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

"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

Using the HOMER Model in Air Quality Analysis

HOMER®, the micropower optimization model created by the National Renewable Energy Laboratory (NREL), helps design and analyze off-grid and grid-connected power systems. One of HOMER's newest features is its enhanced ability to estimate air emissions for different micropower systems. HOMER's optimization and sensitivity analysis capabilities can explore the amount and cost of air emissions constraints or penalties, and rapidly determine the cost-effectiveness of a variety of technologies.

HOMER can analyze simple and complex hybrid distributed generation (DG) systems and grid-connection alternatives. It can determine benefits relating to:

Environmental issues
- Reduction of waste streams
- Application of emission-free technologies
- Regulatory changes
- Incentive programs

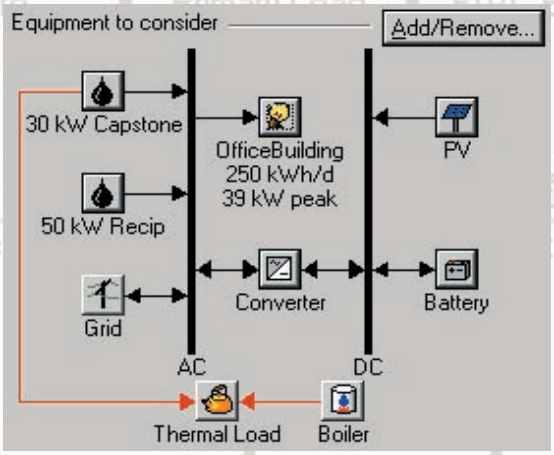
Energy impacts
- Efficiency of combined heat and power (CHP)
- Optimal integration with end-use efficiency

Renewable Resource Reliability

How HOMER can help in air quality analysis

HOMER can find the least-cost system to meet a user-selected emissions constraint. Sensitivity analysis on this constraint can be used to determine how changes to the constraint will increase or reduce cost, and help determine the optimal level for emissions reduction.

HOMER can be used to examine emission-reduction benefits of hybrid renewable and conventional systems and under a variety of circumstances including initial capital cost, cost of fuel, variable rate



HOMER simulates all the hourly energy flows for complex hybrid systems. This schematic shows the variety of technical choices that HOMER optimized for a particular analysis.

schedules, and emission levels. Graphical results help identify market opportunities and barriers for each micropower technology. These results also determine the effect of several factors, including:

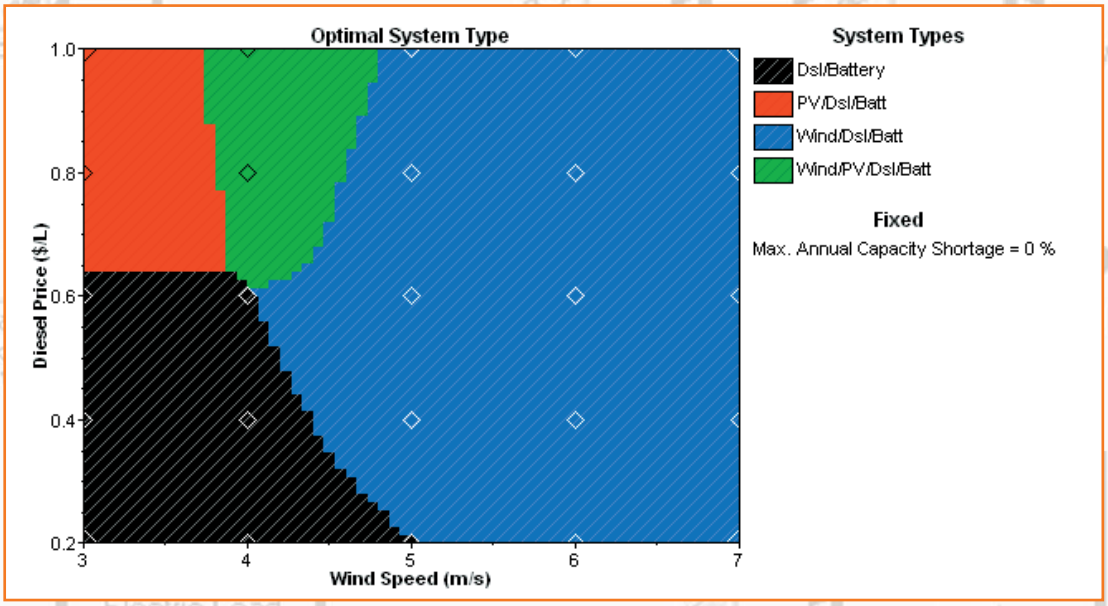
- Environmental performance, especially regarding emissions
- Technology performance/cost
- Fuel prices, utility rates, renewable resource
- Load shape, electrical, thermal

HOMER helps determine how different conventional, renewable, and hybrid systems interact with end-use demand and irrigation options.

Working with environmental agencies

NREL would welcome opportunities to work with local, state, and federal environmental agencies to use HOMER in air quality planning. HOMER can assist environmental agencies by:

- Analyzing energy and environmental impacts of DG and CHP
- Revealing market implications of incentives, constraints, and penalties
- Determining the impact of climate, resource, and utility rates.



HOMER identifies the least-cost option under a variety of user-specified scenarios. For this off-grid analysis, it shows the minimum fuel price for PV to be cost-effective, the minimum windspeed for wind to be cost-effective, and the conditions under which a PV-wind hybrid are optimal.

Working with industry stakeholders

Industry stakeholders can use HOMER to address a variety of investment and emissions planning issues. Businesses that have micropower systems (or are considering investing in micropower systems), or that manufacture these systems can use this model to address questions such as:

- What is the most cost-effective micropower system that meets my energy needs and emissions goals?
- Can my existing micropower system improve its energy costs and emissions profile through hybridization?
- At what level of subsidy would a more expensive, cleaner technology become financially attractive to my business?

Key HOMER concepts

Rigorous optimization is critical to finding the least-cost power system and identifying the potential of a wide array of micropower technologies.

HOMER is an ideal tool for gaining further understanding of how potential regulations may affect power and emission markets under different scenarios. Sensitivity analysis can examine the impact of changes in external factors, including:

- Environmental (emission constraints, penalties)
- Economic (fuel price, component cost)
- Technical (wind speed, demand)

For more information on how HOMER works and to download the model at no cost, please visit www.nrel.gov/homer.

NREL also can customize the software for particular applications or perform specific analyses on request. Please contact Peter Lilienthal at peter_lilienthal@nrel.gov or 303-384-7444 for more information.

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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Operated for the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy by Midwest Research Institute • Battelle

NREL/FS-620-36683 • August 2004

Printed with biodegradable ink on paper containing at least 50% wastepaper, including 20% post consumer waste.