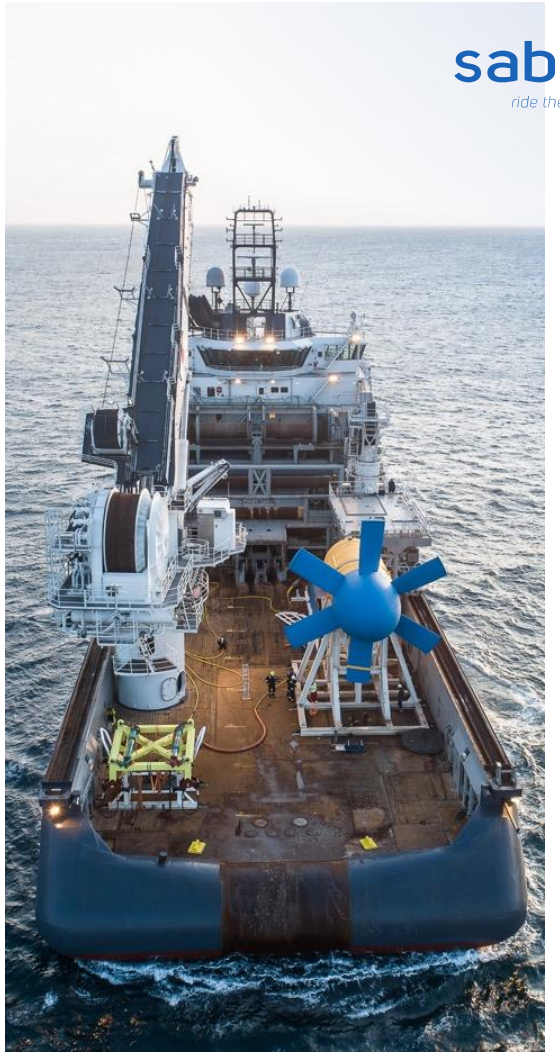

TECHNICAL, ECONOMIC, SOCIAL AND ENVIRONMENTAL STAKES

- **Decarbonization of Capul**: 14,000 islanders powered by a thermal power plant equipped with 4 diesel generators, saving of over 850 tCO2 per year
- **Energy security and cost competitiveness:** 24-hour reliable electricity supply competitive electricity cost independent from fuel price volatility
- **Economic development:** grid-connection of hospital and schools


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