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DER Overview

**Visit of the Education and Research
Consortium of the Western Carolinas**

December 10, 2003

Distributed Energy Resource Production

a new century, a changing economy, new opportunities



Storage Systems



Reciprocating Engines



Microturbines



Photovoltaics



Fuel Cells



Wind

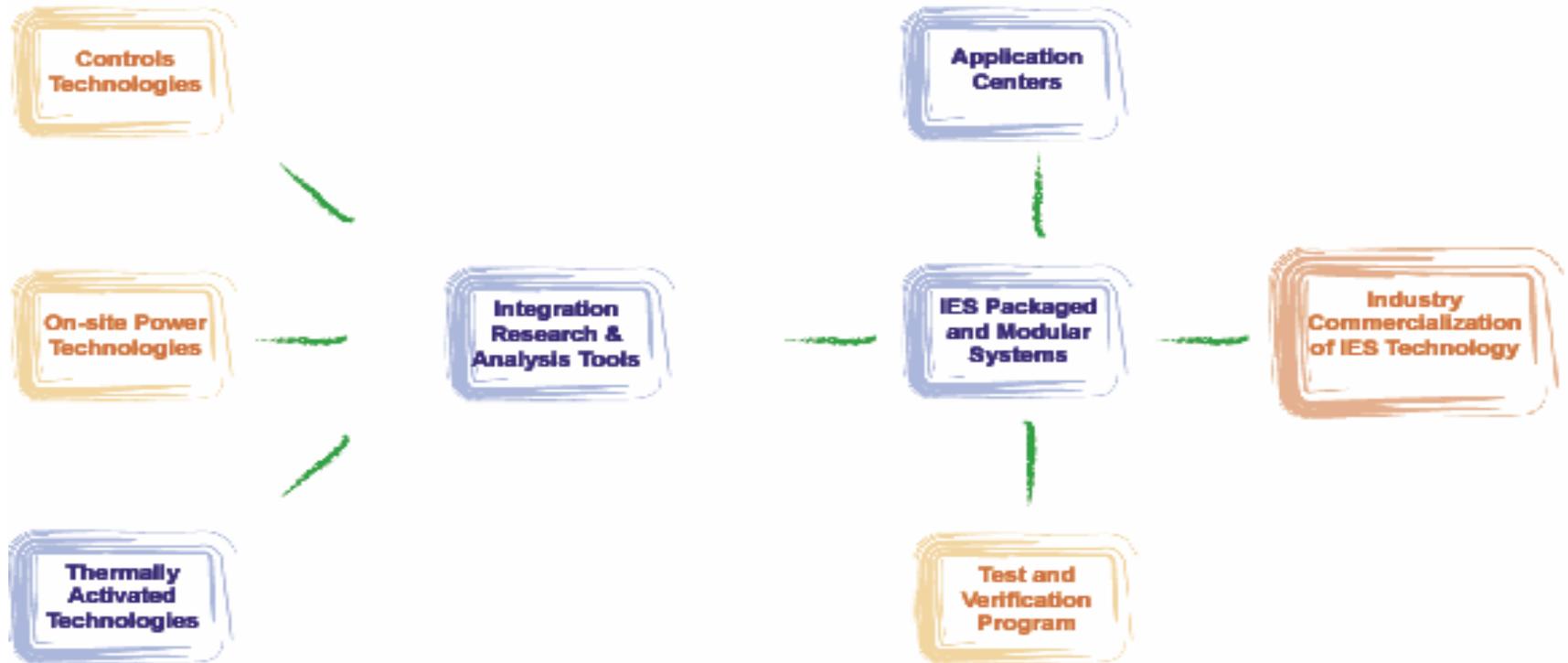


Thermally Activated Technologies

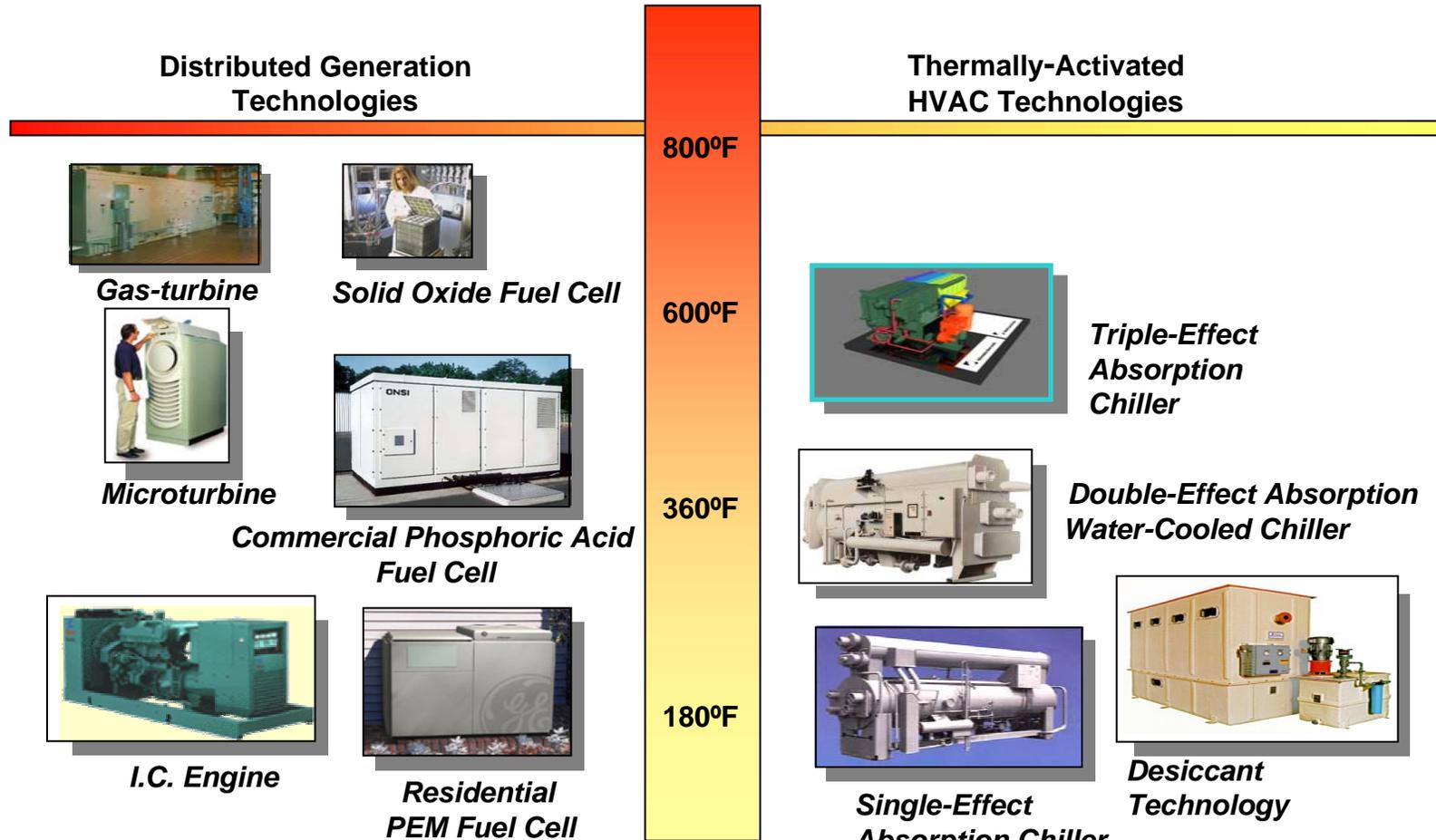


Grid Integration

IES and TAT Program Elements



Thermally-Activated HVAC Technologies Are Key to Improving Overall Efficiency of DG



Recoverable Energy Quality (Temperature) and HVAC Technology Match

CHP Integration Lab Supports DER

- **ORNL CHP Heat Recovery Laboratory operational since 2001**
- **Baseline Performance Tests of Microturbine DG Equipment Completed**
- **CHP Analytical Work Underway**
 - Assessing different heat recovery and design options
- **Test Heat Utilization Equipment**
 - Absorption chiller
 - 2 Desiccant systems
 - Hot water/steam heat exchanger



CHP Integration Lab Equipment

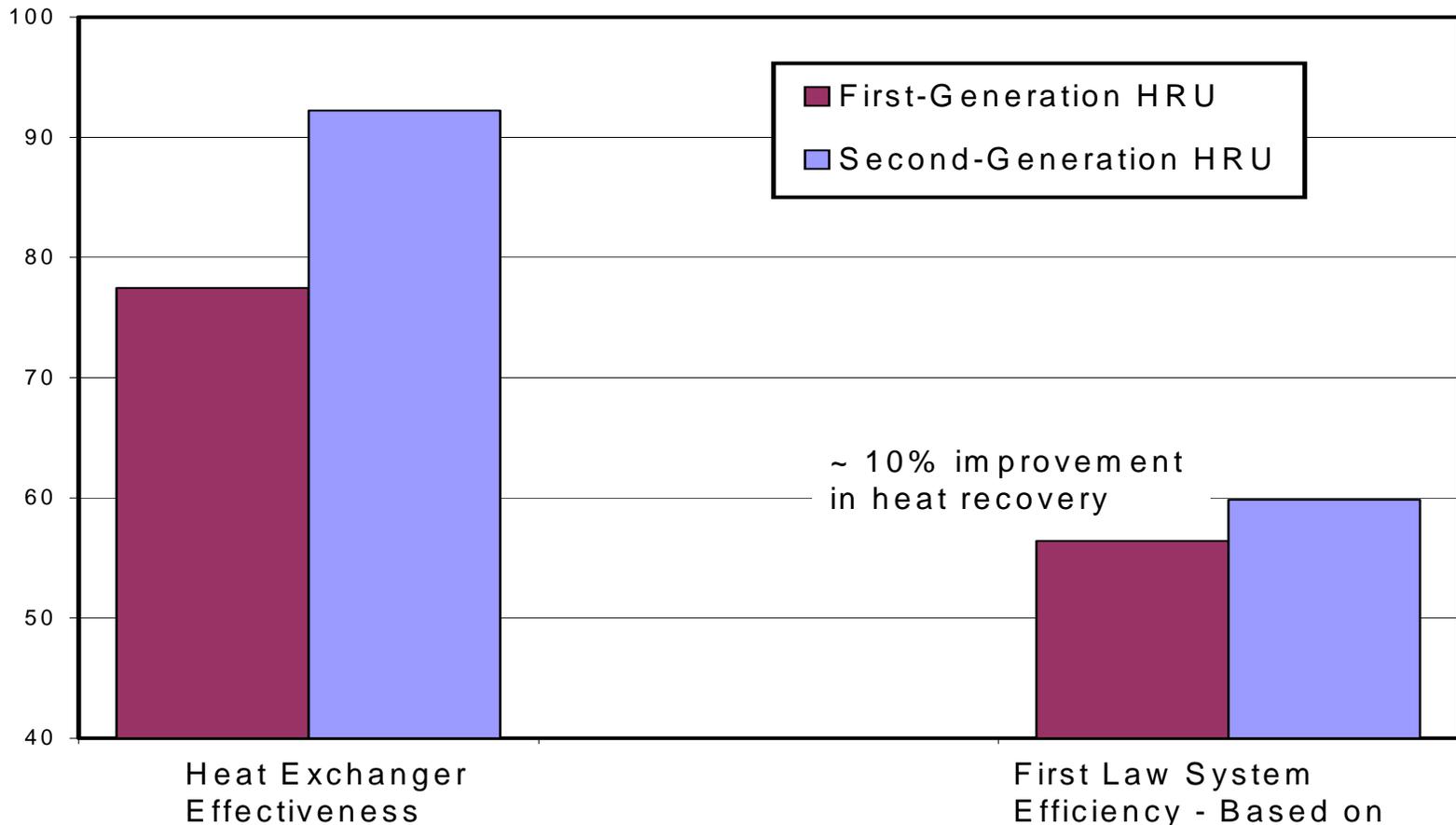


Capstone Model 330



Thermal Recovery Test Loops

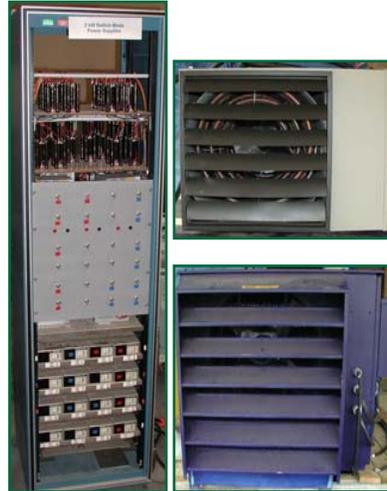
Unifin Heat Recovery Unit Performance Improvement



DER Dynamics Testing (PEAC)



**Dual Mode and Blackstart
30-kW Microturbine**



**Resistive &
Electronic Loads**



**Portable Sag
Generator**



Energy Storage

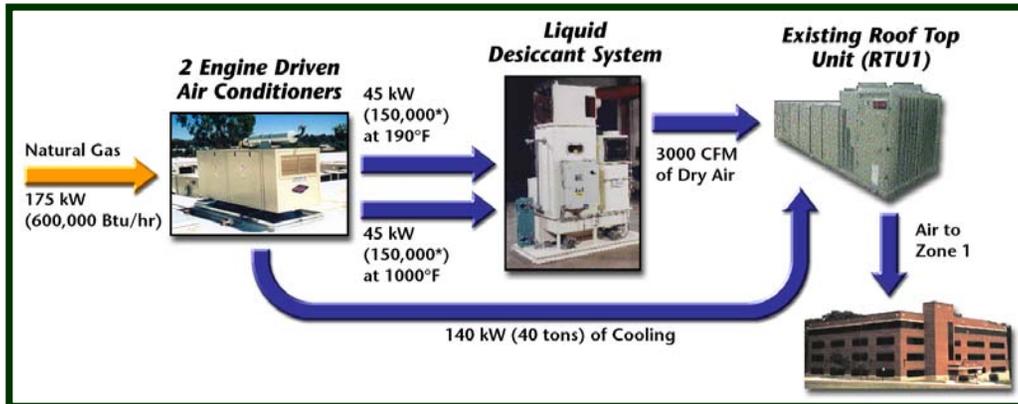
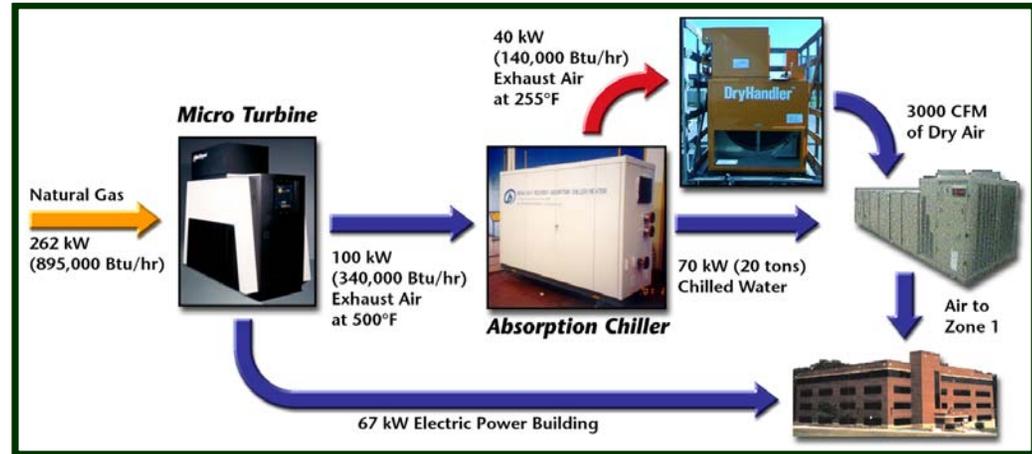


Motors

University Test Center for IES/Building Integration CHP



University of Maryland,
College Park



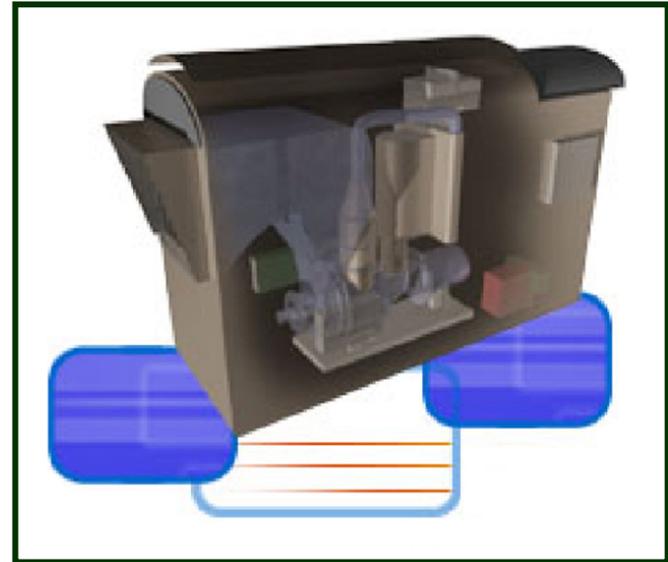
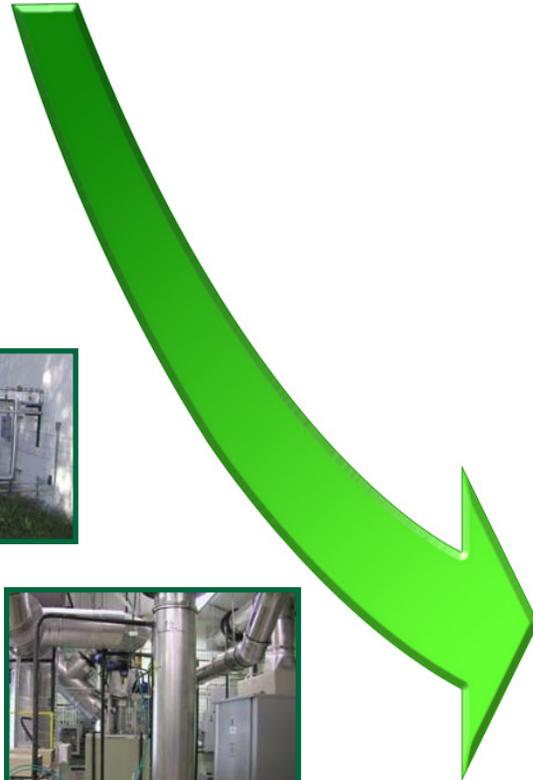
- Integrate IES into building, HVAC System
- Test advanced controls, diagnostics, operating strategies

Packaged CHP Projects for Buildings

- **Competitively procured in 2001 – Industry teams**
- **R, D, and T of “First Generation” Packaged CHP Systems for Buildings**
- **DER systems are highly efficient with low emissions**
 - **small-scale power generation close to the point of use**
 - **combined with thermal recovery to heat or cool nearby buildings**
- **Over \$30M total project funding over 3 years with more than 43% Industry cost-sharing**

IES Vision Packaged System Integration

**2001: Individually optimized
products combined on site**



**2010: IES – single
optimized package
from manufacturer**

2003 Accomplishments and Progress

United Technologies/Capstone Team

- **Four 60 kW microturbines integrated with a 110 RT Pure Comfort waste-heat fired D-E chiller**
- **Successful through lab testing**
- **UT Power announced plans to commercialize first Packaged CHP System early in FY 2004**



Honeywell Laboratories Team

- **5 MW turbine generator integrated with (“split-flow”) 1,000 RT waste-heat chiller and HRSG**
- **Chiller & turbine delivered, Fort Bragg proceeding with construction, system operation expected by mid-2004**



2003 Accomplishments and Progress (cont'd.)

Burns and McDonnell Team

- **5 MW turbine generator integrated with 2,500 RT of waste-heat absorption chilled water**
- **Burns & McDonnell site selected with Austin Energy as strong partner – potential “event” for DOE in 2004**

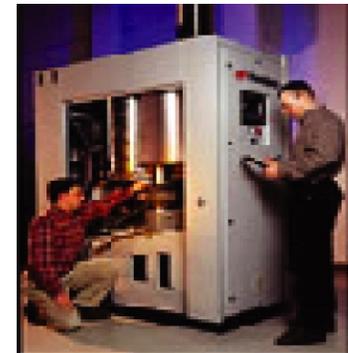


Sure Power

- **New partnership with Connecticut Public Television: digital broadcast center**

Ingersoll-Rand Team

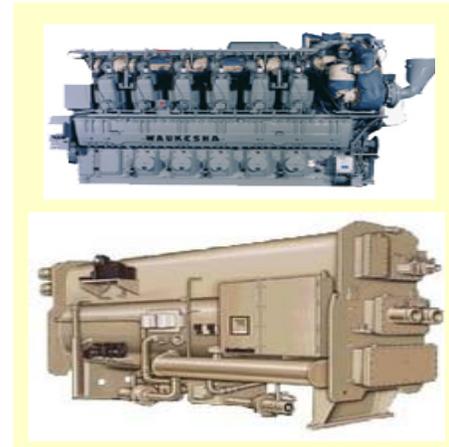
- **70-100 kW microturbine integrated with waste-heat fired absorption refrigeration, inlet air cooling**
- **initial lab prototype HR vapor generator and ammonia-water refrigeration unit fabricated and laboratory testing underway**



2003 Accomplishments and Progress (cont'd.)

GTI/Waukesha/Trane Team

- Engine generator (290kW to 770 kW) integrated with absorption chillers
- Trane absorption chiller (critical path component) has been fabricated and satisfactorily tested
- Design and assembly of the complete packaged system underway
- **DER/CHP End-Use** focus on key market segments (hospitals, educational facilities, national accounts)
 - Industry leaders, associations “engaged”
 - Customer base for packaged CHP systems
 - Linkage with Regional CHP efforts

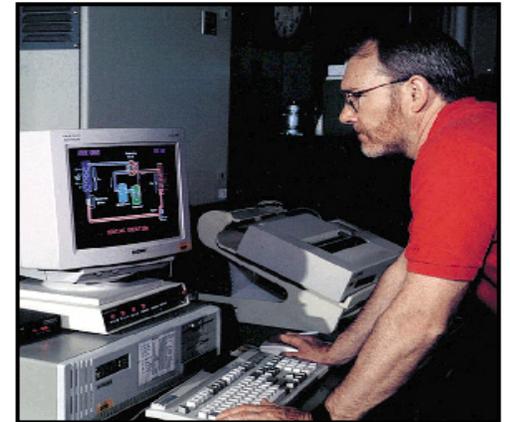


2003 Accomplishments and Progress (cont'd.)

Analysis/tools: developed engineering algorithms,
screening tools

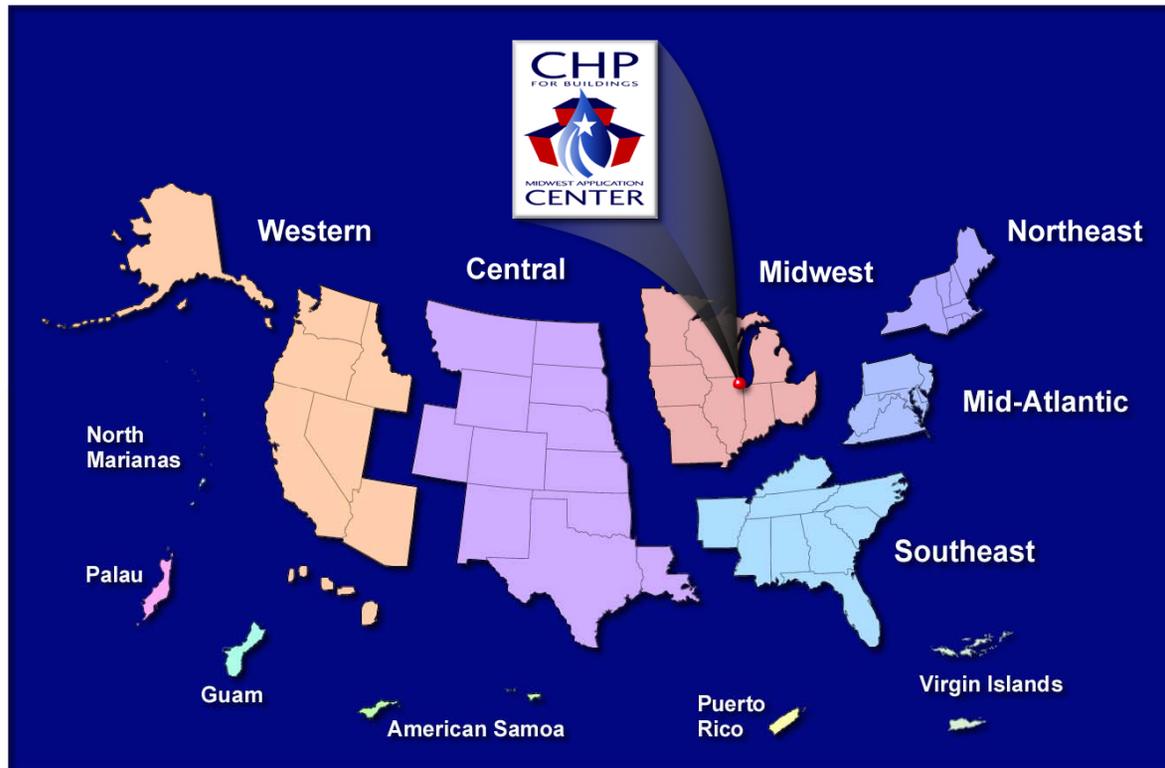
- **Synergistic evaluation of CHP for Federal, commercial/institutional applications**

- **Experimental integration research:**
ORNL CHP Integration Lab, U. of MD.
Building/CHP test center
 - **Collaborative testing with PEAC**
 - **Tech coordination with ASERTTI protocol work**
 - **Industry Advisory Committee (useful feedback)**



University of Illinois-Chicago: Midwest Regional CHP Applications Center

- Facilitate CHP projects, technical assistance
- Region-specific information, application knowledge



Regional CHP Application Center Expansion

- **Issued Solicitation in early 2003 to develop new Regional CHP Application Centers with focus on**
 - **Education and Outreach (baseline assessments, case studies, outreach information, website development, coalition building)**
 - **Identification and Facilitation of High Impact Projects**
- **Five new Centers Selected in August '03**

Intermountain

Northwest

Mid-Atlantic

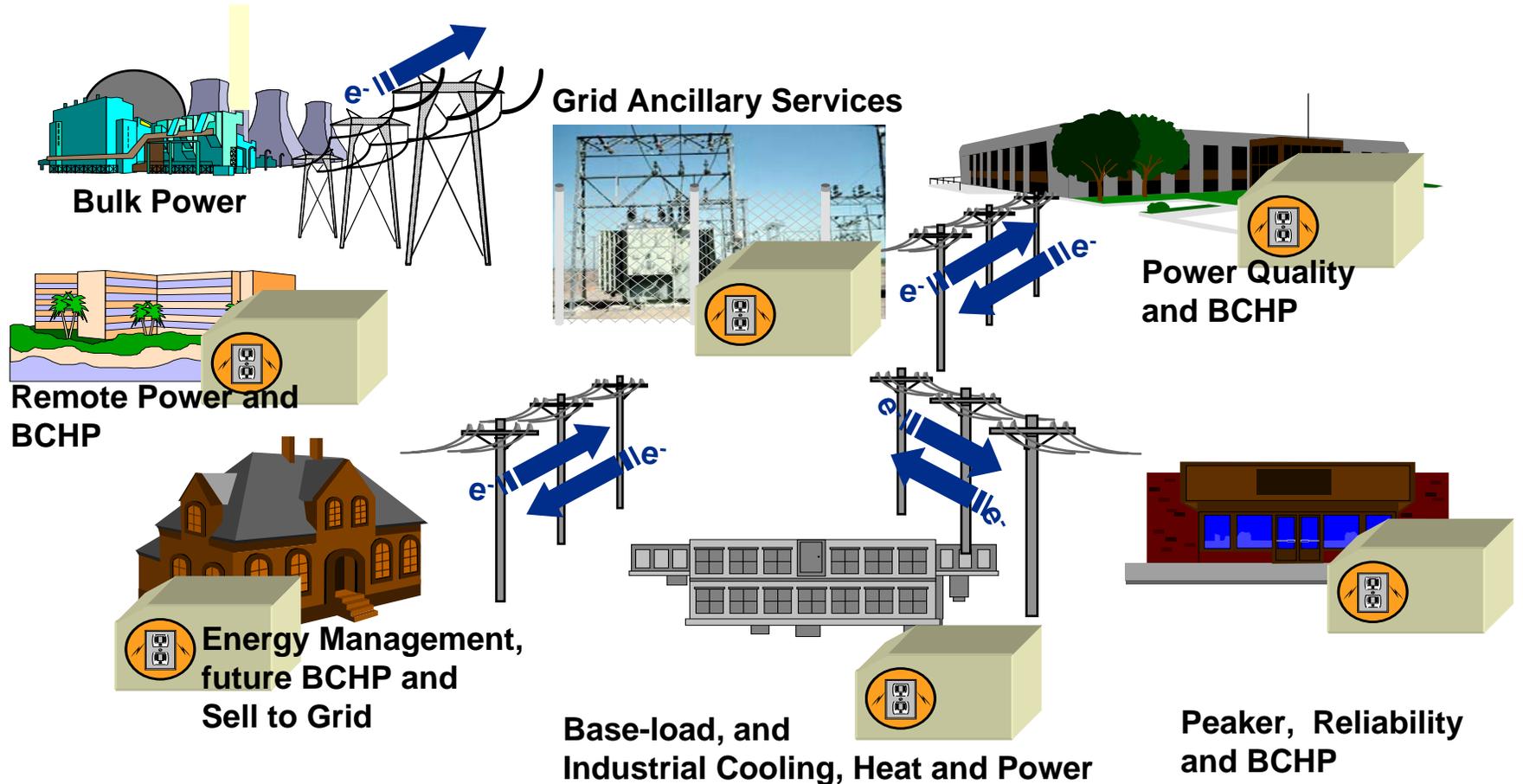
Pacific

Northeast



Summary

A Distributed Energy Future



Partnership

- Industry leadership is essential.
- DG and CHP technologies are ready today to be applied.
- Take advantage of partnership potential