

*Microgrids Simplified*

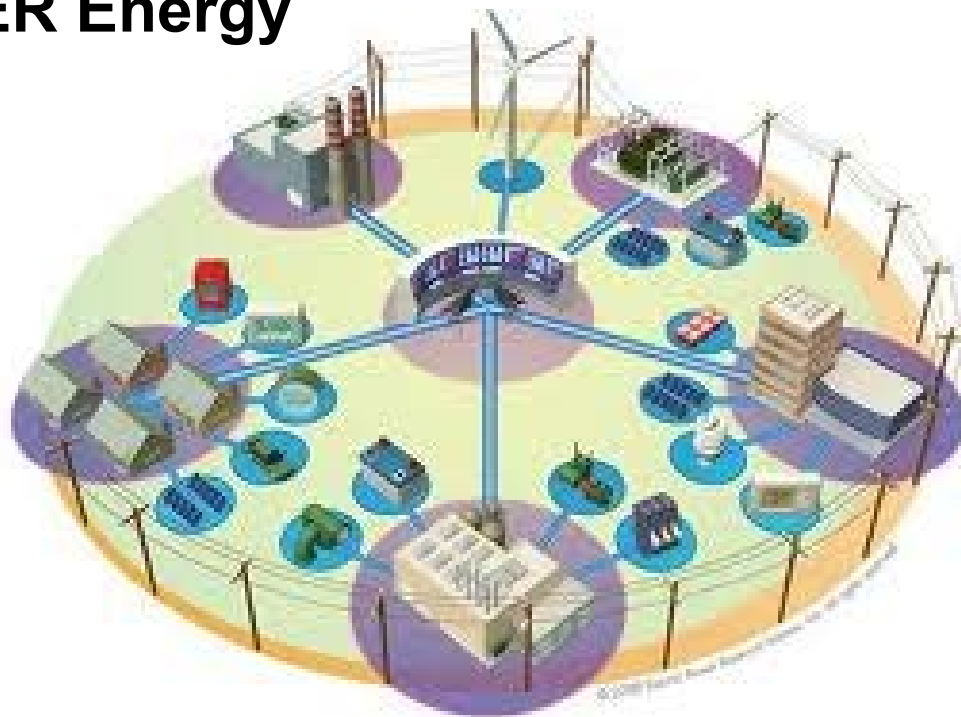
# Designing Affordable Mini-grids

May 23, 2016

Nairobi, Kenya

Dr. Peter Lilienthal

CEO, HOMER Energy



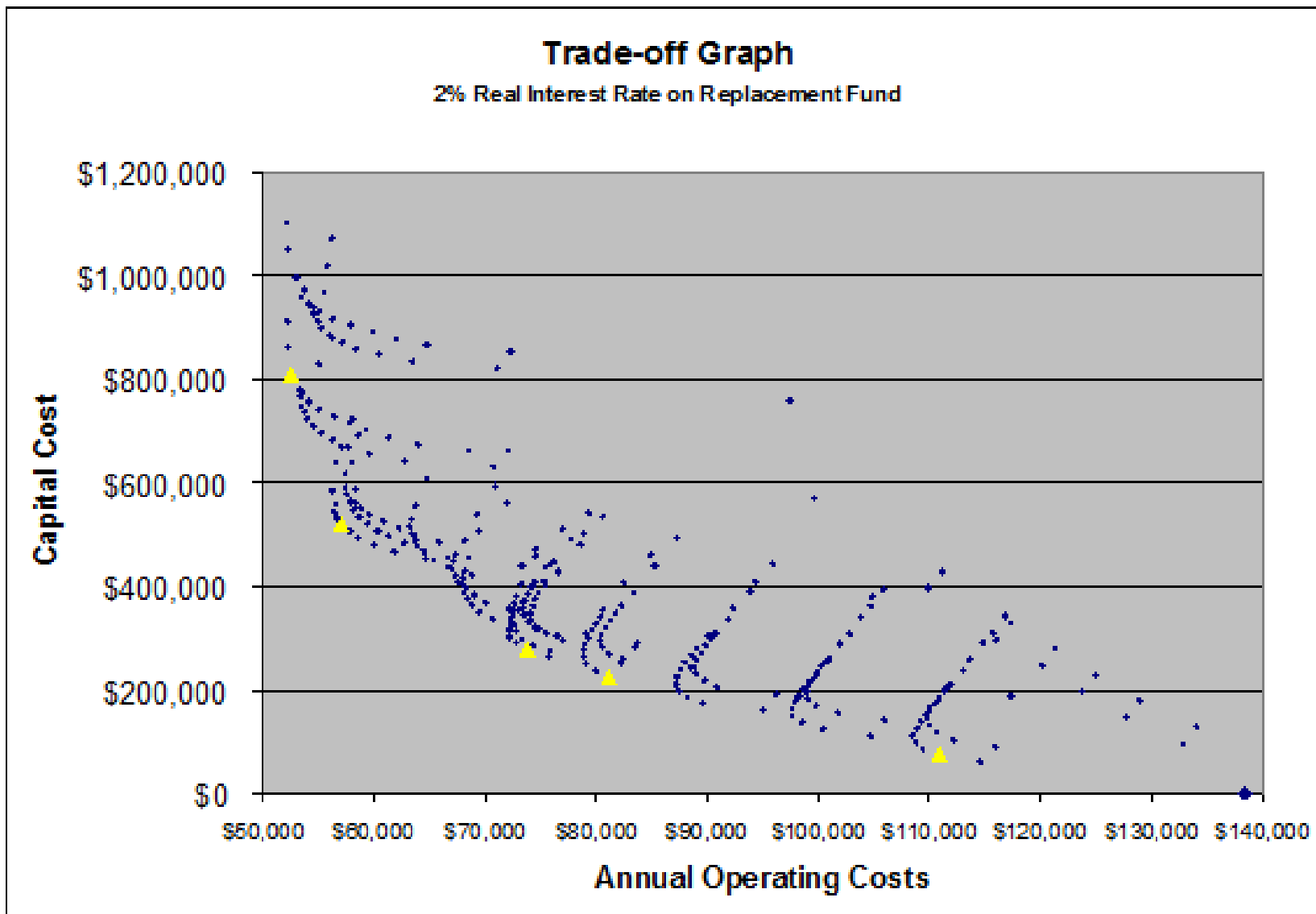
1790 30th St, Suite 100, Boulder, Colorado 80301, USA  
<http://www.homerenergy.com> • +1-720-565-4046

# Tariff Design



- Diesel systems
  - Low capital cost, high operating cost
    - Need for continuing subsidies
- Solar Systems
  - High capital cost, low operating cost
    - Need attractive financing
- Hybrid Systems
  - Optimize the tradeoff

# Capital / Operating Cost Tradeoff



# Sustainable Tariffs

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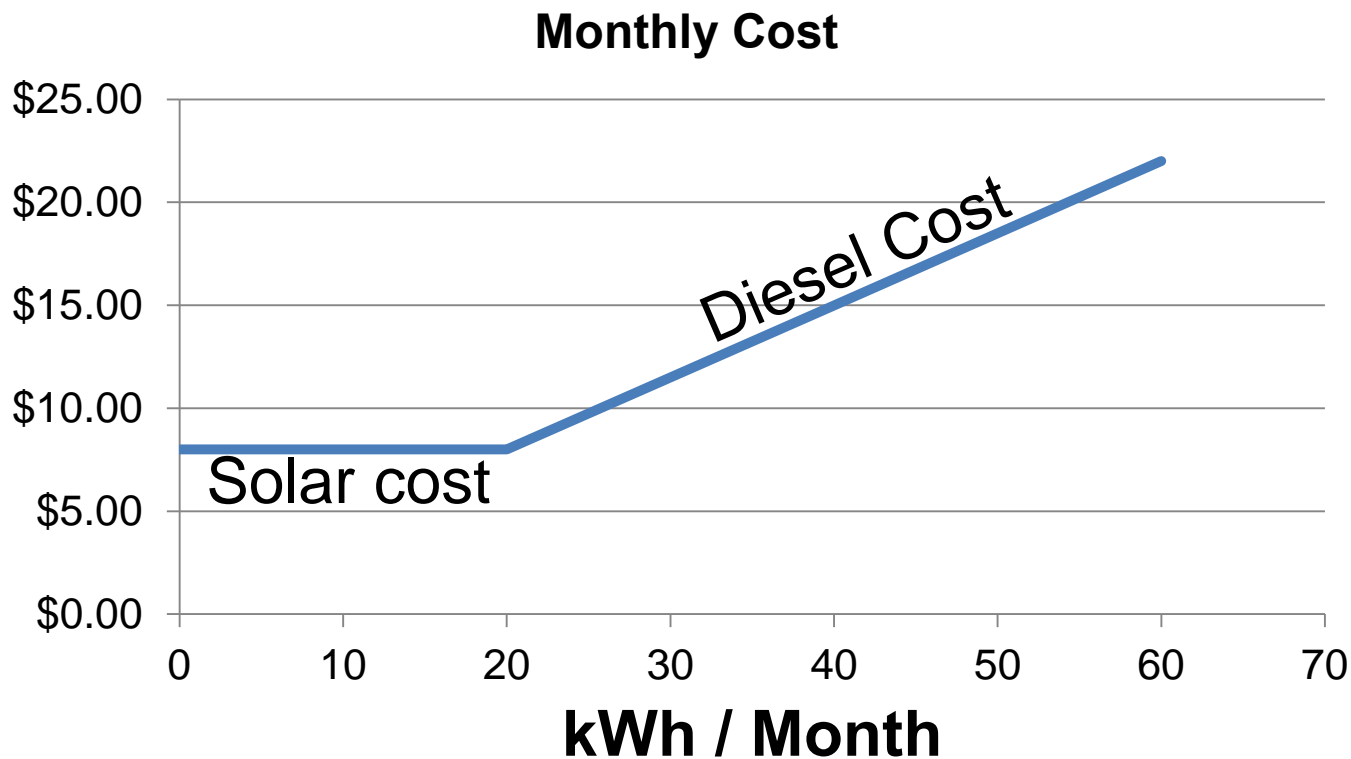
- Affordable
  - Consumers
  - Producers
  - Government
- Equitable
  - Subsidy goes to poor
- Efficient
  - Incentive to use most efficient appliances

# Tariff Design

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- What's wrong with a flat rate:
  - Wealthy households with more appliances get more subsidy
  - Subsidy grows faster than economy
  - No incentive for energy efficiency
- Two-part tariff
  - Subsidy goes to the poor
  - Limited fiscal burden
  - Maintains incentive for energy efficiency

# Two-part Tariff



- 2-part tariff
  - Lifeline rate for basic needs
  - Full cost recovery for increased load
    - Pays for system expansion

# Two-part Tariff

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- Also called Lifeline Rate, Social tariff
- Fixed monthly charge
  - Covers basic consumption
  - Based on PV for daytime power
    - PV + Batteries for evening power
- Above threshold, based on diesel power

# Three Scenarios

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- Small, 30 kW peak load, no diesel
  - Medium, 300 kW, peak load, backup diesel
  - Large, 3 MW peak load, multiple diesels, no battery
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- Tariff recovers operating costs
  - Impact of load growth



# 100% renewables without diesel backup

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- Advantages:
    - No fuel supply issues
    - Vastly reduced maintenance
  - Disadvantages:
    - Unmet load
    - Battery management
  - Appropriate for very small systems
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