

This document shortly reports the results of the use of the OGTC Microgrid Assessment Tool. The tool has been used to assess a possible microgrid located at or close to du-madr.

## Microgrids

In order to make this report comprehensible to the user the general properties of a microgrid are shortly discussed.

A microgrid is a local energy system that is capable of generating, storing and delivering energy locally. Microgrids can be both connected to the main grid (grid-connected microgrids) as well as being completely isolated (off-grid microgrids). The microgrid considered in this assessment is a off-grid microgrid. This means that the microgrid has to generate all electrical energy consumed in the grid locally and that no extra energy can be bought from external parties. Shortages are fulfilled by using a back-up diesel generator. There

are multiple possible reasons to apply a micro-grid:

- No grid is available (remote location)
- There is a grid available, but it is not reliable (enough)
- The wish to generate the own energy locally as a stakeholder or a community

In all cases renewable sources are often considered as a possible source of energy for the microgrid, either from an economic or a sustainable drive. In the case of this microgrid the following sources are considered: wind power, solar power and a back-up generator.

## Your microgrid

The assessed situation results in the microgrid configuration and associated economics described below.

## System sizing

The calculation described above has resulted in the following system:

Component	Capacity	Unit
Installed solar power	3,490.77	kWp
Installed wind power	3,461.51	kW
Installed backup power	1,864.62	kW

Table 1: Sizing of the main components of the system

The system defined by the parameters above realises a levelised cost of electricity of €0.53 per kWh. the system does this at a renewable energy share of 39.7 %.

## System economics

In order to assess the economics of the system the following economic parameters have been assumed:

Variable	Value	Units
Fuel price	1.22	€/liter
Annual change in fuel price	0.05	€/liter
Import tax	21.00	%
WACC	2.00	%

Table 2: Economic input variables

The investment costs associated with the use of the different main components are assumed to be:

Component	Investment costs	Units
Solar	€ 2,800.00	kWp
Wind	€ 2,500.00	kW
Backup generator	€ 820.00	kW

Table 3: Per unit investment cost of the main considered system components

Based on these the investment costs of the main components of the system are estimated as:

Component	Investment cost
Solar modules	€10,888,372.00
Wind turbines	€10,471,081.86
Backup generator	€ 3,369,304.57

Table 4: Investment cost of the system

The operational expenditure is estimated as:

Component	Annual pu OPEX	Units
Solar panels	€ 25.00	kWp
Wind turbines	€ 0.00	kW
Backup generator	€ 0.05	kW

Table 5: Operational expenditure of the main components of the system

## Method

The OGTC Microgrid Assessment Tool utilizes the Open Energy MOdelling Framework (OEMOF) to make a first estimation of the (economical) optimal size of the generation and storage components in an (off-grid) microgrid. This estimation is made by deriving an equation that describes the cost of energy of a microgrid with the chosen components and solving for the lowest system cost.

The total electricity demand has been specified as 11781000 kWh per year and has been converted to a demand time series using historic load data collected by ENTSO-E.

The expected energy production by solar pan-

els and wind turbines has been estimated based on weather data made available by the PVGIS project. This weather data (solar radiation and windspeed) has been used to calculate the expected generated power per installed kW of wind power and kWp of solar power, respectively.

## Used input data and method

The timeseries used in and resulting from the calculations are listed on this page.

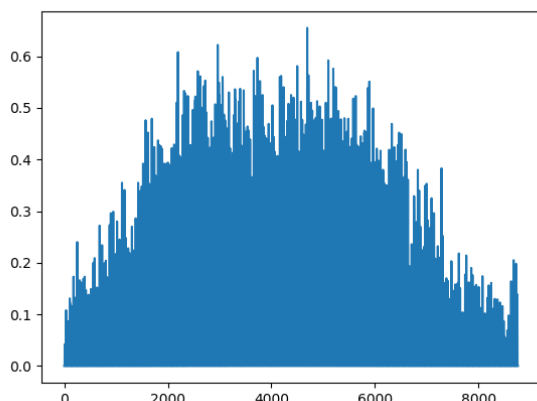


Figure 1: Time series of the solar energy production in kW per kWp of installed solar power

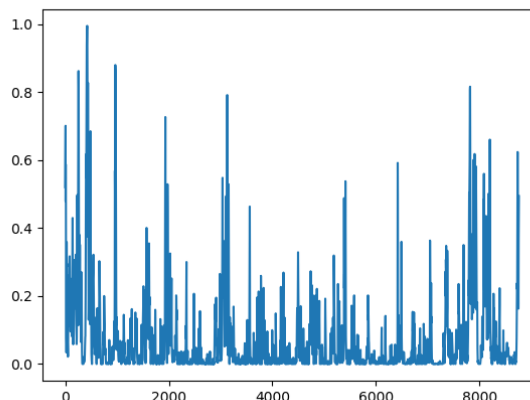


Figure 2: Time series of the wind energy production in kW per kW of installed wind power

## Contributors

The Microgrid Assessment Tool has been developed by the LOGiC Team at the Off Grid Test Center.

The tool is based on the Offgridders tool, initially developed by Martha Hoffmann at the Reinier Lemoine Institute in Berlin, Germany.

Based on this work and with financial support by LOGiC the team was able to successfully develop this implementation.

Other contributors to the tool are:

- Alex and Stan Bankras at Stalex (web development)

- Ewout van der Beek at NEDU (data interpretation)
- Wind Energy Solutions BV (general support)



The OGTC MAT is powered by LOGiC