

Distributed Generation Improvements in Industrial Applications

1st DOE Distributed Energy Resource
Conference and Peer Review

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Washington, D.C.



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Distributed Generation Improvements in Industrial Applications

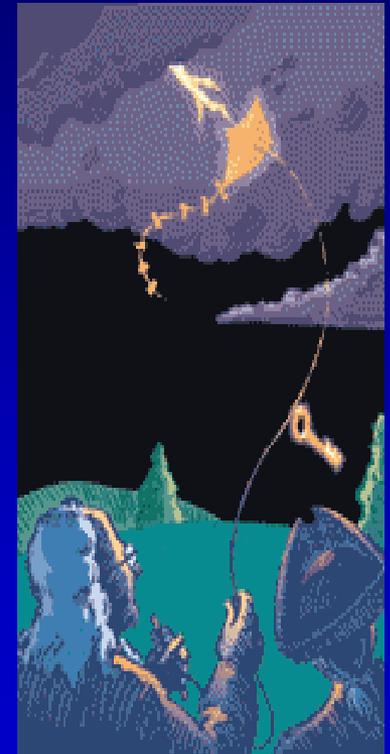
- A joint program between the DOE Office of DER and the Industrial Center
- Awarded in December 2000 in response to RFP No. 340002748
- Cost Share: Industrial Center Team 85% and DOE 15%
- DOE DER Program Mgr: Ms. Merrill Smith
- ORNL Project Manager: Ms. Patti Garland

Project Duration: 22 months



PRESENTATION OUTLINE

- **Industrial Center and the DG Consortium**
- **Technical and Economic Screening of Industrial DG systems**
- **Market Assessment**
- **Demonstrations & Market Transformation Tools (DG Applications Manual)**



Industrial Center

Provides commercialization & market development support for natural gas technologies in the industrial sector

- Established in 1991 (spin-off from AGA)
- 501(c) 6 trade association of 28 energy utilities and associated companies
- Located in Washington, DC
- Executive Director: David Weiss
- **Consortium approach** to products and services

www.industrialcenter.org



Current Industrial Center Consortia

- Air Toxics Compliance
- Heat Treating
- Engine-driven Air Compressors
- Infrared Paper Drying
- Industrial Refrigeration
- Plastics Alliance
- Vacuum Furnace and
- *Distributed Generation (DG)*



Industrial Center DG Consortium Membership Statistics

- **Members:** *Fourteen utilities*
- **Product Champions:** *Henry Mak, SoCal Gas
Bob Scott, NiSource*
- **Technology Lead:** *Bob Fegan, MichCon
Interconnect Standards*
- **Center Coordinator:** *Richard Biljetina*



DG CONSORTIUM MEMBER COMPANIES

Dominion Energy

Enbridge Consumers Gas

Exelon Corp. (PECO)

KeySpan Energy

Michigan Consolidated Gas

National Fuel Gas

Nicor Gas

NiSource Inc.

NW Natural

Southern Natural Gas

SoCal Gas Co.

TXU Electric and Gas

Wisconsin Gas Co.

Yankee Gas Services Co.



Overall Joint Program Objective

To accelerate the market acceptance of DG technologies by industrial and institutional customers.



How can we Improve the Efficiency and Economics of DG Systems?

- Use the waste heat!
- Minimize site engineering!
- Standardize designs!

***Combined Process Heating & Power
“CPHP”***



Industrial CPHP Program Elements

Phase I - Completed

- Provided a technical and economic screening of “replicable” CPHP systems in industrial apps
- Completed a market assessment

Key subcontractors: RDC and CSGI Inc.

Phase II – In progress

- Participate in key demonstrations
- Provide market transformation tools (applications manual)

Key subcontractors: Exergy Partners and Energy Nexus Group



Power Generation Technologies (up to 1 MW)

Equipment included in the study:

- **Reciprocating Engines**
- **Turbines and Microturbines**
- **Fuel Cells**



Some CPHP Data

1 MWe Engine:	>3,500 lb/hr steam (15 psig) plus 100-200 GPM hot water (HW)
1 MWe Turbine:	>8,000 lb/hr steam (125 psig)
120 kWe MTs*:	30 – 90 GPM (200°F HW or 300°F Thermal Fluid)
30 kWe MT:	10 - 40 GPM (200°F HW or 300°F Thermal Fluid)

*** Four Capstones / One Unifin Heater**



What and Where is the Market Potential for Industrial CPHP Systems up to 1 MW ?



Study completed by RDC and CSGI

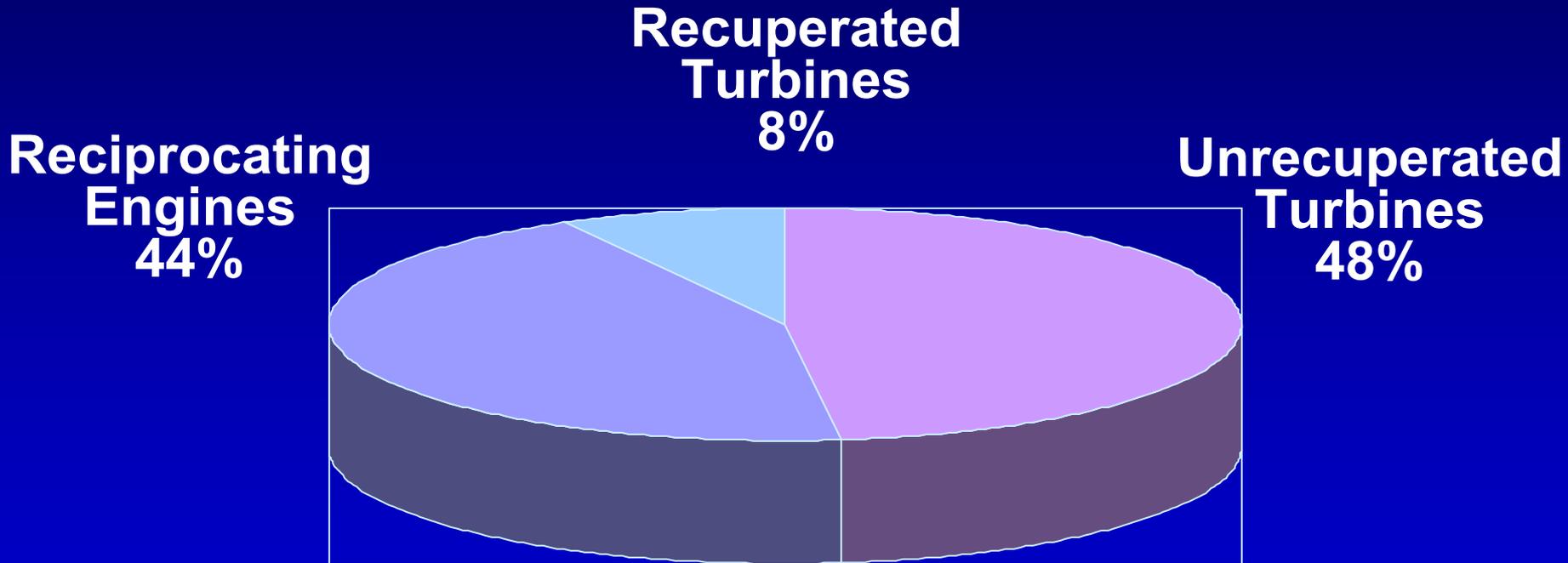
Top 5 Industrial CPHP Systems

11 GW Potential

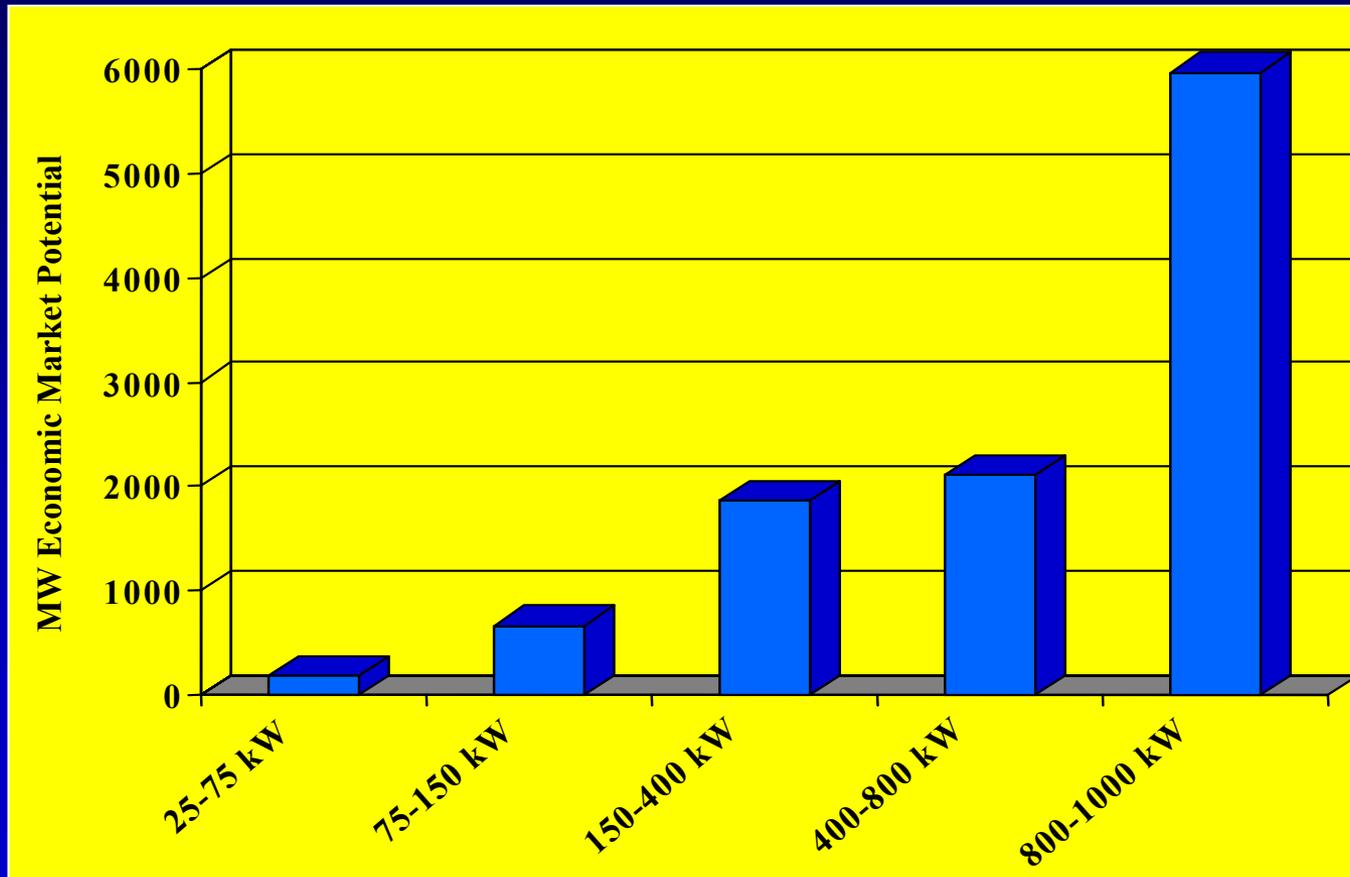
- Boiler systems using turbine exhaust gas as a combustion oxidant: **4,251 MWe**
- Direct contact water heaters fed directly with engine/turbine exhaust: **2,435 MWe**
- Indirect air heating using air-to-air heat exchangers fed with engine/turbine exhaust: **2,332 MWe**
- Indirect liquid heating: **1,010 MWe**
- Direct process heating: **760 MWe**



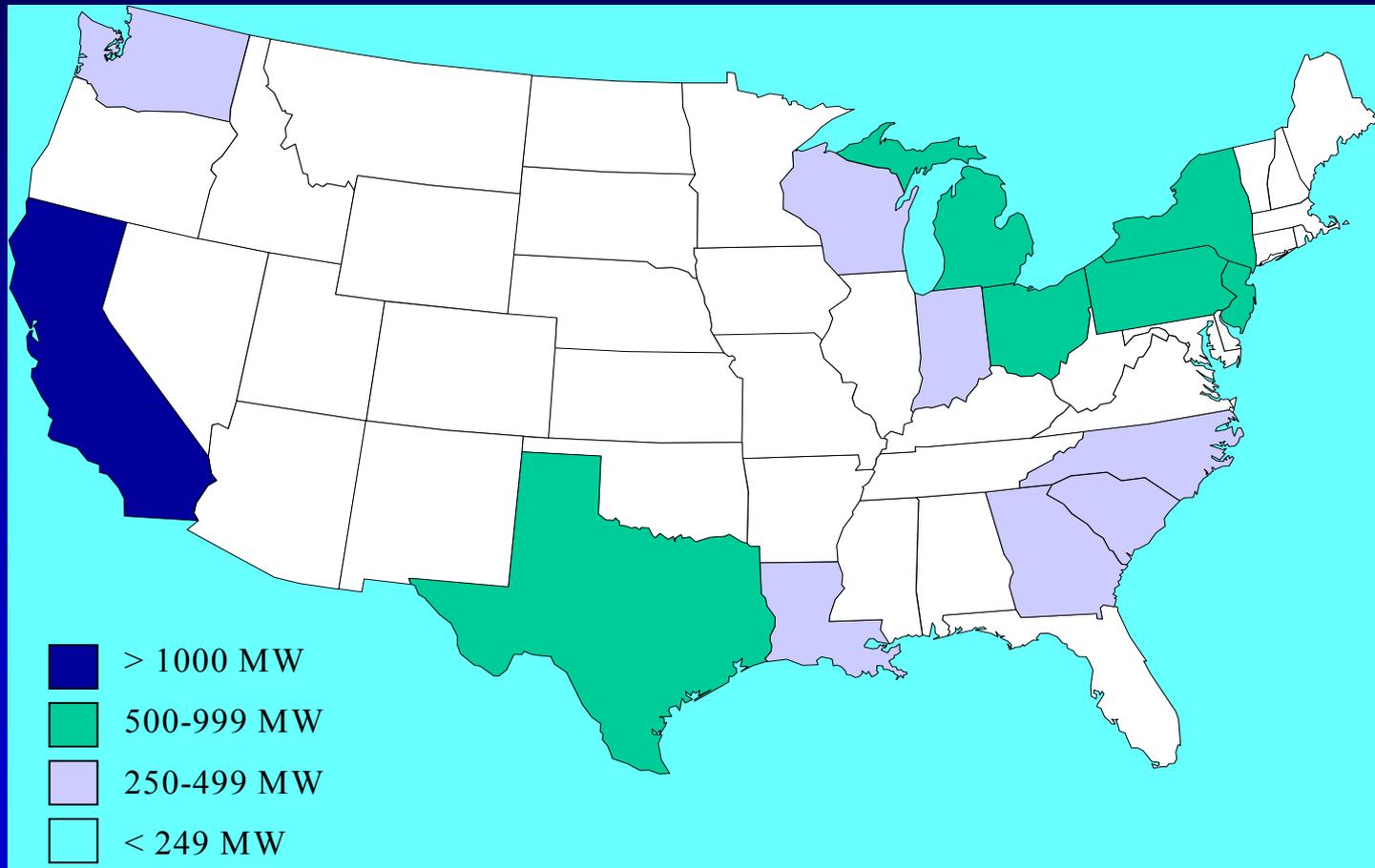
Results by Prime Mover Type



MW Potential by Size Range



Results by State for 11 GW total



11 GW Total Economic Potential for Units up to 1MW

KEY POINTS:

- ✓ **Units between 800 –1000 kW capture more than half of the new load (6 GW)**
- ✓ **Unrecuperated turbines and reciprocating engines the leading power providers (92%)**
- ✓ **Applications that have low thermal system efficiencies and low retrofit costs are favored.**



Phase II: Demonstrations and Market Transformation

- Initiated in September, 2001
- Technical support by Energy Nexus Group and Exergy Partners
- DG Consortium membership identified and screened 26 candidate sites
- Two demonstration sites selected



Industrial CPHP Support

- **DOE Office of DER & Industrial Center provide**
 - CHP integration and design engineering
 - data acquisition for minimum of 6 months
 - case studies and market transformation tools

- **DOE Office of DER & Industrial Center**
 - retain data rights
 - make public results of DG projects

- **Host site finances, owns, operates and maintains total system**



Two of Five Sites Selected

Meat Processing:

DG: 2 – 1125 kW
Waukesha
Engines

Nicor Gas Site

HR: boiler feed-water heating (base case)



Plating Shop:

DG: 4 - 30 kW
Capstone
Microturbines

SoCal Gas Site

HR: plating tank heating
& sludge drying



Market Transformation

- **Reliability Database**
- **Screening Tools (d-gen Pro)**
- **Case histories & Application Guide**
- **Training/Website**
- **Sales Channel Management**
(in cooperation with Eq. Mfgs.)



What's next?



1. Complete site assessments and data plans – 4th qtr. 2001
2. Define, design, and install additional data acquisition items – 1st qtr. 2002
3. Manage data collection activities leading to case histories and an applications manual – remainder 2002