



# **U.S. Perspectives on Combined Heat and Power**

## ***Opportunities in the APEC Regions***

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# Discussion Topics

- Introduction to Electric Power Research Institute
- U.S. Update on Distributed Generation and CHP
- Markets and Opportunities for CHP
- Regulations and Barriers
- Opportunities for the APEC Region

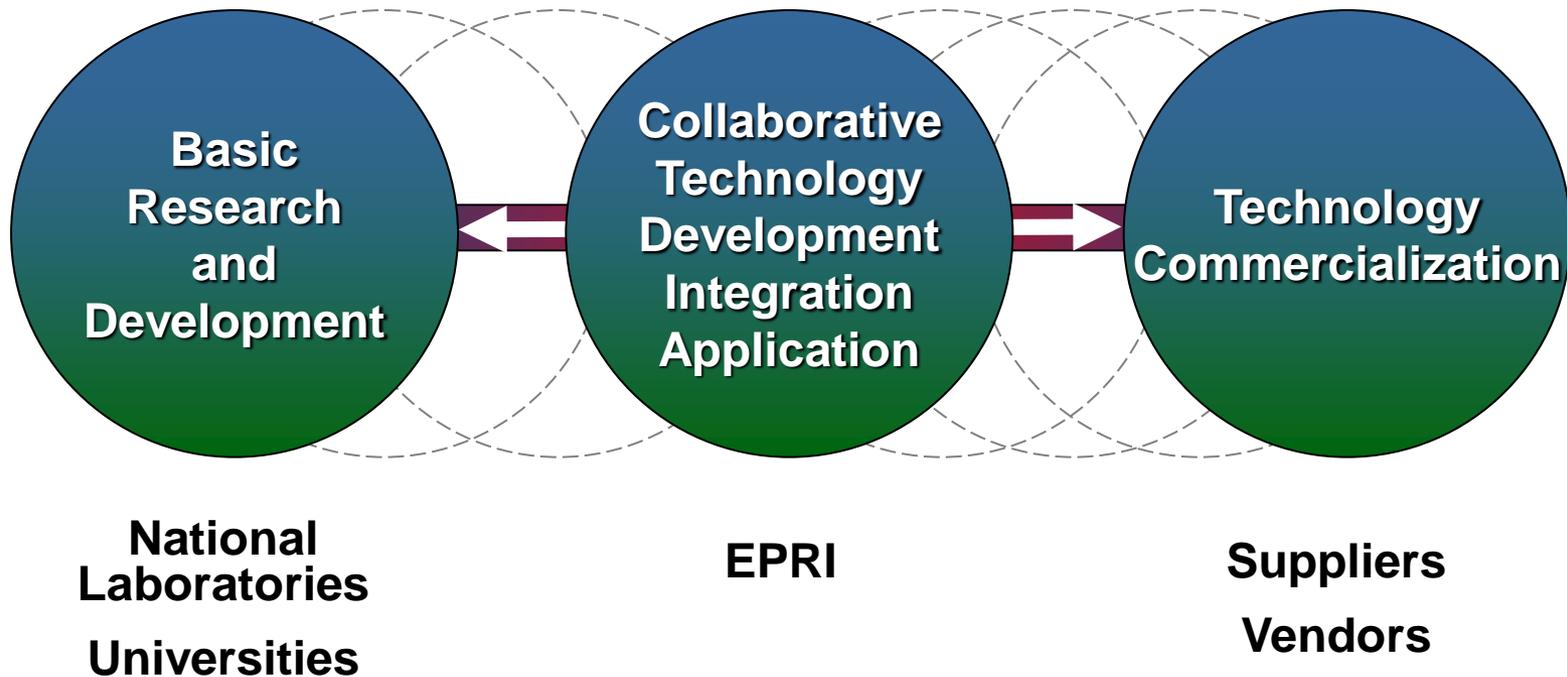
# The Electric Power Research Institute (EPRI)

- Independent, non-profit, **collaborative** research institute, with full spectrum industry coverage
  - *Nuclear*
  - *Generation*
  - *Power Delivery & Utilization*
  - *Environment*
- Major offices in Palo Alto, CA; Charlotte, NC; and Knoxville, TN



# Our Role...

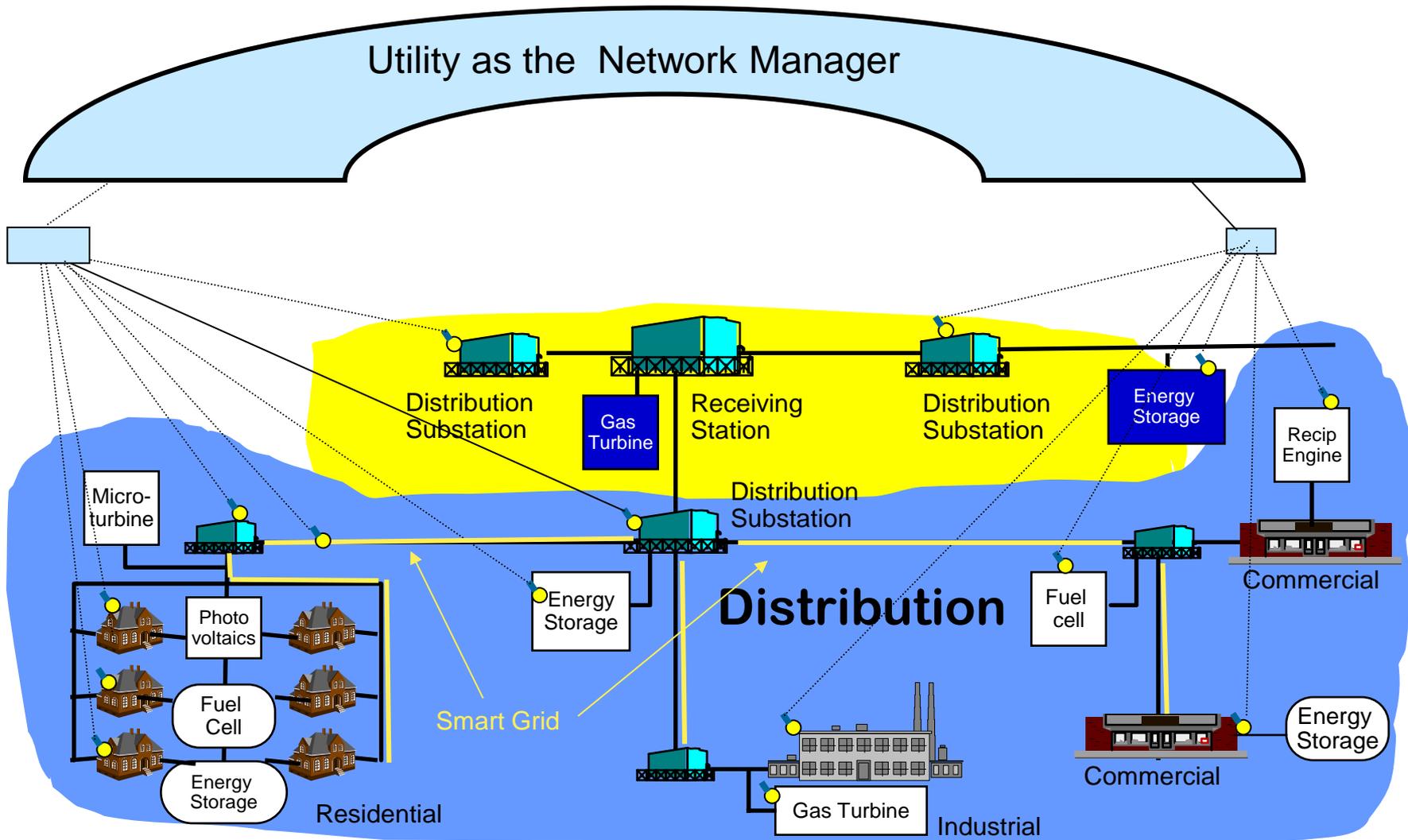
*Help Move Technologies to the Commercialization Stage...*



***Technology Accelerator!***

# EPRI Vision: a Virtual Power Plant

Imbedded systems at End-user locations; Smart Grid; Dispatchable DER Assets; Utility as the Network Manager



Imbedded technology with communication function

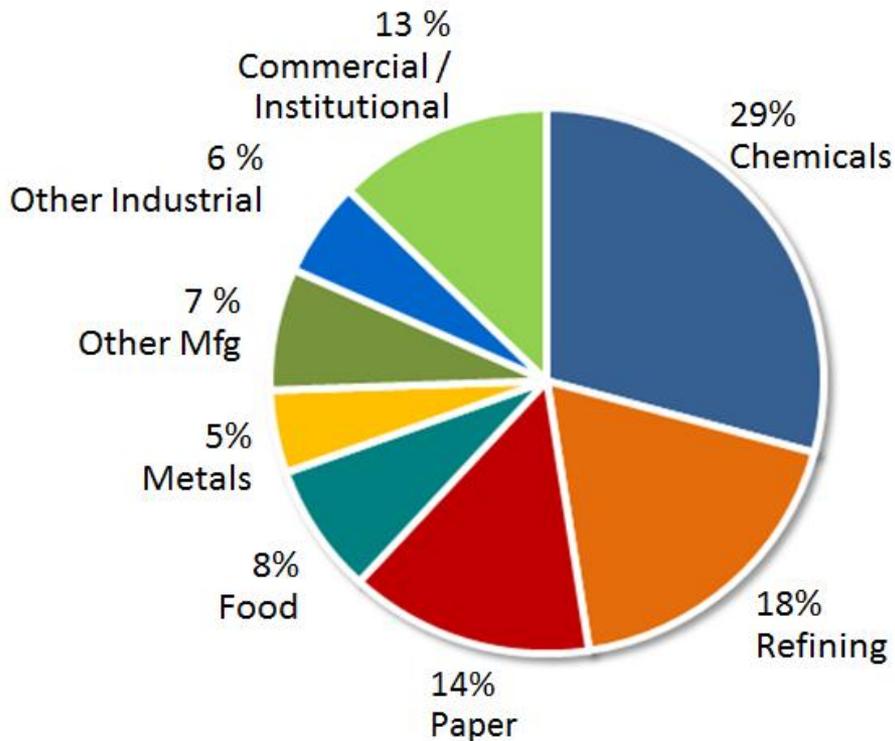
# Industry Drivers for Distributed Generation

- Low Cost Natural Gas
- Renewable Integration
- Retirement of old Coal Plants
- T&D Constraints & Load Pockets
- High Retail Rates
- Economic Development
- Jobs



# US Update on Combined Heat and Power

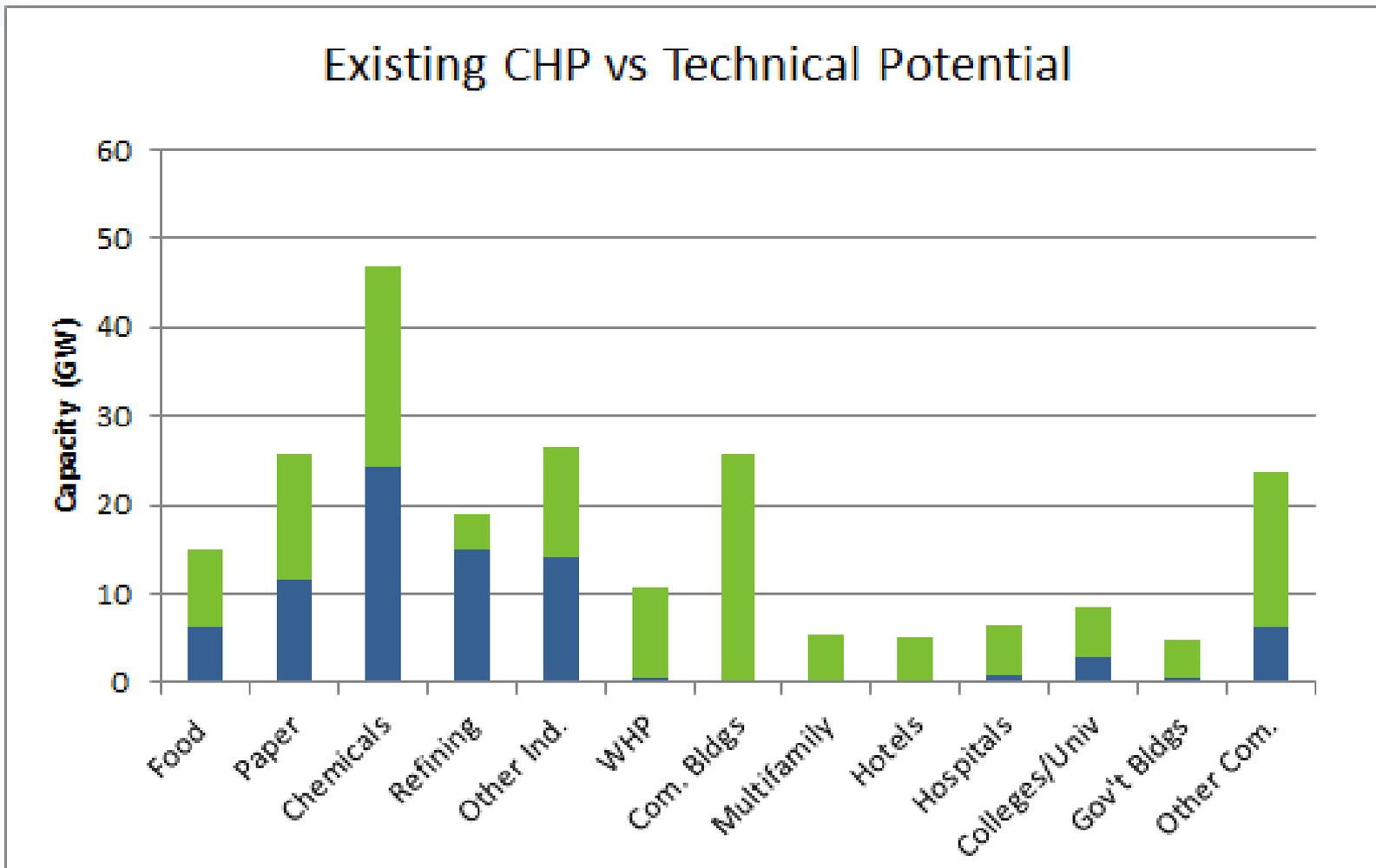
## Where Are We Today?



- **82 GW** of installed CHP at 3,842 industrial and commercial facilities (2011)
- 87% of capacity in industrial applications
- 71% of capacity is natural gas fired
- Avoids more than **1.8 quadrillion Btus** of fuel consumption annually
- Avoids **241 million metric tons of CO<sub>2</sub>** compared to separate production

Source: CHP Installation Database  
ICFI.com

# Where is the Remaining Potential for CHP ?



Source: CHP Installation Database

ICFI.com

# US Initiatives and Evolving Policy

- **Executive Order:** “Coordinate and strongly encourage efforts to achieve a national goal of deploying 40 gigawatts of new, cost effective industrial CHP in the United States by the end of 2020”;
- **EPA recognizes CHP as an efficiency measure** under developing greenhouse gas emission standards and promoting output-based options that recognize CHP benefits;
- **Pending modifications to the Investment Tax Credit ( ITC )**
  - Energy Improvement and Extension Act of 2008 provides a 10% investment tax credit (ITC) for the first 15 MW of CHP property
  - HR 2783: Proposes to increase ITC to 30% for CHP 70% efficient or greater
- **Legislative support for CHP**
  - Promote rate-basing of behind the meter energy efficiency investments (including CHP) through increased tax incentives

# Distributed Energy Resources – Current Options ( Size Range and Electrical Efficiency LHV)

## 50 MW - 1 MW

### Aero-derivative CT's

- 25-60 MW
- 40+ % Eff.

### Small CT's

- 1-5 MW
- ~ 40% Eff

### Diesel and IC Engines

- 1.6 MW
- 36% Eff.

## 1 MW - 1.5 kW

### Microturbines

- 30-300 kW
- 25-30% Eff

### PAFC Fuel Cells

- 400 -1000 kW
- 40-45 % Eff

### Micro IC engines

- 1-2 kW
- 30 Eff.



# Distributed Energy Resources - Emerging Options

(Size Range and Electrical Efficiency LHV )



## Solid Oxide Fuel Cells

- 2 kW – 100 kW
- ~ 55%-60% Efficient

## SOFC – Hybrids

- 1 MW – 60% Eff



## PEM Fuel Cells

- 1 – 5 kW
- ~ 40% Eff



## Stirling Engines

- 1-5 kW
- 15-25% Eff

# Micro-generation & Storage for Micro-grids and Evolving Grids

- Emerging technologies show potential for micro grids
- Energy storage systems to support energy management
- Aggregation via Smart Grid Technology
- CHP + Storage in micro grid



# Historical Barriers to Adoption of DG

Technology Improvements Have Been Incremental, Barriers Still Exist

- Contractual & technical interconnection requirements
- Utility tariffs requiring surcharges for standby service
- Environmental & permitting requirements
- Average cost pricing of utility services
- Patch work of State Regulatory Policy
  - In many jurisdictions utilities can not own DG
- Lack of incentives for third party Energy Services Company; End-users want providers to offer “Energy Services”
- Utility Business Model?

# Key Research and Modeling Questions

... to assess and advance CHP opportunities in the APEC Regions

1. What is the societal value of a grid which optimally utilizes 15-20% of distributed generation and CHP, and energy storage?
2. What are the benefits and costs of a more integrated natural gas – smart grid enabled by DG / CHP Options?
3. What and where are high value market opportunities for DG /CHP – to enable stakeholders to provide more targeted and focused programs?
4. What technologies have the potential for significant break-throughs in cost and performance? Is there a Game Changer Technology?
5. What business models will be most effective for utilities; third parties; end-users, and what are the policy implications?
6. Based on research findings what is the roadmap and action plan?

# EPRI References

1. Technology Review and Assessment of Distributed Energy Resources; 2005; 1010525
2. Information to Support Distributed Resources Business Strategies; 1999; TR-114272
3. Using DER in Transmission Constrained Urban Load Pockets; 2007;1014314
4. Regional Analysis of Business & Regulatory Climate for Distributed Resources; 2000;TR-114274
5. Assessment of California Combined Heat and Power Markets and Policy Options for Increased Penetration; 2005;1012075
6. Quantification of Regional Green House Gas Emission Impacts and Benefits for Distributed Generation; 2007;1014312
7. Creating Incentives for Electricity Providers to Integrate Distributed Energy Resources; 2007; 1014899
8. Assessment of MicroGeneration Technologies for Distributed Generation Applications; 1997;TR-107634
9. Technology Review and Assessment of Distributed Energy Resources: Distributed Energy Storage; 2006;1012983
10. Assessment of Distributed Resource Technologies; 1999; TR-114180
11. Commercial Sector Solid Oxide Fuel Cell Business Assessment; 1996; TR106645
12. Strategic Market Assessment of Distributed Resources; 1995; TR-106055

# Together...Shaping the Future of Electricity

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