



Renewable Energy & Micro-Grid Test Solutions

NH Research (NHR)
Enabling Electrification

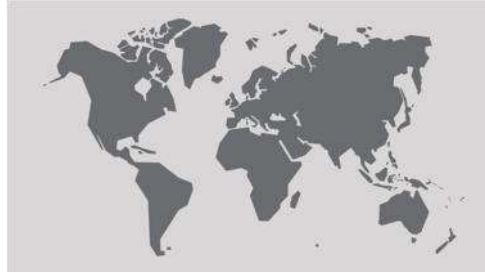


Enabling Electrification

NHR enables electrification by accelerating innovation, validation & functional test of today's & tomorrow's technologies

Backed by over 50 years of experience

- ✓ Best in class performance
- ✓ Ease of use
- ✓ Modular & scalable solutions
- ✓ Reduced testing time
- ✓ Improved safety
- ✓ Energy savings



World-Class Test Solutions

**Flexible, Modular Hardware
AND Software**

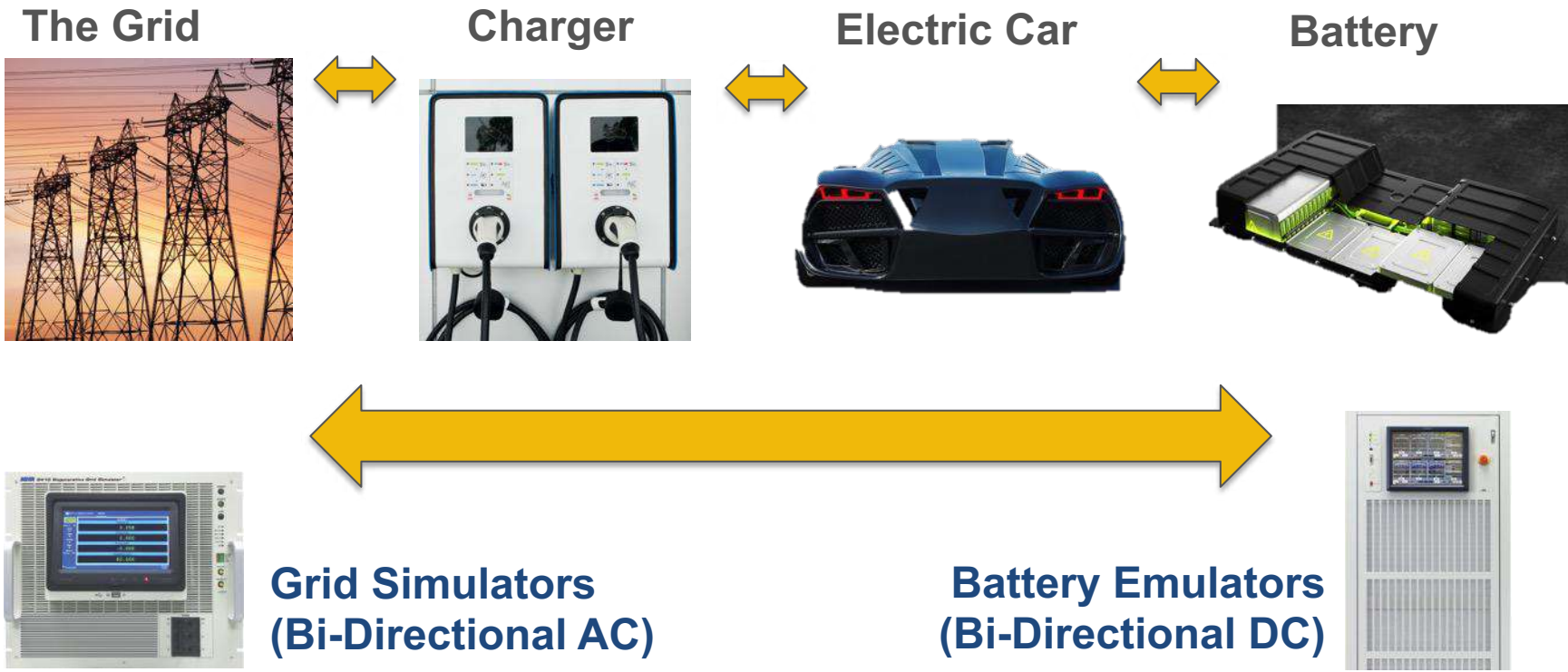


Product Portfolio

- ✓ Battery/Fuel Cell Test Systems
- ✓ Bi-directional DC Source
- ✓ Grid Simulators
- ✓ AC & DC Electronic Loads
- ✓ AC & DC Power Sources
- ✓ Power Supply Test Systems

...Your Partner in Test

Bi-Directional Power is the New Normal



Microgrid Test Solutions



Solar



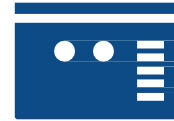
ESS



Wind



V2G



Generator



Loads

Tech Trends

- ✓ Bi-Directional Sources
- ✓ Battery & Fuel Cell Emulation
- ✓ AC/DC Source & Loads
- ✓ Regenerative Grid Simulators



Utility

Applications

- ✓ Vehicle to Grid (V2G)
- ✓ Solar PV Inverters
- ✓ Energy Storage
- ✓ Distributed Grid (DG) Inverters

Microgrid Test Solutions

Solar



[9200/9300](#)
Solar Emulator

ESS



[9200/9300](#)
Battery Emulator

Wind



[9200/9300](#)
Wind Emulator

V2G



[9430](#)
Regen Load

Generator

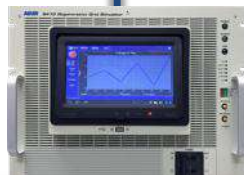


[9420](#)
AC Source

Loads



[9430](#)
Regen Load



[9410/9420](#)
Grid Sim/AC Source

**Regenerative, Bidirectional
Source Simulation**

- [9200 & 9300 DC Source](#)
- [9410 Regenerative Grid Simulator](#)
- [9420 AC Source with HIVAR](#)

Load Simulation

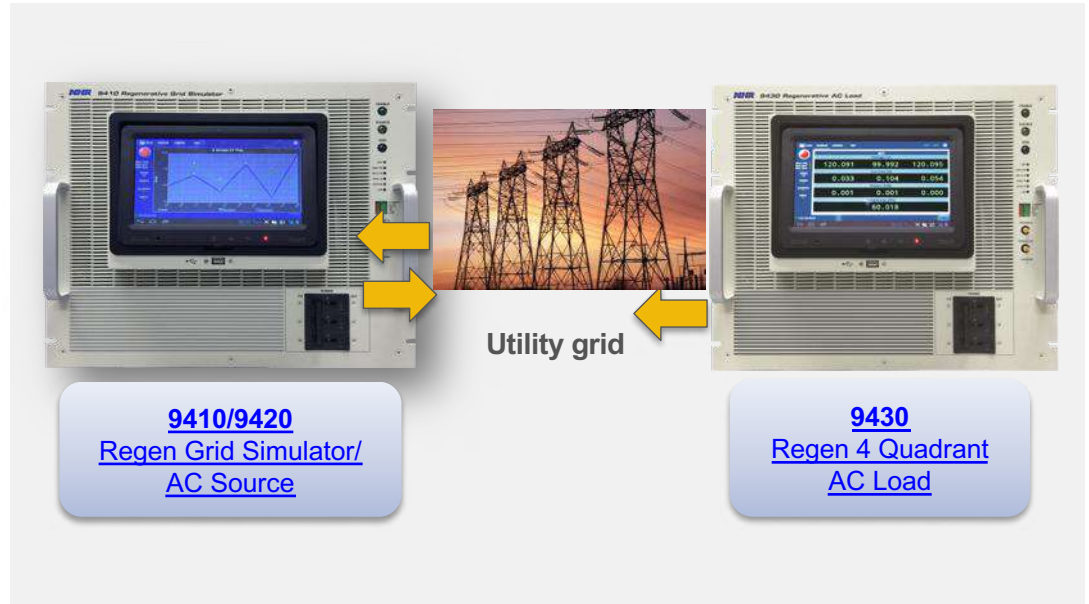
- [9430 AC 4-Quadrant Source](#)
- [4600 AC Electronic Load](#)

Utility Grid Load Testing

Utility Grid



Test effects of energy to & from the grid

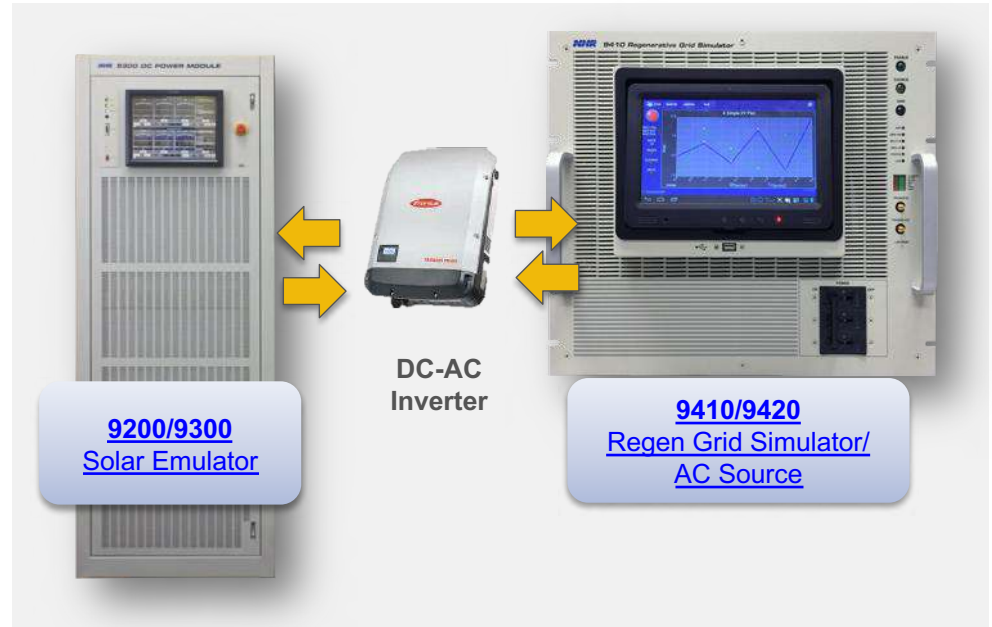


Solar PV to Grid Testing

Residential Solar PV



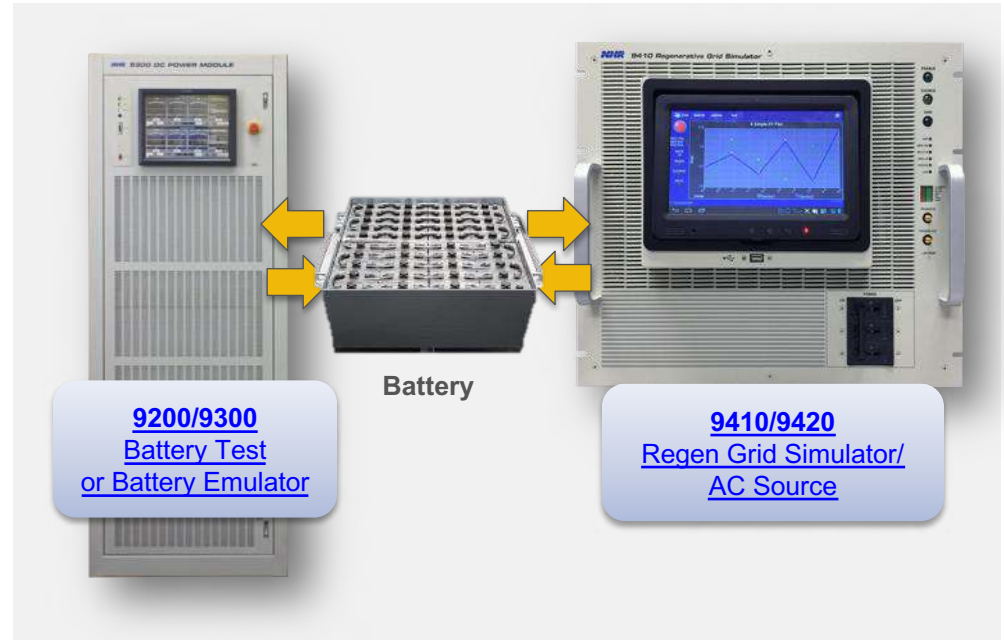
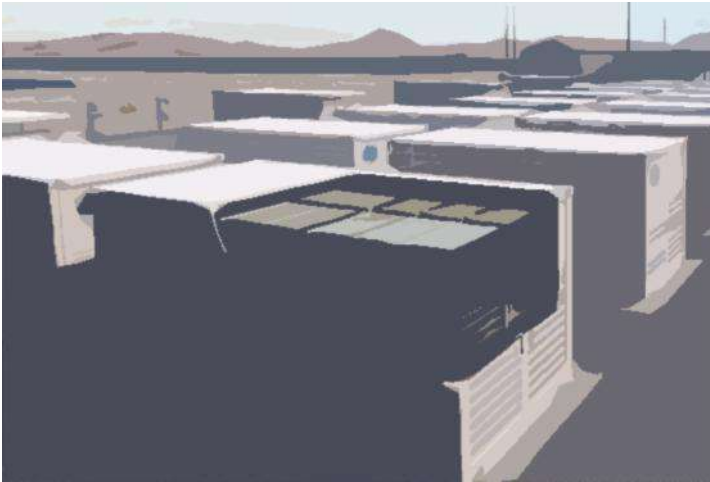
Test effects of energy to the grid



ESS/Battery Test or Emulation

Residential or Large Scale Energy Storage

Test the battery or effects of energy to the grid



Wind to Grid Testing

Wind Sources (DG)



Test effects of energy to the grid



Wind DG



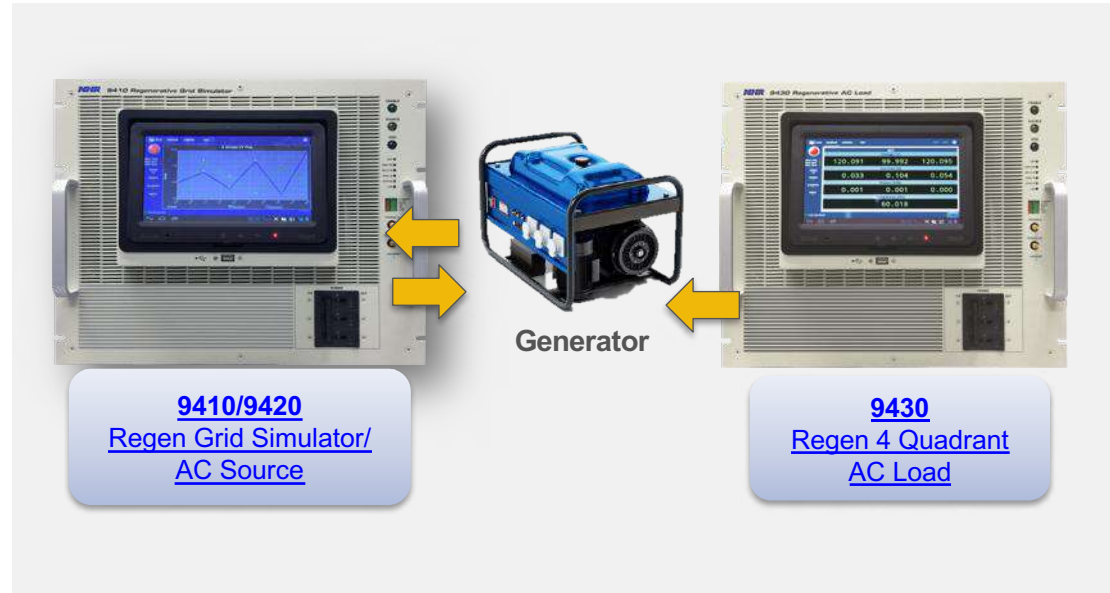
9430
Regen 4 Quadrant
AC Load

Generator Testing

Generator



Test effects of energy to & from the grid

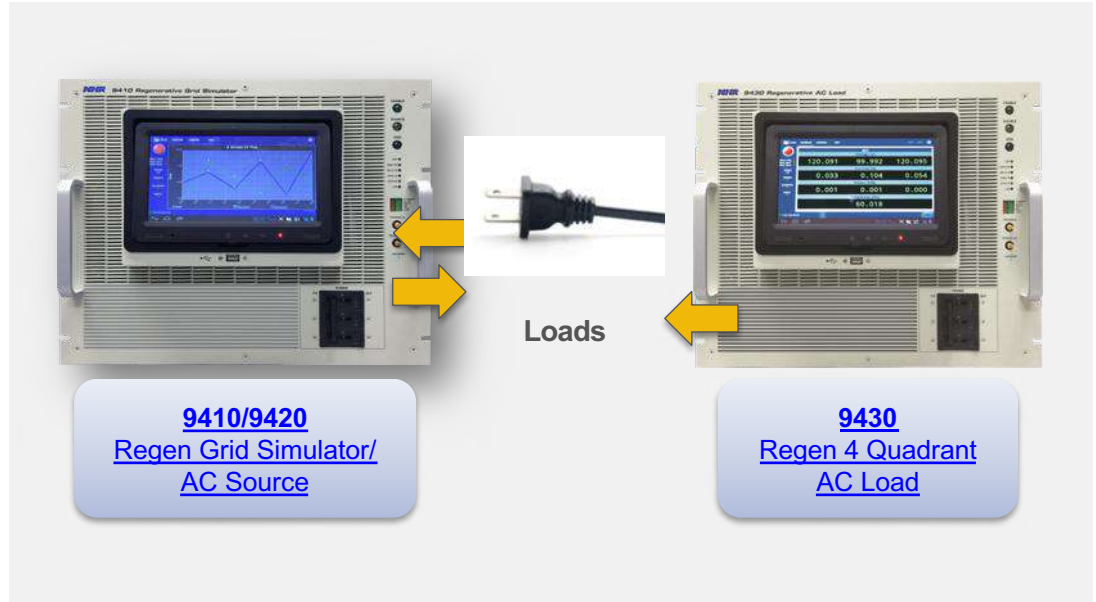


Facility Load Testing

Facility Loads



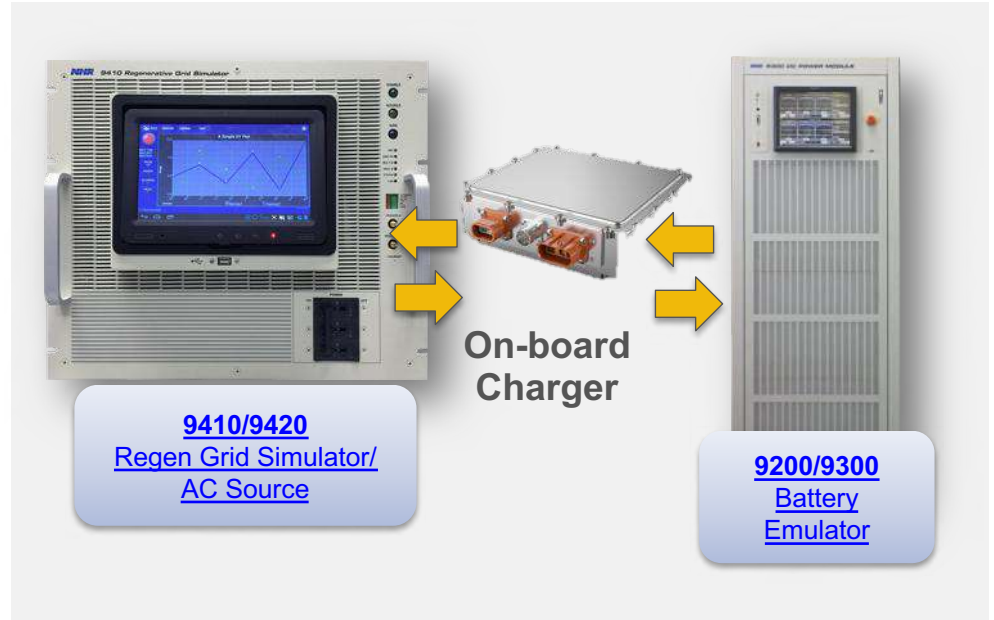
Test effects of energy to & from the grid



EV Onboard Charger

Electric Vehicles

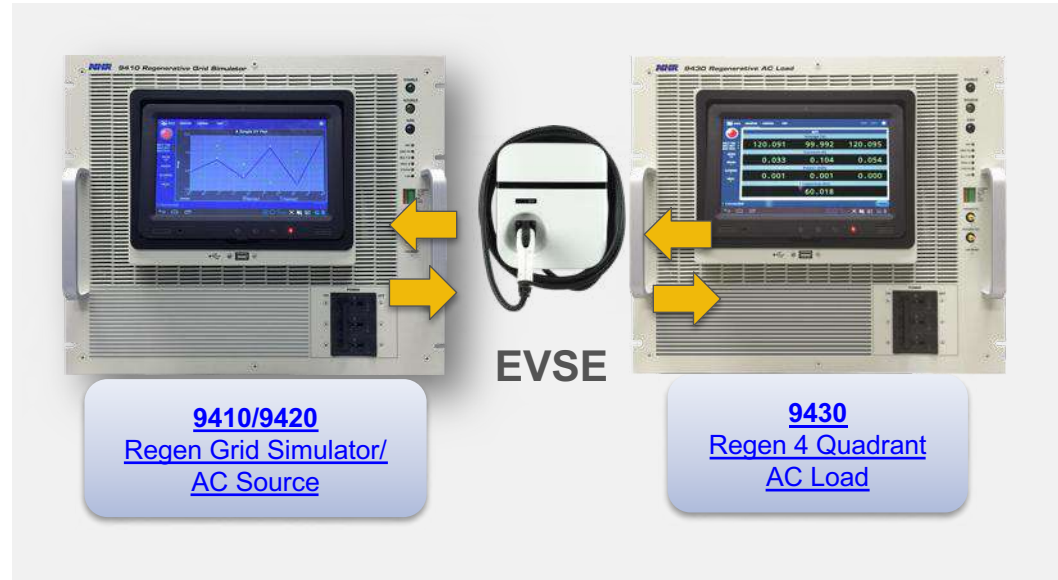
Test effects of energy to the grid



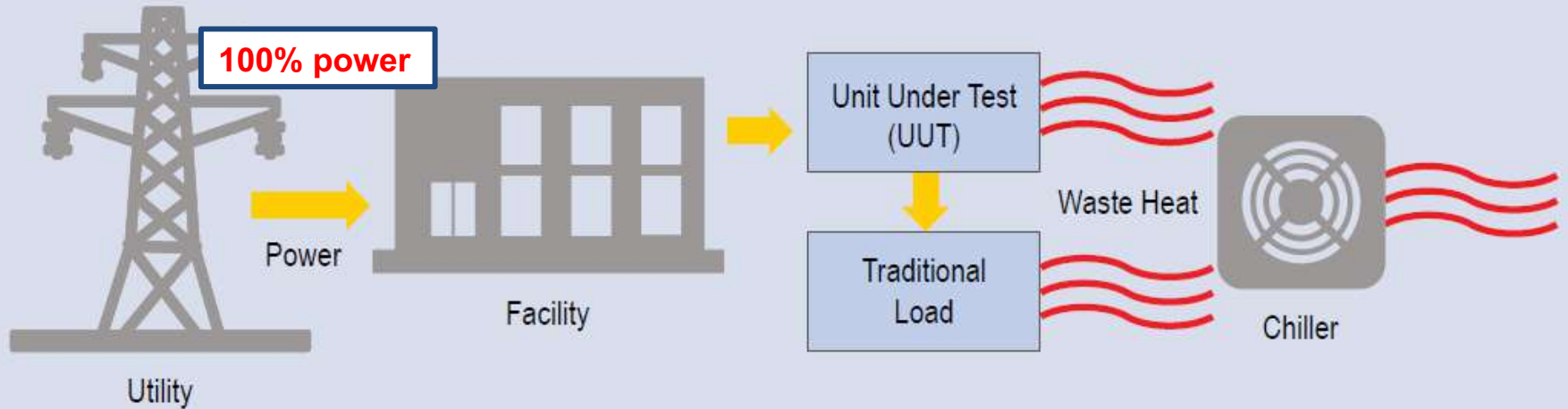
Vehicle 2 Grid Testing

Electric Vehicles

Test effects of energy to the grid



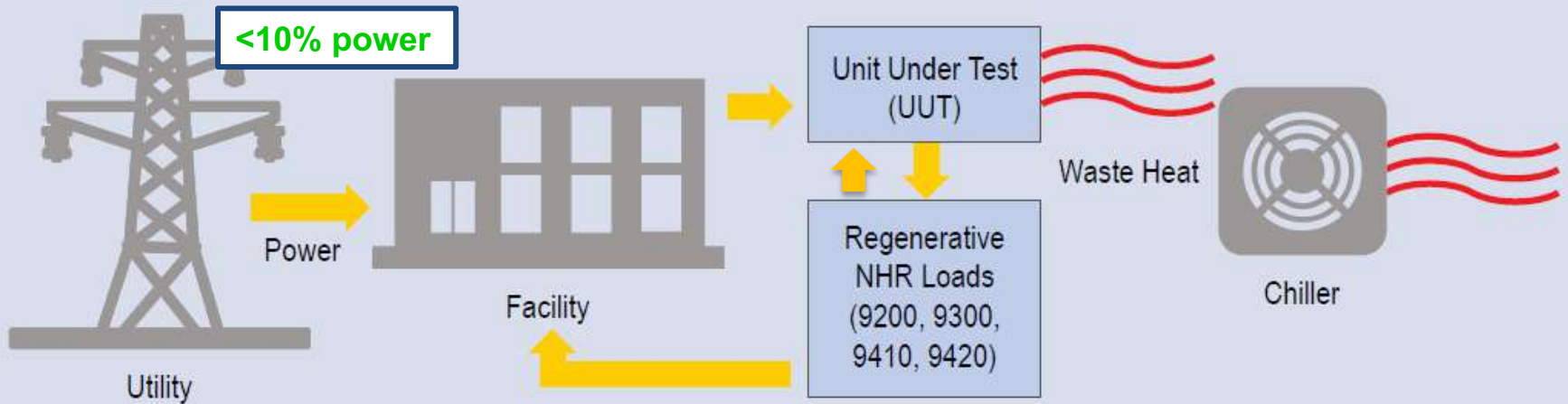
Traditional Loads Vs. Regenerative



Traditional Loads

- Heat Loss
- Poor Working Conditions
- Operating Costs

The Benefits of Regenerative Loads



Regenerative Loads

- ✓ Reduce Waste Heat
- ✓ Recycle Energy >90% back to UUT or facility
- ✓ Huge Cost Savings

9200/9300 Battery/Energy Storage Test Systems

Flexible Hardware & Software



12 kW up to
21 Channels



100 kW up to
2.4 MW

Key Features

- ✓ Modular & scalable power
- ✓ Flexible configuration – mix & match
- ✓ Fast response times
- ✓ Regenerative > 90% energy efficiency
- ✓ All modes - CC, CV, CP, and/or CR
- ✓ Battery Emulation Mode
- ✓ Multiple layers of Safety
- ✓ Flexible & easy integration
(CAN, BMS, DAQ, chambers, etc.)

9400 Series Regenerative Loads & Sources



- [9410 – Grid Simulator](#)
- [9420 – AC Source HVAR](#)
- [9430 – AC 4 Quadrant Load](#)

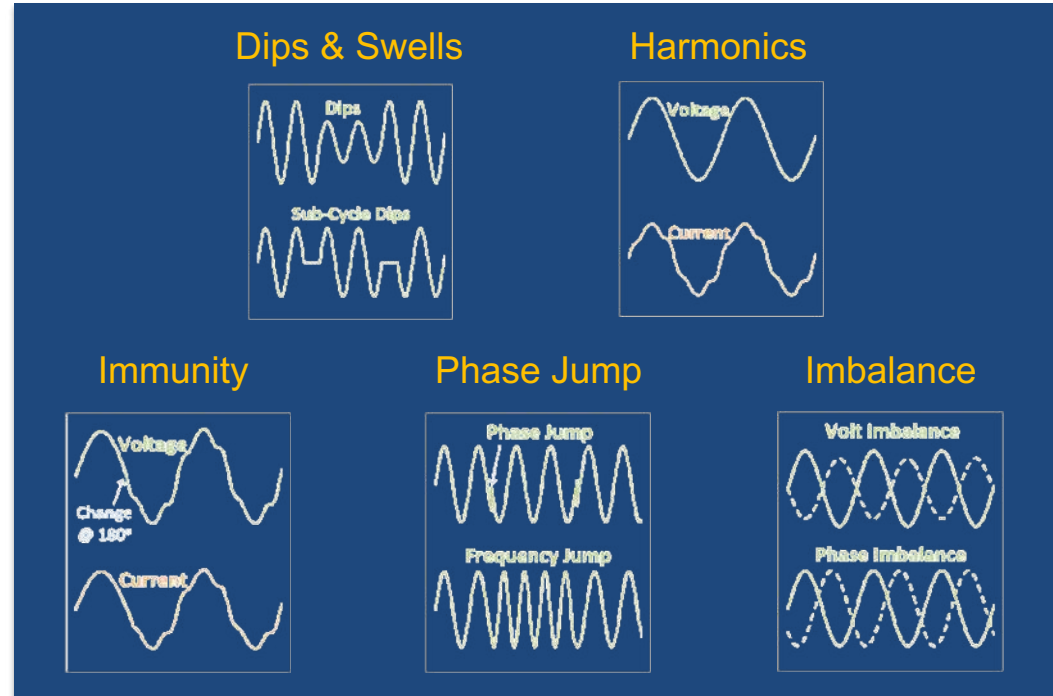
Key Features

- ✓ Scalable from 4 to 96 kW
- ✓ 8 power ratings
- ✓ Multiple Ranges 175 & 350Vrms(l-n)
- ✓ Up to 880Hz
- ✓ Regenerative > 90% energy efficiency
- ✓ Programmable 1, 2 or 3-Phase mode
- ✓ Mix AC & DC on separate outputs
- ✓ Built-in safety isolation relays

9410 Regenerative Grid Simulator

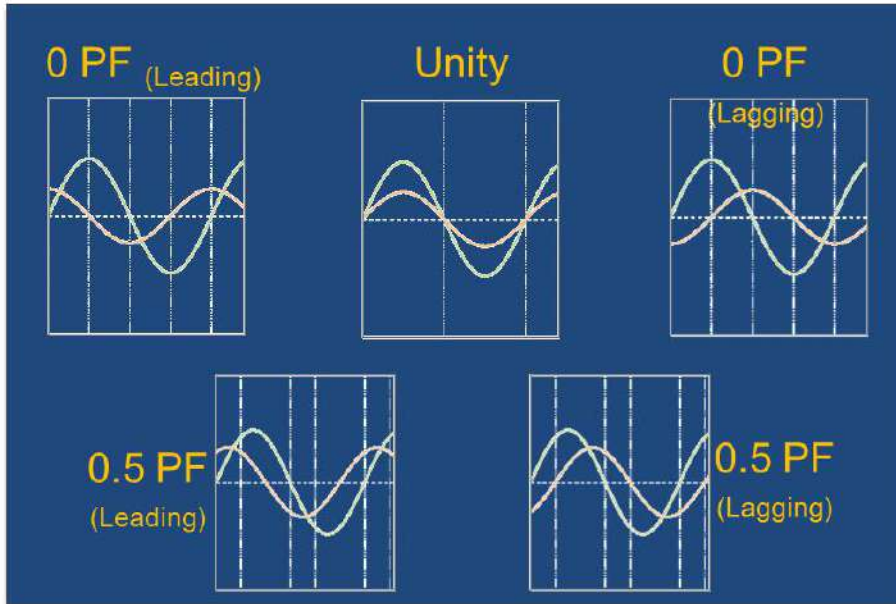


**NHR 9410
Grid Simulator**

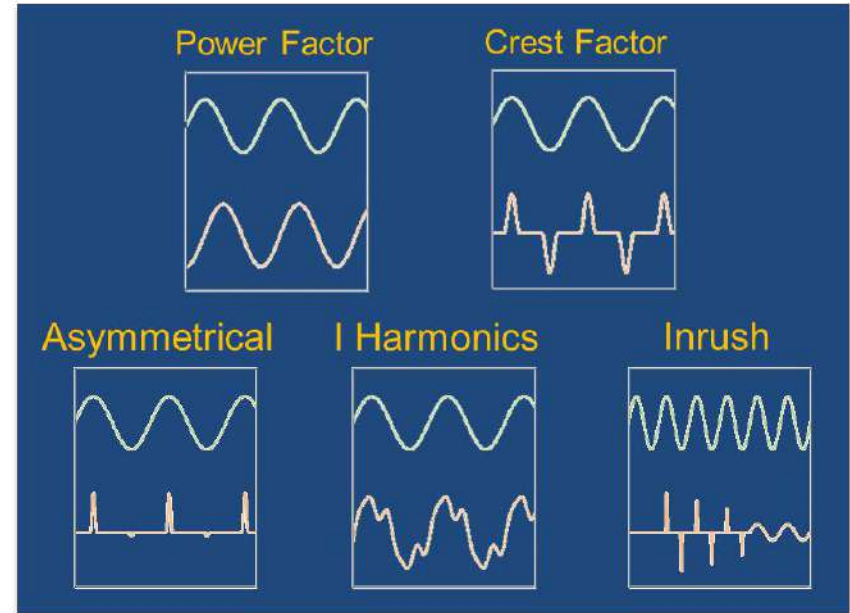


The Right Tool for Simulating AC Voltage Disturbances

9430 Regenerative 4-Quadrant Loading



**Simulate Any Power
Factor/Current Control**



**Simulate Any Combination
of Load Profiles**

Renewable Energy & Micro Grid Test Solutions



9430 Regen
4 Quadrant Load
up to 96kW



4600 AC Load
up to 36kW



9200 Series
12 kW, 21 channels



9300 Series
100 kW to 2.4 MW



4300 Chassis
150W, 300W, 600W



9410 Grid Sim
up to 96kW



9420 AC Source
up to 96kW



4700 & 4760
1kW to 36kW

AC Grid Sim AC Sources

- 9410
- 9420

AC Loads

- 9430
- 4600

Bi-directional DC Source Battery Emulators

- 9200 Series
- 9300 Series

Battery Test

- 9200 Series
- 9300 Series

DC Loads

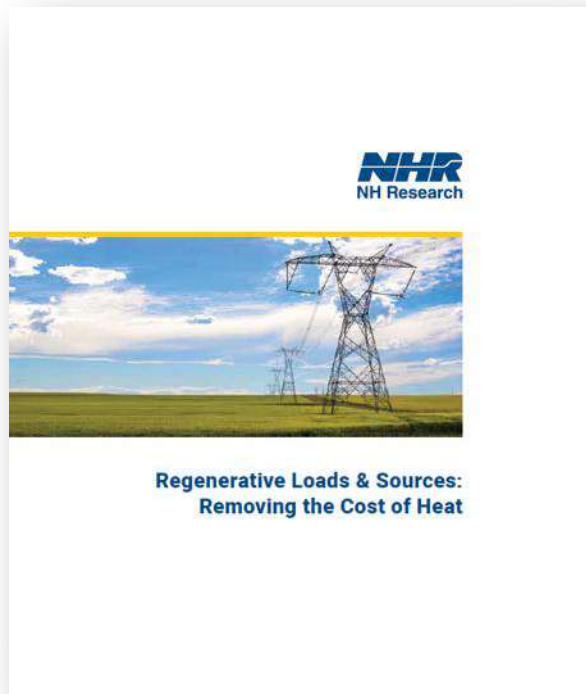
- 4300
- 4700/4760

DC Regenerative Loads

- 9200 Series
- 9300 Series

Access Resource Library

- **Download Application Notes**
 - Microgrid Test Solutions Diagram
 - Regenerative Loads and Sources Application Note
 - Battery Emulation: Testing without Batteries
- **On-Demand Webinars**
- **Schedule a Consultation**
- **Renewable Energy & Microgrid Webpage**
- Visit us at <http://nhresearch.com>



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*“At NHR, we consider every customer a **partner.**”*

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