

REPIC



Schweizerische Eidgenossenschaft  
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State Secretariat for Economic Affairs SECO

Swiss Agency for Development and Cooperation SDC

Federal Office for the Environment FOEN

Swiss Federal Office of Energy SFOE

## REPIC Intermediate Report, M3

<b>Project Title</b>	<b>Solar Powered E-longtail Boat</b>	
<b>Institution / Contact Person</b>	ZENNA AG / Roland Schlegel	
<b>Contract Number</b>	2019.02	
<b>End of Project According to Contract</b>	30.09.2021	
<b>Planned End of Project According Current Schedule</b>	30.09.2022 (M4)	
<b>Date</b>	09.11.2021	

AERO 

ZENNA  
Solar. Aber richtig.



cdw stiftung

## 1. Short Report

The project and most of the deliverables are on track, due to COVID-Situation with a little delay. The first tests with the boat have been done successfully. The boat is running and can be charged by solar energy. With the current setting the boat has a range of approximately 30km at an average speed of 17 km/h. The 15kW AC-motor which is connected directly to the shaft and propeller can accelerate the boat to a maximum speed of 19 km/h. The solar system with 20 modules and total power of 5.2 kWp produces roughly 20 kWh on a sunny day. There is still room for optimization especially the shaft and it's bearings which are originally out of wood, cause high friction. Due to COVID restrictions the milestone c) Report Business model and Financing model could not be achieved. Together with REPIC we decided on 4<sup>th</sup> November 2021 to move part c) of milestone M3 to M4.

### Milestones / Deliverables

#### a. Proof of boat in operation (photos)



A short video can be found under:

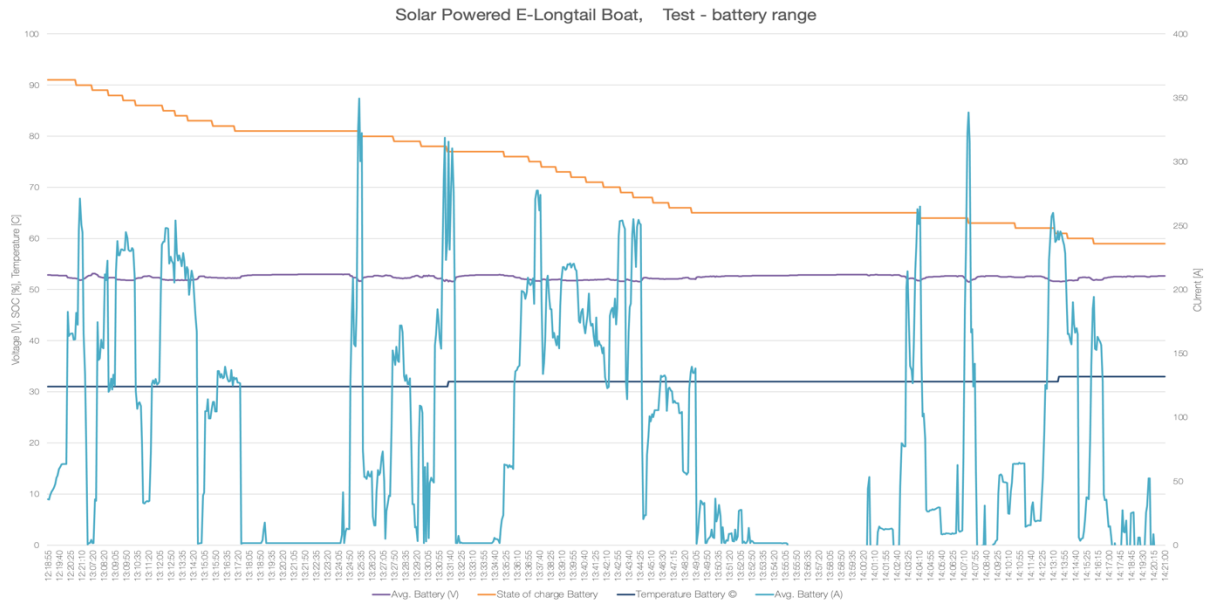
- <https://vimeo.com/zenna/e-longtail-boat>

## b. Test results

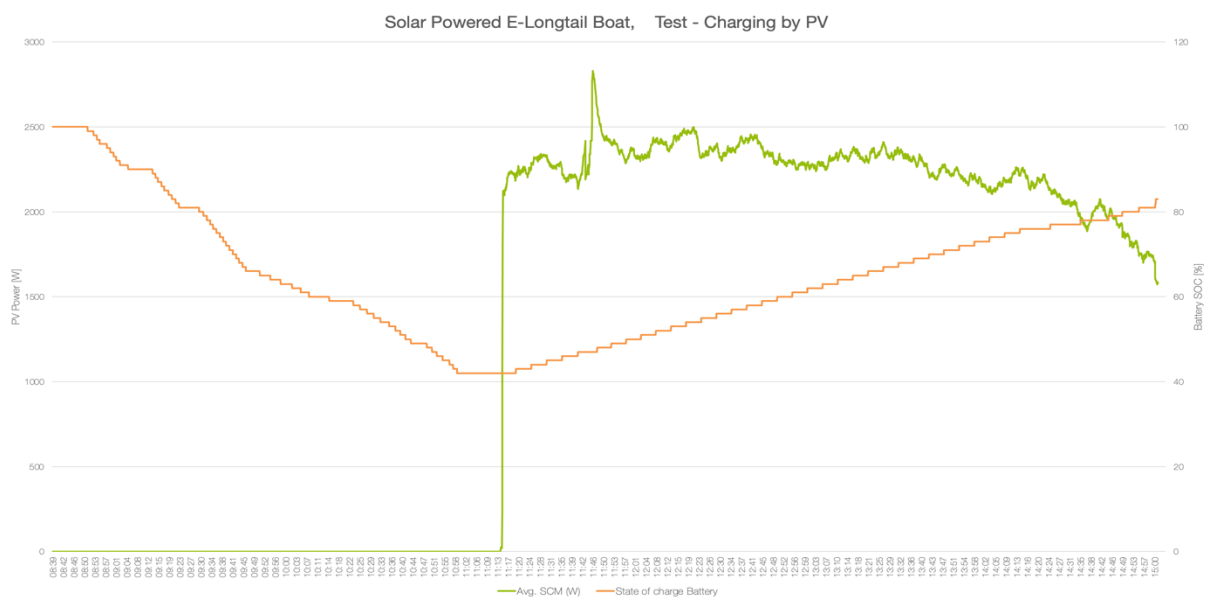
To collect the data a notebook has been connected directly to the system. For the test ride always 3-4 people were on the boat. The test were executed on the Nakhon Nueang Khet Canal near Bangkok.



The data on following charts have been collected on 19<sup>th</sup> September 2021. The passenger load was approximately 350 kg. The weather overcast with no direct sunshine. The following graph shows the battery data of the boat. To cover a distance of 10.3 km, the state of charge (SOC) went from 91% to 59%, the solar system was turned off. This means with a SOC of 32% or 7.04 kWh we could cover a distance of 10.3 km with an average speed of 17 km/h. Out of this data we can derive a maximum range without solar system or at bad weather of 30 km at an average speed of 17 km/h.



On a test on November 7<sup>th</sup> 2021 the charging of the battery has been tested. From the time stamp of 08:39 to 11:14 the solar system was turned off and the boat was running. The state of charge (SOC) of the battery changed during this time frame from 100% to 42%. At the time stamp 11.16 the boat has been parked and was not running anymore. The solar system produced in average at 2'300 W and could charge the battery from an SOC of 42% back to 83% in less than 4 hours. In average the solar system produced 2'300 Wh per hour. The weather conditions were not perfect, but the solar system provided the expected results. On a fully sunny day, the system will produce even more energy.



Overall, the boat is running well. Especially the electrical components (solar panel, inverter and motor) are running as expected. Some improvements and fine tuning have to be done for the shaft. The part of the shaft in the water has originally a bearing made of wood which causes high friction, imbalance and vibrations on the shaft. For a solution a local supplier will be contacted to fix the problem.

### **c. Report Business model and Financing model**

Due to the COVID restrictions the milestone c) “with elaboration of the concrete financing and business model as well as meeting with potential investors must be part of the project” could not be achieved. It was not possible to enter Thailand without undergoing a 15 days quarantine until end of October.

In agreement with REPIC this milestone has been moved from M3 to M4.

Following financing models, we have in mind to discuss on site, once possible:

#### **1. Borrowing agreement**

A borrowing finance plan can be established by the project company on a loan basis with amortisations over 7 years.

#### **2. Finance lease**

A finance lease (also known as a capital lease or a sales lease) is a type of lease in which a finance company is typically the legal owner of the asset for the duration of the lease, while the lessee not only has operating control over the asset, but also some share of the economic risks and returns from the change in the valuation of the underlying asset.

#### **3. Operational lease**

An operational lease works like a rent agreement. In a operational leases the residual values are kept very low so that lessees purchase the equipment at the end of the leasing period instead of returning it.