# Evaluation of Software Tools for Standalone Microgrid Design and Optimization

IEA PVPS Task 18, Report IEA-PVPS T18-03:2024, March 2024
ISBN 978-3-907281-45-1

**Authors:**
Gautam Rituraj, Jorge Ortiz, Niccolo Ficarelli, Gautham Ram, Chandra Mouli, Paul Rodden, Christopher Martell, Xavier Vallve, Pavol Bauer

The Technical Report is available for download from the IEA-PVPS website www.iea-pvps.org.

## Executive Summary

The standalone microgrid (SM) is getting attention and being adopted by energy communities due to several factors, such as increasing access to electrification, electrification of vehicles, and reducing greenhouse gas emissions in a generation. It involves different phases to get the comprehensive design of SM. The objective of the first phase is to pre-design the SM and to optimize the capacities of each component. In this phase, software tools, if used properly, play a valuable role and help to ensure an efficient, reliable, and cost-effective SM.

Various publicly available software tools (whether freely accessible or paid) supporting microgrid initial sizing and analysis are reported in the literature. However, the questions are: Are they really for sizing and optimization? If yes, then which one should be used? If more than one similar tool is available, will they produce similar results for the same inputs? If the results are similar, which tool provides results more aligned with the measurement data? These are the common questions for users when selecting software tools for pre-designing and optimizing SMs (with single or multiple energy sources used). In this context, this report attempts to answer these questions to help engineers, designers, and planners select the right software tools during the initial phase of designing and optimizing SM per their requirements.

A literature survey has been done to find publicly available software tools for pre-designing, analyzing, and optimizing SM. From the survey, it has been found that HOMER Pro is widely utilized for it. Besides that, another tool, iHOGA PRO+, is reported to have a similar objective to the HOMER Pro. Since both software tools use distinct optimization algorithms, they may produce different results for a given set of inputs. Therefore, these tools (HOMER Pro version 3.16.2 and iHOGA PRO+ version 3.4 build 20231114) have been evaluated in detail to know their results' differences, main advantages and weaknesses, and the existing gaps.

For a fair comparison, the number of criteria (i.e., 22) has been defined and categorized under quantitative (i.e.,1-7) and qualitative (i.e., 8-22). For quantitative comparison, three case studies are defined based on the geographical location, with different system components. These locations are the Daly River, Australia (case study 1); Delft, the Netherlands (case study 2); and Sheldon (Vermont), U.S.A. (case study 3). Each case is simulated in both software tools for the same inputs. The obtained results are compared using quantitative criteria. Moreover, for case study 1, the simulation results are compared with the measurement data. Thus, a total of three different quantitative comparisons are presented. However, the qualitative comparison of these tools was independent of the specific case studies presented.

Simulations in both software tools have proven to match (within a reasonable tolerance) measurement data from a real microgrid (i.e., case study 1). However, both software tools arrive at slightly different optimum sizing when optimizing a microgrid from scratch (i.e., case studies 2 and 3).

In summary, this report provides and analyses 22 criteria for comparison of HOMER Pro and iHOGA PRO+. However, per the user's requirement, the software must be selected based on the criteria that apply to their needs.