

Operational Management of an Off-Grid Energy Hub Manual

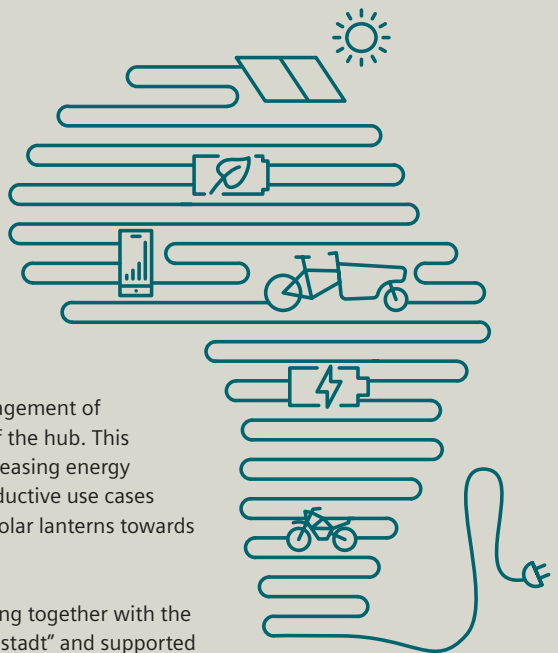
www.siemens-stiftung.org

By powering electric appliances for productive uses and charging batteries (e.g., for electric vehicles) off-grid solar PV “energy hubs” can make a meaningful contribution towards electricity access in rural and peri-urban areas.

Planning and implementing such energy hubs require both thorough planning as well as an operational management of all assets to ensure economic viability of the hub. This is especially important in case of an increasing energy demand over time and/or changing productive use cases (e.g., from charging mobile phones or solar lanterns towards charging electric vehicles).

Against this background, Siemens Stiftung together with the university “Technische Hochschule Ingolstadt” and supported by the German Development Cooperation developed an app which resulted from the joint research project in Western Kenya.

Use case: In order to facilitate the development of energy hubs, the following application was designed to assist the operator in planning an appropriate PV system as well as to schedule and optimize the load charging throughout the day using PV forecast.



Manual

STEP 1

The operator can size a PV / battery system based on the different load's specifications using characteristic values (e.g., energy capacity, charging rate etc.). In addition, the application allows the operator to specify the energy hub's setting (e.g., number of days of autonomy, nominal battery voltage, battery DoD etc.), resulting in a technical setup (i.e., installed PV / battery capacity) of for the specified loads.



STEP 3

Based on the setting specified in the prior steps, the Energy Hub's operator can now utilize the application's in-built load optimization algorithm in a user-friendly environment. The load optimization algorithm optimizes, shifts and schedules the various loads of the operator throughout the day by prioritizing the various loads in line with the PV forecast.



STEP 2

The operator is given the chance to calculate the annual energy yield of the PV system based on the performance ratio of the system, number of PV modules and the global horizontal irradiation available at the system's location.



STEP 4

In the last step, the energy hub's operator Step 4 can export the results of the load optimization in Microsoft® Excel® for further action.



HOW TO USE AND INSTALL:

You can download the file here: <https://www.siemens-stiftung.org/giz-app-energy-hub/App.zip>

To use the app you need MATLAB Runtime (version 9.6). MATLAB Runtime can be downloaded here: <https://de.mathworks.com/products/compiler/matlab-runtime.html>

Your installation workflow should be as follows

1. Download of MATLAB Runtime (version 9.6)
2. Installation of MATLAB Runtime
3. Download / Run the app „APP“ (see download link above)

See also our Virtual Session on Youtube

Spotlight On: the Operational Management of an Off-Grid Energy Hub

<https://youtu.be/9vTHcfzx7tQ>

supported by

Implemented by