

Welcome to

# Microgrids and Hybrid Power Everywhere

Optimizing the new energy wave



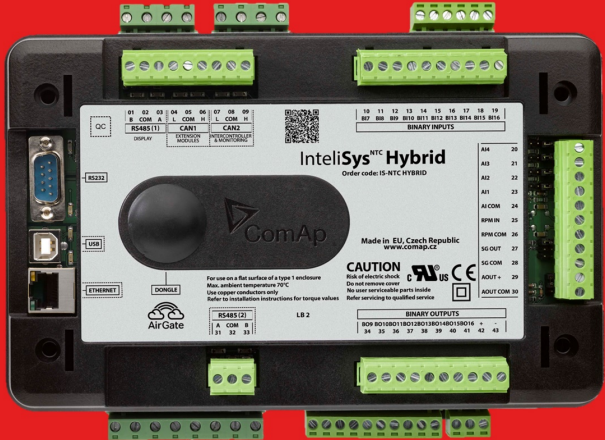
Microgrids and Hybrid Power Everywhere:  
Optimizing the new energy wave

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



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# Thank you ComAp



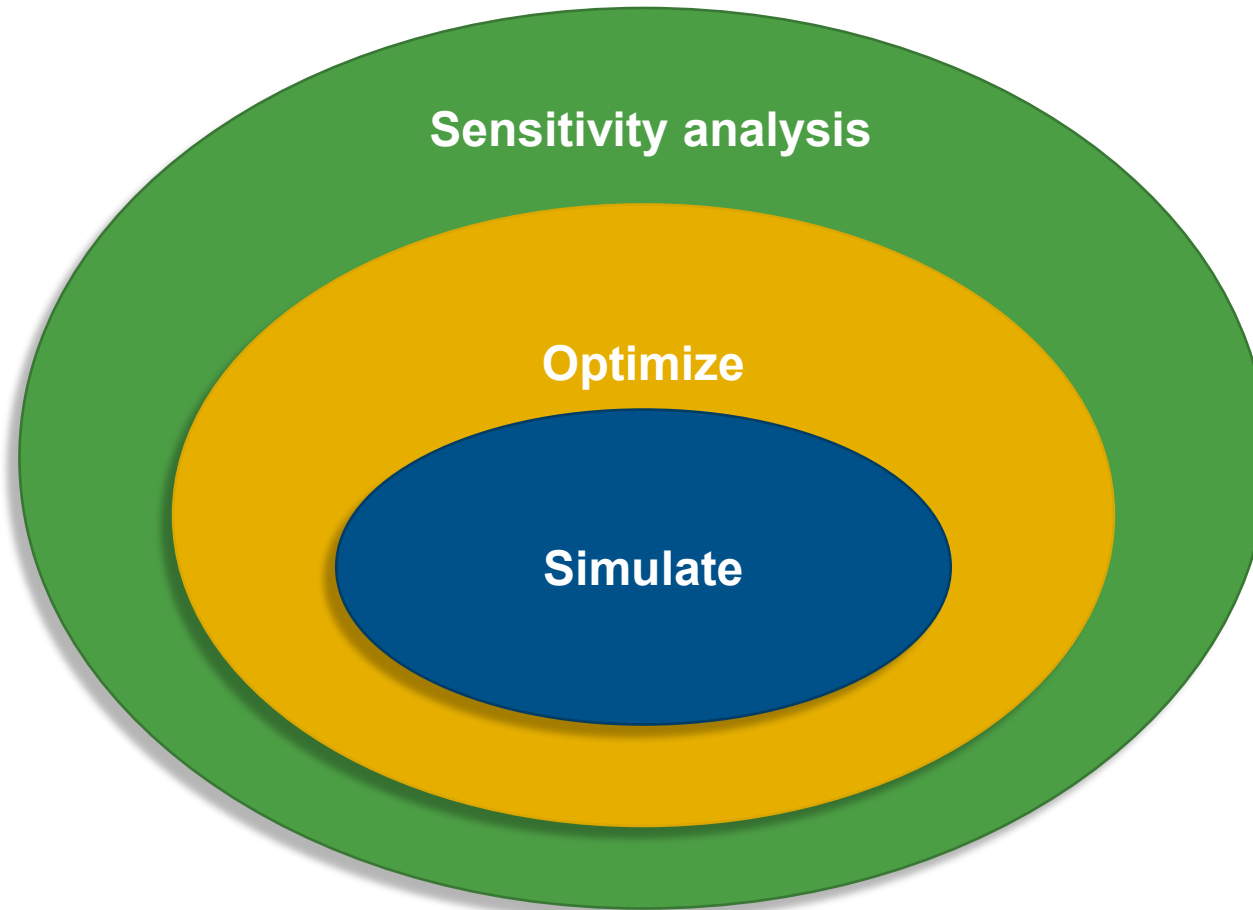
## IntelliSys Hybrid

### Smart Control for Hybrid Systems

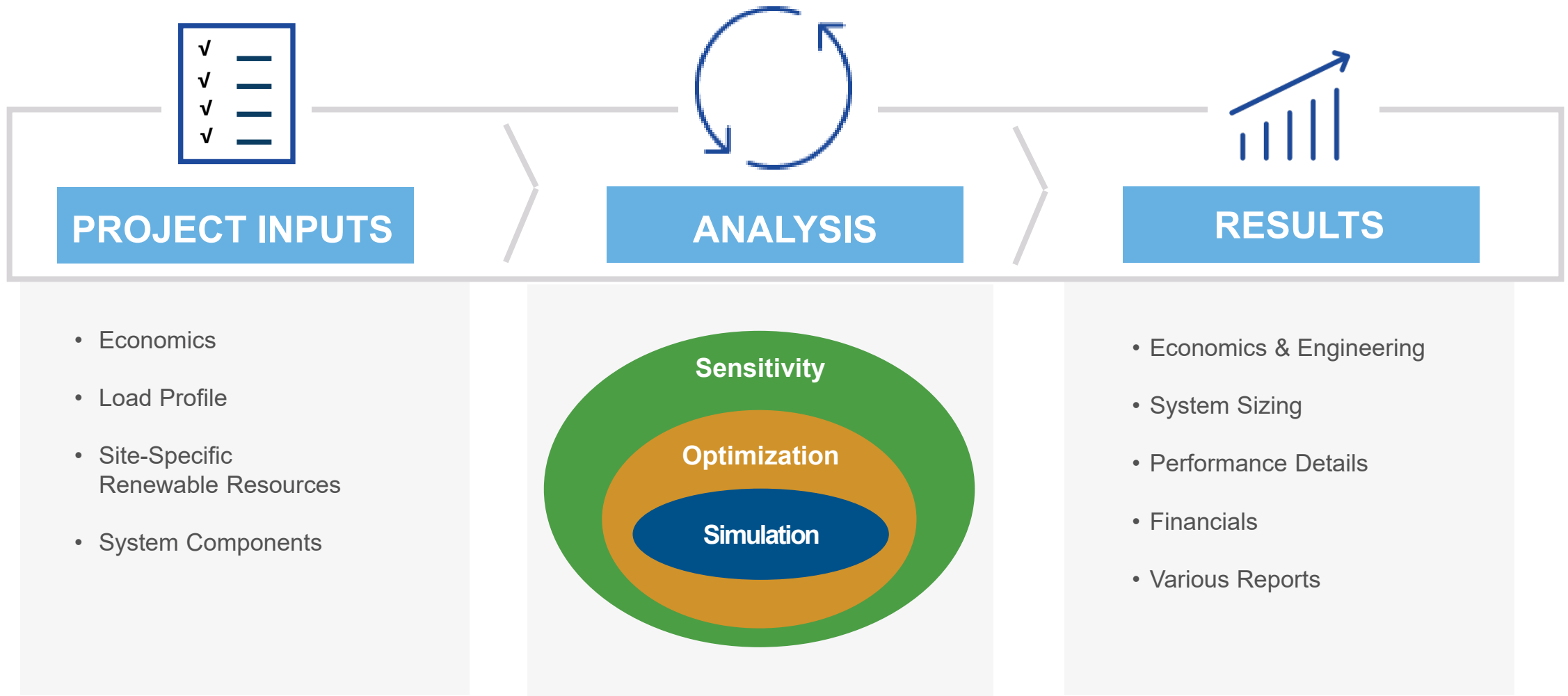
Learn more at [www.comap-control.com](http://www.comap-control.com)



# HOMER Software: Hybrid Optimization of Multiple Energy Resources



# How HOMER Works



# Hybrid Power System Decisions Simplified

## Stand-alone



### Stand-alone Microgrids

Determine best energy mix and least-cost solution for remote islands, mines, campuses

Simulate and Optimize

Advanced Sensitivity Analysis

## Behind-the-Meter



### Distributed Generation

Determine least-cost solution for residential, commercial and industrial

Demand-Charge Reduction

Tariff Modeling

Value Stacking

## Front-of-the-Meter

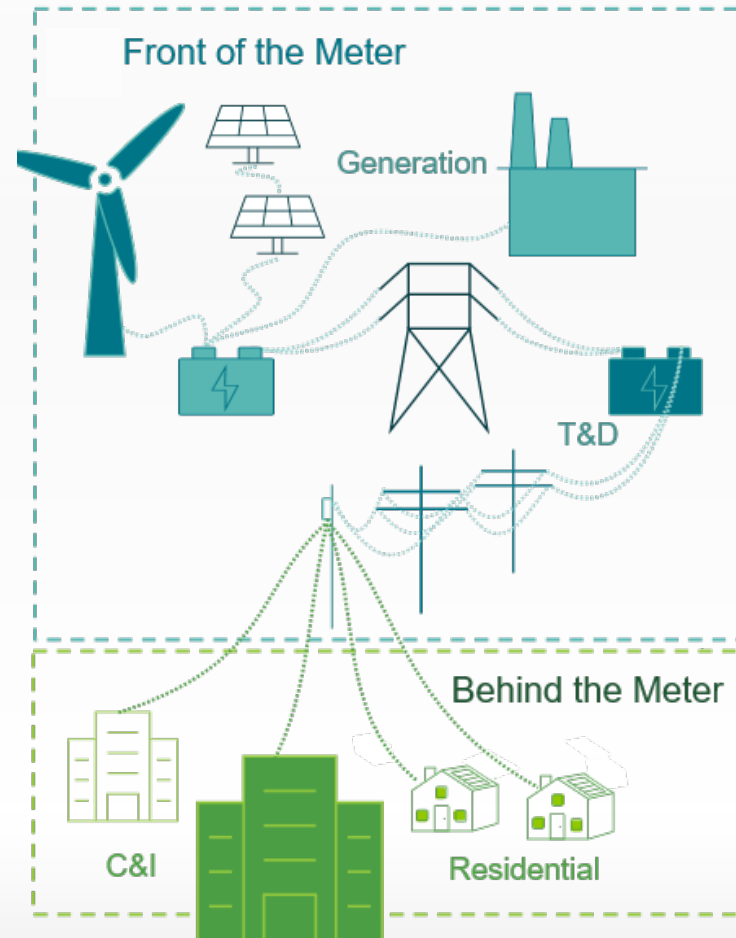


### Utility Scale Analysis

Evaluate financial returns of utility-scale hybrid projects that utilize wind, solar + energy storage

Project Site Screening

Battery Management






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# Key office locations - renewables



**500+**  
RENEWABLE  
ENERGY EXPERTS

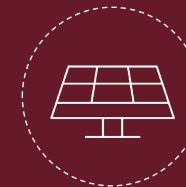
**35+** *years of*  
EXPERIENCE IN  
RENEWABLE ENERGY



UL has assessed  
**100+**  
UTILITY-SCALE SOLAR  
PROJECTS SINCE 2013



HOMER Energy  
Software is used in  
**190+**  
Countries, with over  
**250,000** users



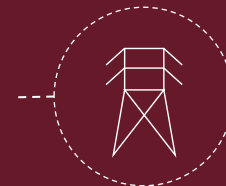
**1000+**  
PV products  
evaluations annually



**100,000+**  
HYBRID POWER PROJECTS  
MODELED SINCE 2014



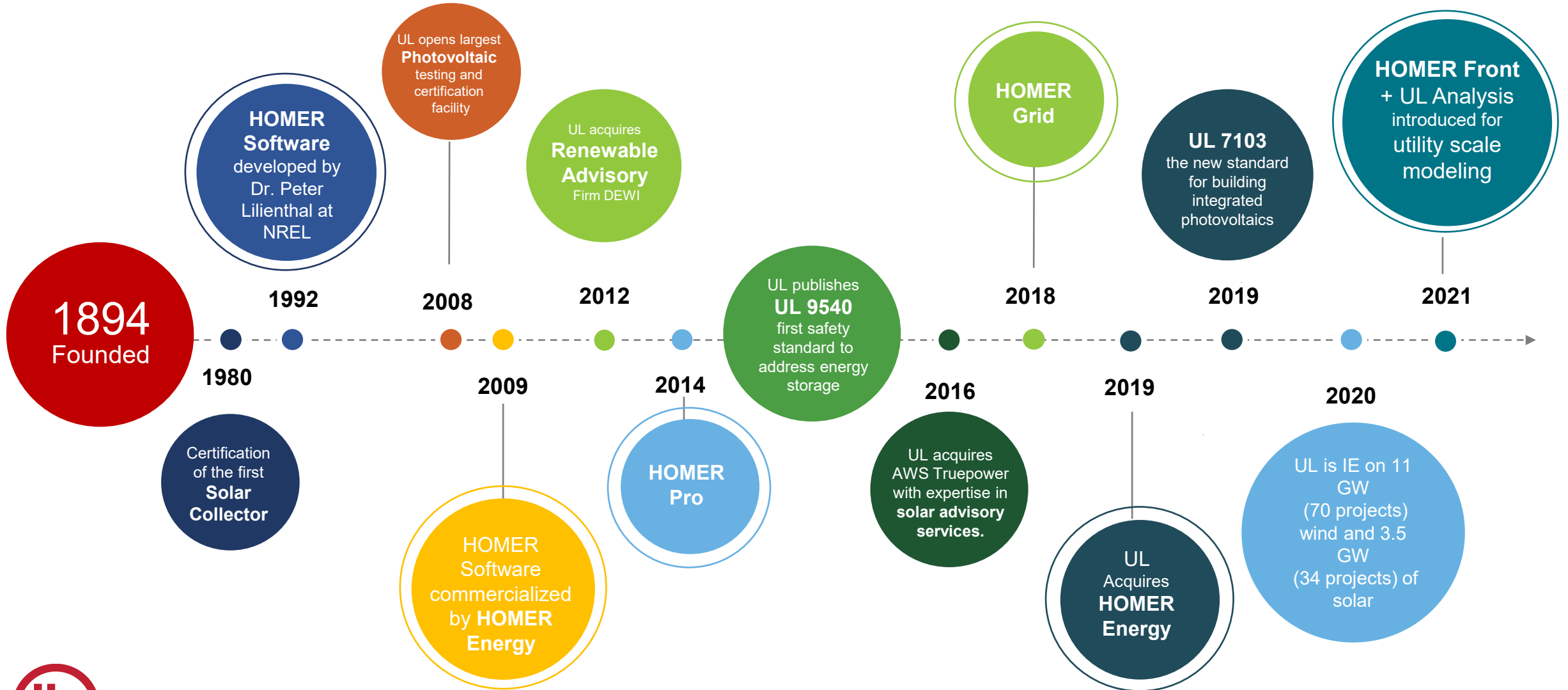
Forecast provider for  
**100+ GIGAWATTS**  
OF INSTALLED RENEWABLE ENERGY  
PROJECTS



Independent/Owners Engineer for  
**600+**  
WIND AND SOLAR PROJECTS  
SINCE 2012



# UL – A history of trust





# Microgrids and Hybrid Power Everywhere

## Everywhere?

### First deployments remote

- Compete with diesel
  - Small village systems
  - Islands



### Lithium battery revolution

- EV's



### Renewables now compete with centralized fossil and nuclear

- Need to be hybrids integrated with storage
  - PV & Wind don't stand on their own

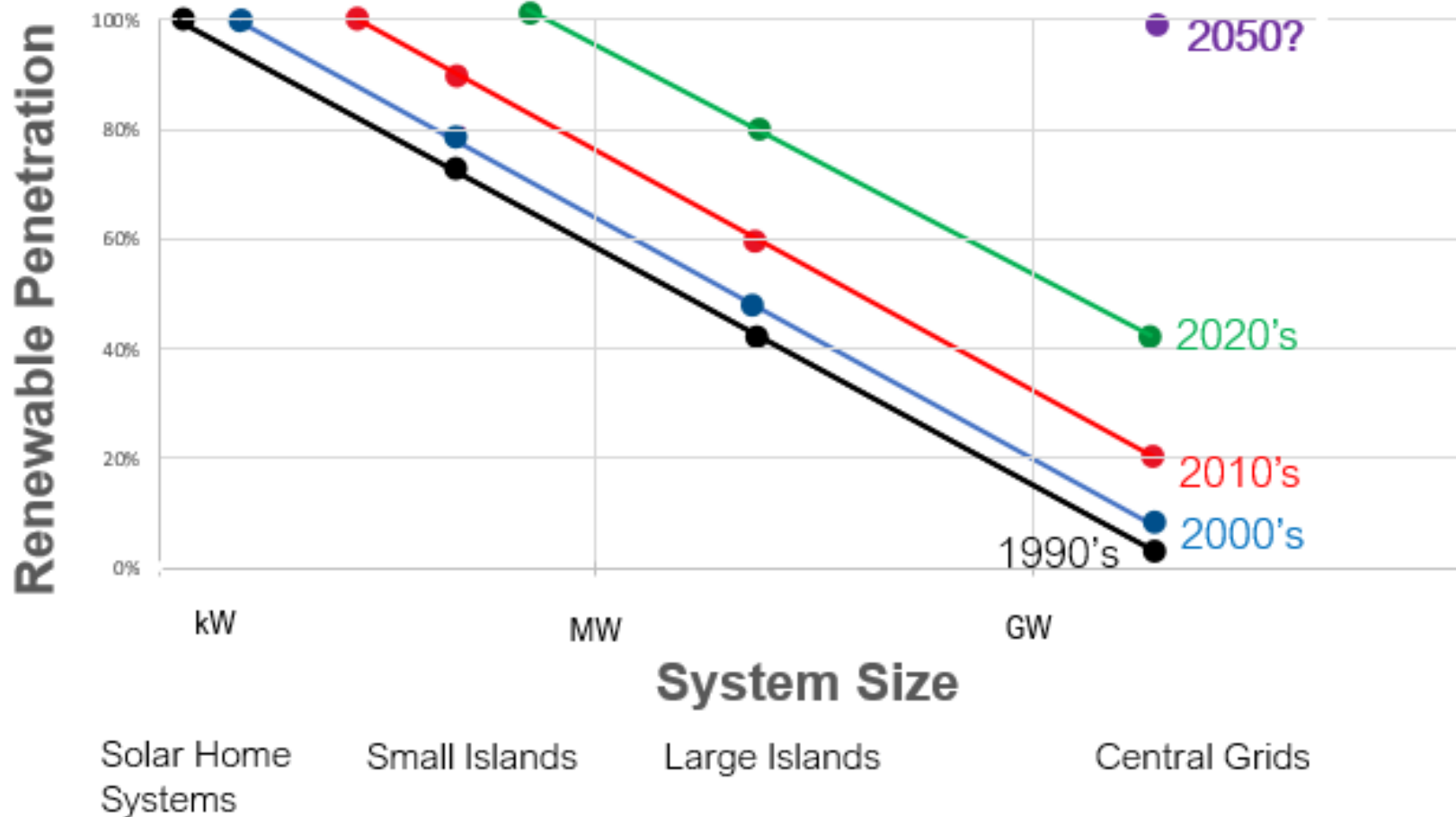


## BTM

- Resilience and demand charge management



# Evolution of state-of-the-art renewable energy systems



Small systems led the way to 100%

Change is accelerating

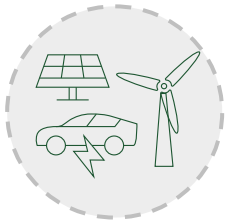


# Change is accelerating



## 100% renewable systems getting bigger

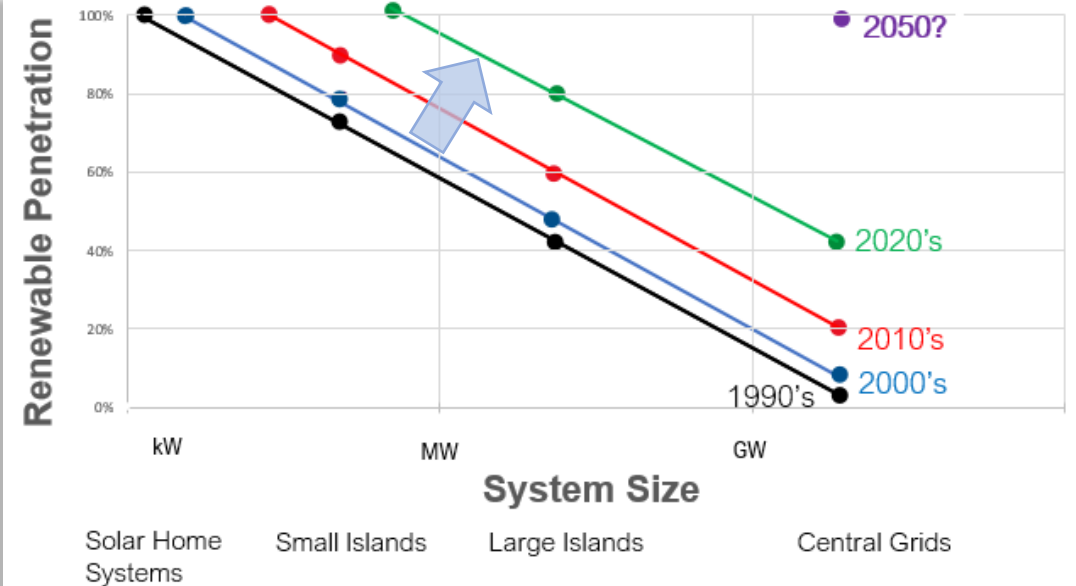
- Still small, though



## Big systems have more renewable resources

- Percentage still small
- Room to grow

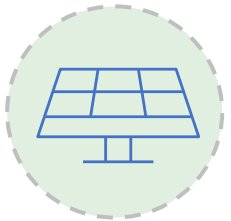
## Evolution of Renewable Energy Systems



# Small is beautiful

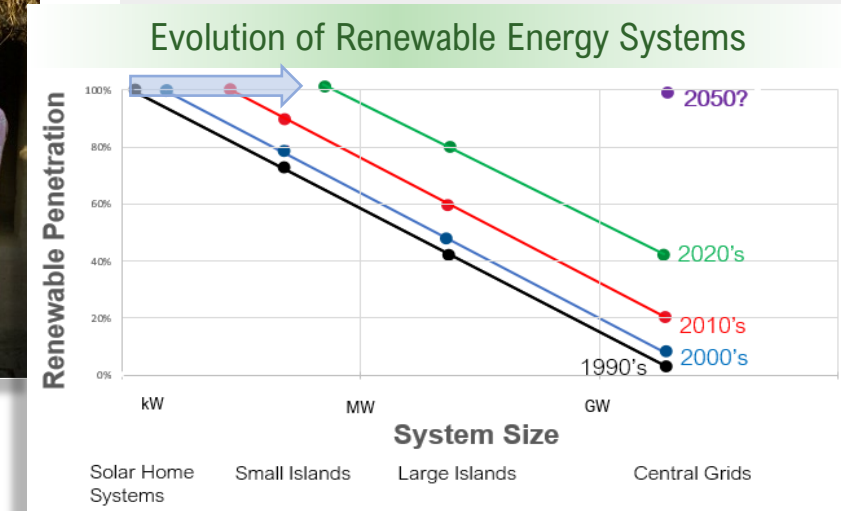


The smallest systems have always been 100%

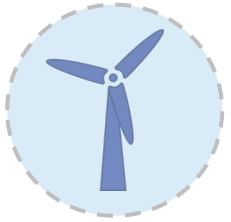


Innovation is always easier in small systems

- Storage integration
- Flexible demand
- Power electronics



# Hybrids the path to 100% RE and zero carbon

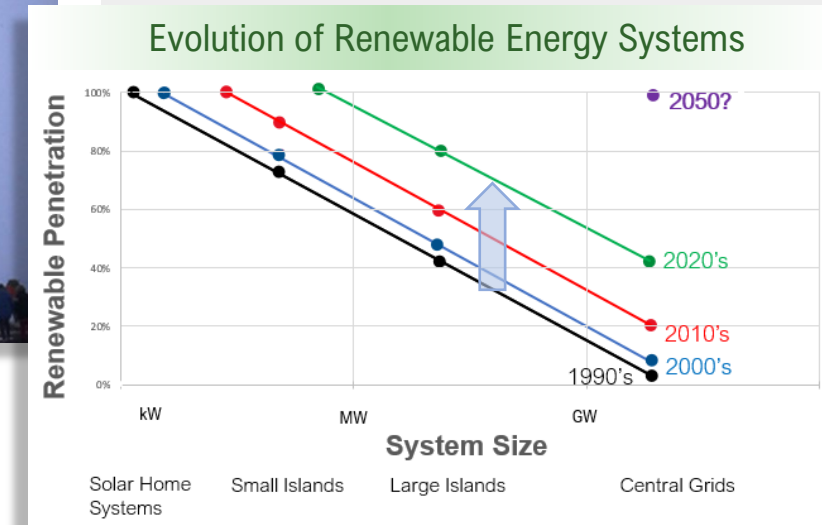


Early hybrids were wind diesel  
Alaskan experience



Before lithium batteries, larger  
systems avoided batteries

- Fuel saver systems that kept diesels running but at lower loads
- Reduced efficiency, maintenance issues, special modification to allow lower loads



# Central grid challenge



100% of what by 2050?

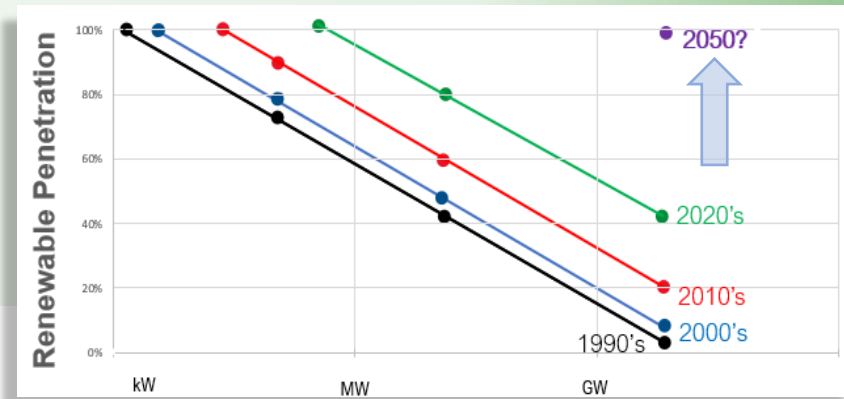
What does net zero mean?



## Challenges

- Sheer scale of deployments
- Avoiding the cost of overbuilding
- Communication & control issues
  - Flexible demand, EV charging
- Regulatory issues

Evolution of Renewable Energy Systems



# Flexible demand

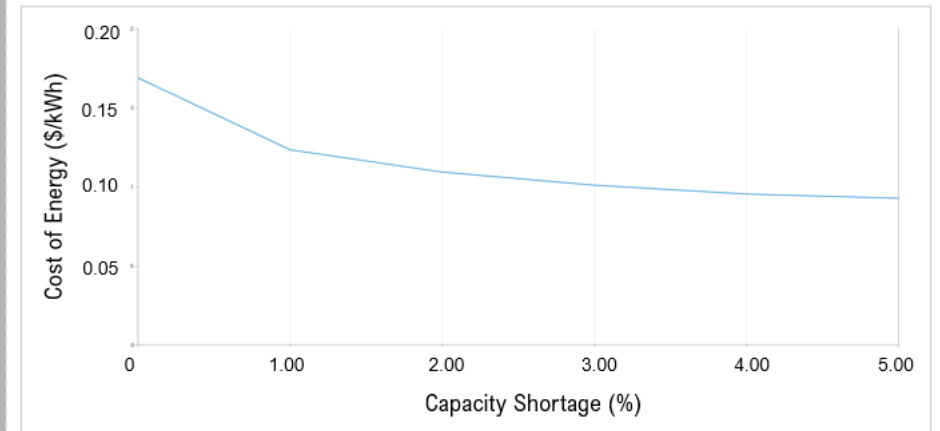
HOMER modeling and microgrid experience has proven the value of flexible demand

- e.g. Waterpumping

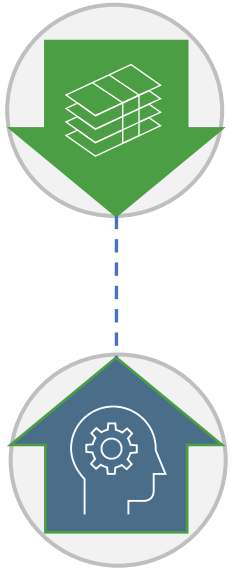
## EVs

- Huge new load
- But flexible

5% of VMTs in EVs = 1% of today's total electricity



# HOMER software is all about optimization

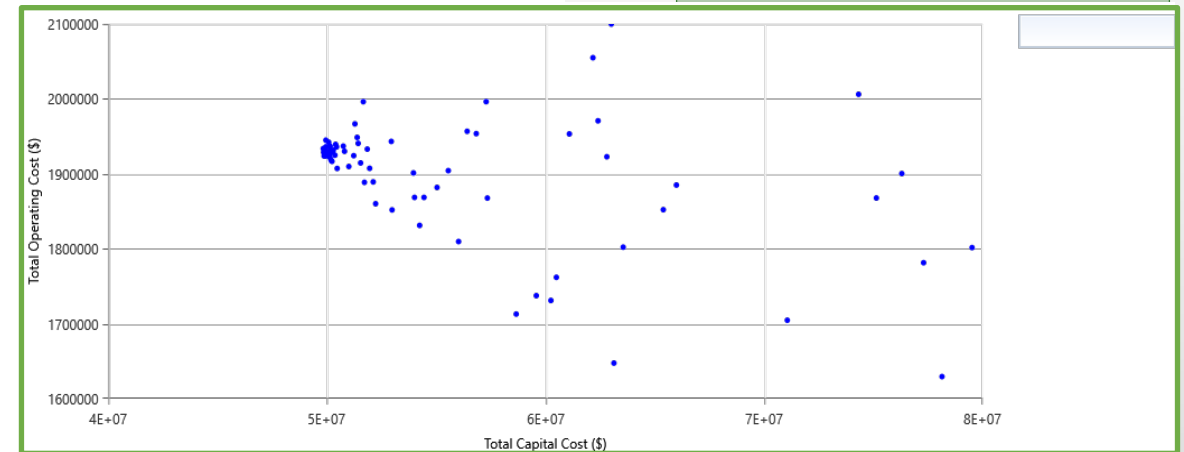
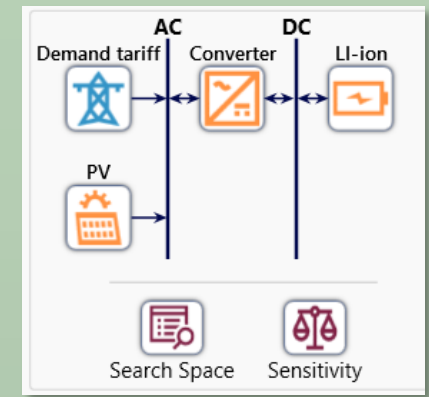


## 1. Decide on best project design

- Least-cost solutions
  - Avoid bad ideas

## 2. Improve understanding

- Many degrees of freedom
- Tradeoffs
  - Fuel use vs. battery sizing vs. PV sizing
  - Control strategies
- Identify new applications
  - Is 100% RE/ zero carbon possible or reasonably economic





# Conclusion

## Electric Storage

Electric storage is changing everything.

## Accelerating Change

Change is coming faster and faster.

## Electric Vehicles

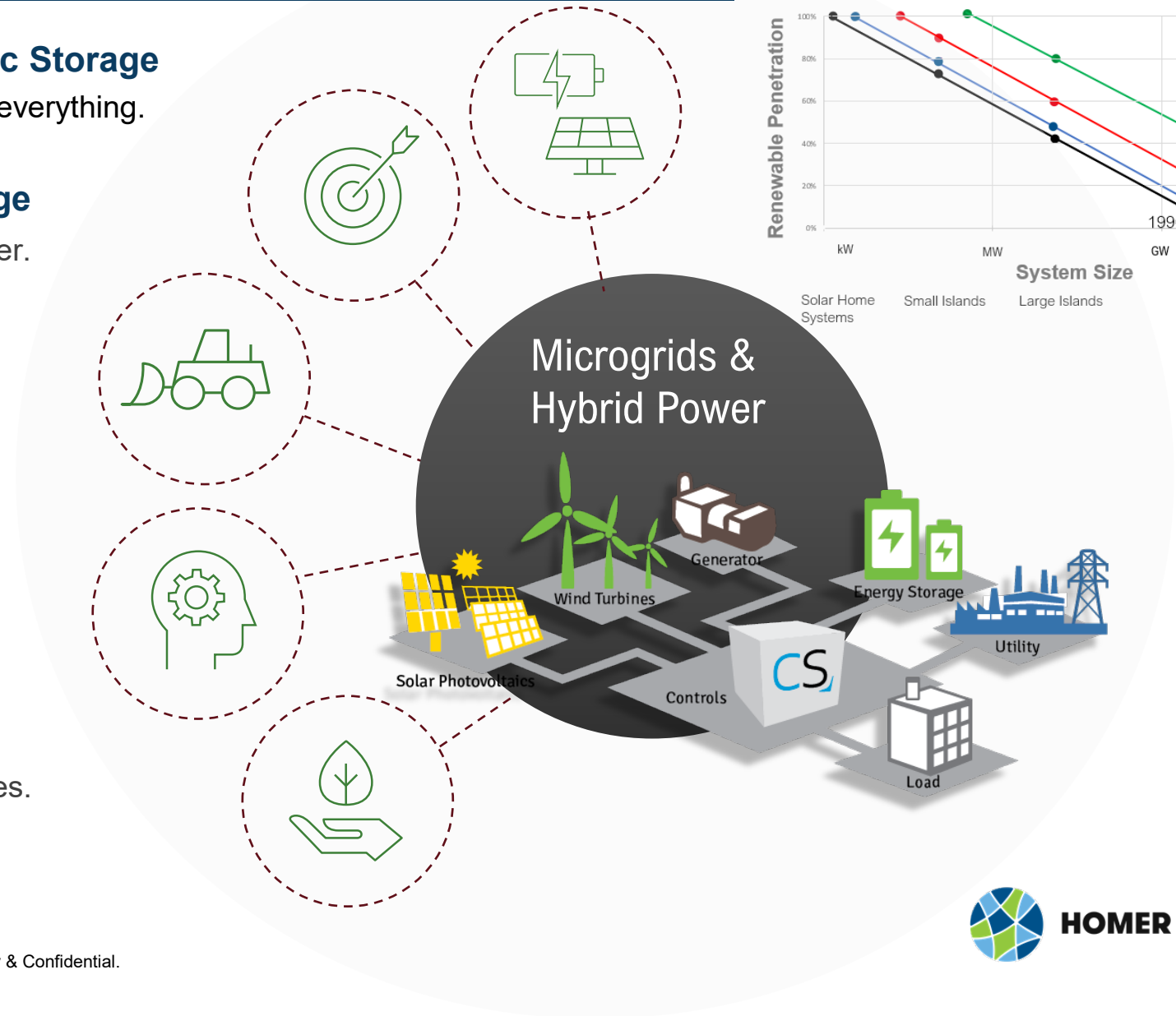
EVs are not just creating a better battery industry. They are driving demand flexibility.

## Small Is Beautiful

The energy world has a lot to learn from the experience of smaller systems.

## Optimization Is Key to Success

Optimization is critical to overcoming challenges.



# Need help with your project?

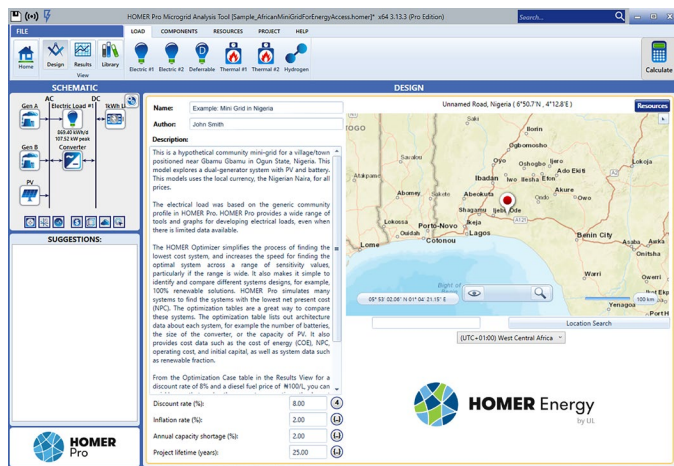
Software Solutions & Training

Advisory Services

HOMER Pro or HOMER Grid

Training and Engineering Hours

Project Consulting Services



Free 21-Day Trial  
HOMERenergy.com



Training in HOMER® Software and Analysis

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# Questions & Answers

## **Marilyn Walker, Ph.D.**

Global Hybrid Power Systems Lead, UL  
Founder, HOMER Energy by UL



## **Peter Lilienthal, Ph.D.**

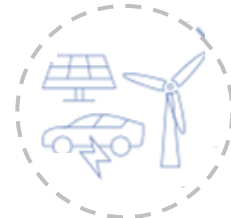
Global Microgrid Lead, UL  
Founder, HOMER Energy by UL



## Resources

### **HOMER software**

[Sales@HOMERenergy.com](mailto:Sales@HOMERenergy.com)



### **Free trial of HOMER software**

[HOMERenergy.com](http://HOMERenergy.com)



### **Training and Engineering Hours**

[Support@HOMERenergy.com](mailto:Support@HOMERenergy.com)



### **Full project support**

[RenewableEnergyServices@ul.com](mailto:RenewableEnergyServices@ul.com)



# Upcoming Events

## Webinars & industry news

**PEER and HOMER: Best practices for hybrid power from concept to completion**

**April 29, 9 a.m. MDT**

Sign-up to get notifications of upcoming events and current news stories at [MicrogridNews.com](https://MicrogridNews.com).

Also stay tuned for an upcoming Call for Speakers for the 9<sup>th</sup> Annual HOMER Conference!



**Sign-up at [microgridnews.com](https://microgridnews.com)**

The screenshot shows the HOMER Microgrid News website. The header includes the logo and navigation links: BLOG, CASE STUDIES, NEWS, TECHNICAL PAPERS, EVENTS. A red arrow points to the sign-up form on the right side of the page. The main content area features two articles under the heading 'Top Stories':

- The Need for Operational Resilience Drives Microgrid Innovation**  
By Laura Sanchez on January 14, 2021  
A Colorado car dealership experienced several prolonged power outages during business hours each year. The lost business was consequential, so it installed an innovative grid-tied, solar + storage microgrid that today provides a myriad of benefits.
- Ripple Effect: An Educational Microgrid in Indonesia With Far-Reaching Benefits**  
By Laura Sanchez on January 7, 2021  
Access to energy is a challenge for inhabitants of remote islands in Maluku Province, Indonesia. But a new campus mini-grid lab will soon offer engineering students practical experience that could produce a groundswell of interest in renewable energy and provide more villages with power.

The sign-up form on the right includes the following fields: First Name, Last Name, Company, Email, Role, Country, and a checkbox for 'I'm not a robot'. The HOMER Energy logo is also present in the top right corner of the website screenshot.



# Thank you!



## Stay connected

Register for our  
upcoming webinar  
and sign-up for our  
newsletter at  
[microgridnews.com](http://microgridnews.com)

A promotional graphic for a webinar. The background shows a city skyline and solar panels. A blue semi-transparent box contains the title and presenter information. A portrait of Peter Lilienthal is in the top right. Logos for HOMER Energy and ComAp are at the bottom.

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