



# Welcome to 9th Annual HOMER Microgrid & Hybrid Power International

Peter Lilienthal, Ph.D.

Global Microgrid Lead, UL and HOMER Energy by UL, Founder

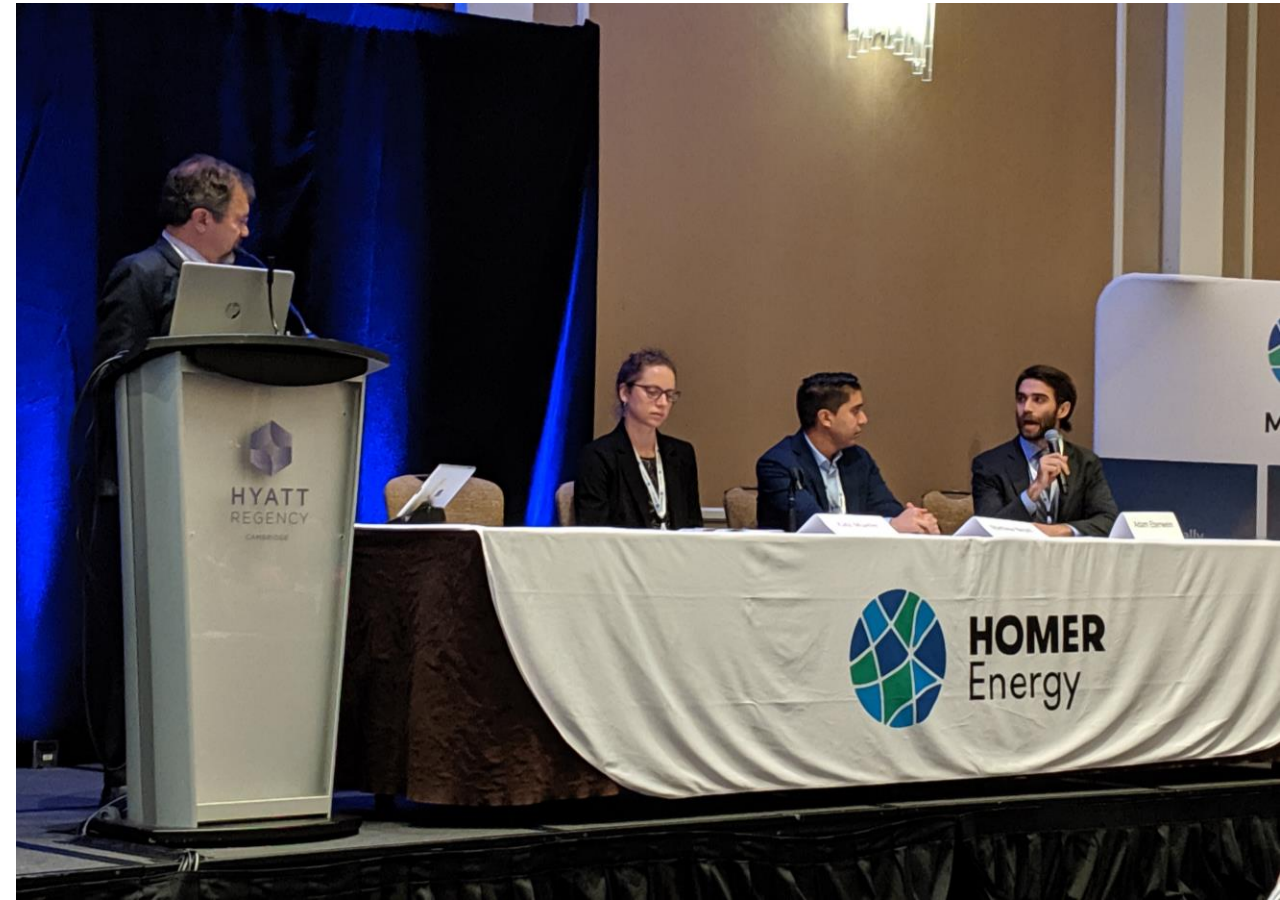
Oct. 12, 2021

# Evolving microgrid industry

29 years thinking about hybrid systems

HOMER has followed the market

1. Village power; rural developing country
  - Island power; 24/7 diesel systems
  - HOMER Pro
2. C&I behind the meter
  - HOMER Grid
3. Utility scale front of the meter
  - Integrate high renewable penetration
  - HOMER Front



# Expanded to hybrid power more broadly

- Microgrids are always hybrids
  - except dumb, dirty diesel microgrids
- Storage used to be the weak link
  - Now it is the star of the systems
- Now, utility-scale, front-of-the-meter projects are hybrids





# Village power systems

- Very small systems with lead-acid batteries
- Durability and support problems



*Lomiro community in Ogun State, South West Nigeria | Images courtesy of Ashipa Electric*

# Early systems without batteries

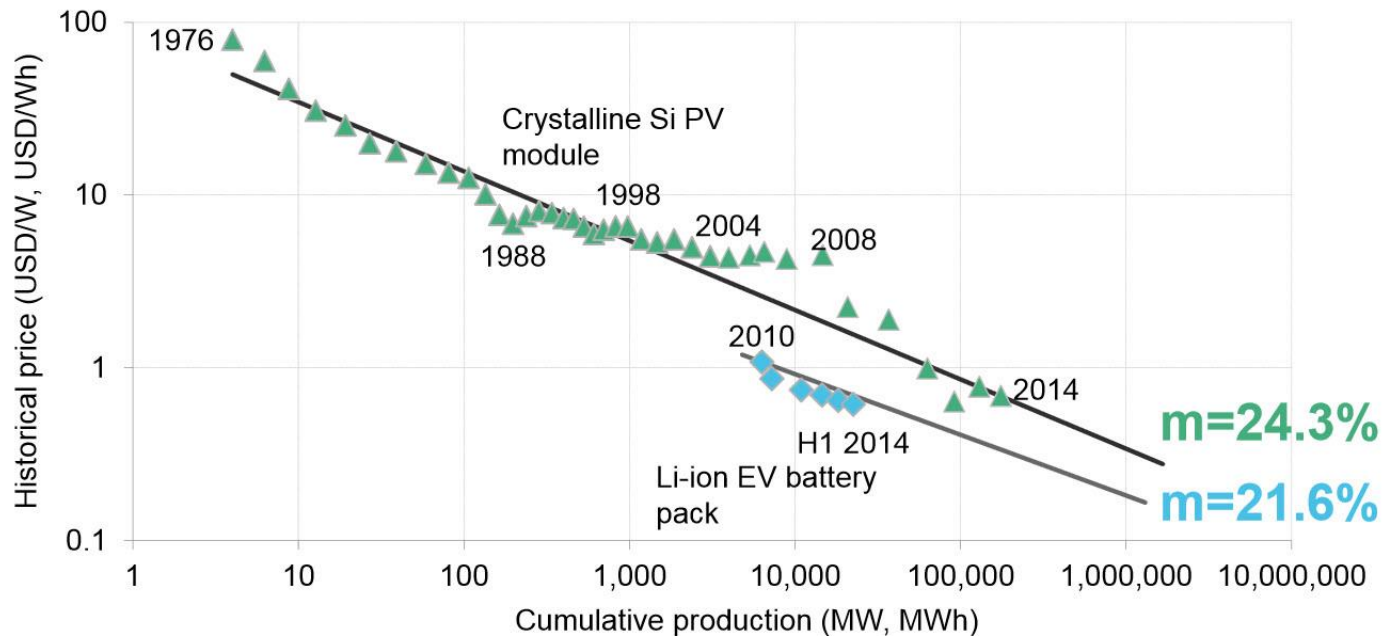
- Fuel saver systems
  - Limited RE penetration
  - Diesels ran all of the time
- St. Paul, Alaska
  - 100% renewable for weeks at a time
  - No batteries
  - Load management



# The world has changed

## LITHIUM-ION EV BATTERY EXPERIENCE CURVE COMPARED WITH SOLAR PV EXPERIENCE CURVE

Bloomberg  
NEW ENERGY FINANCE



Not just for remote systems anymore  
Fully loaded PV cost  $\approx$  just fossil OPEX

Note: Prices are in real (2014) USD.

Source: Bloomberg New Energy Finance, Maycock, Battery University, MIT

Michael Liebreich, New York, 14 April 2015

@MLiebreich #BNEFSummit

13



**HOMER** MICROGRID AND  
HYBRID POWER

9<sup>TH</sup> ANNUAL  
INTERNATIONAL



# Flexibility & Resilience

**Flexibility** is the key to a renewable future

**Storage** is the key to a resilient future

**Hybrids with storage** provide flexibility and resilience

**Huge** diversity of hybrid power applications



**HOMER** MICROGRID AND HYBRID POWER

9<sup>TH</sup> ANNUAL INTERNATIONAL



# Thank you

Peter Lilienthal, Ph.D.  
Global Microgrid Lead, UL  
HOMER Energy by UL, Founder



UL and the UL logo are trademarks of UL LLC © 2021.



**HOMER** MICROGRID AND  
HYBRID POWER

9<sup>TH</sup> ANNUAL  
INTERNATIONAL

