

# Sustainable Marine Tourism Integrated Masterplan for Maratua



By : 1. Nadia Sanggra Puspita (Chemical Engineering, ITS)  
2. Andre Prakoso (Ocean Engineering, ITS)  
3. Dendy Satrio (Power Generating System, PENS)  
4. Frenky Cahya Nugraha (Naval Architecture, ITS)  
5. Parasina Dewandari (Urban & Regional Planning, ITS)

# Sustainable Development



Sustainable Development Venn Diagram  
(<https://conceptdraw.com/>)

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Agenda 21).

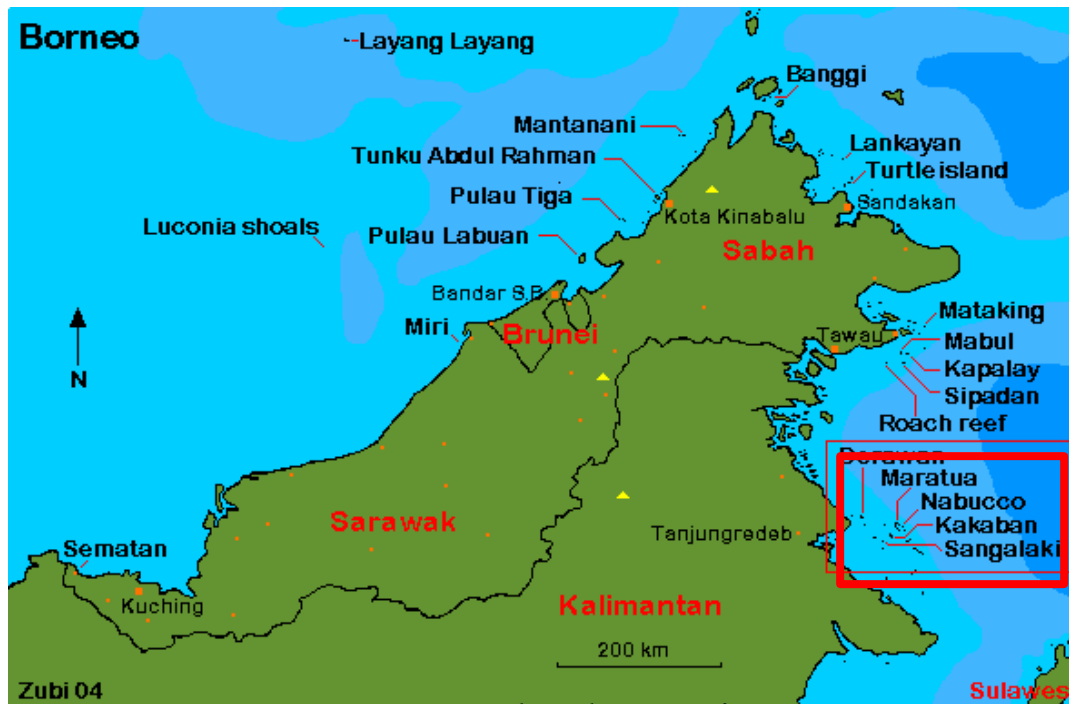
# Proven Case



El Hierro Island, Canaria Archipelago, Spain  
(Source: <http://www.dw.de>)

- 100% Renewable Energy
- Environmentally Friendly
- Self Sustainable (Off the grid)
- Electricity Surplus (Alt. Income)
- Community Empowerment

# Maratua Island



Maratua Island Location

(<http://vacationspotindonesia.wordpress.com/>)

General Data : - Wind Speed = 2,5 – 7,7 m/s

(Source: DKP) - Tidal Range = 1 – 1,6 m

- Temperature = 19 – 35 °C

- Current Speed = 87 – 102 cm/s

- Population = 3444 person (2013) for 4 villages

- Land use = 20% occupied, 80% forest



Village Location

(<http://tehtubrukulabatu.blogspot.com/>)



# Maratua Potential



Beautiful Scenery



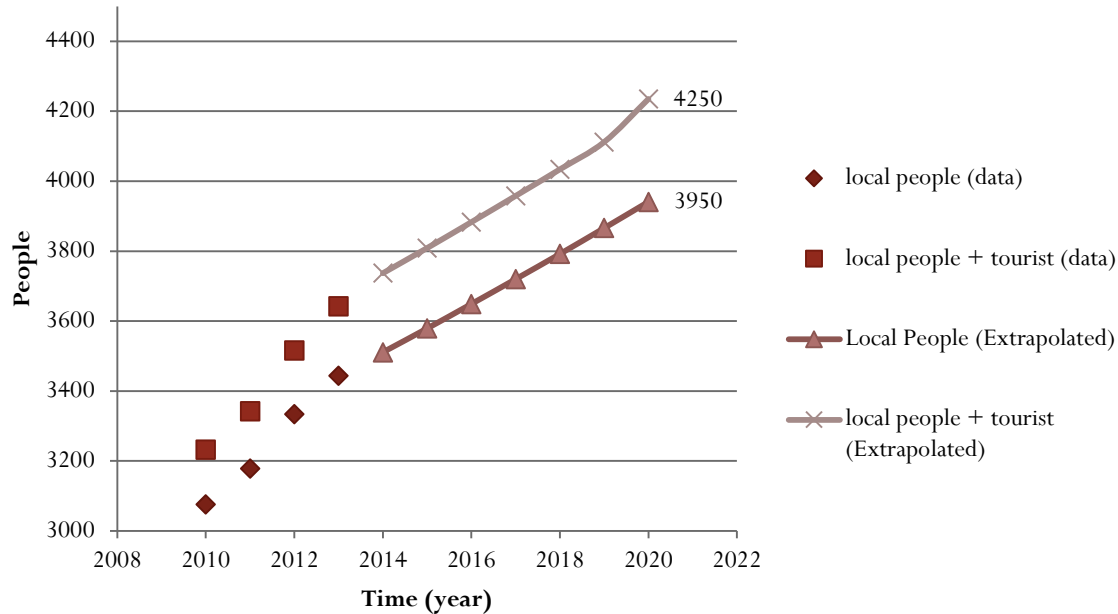
Vast Biodiversity



Motivated People

# Supporting Data

## Population Growth

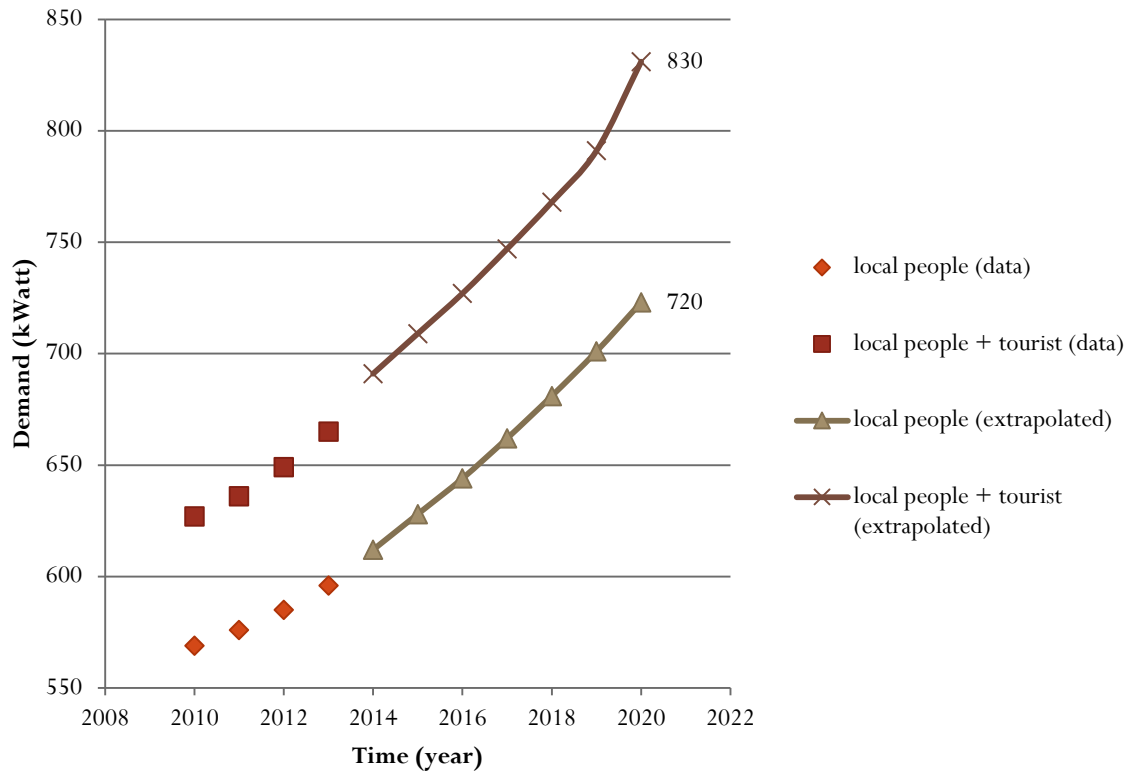


Bajo Tribe Kids

- Note =
- Local people population based on BPS (2010, 2011, & 2012) Maratua Master Plan (2013)
  - Local people growth rate assumption 1,9%/year
  - Tourist visit growth rate assumption 2,5%/year
  - Tourist visit initial data based on maximum accommodation capacity in Maratua (incl. Nabucco (34), Nabucco 2 (30), Paradise (30))

# Supporting Data

## Electricity Demand Growth



Note =

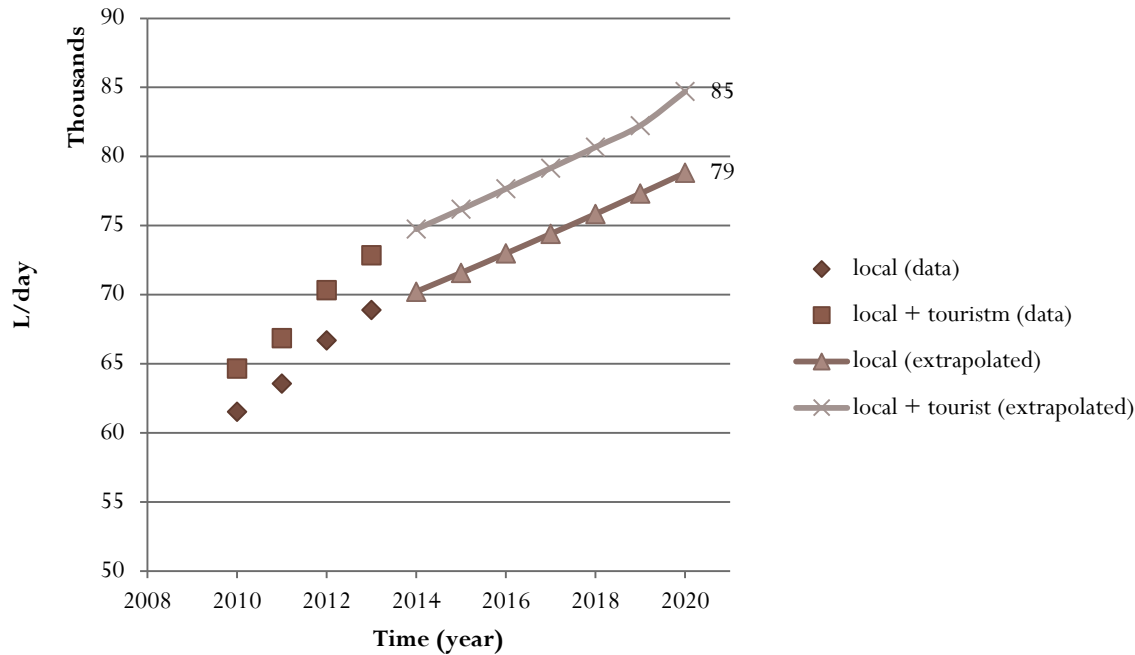
- Initial data based on Maratua Master Plan (2013)
- Electricity consumption growth rate assumption 2,5%/year with addition 0.1%/year
- Tourist electricity consumption, twice the local people (local people = 170 W/person)



Maratua Diesel Generator  
(main electricity source)

# Supporting Data

## Clean Water Demand



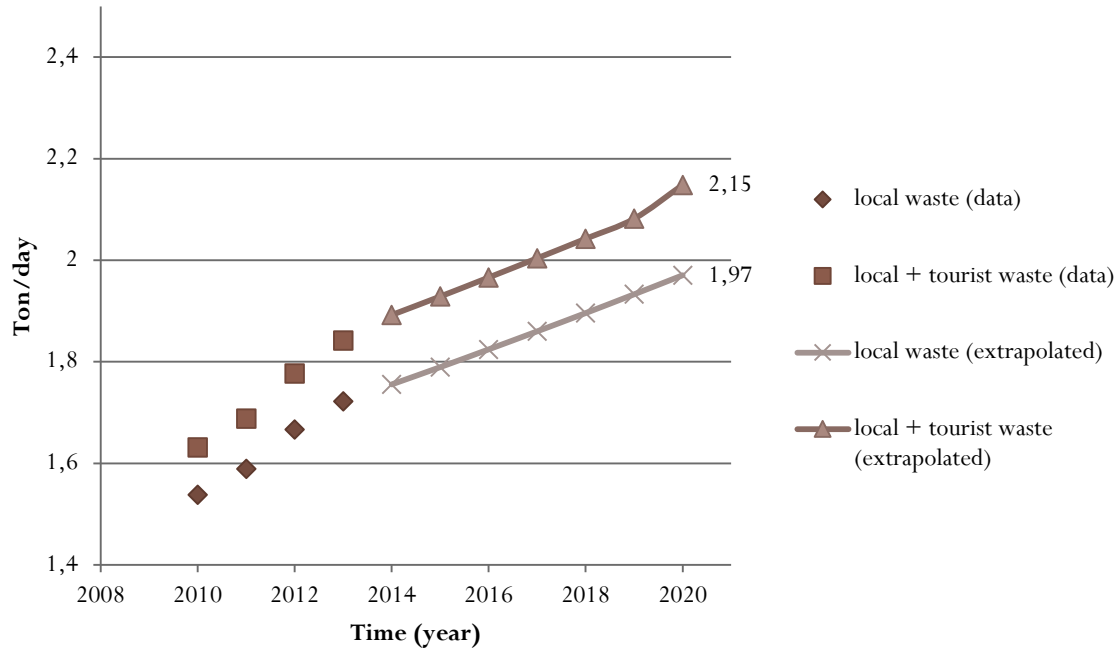
**Rain Water Containment System**  
(main water source)

- Note =
- Initial data based on Maratua Master Plan (2013)
  - Clean water demand growth rate constantly related to population growth (20 L/day)



# Supporting Data

## Waste Production



Poor Waste Disposal

Note =

- Initial data based on Maratua Master Plan (2013)
- Tourist will produce more plastic waste than the local people (20% of the total waste produced)
- Plastic waste production growth assumption, 5%/year

# Problem Faced



Environment



Transportation



Accommodation



Electricity

**SOLUTION ?**

# PROPOSED IDEA

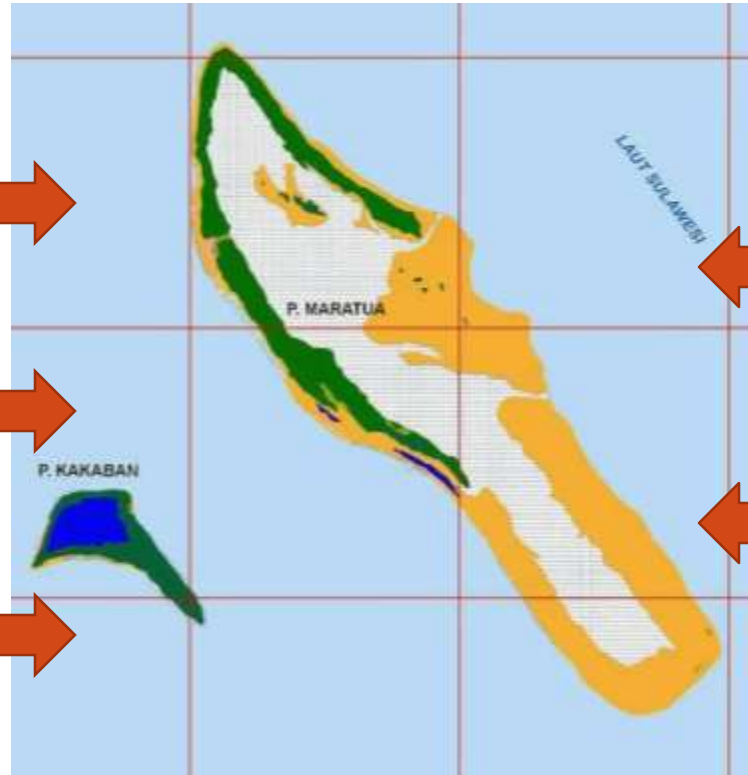
**Bio-  
Transplantation  
Electrict**



**Solar Boat**



**Site Plan**



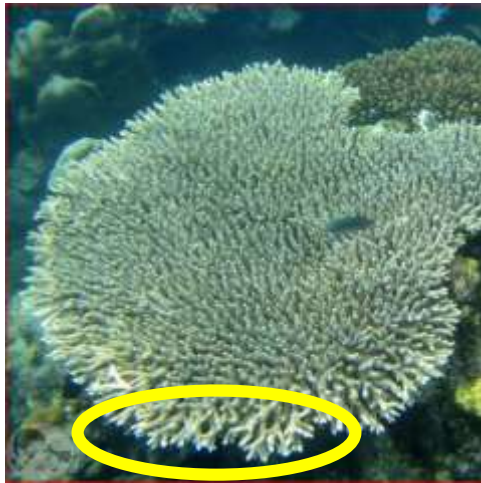
**Homestay  
Regulation**



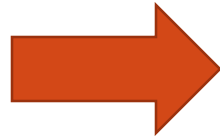
**Wind  
Turbine**



# BIO-TREC



**Existing Condition  
(Dying)**



Deteriorating

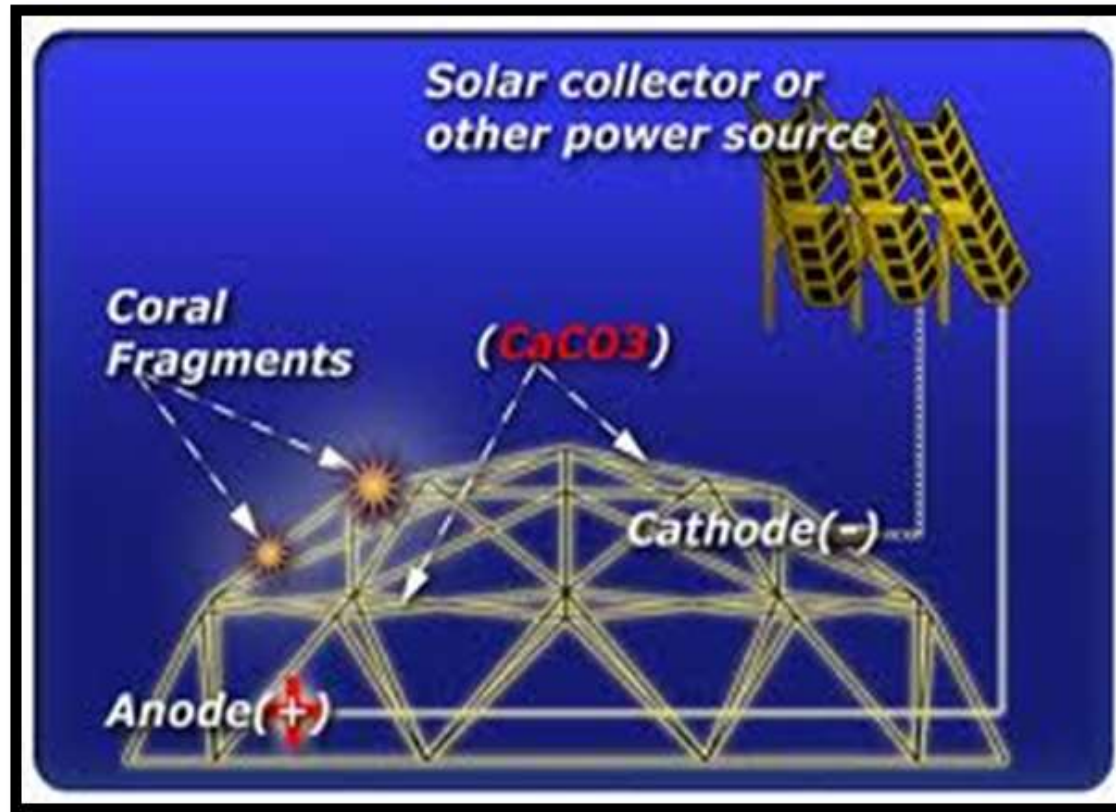


Recovering



**Ideal Condition  
(Healthy)**

# Concept



this technological innovation using **coral transplantation** technique as an initial growth of coral and **current electricity** as catalyst of rock formation on coral reefs.



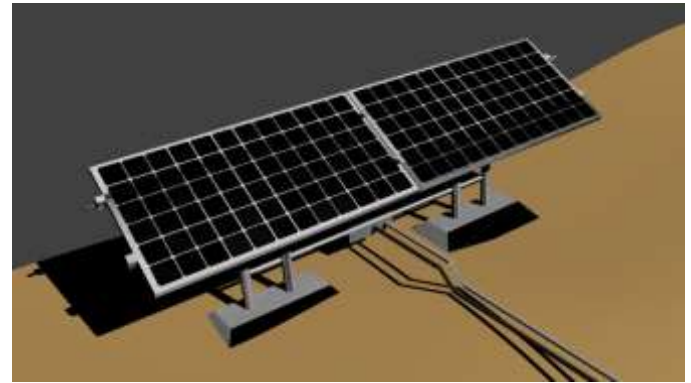
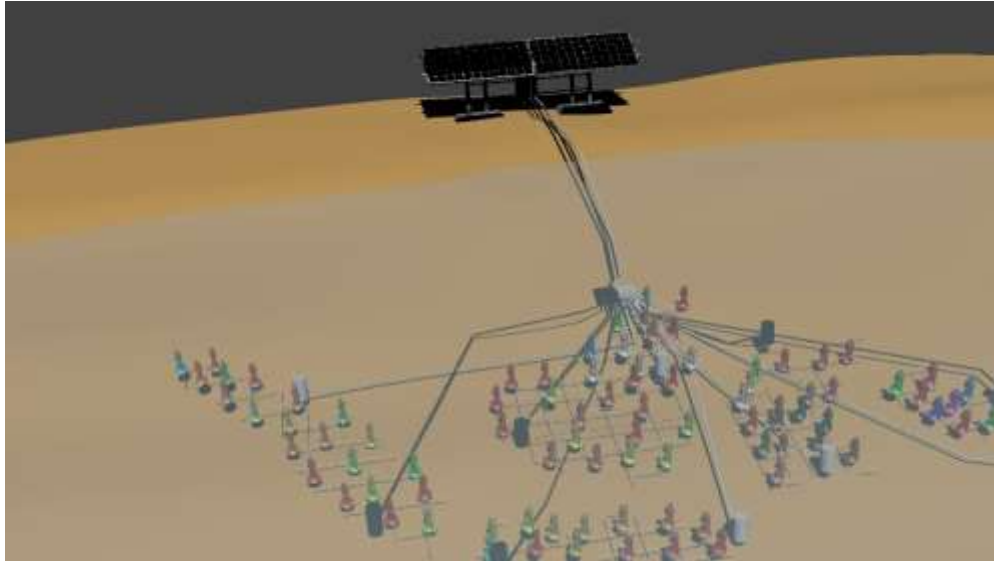
# Benefit

*Growth Rate 10 Times Faster*

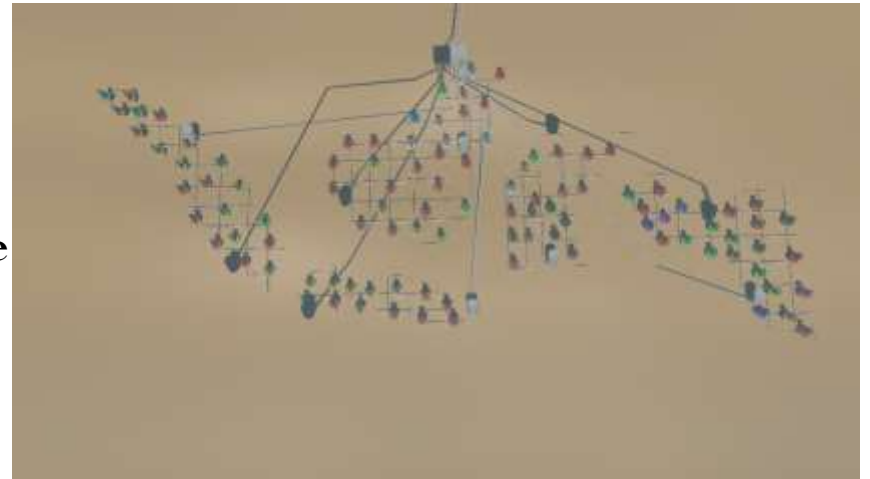


*New Tourist Attraction*

# BIO-TREC Design



**Coral reef net electric in Indonesia Map shape**



# HOME-STAY SCHEME



Nabucco Resort



Maratua Home-Stay

Need of  
Accommodations

Home-stay  
business

Standards

Sustainable  
Tourism

# Regulated Sector



Location & Accessibility



Main Facilities



Safety and Security



General Service



Sanitation & Hygiene

# Result

| ITEM NO. | SECTION-ITEM                            | OPERATION STANDARDS  |
|----------|---|--|
| 1.0      | LOCATION AND ACCESSIBILITY OF THE HOUSE |  |
| 1.1.0    | Site and Environment                    | The location should be suitable to accept paying guest. <u>Built</u> up with sufficient support and in compliance with government and local regulation. Having well maintained environment, sanitation, and waste management |

- Benefit :
- Table format (Easy to understand)
  - Made to match Maratua characteristic
  - Can be updated to fit current condition
  - Combination of qualitative and quantitative standards
  - Protect the host and tourist interests



## Existing Wind Turbine



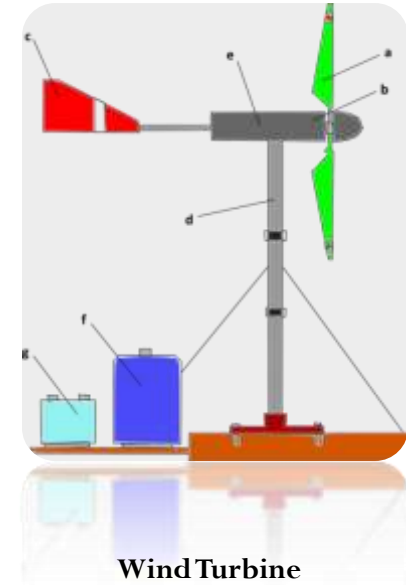
### Review:

- Less efficient design
- Hard to maintain
- Hard to produce
- Expensive
- Bad location

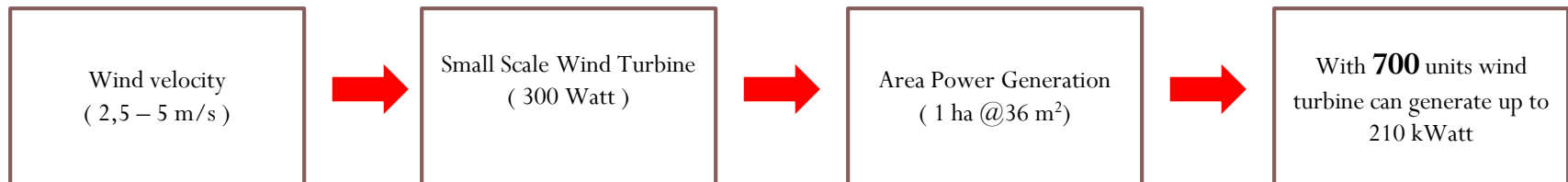
# Wind Turbine

**General Design Calculation Table**

| Symbols   | Design                 | Value       | Units |
|-----------|------------------------|-------------|-------|
| $P_G$     | Generator power output | 300 Watt    |       |
| $P_t$     | Turbine power          | 352 Watt    |       |
| $P_a$     | Wind power             | 596 Watt    |       |
| $R$       | Blade radius           | 1.5 m       |       |
| $B$       | Number of blades       | 3 -         |       |
| TSR       | Tip speed ratio        | 5.16 -      |       |
| $\omega$  | Angular speed          | 17.2 rad/s  |       |
|           |                        | 165 Rpm     |       |
| $V_{rel}$ | Relative velocity      | 26.28 m/s   |       |
| $Re$      | Reynold Numbers        | 2636600 -   |       |
|           | Type of airfoil        | NACA 4412 - |       |
| $H$       | Tower high             | 10          | m     |



## Design Proses :

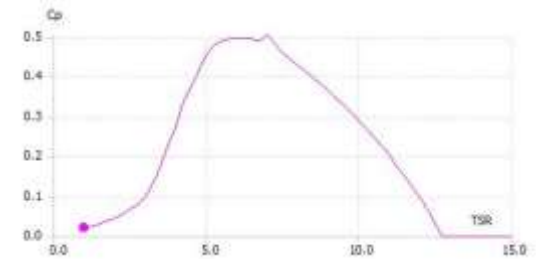
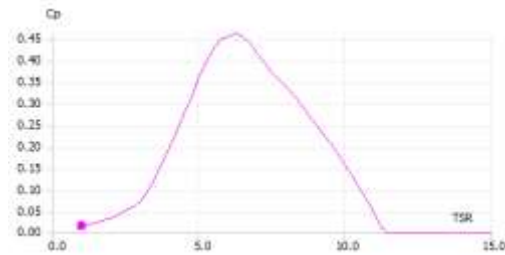
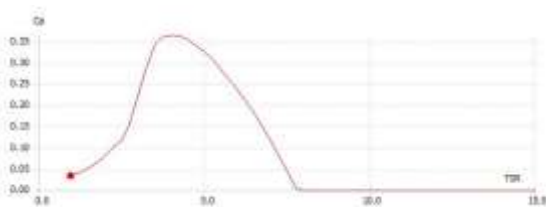


## Rotor Design :



Easy to produce

## Coefficient Performance of Rotor :



More Efficient

# Suitable Place



Costal areas are the best place to set up wind turbines because free stream condition.

# CONCEPT DESIGN BOAT POWERED BY SOLAR ENERGY

EXISTING CONDITION



Nabucco boat



Boat in bohe silian



PROPOSED DESIGN



- LOW DIESEL CONSUMPTION
- ENVIRONMENT FRIENDLY
- SAVE MONEY
- ESTETHICS
- 10 PASSENGER



## PROPOSED ROUTE



### Perairan Tarakan - Tanjung Redep

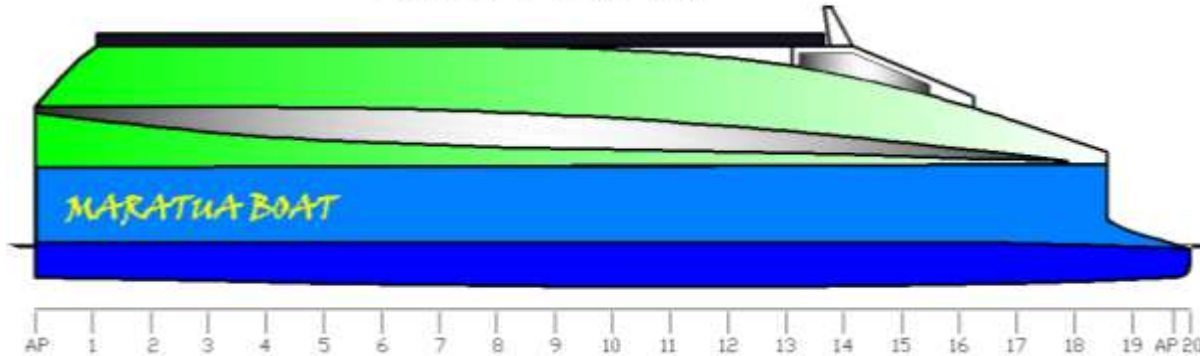
17/10/2014 07:00:00 - 18/10/2014 07:00:00

|                         |                         |
|-------------------------|-------------------------|
| Cuaca                   | : Berawan Sebagian -    |
| Arah Angin              | : Tenggara - Barat Daya |
| Kecepatan Angin (knot)  | : 05 - 10               |
| Gel. Signifikan (Meter) | : 0,3 - 0,7             |
| Gel. Maksimum (Meter)   | : 0,7 - 1,2             |

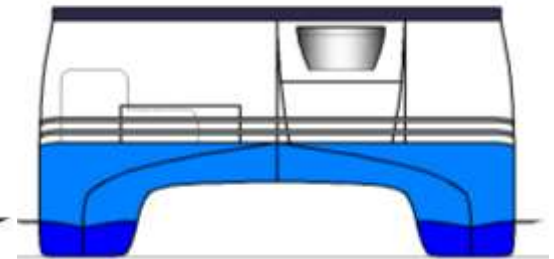
- Closed sea
- Calm sea

# GENERAL ARRANGEMENT

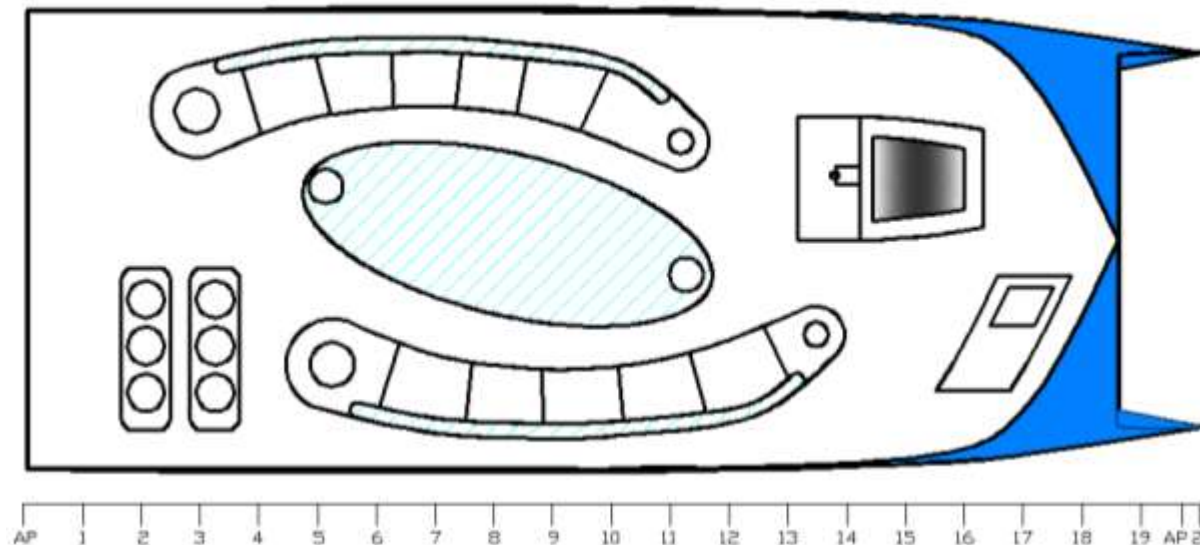
## SIDE VIEW



## FRONT VIEW



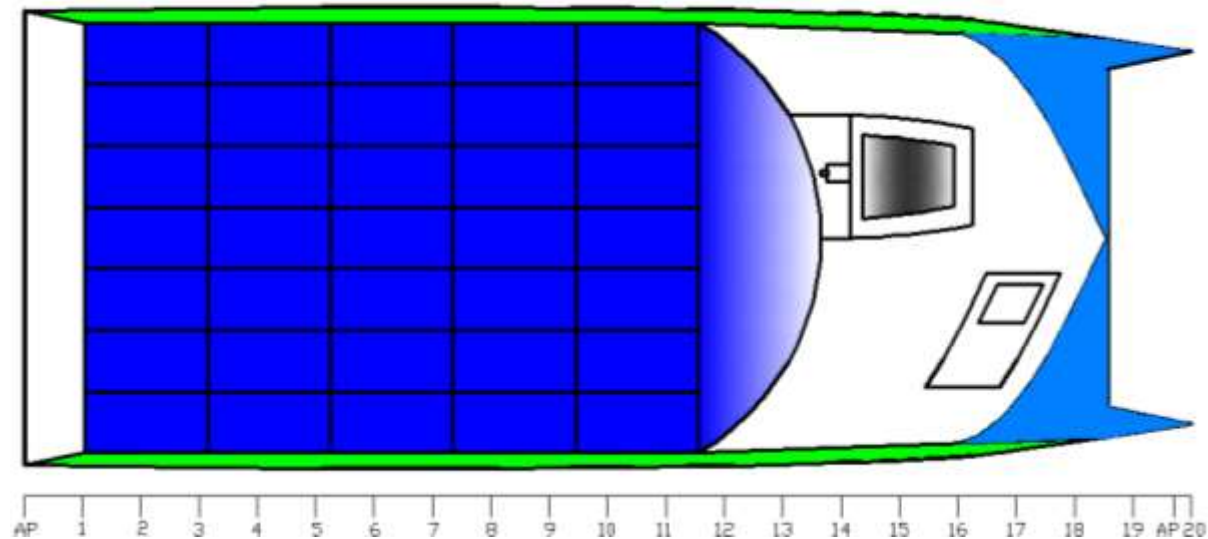
## MAIN DECK



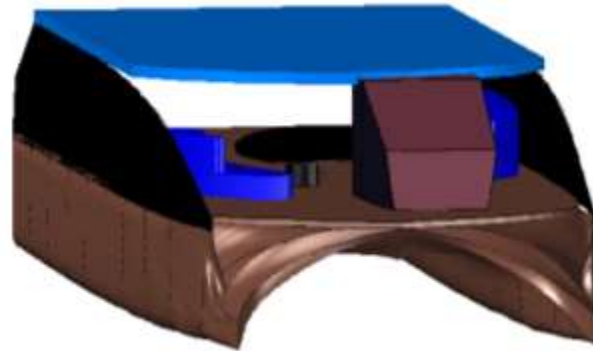
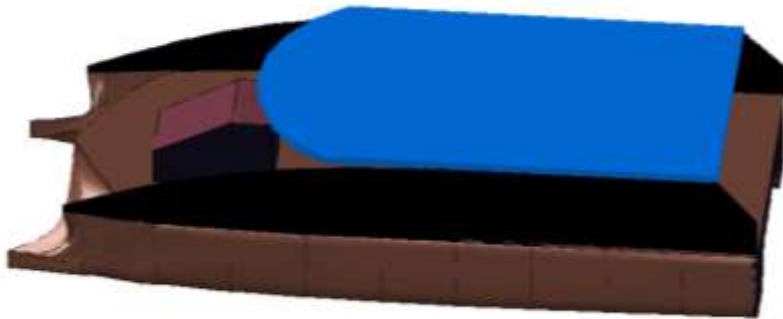
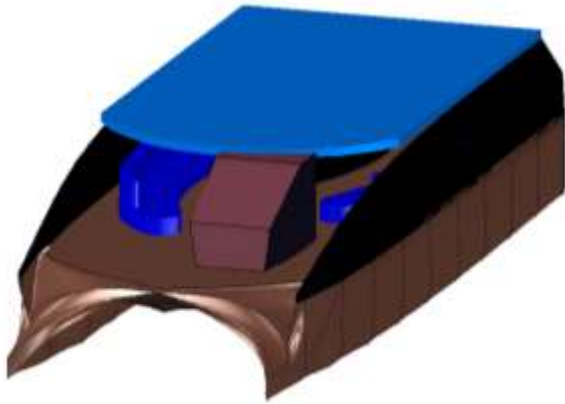
- LOA : 9.5 m
- LWL : 9.38 m
- B : 3.75 m
- H : 1 m
- T : 0.35 m
- Vs: 5 knot
- Capacity : 10 person (@ 80 Kg)

# GENERAL ARRANGEMENT

## TOP DECK

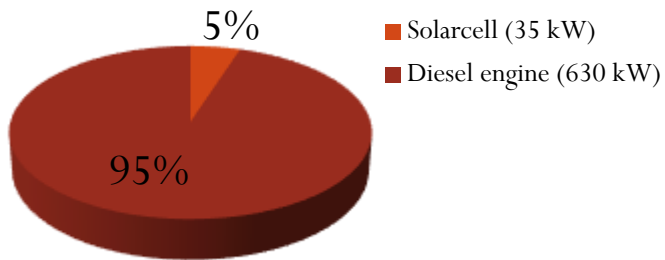


SOLAR CELL : 17.5 m<sup>2</sup>

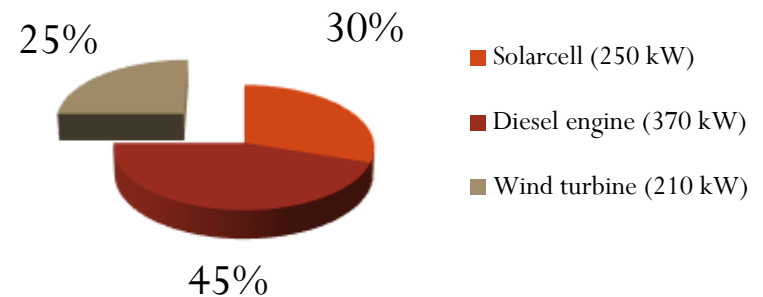


# Maratua Electricity Source

**Existing condition in 2013**



**Forecast for 2020**



- Assumption =
- Dedicated Energy Farm is proposed
  - Installed 700 unit Wind Turbines (300 Watt capacity)
  - Installed 2500 unit Solar Panel (100 Watt capacity)
  - Installed 4 Diesel Generator Container (1MW Capacity)



# ZONATION

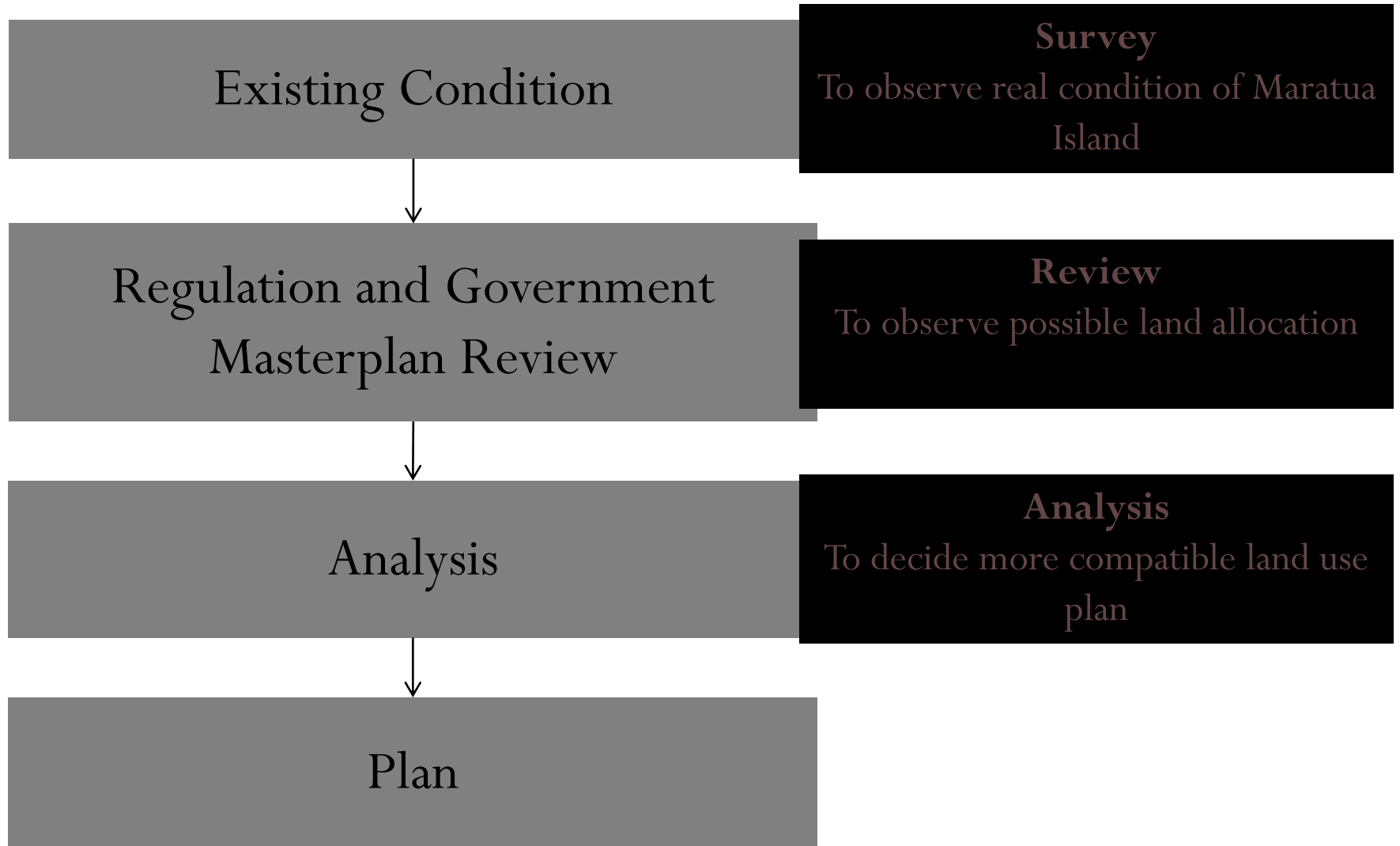
- Zoning plan made to set **land use allocation** thus the **activities** is more **compatible** for Maratua as a **tourism island**
- Results
  - **Zoning Plan**

Dividing area to **general land uses** such as settlement, conservation area, etc.
  - **Tourism Service Area**

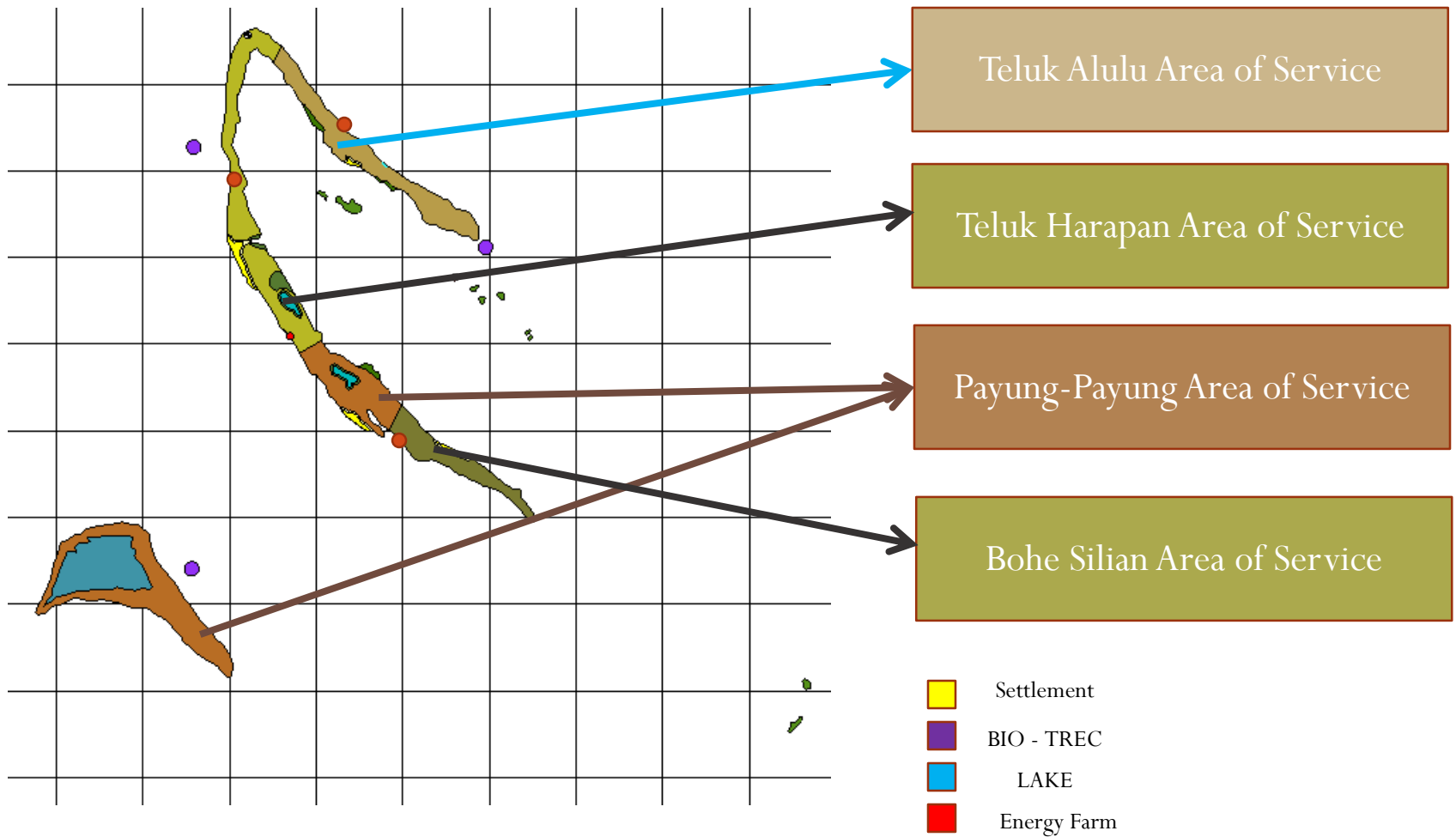
Planning possible **tourism spot** and
  - **Neighborhood Design**

Creating convenient **environment** in the villages

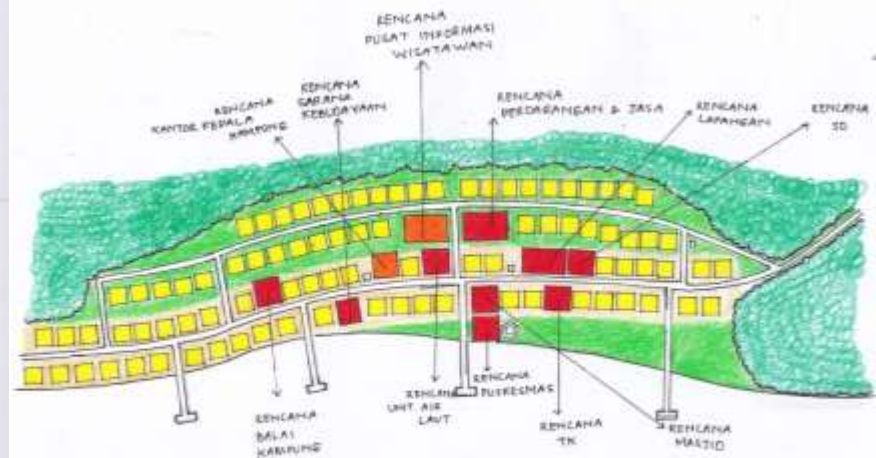
# Methodology



# Tourism Service Area



BONE SILIANG SERVICE AREA PLAN



# Conclusion

- Maratua Potentials (sustainable marine tourism)
- Maratua Problems (Environment Damage, Electricity, Tourist Accommodation, Transportation, Planning)
- Five Solution Proposed (BIO-TREC, WIND TURBINE, HOME-STAY SCHEME, SOLAR BOAT, ZONATION)
- Further research and **coordination** with locals needed for best result





TERIMA KASIH

Kinds of household appliance that owned by the local people :

Main  
requirement

| Household Appliance   | Electricity Consumption |
|-----------------------|-------------------------|
| Lamp                  | 18 Watt                 |
| Water pump            | 150 Watt                |
| Television            | 60 Watt                 |
| Fan                   | 100 Watt                |
| Rice cooker           | 300 Watt                |
| Mobile phone charging | 5 Watt                  |
| Refrigerator          | 100 Watt                |
| Dispenser             | 75 Watt                 |
| Washing machine       | 250 Watt                |
| Computer              | 120 Watt                |
| Iron                  | 300 Watt                |

## Payung - Payung Village

- The population of the village is approximately 650 people.
- The total power requirement of 94,95 kVA.
- There has not been electrical power services.



## Teluk Harapan Village

- District center of Maratua Island.
- The population of this village of approximately 1,100 people.
- The total power requirement of 160,35 kVA.
- Available solar power station with capacity of 10 kWP  
hybrid wind turbine with capacity 4 kWP.



## Bohe Silian Village

- The population of this village of approximately 1,100 people.
- The total power requirement of 156,6 kVA.
- There has not been electrical power services.





## **Teluk Alulu Village**

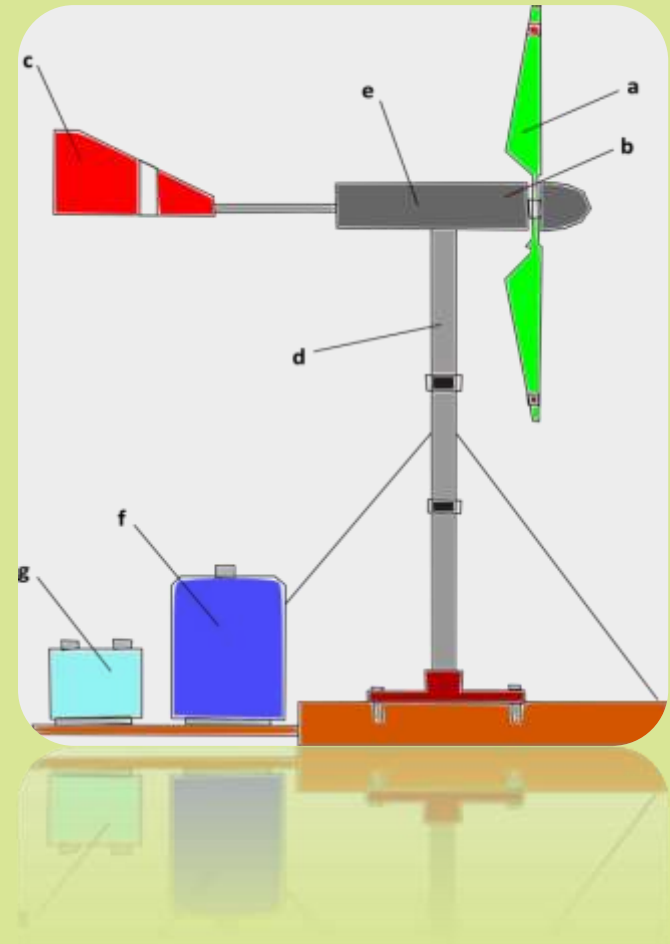
- The population of the village is approximately 700 people.
- The total power requirement of 104.7 kVA.
- There has not been electrical power services.



Horizontal Axis Wind Turbine type is reliable  
Small scale with capacity 300 Watt

### Design Calculation:

- a) Rotor
- b) Gearbox
- c) Tale
- d) Tower

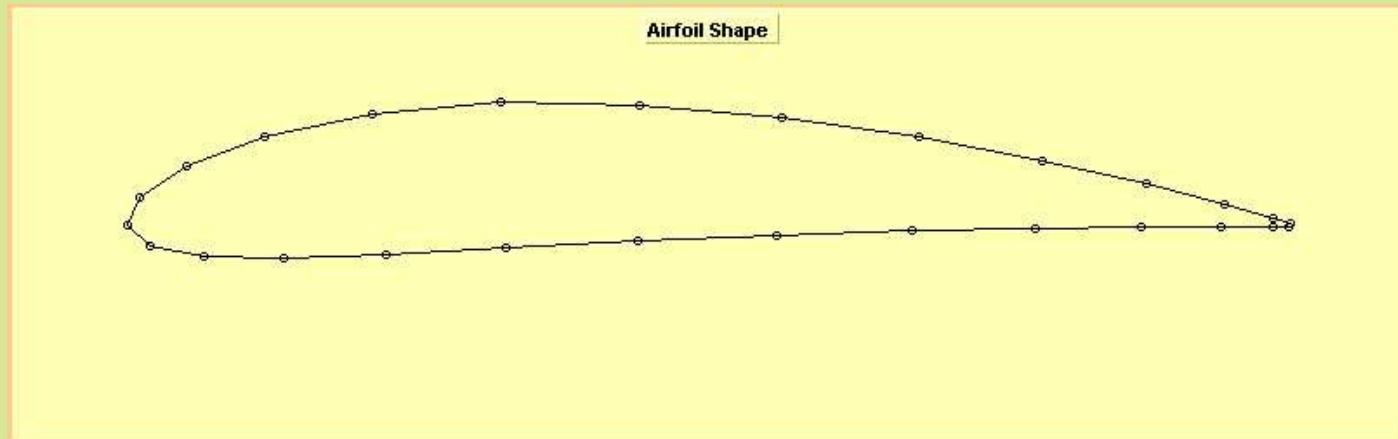


## Rotor Dimension:



Type of Airfoil:

**Naca 4412**



## Design Calculation:

