HOMER

The Micropower Optimization Model

HOMER models micropower systems with single or multiple power sources:

Photovoltaics
Wind turbines
Biomass power
Run-of-river hydro
Diesel and other reciprocating engines
Cogeneration
Microturbines
Batteries
Grid
Fuel cells
Electrolyzers

"HOMER is an indispensable tool when we talk of electrification with renewables."

Cecilio U. Sumaoy
Cagayan Electric Power & Light Co.
Philippines

"I've found HOMER to be incredibly robust and the best application available for system comparison."

Mick Grover
Sharp Laboratories of America, Inc.
Camas, WA

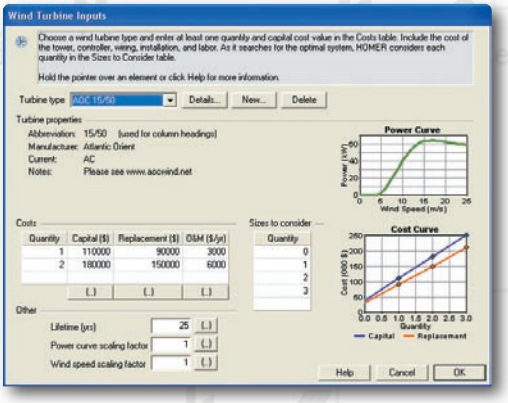
"You guys are really incredible. HOMER has helped me solve and lighten my workload problems in a faster and more efficient way. You have helped many RET enthusiasts, consultants, and students."

Gina Saavedra Fenner
Renewable Energy Engineer
International Centre for Application of Solar Energy (CASE)
Perth, WA, Australia

HOMER, the micropower optimization model, helps you design off-grid and grid-connected systems. You can use HOMER to perform analyses to explore a wide range of design questions:

- Which technologies are most cost-effective?
- What size should components be?
- What happens to the project's economics if costs or loads change?
- Is the renewable resource adequate?

HOMER's optimization and sensitivity analysis capabilities help you answer these difficult questions.



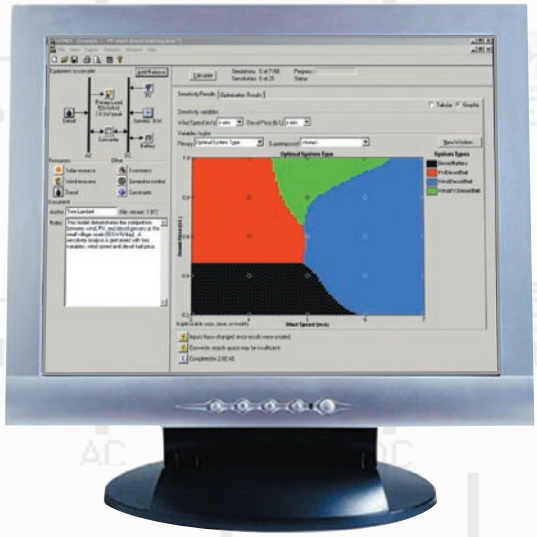
We've designed HOMER's input windows to minimize the effort required to enter data that describes loads, resources and component performance and costs. HOMER provides default values for many inputs so that you can quickly get started with your analysis.

What does HOMER do?

HOMER finds the least cost combination of components that meet electrical and thermal loads. HOMER simulates thousands of system configurations, optimizes for lifecycle cost, and generates results of sensitivity analyses on most inputs.

Simulation

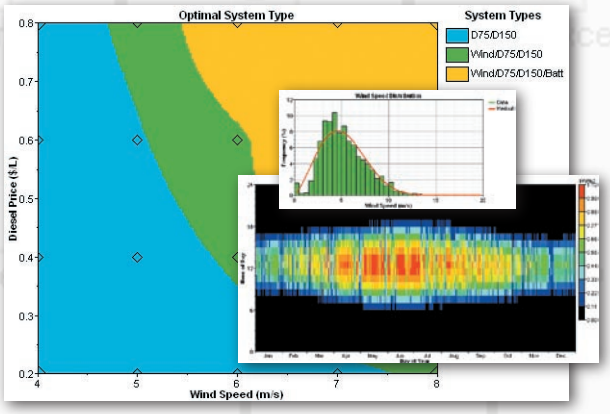
HOMER simulates the operation of a system by making energy balance calculations for each of the 8,760 hours in a year. For each hour, HOMER compares the electric and thermal load in the hour to the energy that the system can supply in that hour. For systems that include batteries or fuel-powered



generators, HOMER also decides for each hour how to operate the generators and whether to charge or discharge the batteries. If the system meets the loads for the entire year, HOMER estimates the lifecycle cost of the system, accounting for the capital, replacement, operation and maintenance, fuel and interest costs. You can view hourly energy flows for each component as well as annual cost and performance summaries.

Optimization

After simulating all of the possible system configurations, HOMER displays a list of feasible systems, sorted by lifecycle cost. You can easily find the least cost system at the top of the list, or you can scan the list for other feasible systems.



HOMER's powerful graphing capability provides a way for you to analyze and communicate the results of your analysis.

Sensitivity Analysis

Sometimes you may find it useful to see how the results vary with changes in inputs, either because they are uncertain or because they

Ian Baring-Gould

The island of Tac, Region de los Lagos, Chile

Rural Electrification in the Chiloe Islands

The Chiloe Islands are located off the Pacific Coast of Southern Chile. Of the more than 40 islands in the group, 32 are too far from the coast to be connected to the mainland electric grid and either have no access to electricity, or intermittent access provided by diesel generators. The islands range in size from 12 to 450 homes, with projected loads ranging from 17 to 1004 kWh/day. Economic activity on the islands includes farming, animal husbandry, and fishing. NREL, through a cooperative agreement between the governments of Chile and the United States, worked with a team of local and international experts to implement a pilot hybrid power system on Isla Tac, one of the Chiloe islands. The team conducted economic, loads, and renewable resource studies and used the results from those studies as inputs to HOMER.

An optimization analysis using HOMER showed that a wind-diesel system with battery storage would most cost-effectively supply the energy required by the island. HOMER's sensitivity analysis capability helped the team assess the impact of fuel price on the least-cost system design.

Ian Baring-Gould

The Isla Tac Power system provides power to the islands' 82 families.

The team also used two other NREL models: ViPOR to determine electric distribution mini-grid costs, and Hybrid2 to finalize the design of the hybrid power system. This work helped lead to a $40 million multilateral development bank loan to provide rural electrification projects, including replication of this pilot project, across the entire Chiloe island region.

represent a range of applications. You can perform a sensitivity analysis on almost any input by assigning more than one value to each input of interest. HOMER repeats the optimization process for each value of the input so that you can examine the effect of changes in the value on the results. You can specify as many sensitivity variables as you want, and analyze the results using HOMER's powerful graphing capabilities.

Downloading HOMER

HOMER is available for free on the HOMER Web site, www.nrel.gov/homer. There you will find instructions for downloading the software, as well as the latest information on the model, sample files, resource data, and contact information. If you do not have access to the Internet, please contact us by phone or mail for a copy of the software.

How can NREL help?

NREL provides classroom and individualized training in the use of HOMER. NREL's International Program also provides broader training and assistance in incorporating renewable energy into rural electrification programs. NREL can customize the software for particular applications or perform specific analyses on request.

NREL offers training and analysis support for HOMER users. Here, Dr. Peter Lilienthal works with a group of energy professionals at Jikedian Renewable Energy Center in Beijing, China.

HOMER

Why do we call it HOMER?

Because we like the classical Greek poet, and because HOMER originally stood for Hybrid Optimization Model for Electric Renewables. But HOMER can model systems that are not hybrids, like simple PV or diesel systems. It can also model thermal and hydrogen loads. We still like the Greek theme, so we're keeping HOMER but we're changing HOMER's motto to the micropower optimization model.

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