



HOMER
Energy

The Economics of Energy Access Mini-grids

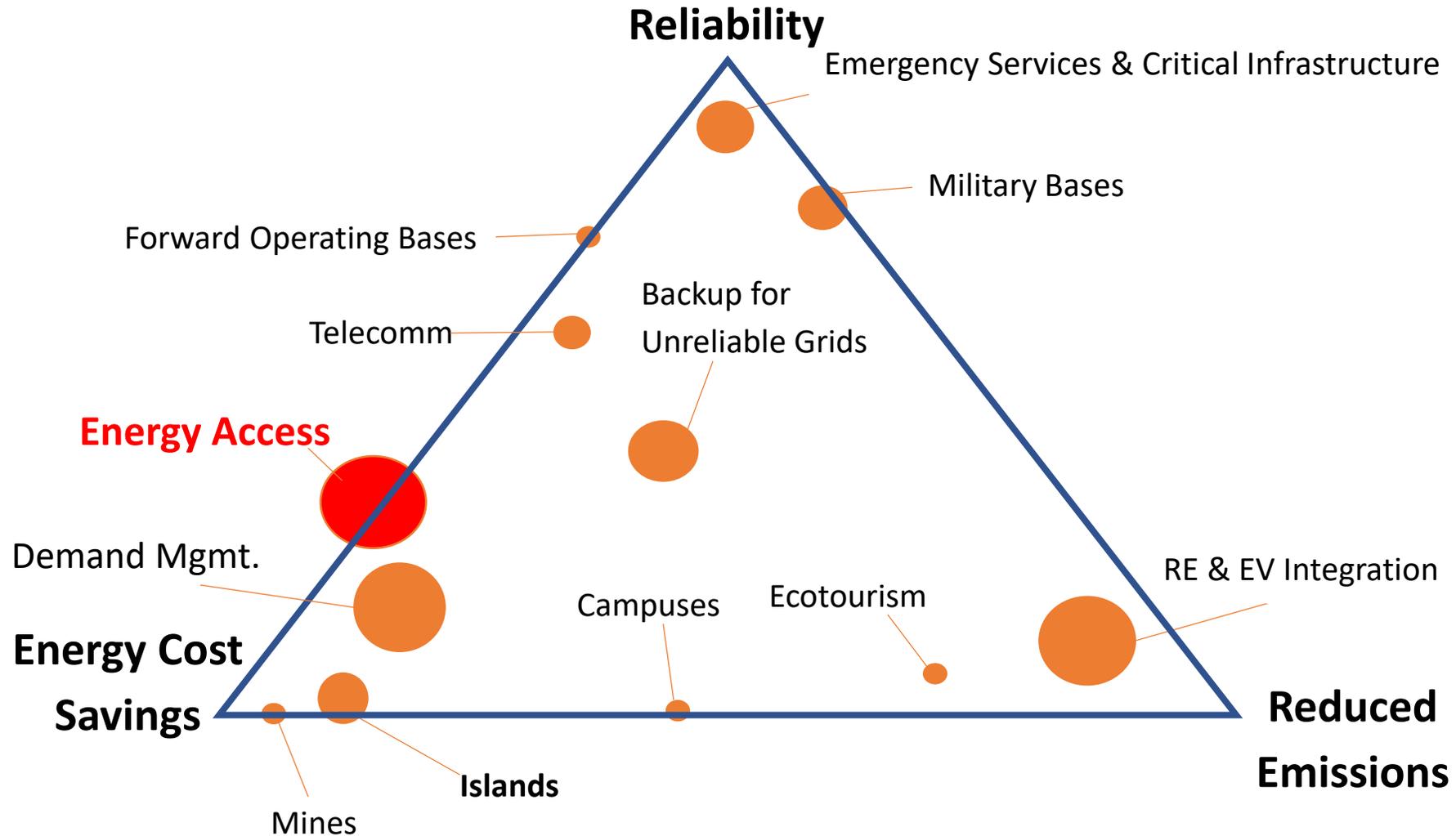
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CEO, HOMER Energy
July 25, 2019

The Future of Power is Distributed



- Technology improvements
 - Solar, storage, communications, controls
 - Erase advantage of centralized plants
- Even more true for developing countries

Mini-grid Value Propositions



3 Challenges

1. Tariff Structures Really Matter

2. Grid Expansion

3. System Design

1. Tariffs: Mini-grids Are Different

- Tariff structure needs to reflected cost structure
- Predominantly renewable systems often curtail excess energy
 - Daytime energy when batteries are full costs nothing
 - Waterpumping can be almost free
- Turning on a backup generator substantially increases OpEx

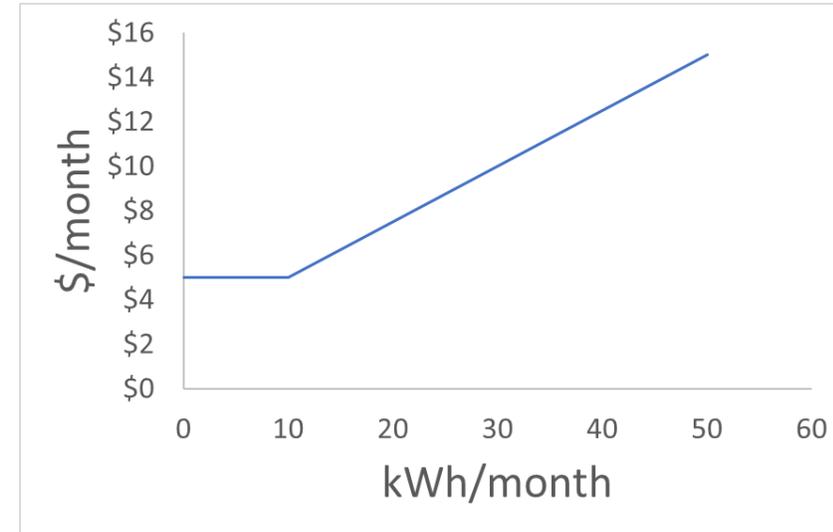
Simple subsidized rates create problems

- Discourages energy efficiency
 - LED lights
 - No second hand refrigerators
- Create growing fiscal burden as kWh sales increase
- Most of subsidy goes to wealthier households with more appliances



Lifeline rates

- Goes by many other names
- Limit subsidy to small amounts of consumption
 - Corresponds to the solar power production
- Larger consumers require more use of backup generation
 - Higher tier consumption priced at full recovery of diesel cost



2: Waiting for the Grid

- Investor uncertainty re: stranded assets
- Mini-grids are not a stop gap measure
 - Well-designed, they have better power than a centralized grid
- Solar competes with copper wire
 - 100 kW mini-grid costs less than a 20 km grid extension
 - Solar Home System for small homes costs less than a 100-foot grid extension.

Centralized utilities should serve existing customers well before adding new ones

3: Too Many Choices

Solar

Fuel Cells

Wind

Hydro

Micro-turbines

Geothermal

Micro-grids

Biomass

Demand Response

New Storage Techs.

Load Management

Electric Vehicles

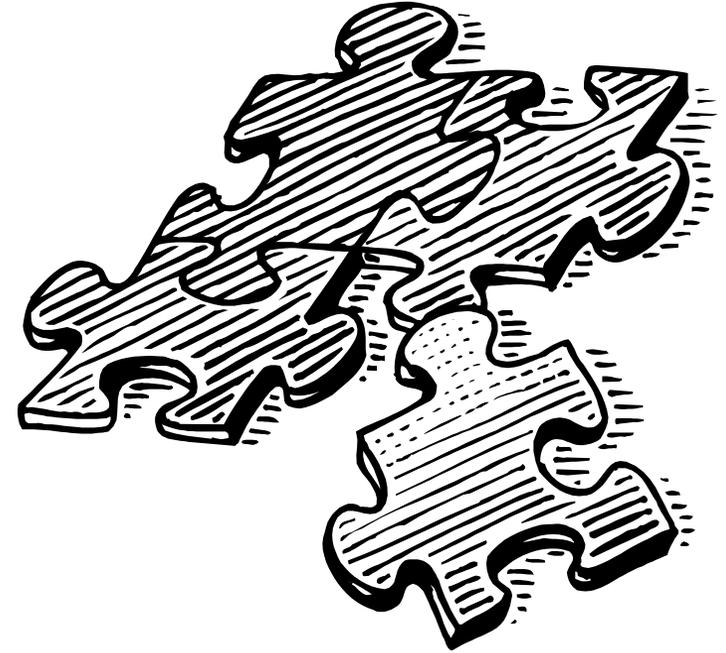
Smart grids



What is best?

It depends on:

- Resources
- Loads
- Equipment prices
- Equipment performance

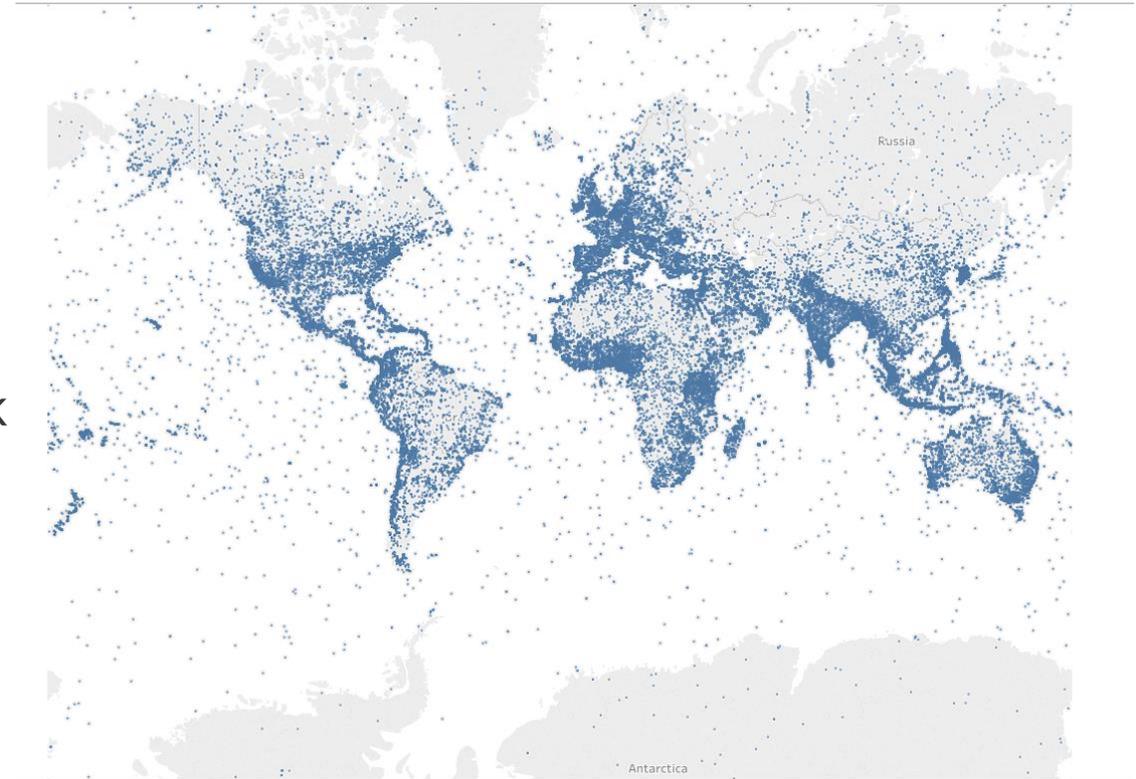


**A confused mind says “No!”
HOMER fits the pieces together**

HOMER Energy

Designing Hybrid Mini-grids for over 25 years

- 1992 – 2008 at NREL
- 2009: HOMER Energy created with exclusive license
- >200,000 people have used HOMER
- >100,000 opted-in to our hybrid system design network
- **Global Data**
 - 3 million HOMER files
 - 70,000 projects modeled since 2014



Hybrid System Design in HOMER[®]

Project Inputs



Economics

Load Profile

Site-Specific
Renewable Resources

System Components

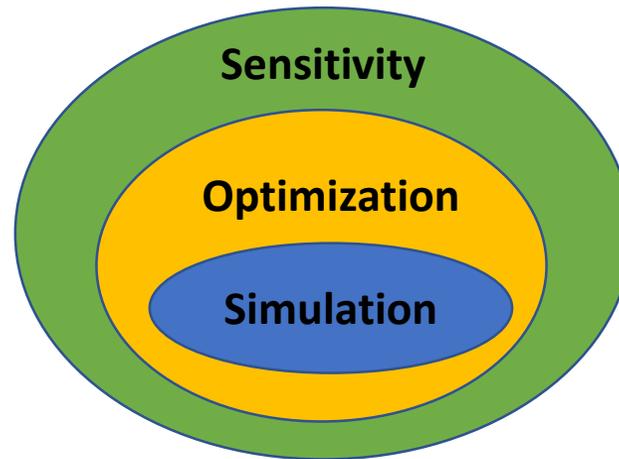
Analysis



HOMER
Pro



HOMER
Grid



Results



Economics & Engineering

System Sizing

Performance Details

Financials

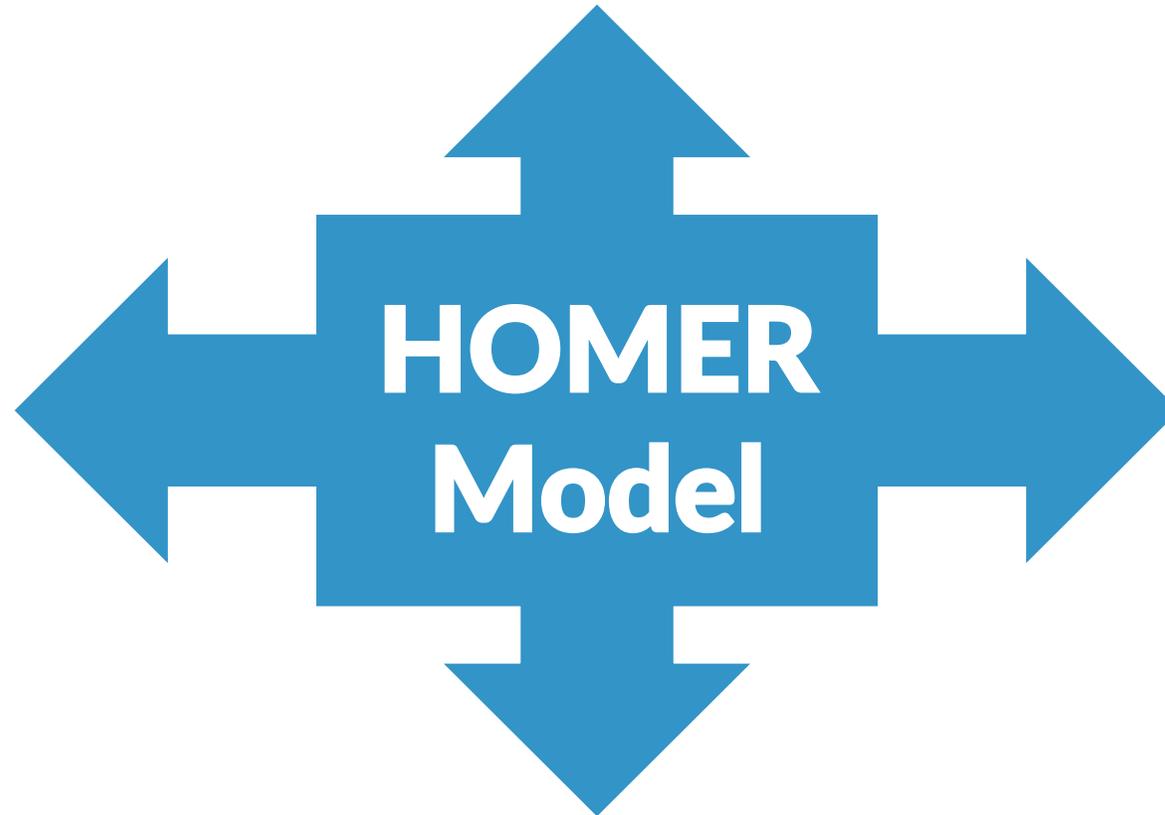
Various Reports



HOMER Connects the Mini-grid World

Renewable Advocates

Power
Engineers



Financiers

Utility Operators

Software as a communication tool



We recommend HOMER to everyone. There is nothing else out there that does what it does.

Anders Pedersen
World Bank

We spent a lot of money developing our own model, but threw it away because everyone kept asking for our HOMER results.

Bruce Levy, CEO
TDX Power

The best hourly assessment tool for hybrid renewable electric generation systems in the world – bar none.

Dr. Jan F. Kreider
Building Systems Program
University of Colorado

HOMER is a beautiful thing... it does most everything you could want it to, and it actually presents results in an intuitive/understandable manner.

Jonathan Murphy
Aerospace Systems Design Laboratory,
Georgia Tech

We are amazed at both the thoroughness of the software and the design complexity it allows us to relatively quickly evaluate. To our knowledge, there is no other software on the market that matches HOMER for the purpose of designing renewable energy systems.

Lisa Michael
Renewable Energy Systems



HOMER International **MICROGRID** Conference

October 7-8 Cambridge, MA

Register now at:

[Microgridconference.com](https://microgridconference.com)

October 6 th	Pre-conference microgrid tour (limited space)
October 7-8	Presentations and networking
October 9 th	Full-day training in HOMER Pro or HOMER Grid (optional, limited space)