

# 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).

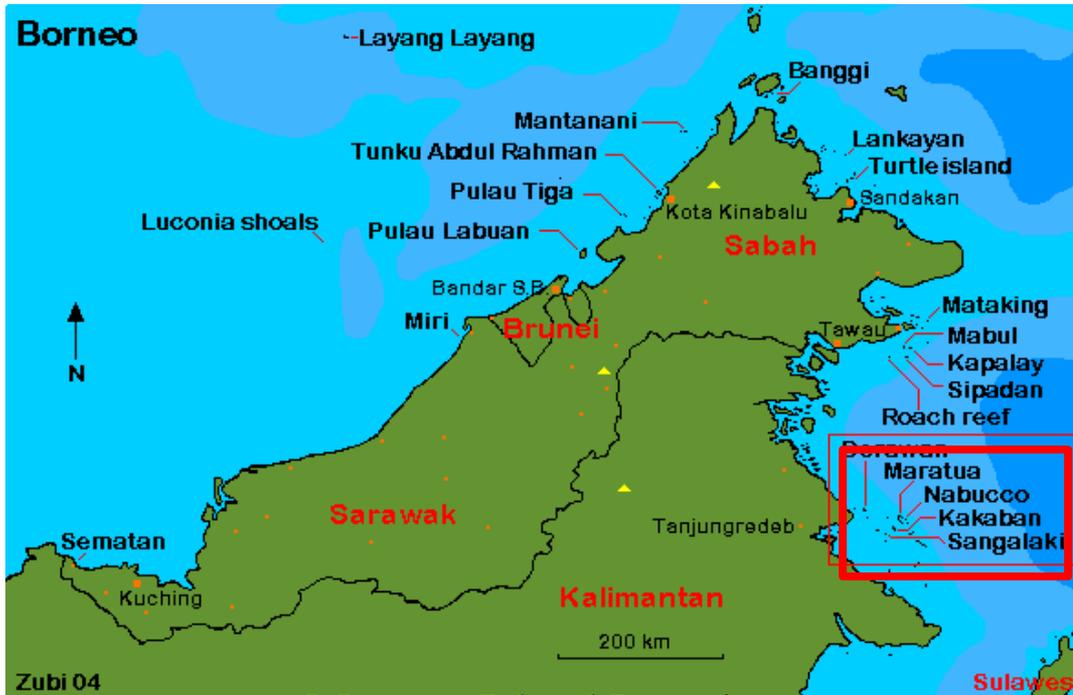
# Proven Case



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

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

# 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



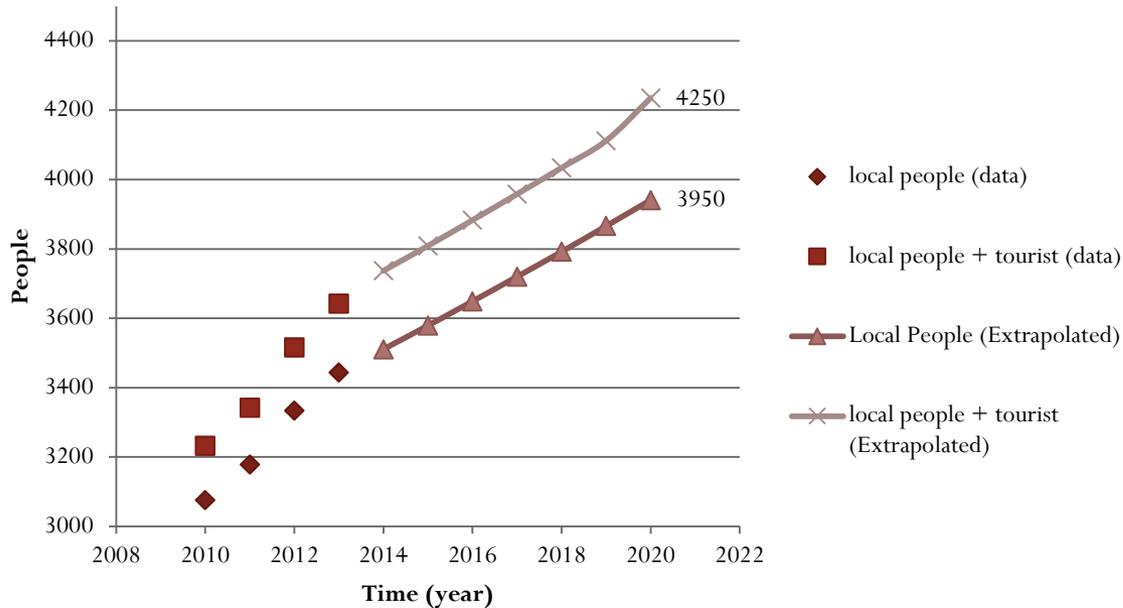
Vast Biodiversity



Motivated People

# Supporting Data

## Population Growth

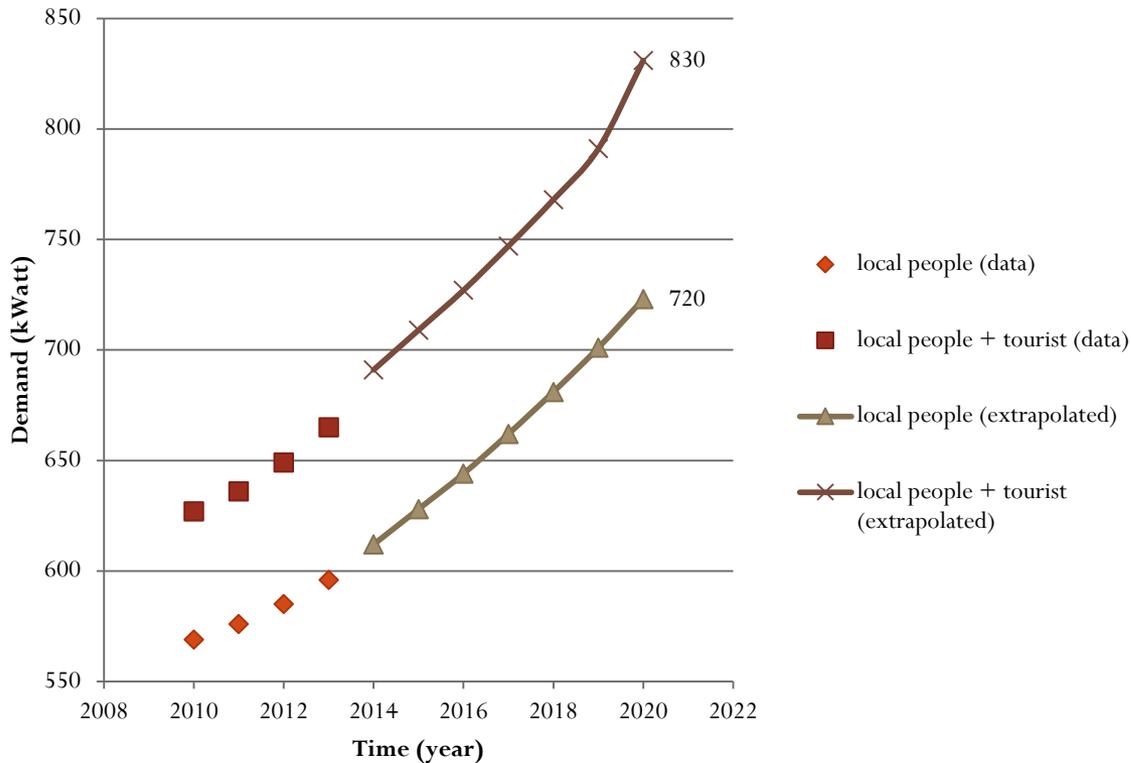


Bajo Tribe Kids

- 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

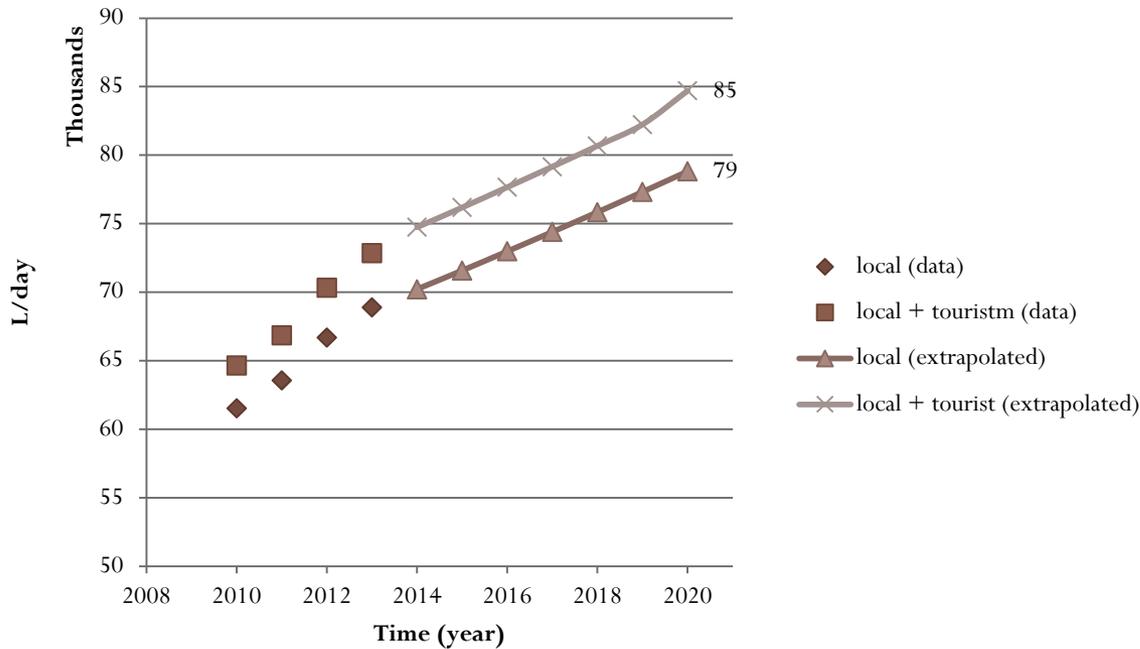


Maratua Diesel Generator  
(main electricity source)

- 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)

# Supporting Data

## Clean Water Demand

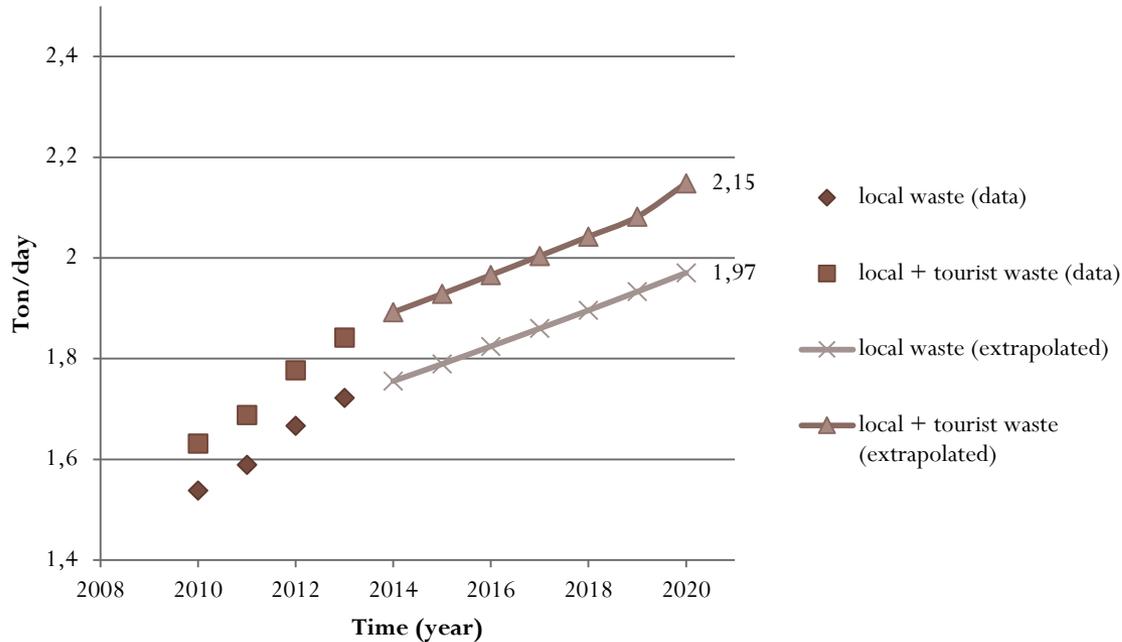


Rain Water Containment System  
(main water source)

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

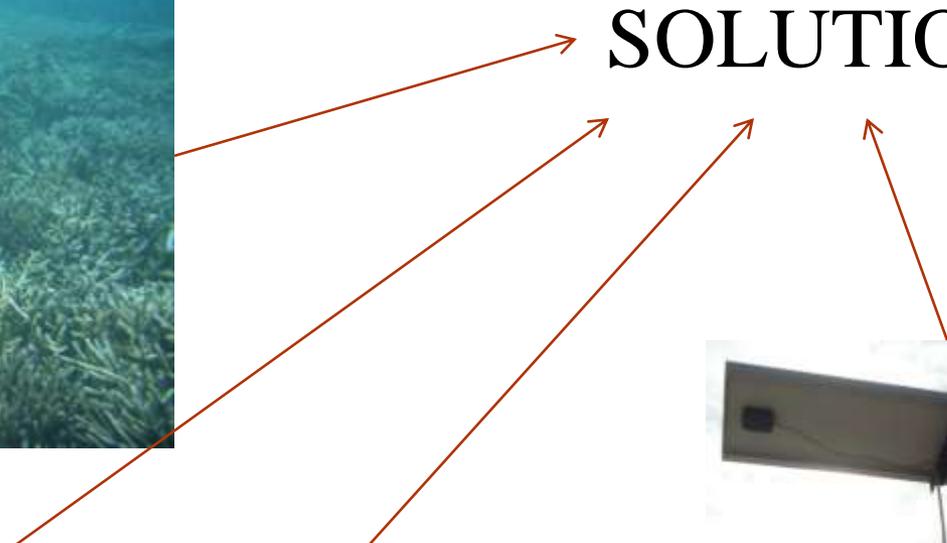


Accommodation



Electricity

**SOLUTION ?**



# PROPOSED IDEA

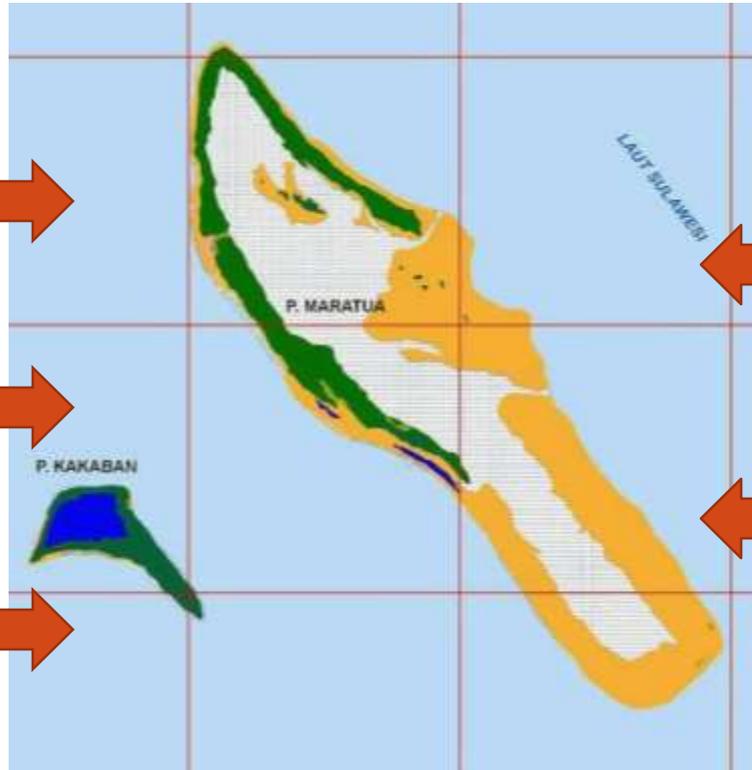
**Bio-  
Transplantation  
Electrict**



**Solar Boat**



**Site Plan**



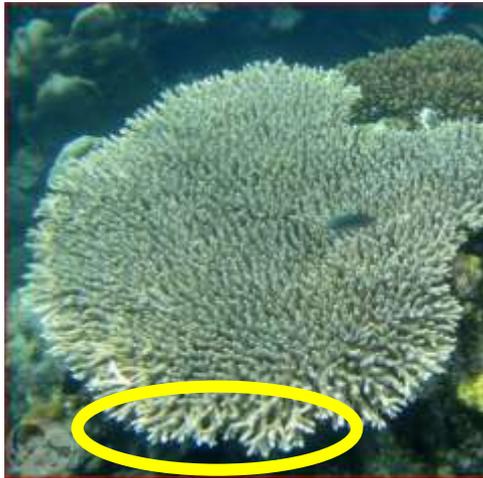
**Homestay  
Regulation**



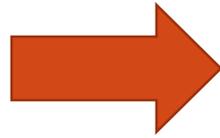
**Wind  
Turbine**



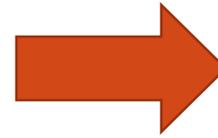
# BIO-TREC



**Existing Condition  
(Dying)**



Deteriorating

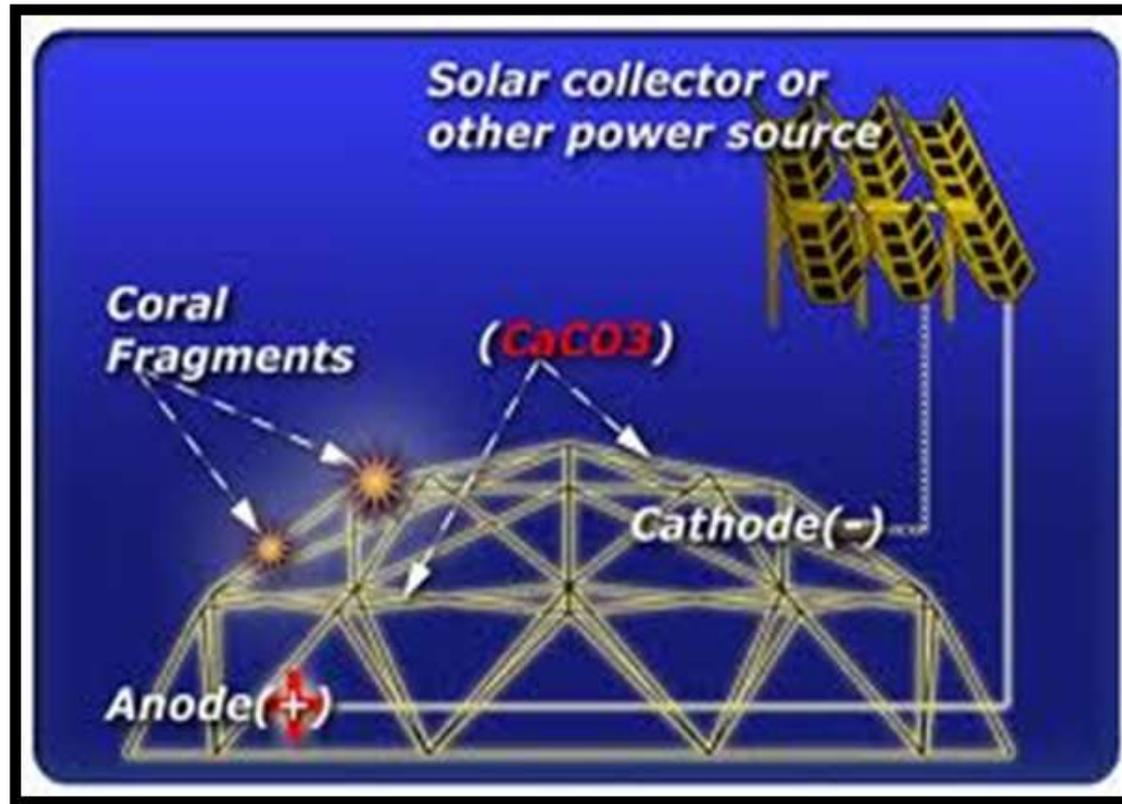


Recovering



**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.

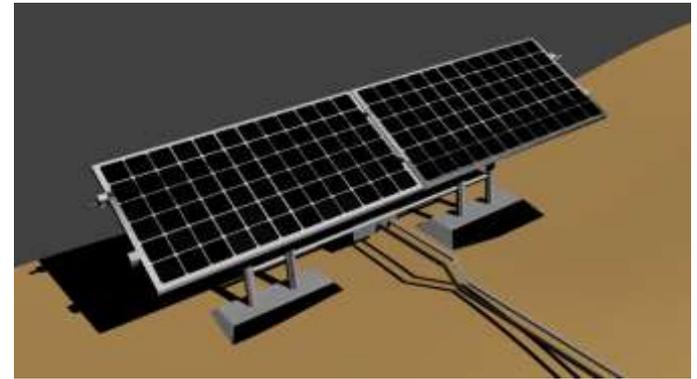
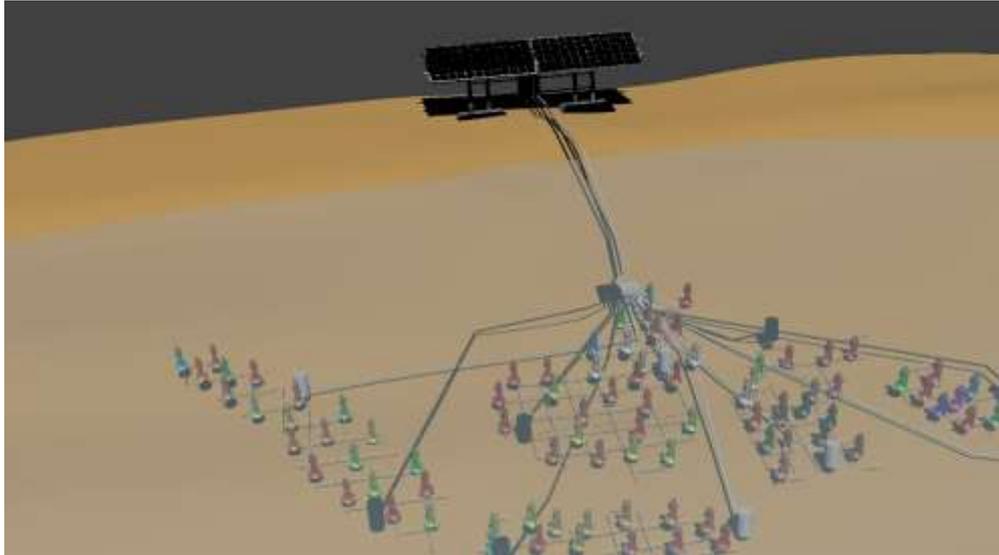
# Benefit

*Growth Rate 10 Times Faster*

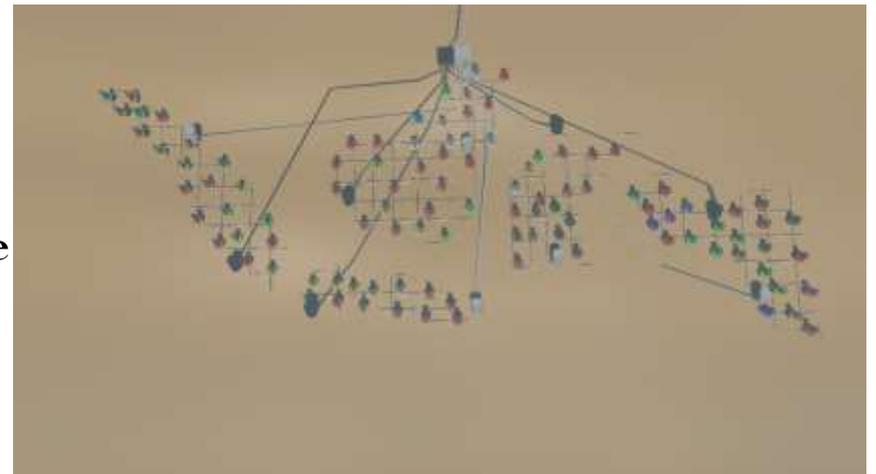


*New Tourist Attraction*

# BIO-TREC Design



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



# HOME-STAY SCHEME



Nabucco Resort



Maratua Home-Stay



# Regulated Sector



Location & Accessibility



Main Facilities



Safety and Security



General Service



Sanitation & Hygiene

# Result

<b>ITEM NO.</b>	<b>SECTION-ITEM</b>	<b>OPERATION STANDARDS</b>
<b>1.0</b>	<b>LOCATION AND ACCESSIBILITY OF THE HOUSE</b>	
1.1.0	Site and Environment	The location should be suitable to accept paying guest. <u>Built up</u> 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



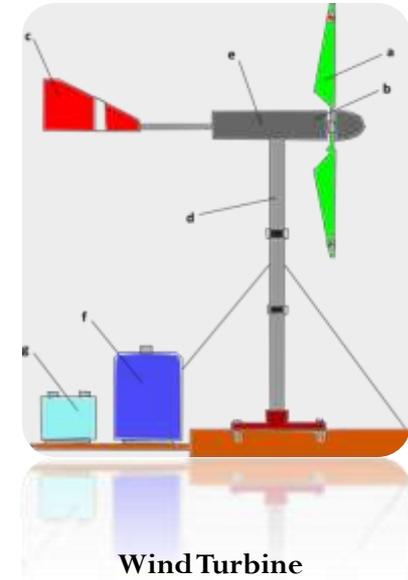
### Review:

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

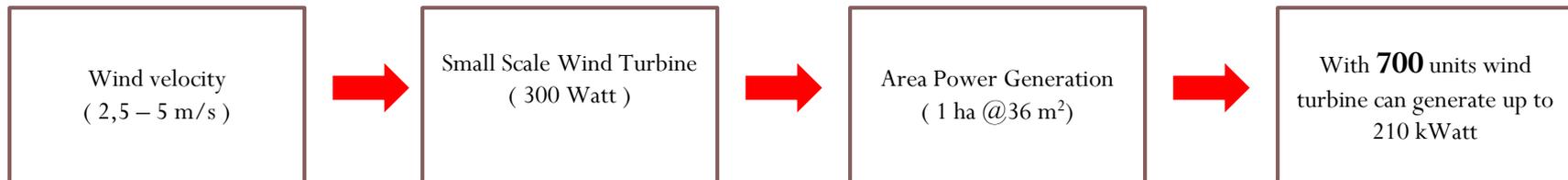
# Wind Turbine

**General Design Calculation Table**

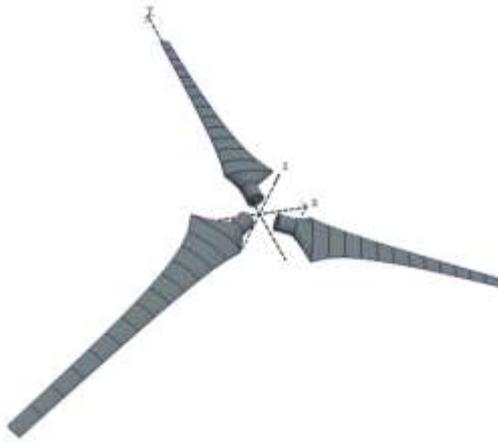
Symbols	Design	Value	Units
$P_G$	Generator power output	300	Watt
$P_t$	Turbine power	352	Watt
$P_a$	Wind power	596	Watt
$R$	Blade radius	1.5	m
$B$	Number of blades	3	-
TSR	Tip speed ratio	5.16	-
$\omega$	Angular speed	17.2	rad/s
		165	Rpm
$V_{rel}$	Relative velocity	26.28	m/s
$Re$	Reynold Numbers	2636600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



## Design Proses :

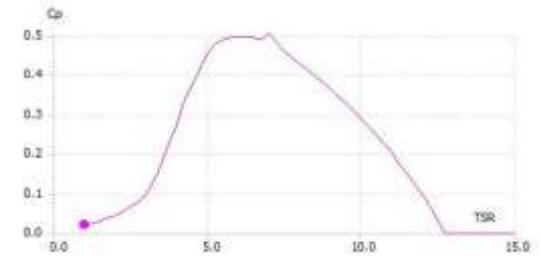
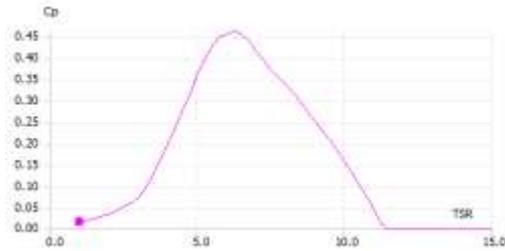
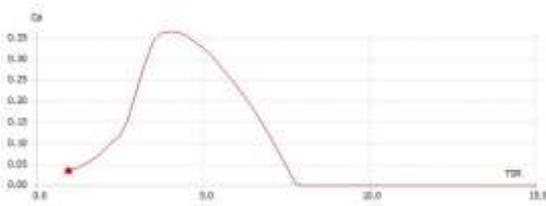


## Rotor Design :



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



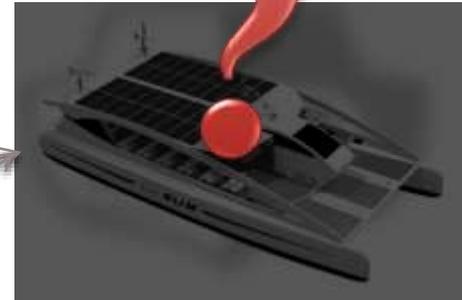
Nabucco boat



Boat in bohe silian



PROPOSED DESIGN



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

# PROPOSED ROUTE



## Perairan Tarakan - Tanjung Redep

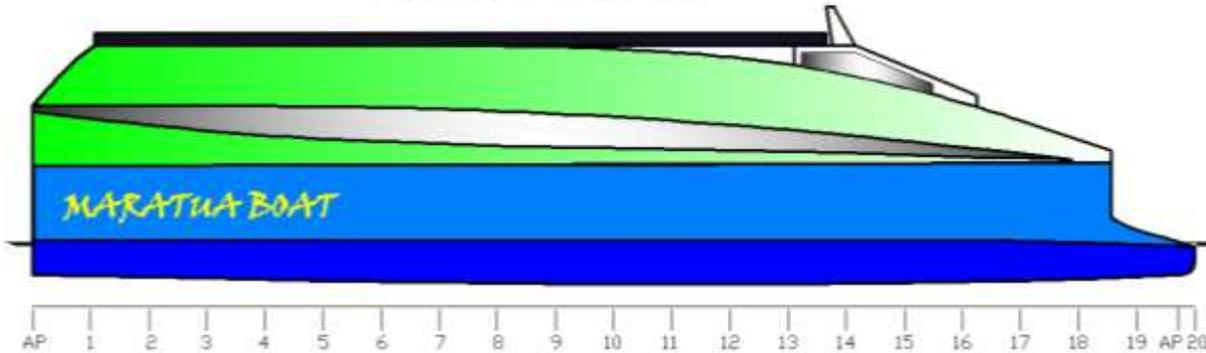
17/10/2014 07:00:00 - 18/10/2014 07:00:00

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

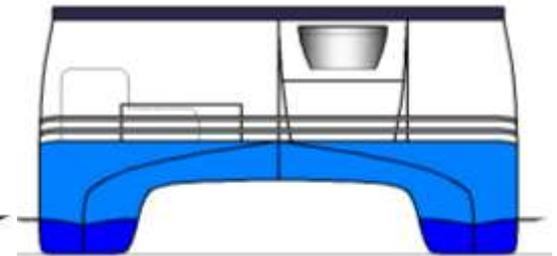
- Closed sea
- Calm sea

# GENERAL ARRANGEMENT

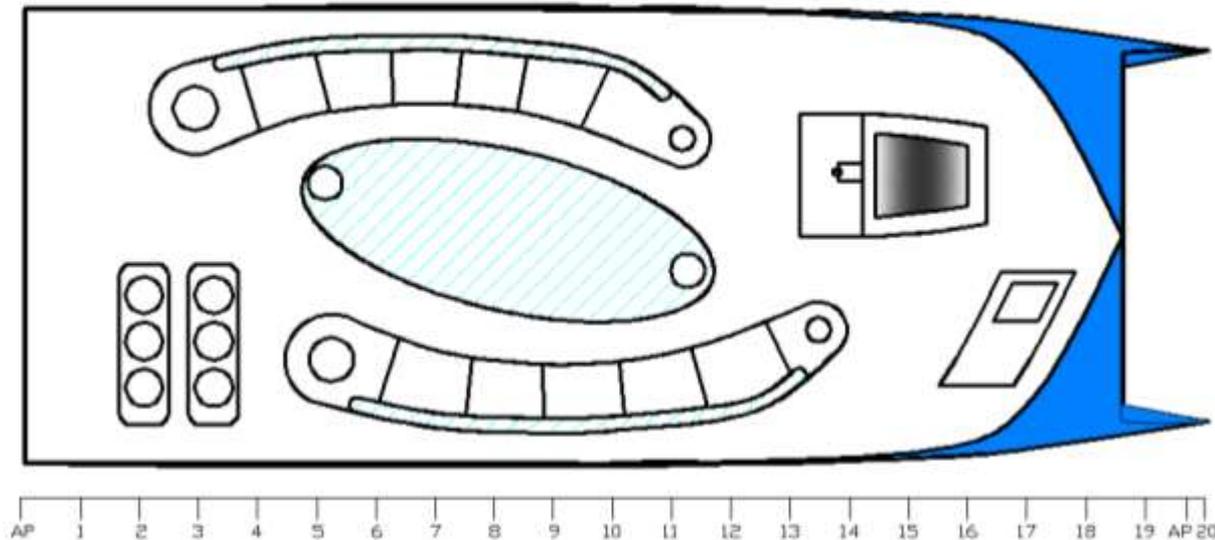
## SIDE VIEW



## FRONT VIEW



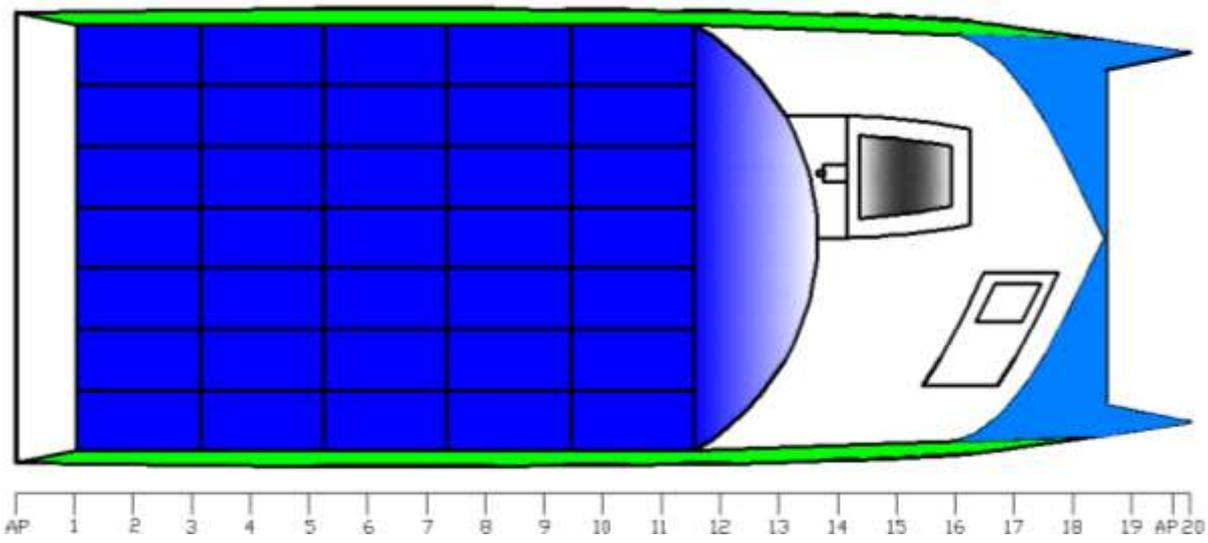
## MAIN DECK



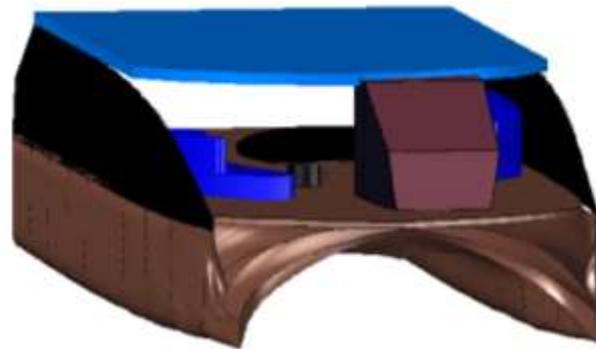
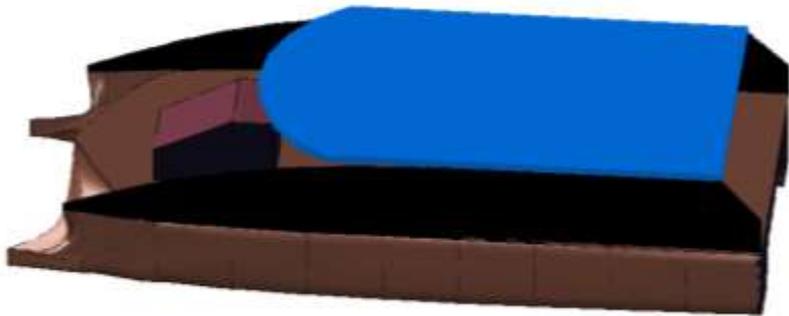
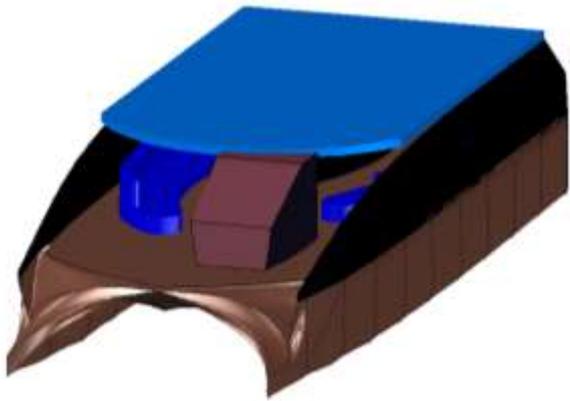
- LOA : 9.5 m
- LWL : 9.38 m
- B : 3.75 m
- H : 1 m
- T : 0.35 m
- Vs: 5 knot
- Capacity : 10 person (@ 80 Kg)

# GENERAL ARRANGEMENT

## TOP DECK

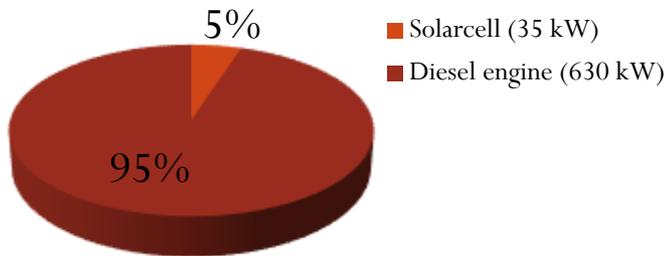


SOLAR CELL : 17.5 m<sup>2</sup>

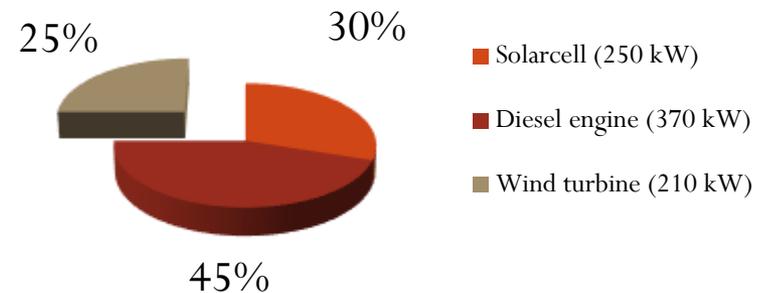


# Maratua Electricity Source

**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

Existing Condition

**Survey**

To observe real condition of Maratua Island

Regulation and Government  
Masterplan Review

**Review**

To observe possible land allocation

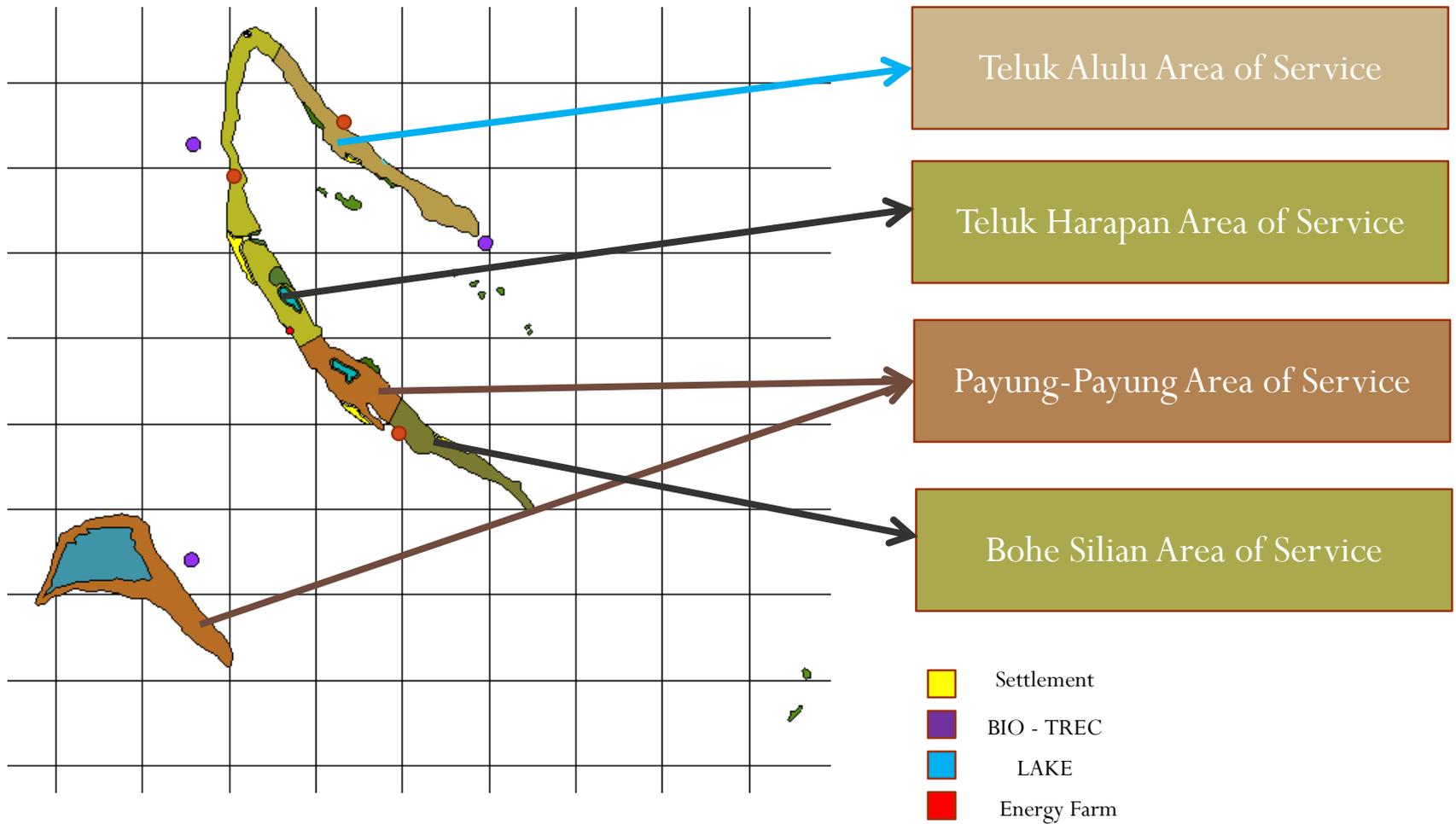
Analysis

**Analysis**

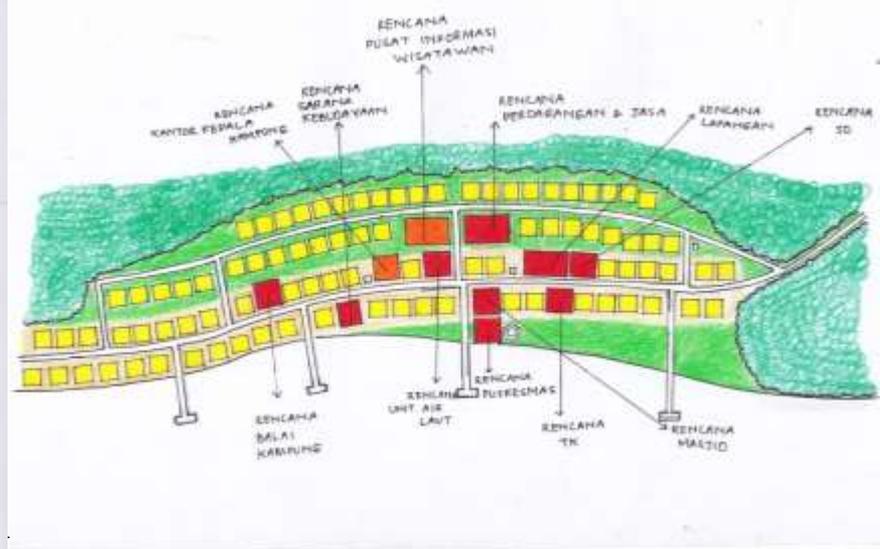
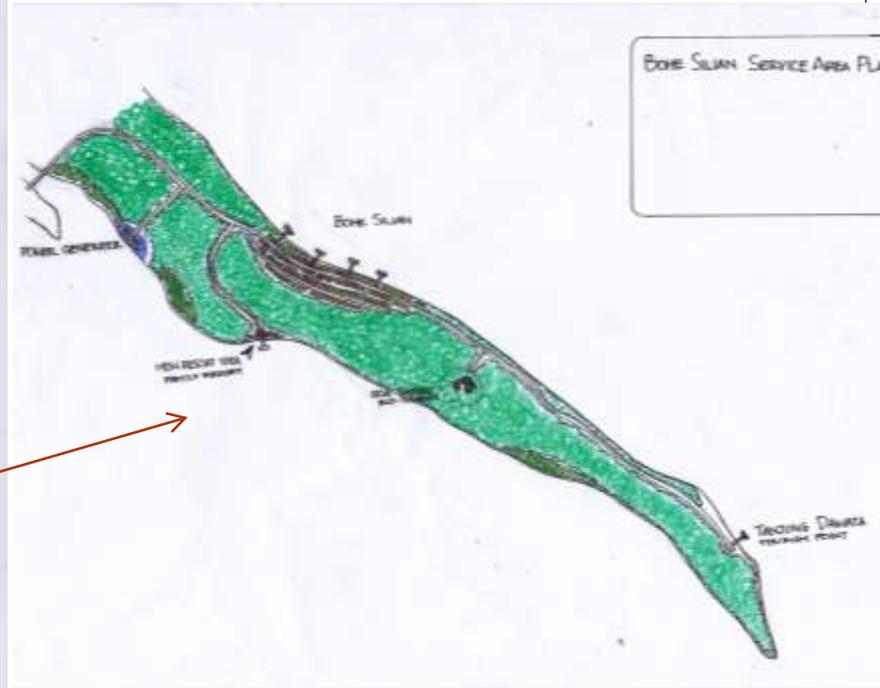
To decide more compatible land use plan

Plan

# Tourism Service Area



# Neighborhood 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

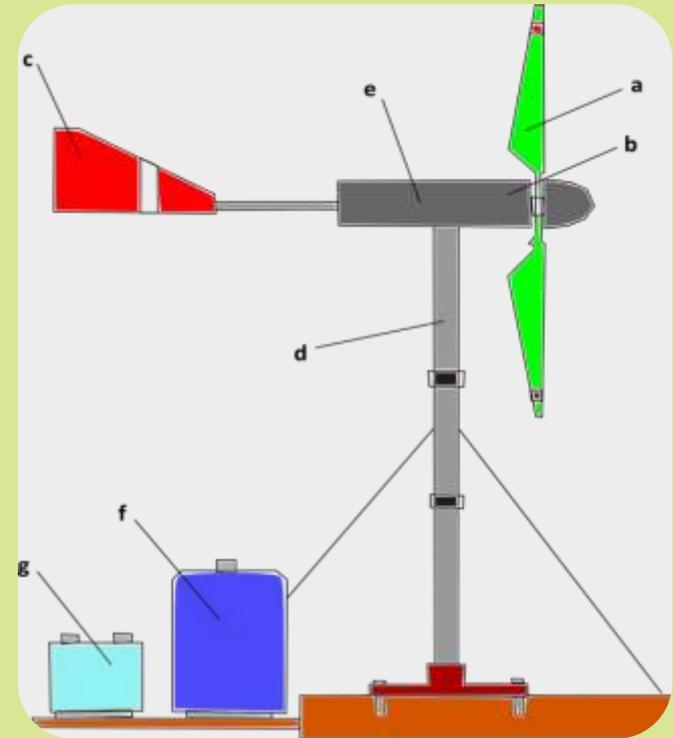
- The population of the village is approximately 700 people.
- The total power requirement of 104.7 kVA.
- There has not been electrical power services.



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

### Design Calculation:

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

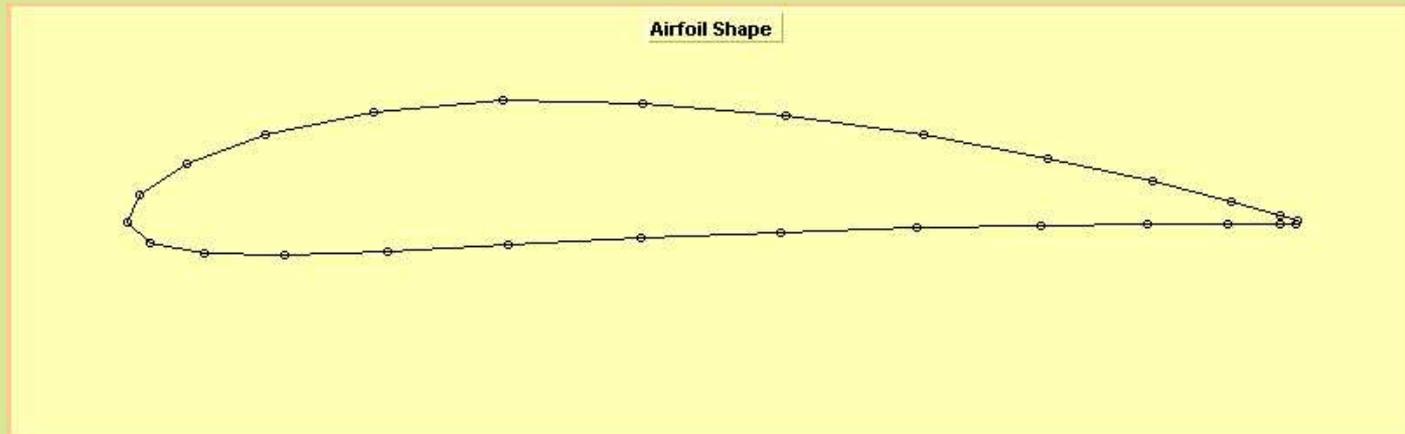


## Rotor Dimension:



## Type of Airfoil:

**Naca 4412**



# Design Calculation:

