

# Hybrid renewable energy systems for remote locations

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**By doing field research at remote islands in Indonesia, the operation and maintenance of hybrid renewable energy systems was investigated. Combinations of energy sources such as solar, wind and diesel generators were found at the locations. The possibility of running a diesel engine on alternative oils such as palm and coconut oil was checked by doing tests in a laboratory at the technical university ITB in Bandung, Indonesia.**

## Background

Many locations in Indonesia such as small islands and remote villages on the main islands are not connected to the main electricity grid, and may never be as they are too remote for grid extensions to be economically justifiable. Therefore, many either do not have electricity or are dependent on expensive diesel transports to fuel their stand-alone, diesel powered mini-grids. Using a hybrid renewable energy system combining solar power and a diesel engine run on vegetable oil could provide this type of location with cheaper, more reliable energy.

## Method

In order to investigate whether this type of system would be feasible, field studies were completed to gain an understanding of how well implemented systems are working and what challenges are connected to them. The field studies were conducted at the Karimunjawa archipelago, where the energy systems of the main island and three smaller islands were studied. The field studies were

complemented by running experiments at the university laboratories to analyze the effect of using vegetable oil as fuel in a



diesel engine.

## Results

The installed solar power was working well on the two islands where it had been implemented recently, whereas another island with an older system had issues with corroding PV-panels. The main island was running on large diesel engines at a newly installed diesel power plant which were not used optimally. Two of the smaller sites also had wind turbines which were all broken.

The experiments showed that it was possible to run the diesel engine with palm and coconut oil. The emissions were slightly lower for the vegetable oils, with palm oil have lower emissions than coconut oil. However, the fuel consumption for the vegetable oils was higher than for diesel, with coconut oil giving the highest result.

## Conclusion

Using the HRES configuration of combining solar power with vegetable oil-driven IC-engine would be functional and could provide reliable, clean energy for remote communities. The results and recommendations can be used as a help for

further research and future hybrid  
renewable energy systems.