



# CHP: The Concept

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**Midwest CHP Application Center (MAC)**

**[www.CHPCenterMW.org](http://www.CHPCenterMW.org)**

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Energy Resources Center*

# What is CHP?

- **Integrated System**
- **Located At or Near a Building/Facility**
- **Provides a Portion of the Electrical Load**
- **Utilizes the Thermal Energy**
  - **Cooling**
  - **Heating**
  - **Dehumidification**
  - **Process Heat**

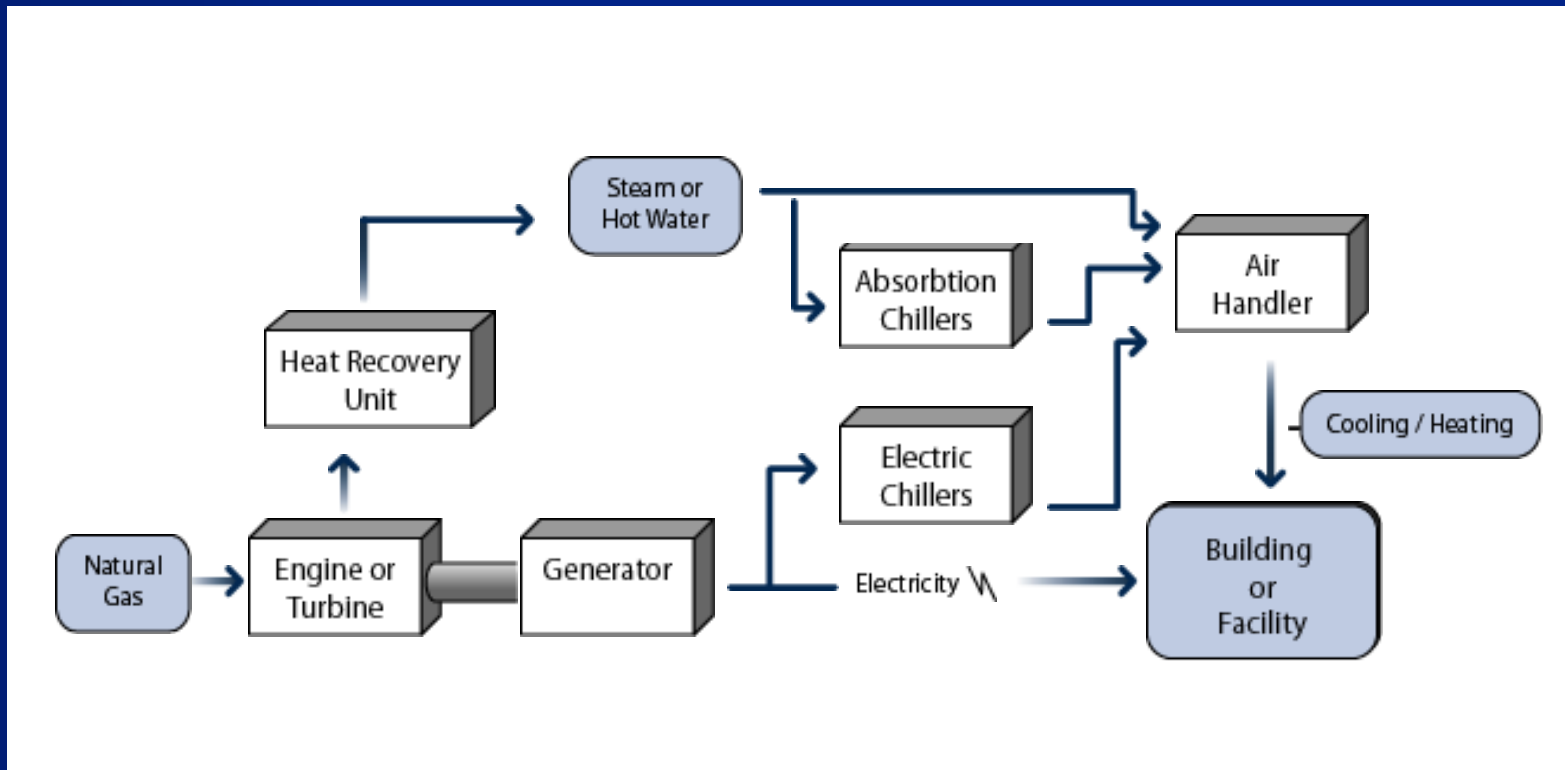
# Acronyms

- **Combined Heat & Power (CHP)**
- **Buildings Cooling, Heating & Power (BCHP)**
- **CHP for Buildings (CHPB)**
- **Integrated Energy Systems (IES)**
- **Total Energy Systems (TES)**
- **Trigeneration (Trigen)**
- **CHP for Industry**
- **Cogeneration**

# CHP System Sizes (*Terminology*)

System Designation	Size Range	Comments
Mega	50 to 100+ MWe	<ul style="list-style-type: none"><li>• Very Large Industrial</li><li>• Usually Multiple Smaller Units</li><li>• Custom Engineered Systems</li></ul>
Large	10's of MWe	<ul style="list-style-type: none"><li>• Industrial &amp; Large Commercial</li><li>• Usually Multiple Smaller Units</li><li>• Custom Engineered Systems</li></ul>
Mid	10's of kWe to Several MWe	<ul style="list-style-type: none"><li>• Commercial &amp; Light Industrial</li><li>• Single to Multiple Units</li><li>• Potential Packaged Units</li></ul>
Micro	<60 kWe	<ul style="list-style-type: none"><li>• Small Commercial &amp; Residential</li><li>• Appliance Like</li></ul>

# Typical Commercial CHP System



# Why is There and Opportunity?

- **DOE/EIA Project Over 360 GWe of New Capacity**
  - To Meet Growing Demand
  - To Compensate for Plant Retirements
- **Today's Central Station Plants Lose 23 Quads of Thermal Energy**
- **Aging Electric Transmission/Distribution System**
  - Difficult to Site New Lines
  - Capacity Constrained
  - Costly to Maintain

# Why is There and Opportunity?

- **Rising Concerns Over**
  - **Blackouts/Brownouts**
  - **Power Supply Constraints**
  - **Electricity Prices**
- **Selected Power Outage Costs**

Industry	Avg. Cost of Downtime
Cellular Communications	\$41,000 per hour
Telephone Ticket Sales	\$72,000 per hour
Airline Reservations	\$90,000 per hour
Credit Card Operations	\$2,580,000 per hour
Brokerage Operations	\$6,480,000 per hour

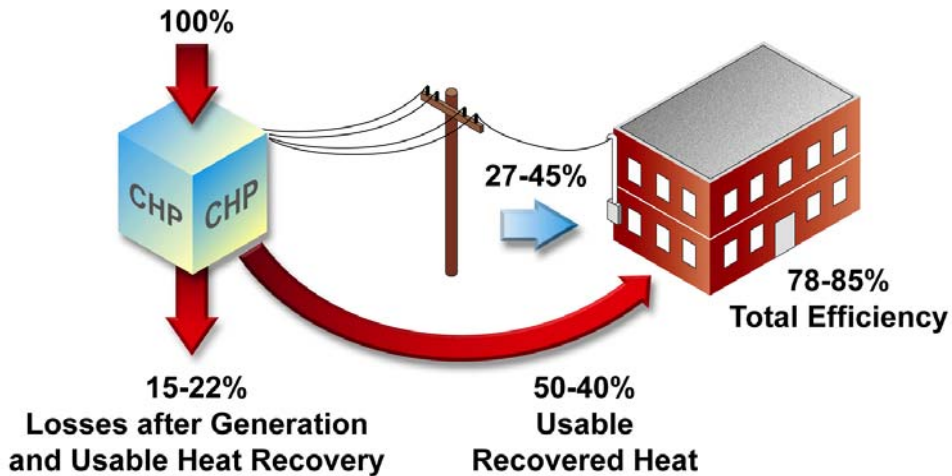
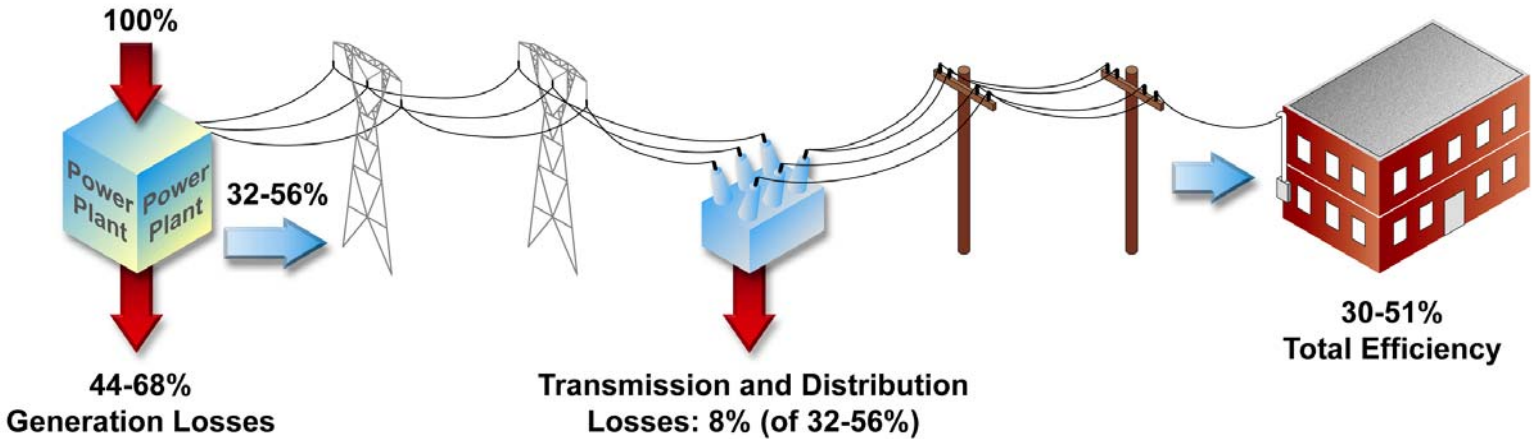
# Benefits of CHP

## *High Efficiency, On-Site Generation Means ...*

- Improved Reliability
- Lower Energy Costs
- Better Power Quality
- Lower Emissions (including CO<sub>2</sub>)
- Conserve Natural Resources
- Support Grid Infrastructure
  - Fewer T&D Constraints
  - Defer Costly Grid Upgrades
  - Price Stability
- Facilitates Deployment of New Clean Energy Technologies
- Enhances Competition



# How CHP Saves Energy



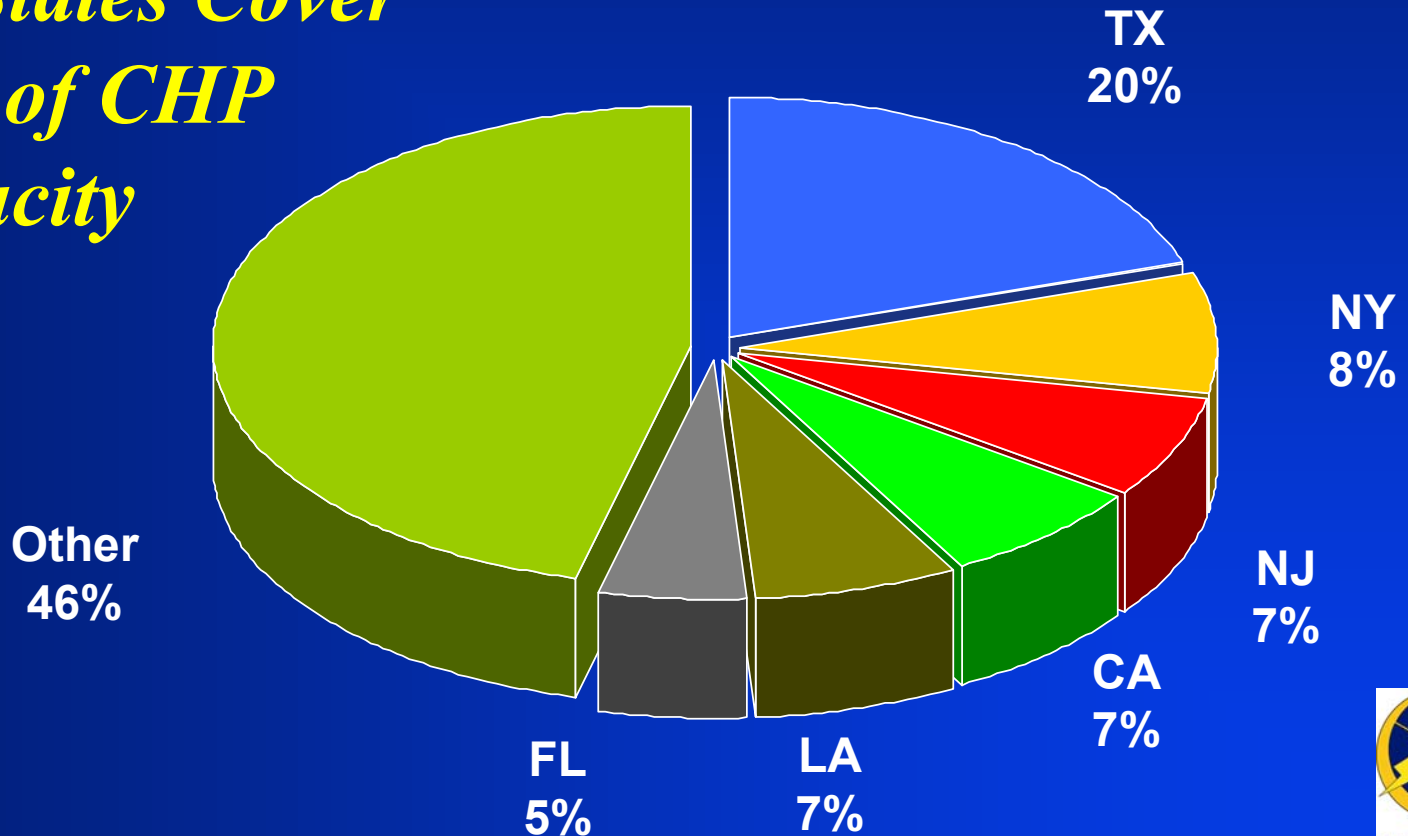
# Key Factors for CHP Attractiveness

- **Coincident Needs for Power & Thermal Energy**
- **Cost of Buying Electric Power from the Grid Relative to the Cost of Natural Gas**  
*a.k.a “Spark Spread”*
- **Installed Cost Differential Between a Conventional and a CHP System**

# Existing Industrial CHP

## 45.5 GW

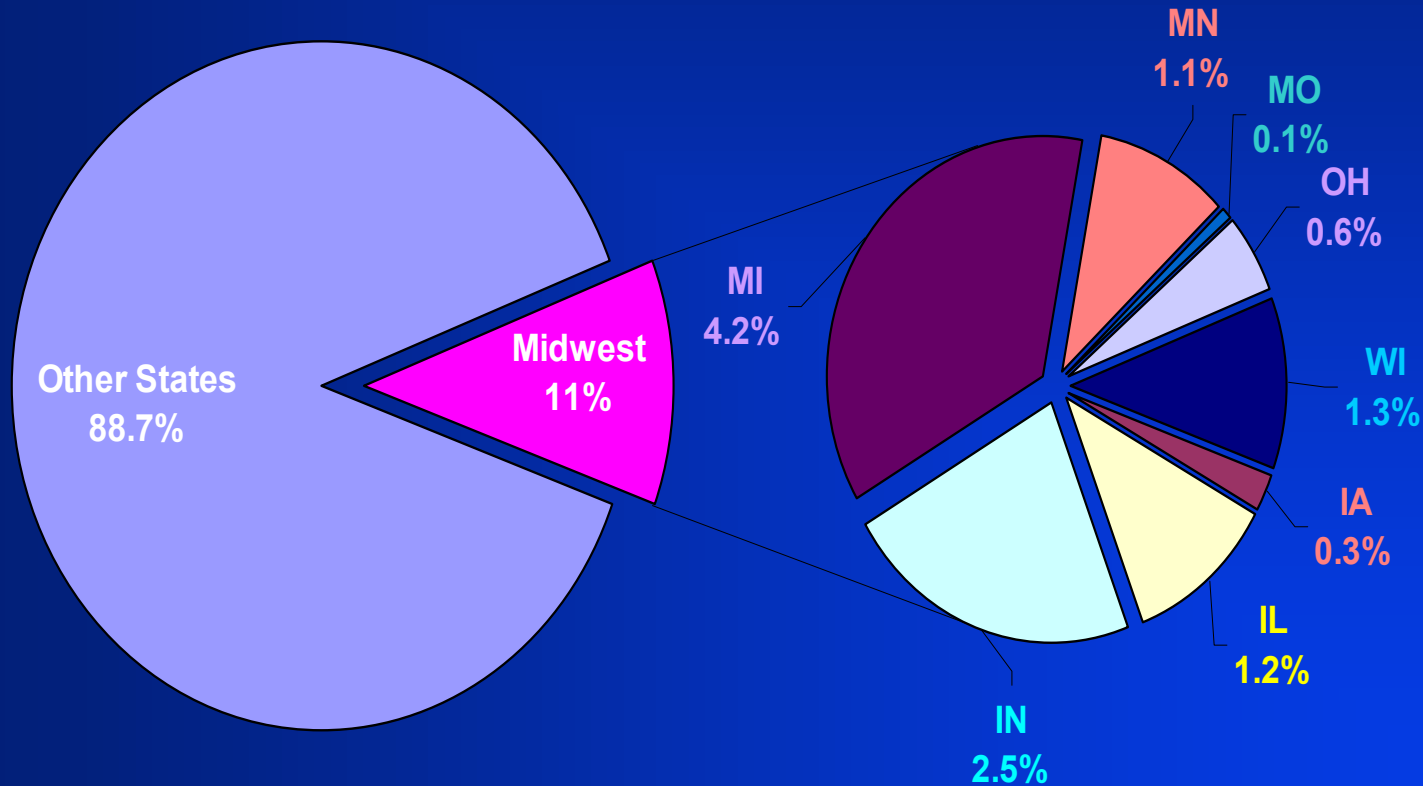
*Six States Cover  
54% of CHP  
Capacity*



# Existing Industrial CHP (Midwest)

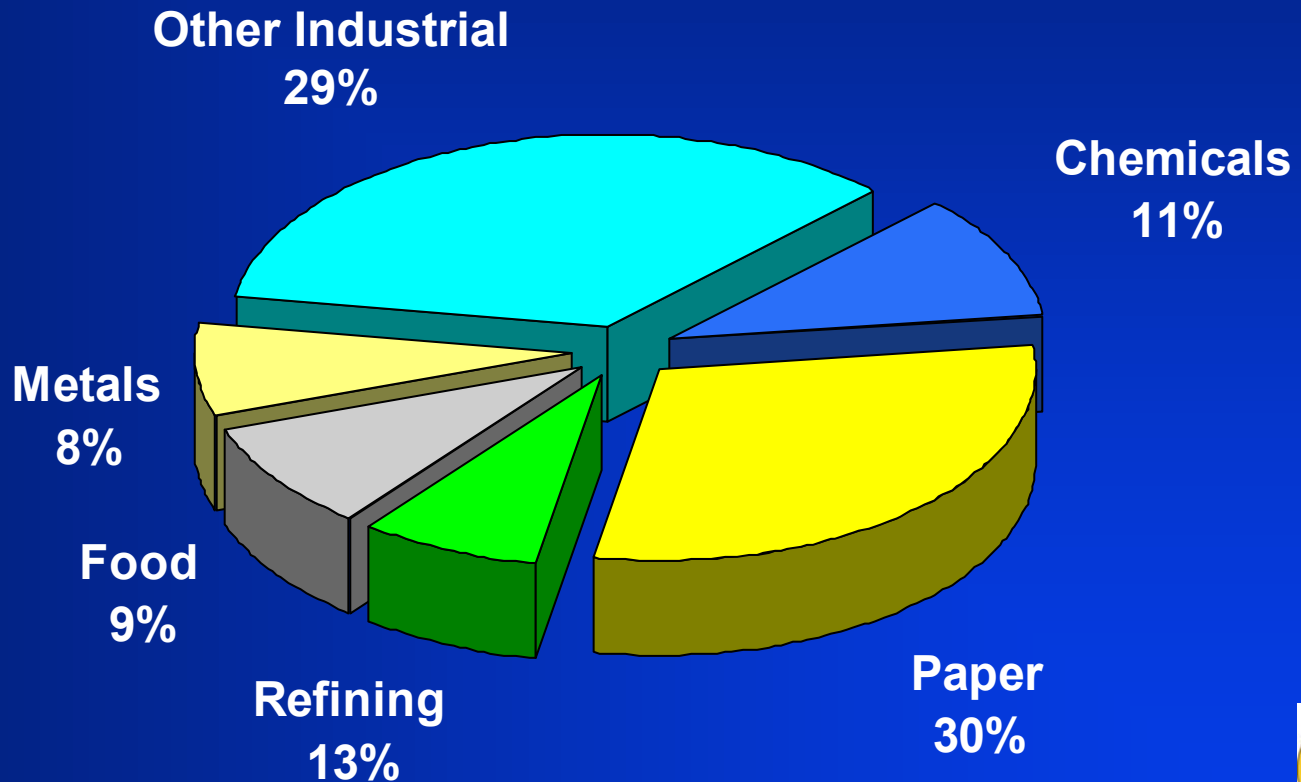
**5.2 GW**

11.3% of Total U.S.  
Installed – 45.5 GW



# Potential for Industrial CHP is Large

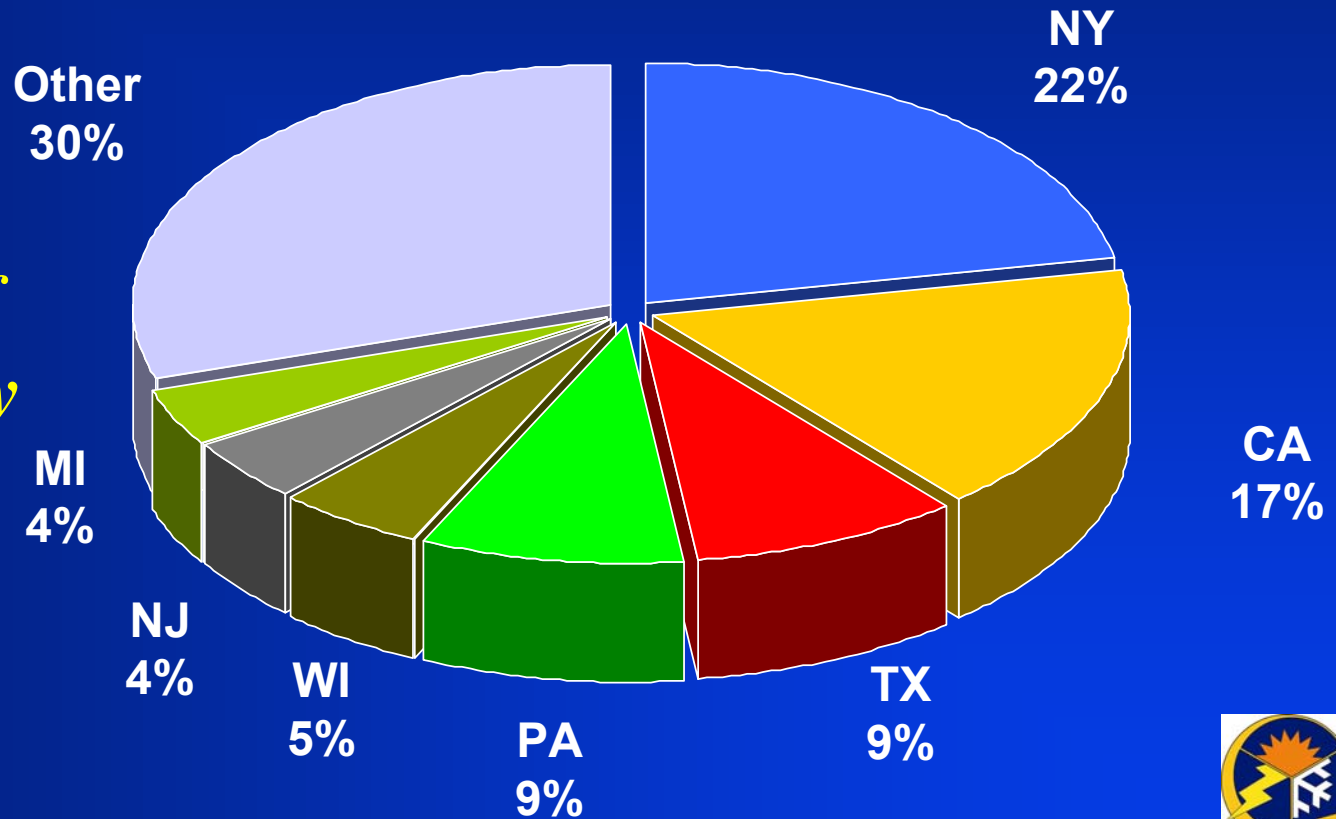
Estimated CHP Potential: 88 GW



# Existing Commercial CHP

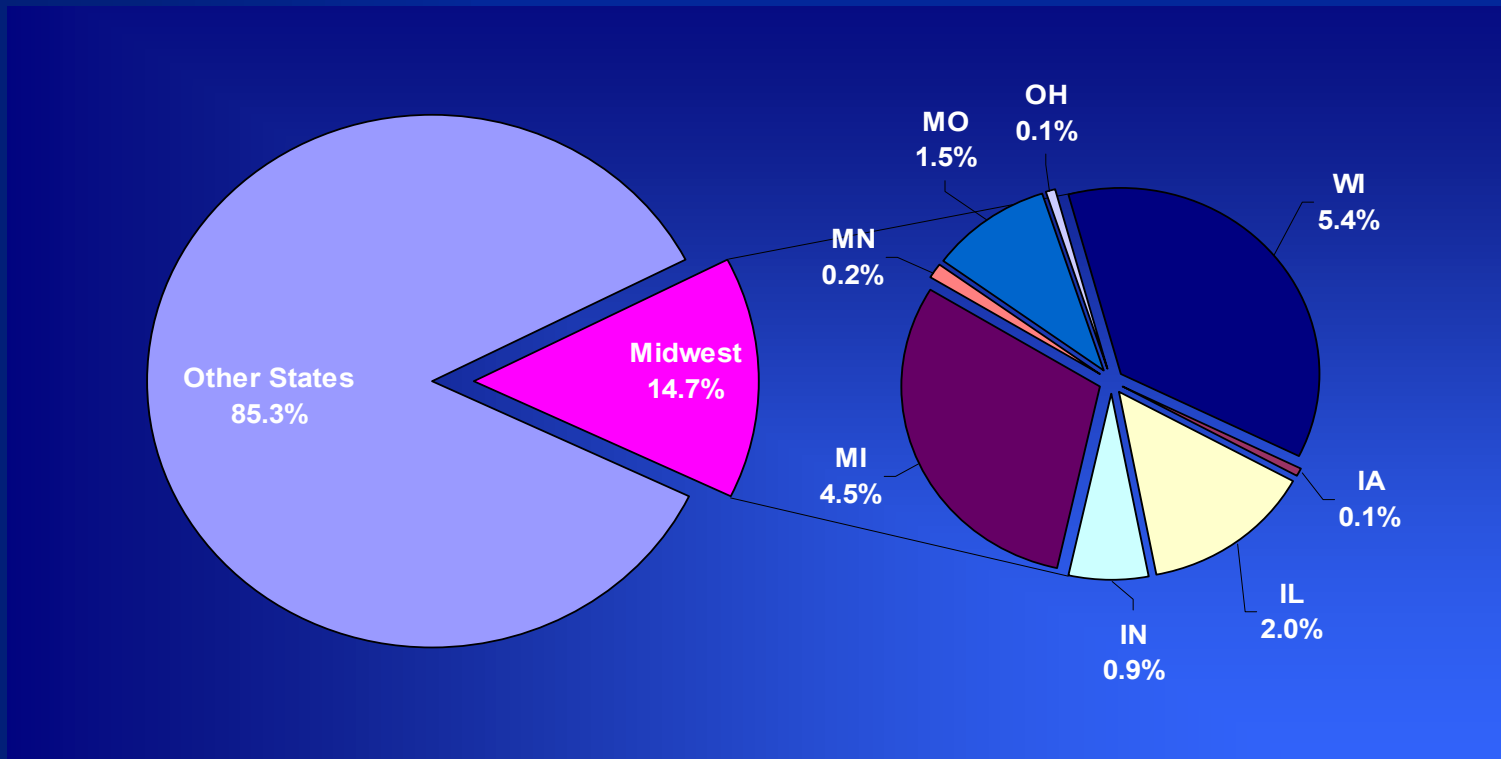
**Existing Commercial CHP Capacity: 4.93 GW**

***Seven States  
Cover 70% of  
CHP Capacity***



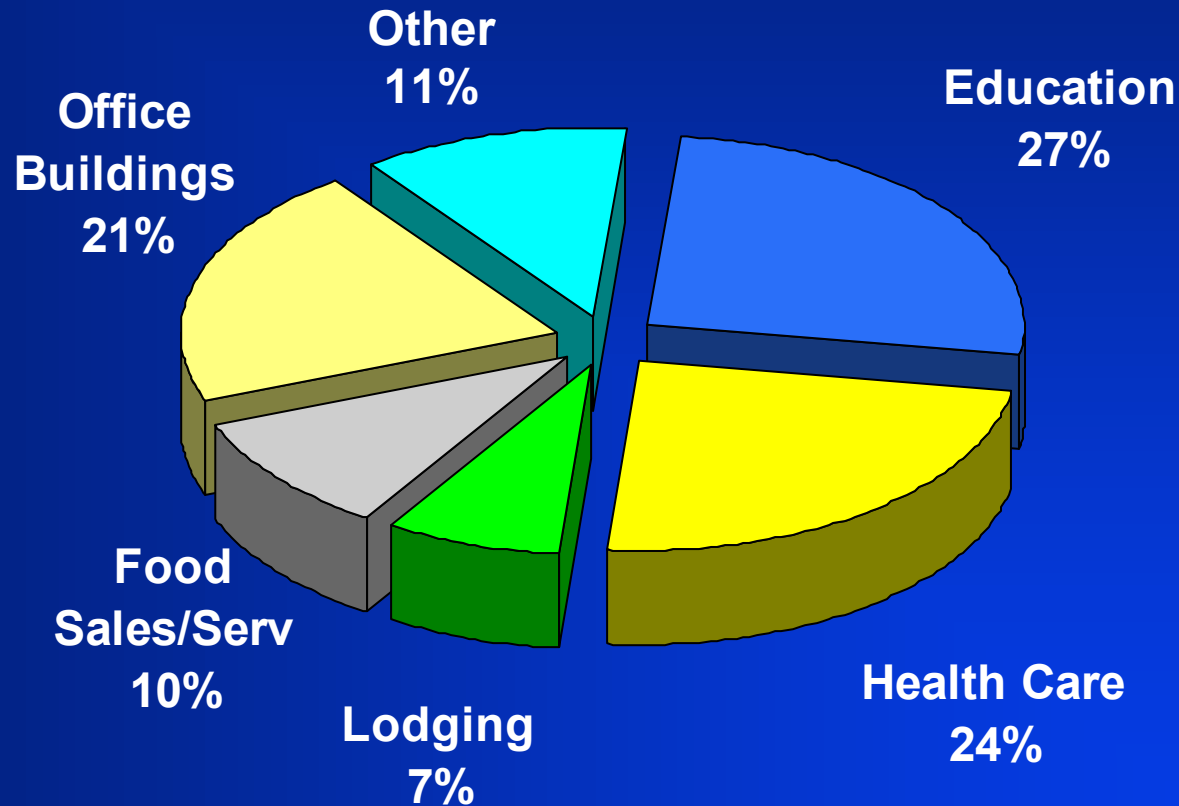
# Existing Commercial CHP (Midwest)

**.7 GW** (14.7% of Total U.S. Installed – 4.93 GW)



# Potential for Commercial CHP is Large

**Estimated CHP Potential: 75 GW**





# Top 10 Impediments to CHP

## 6. Assigning CHP Value

*Hard to Identify, Quantify, and Allocate Among Parties*

## 7. Stakeholder Confusion

*Unfamiliarity and Uncertainty with CHP (System and Benefits)*

## 8. High First Cost

*Discourages Investment Despite Life Cycle Benefits*

## 9. Electric Restructuring

*Creates Uncertainty and a “Wait and See” Attitude*

## 10. Few Case Studies

*Inconsistent and Hard to Find*

# Top 10 Impediments to CHP

## 1. Interconnection

*Inconsistent Standards, Complex Process, and Unpredictable or High Costs*

## 2. Utility Tariffs

*Stranded Costs, Exit Fess, Standby Charges, and General Rate Design*

## 3. Interconnect Technology

*Sometimes Poorly Understood, Inadequate, or Costly*

## 4. Lack of Familiarity

*With CHP Technologies, Concepts, and Environmental Benefits*

## 5. Permitting Process

*Sometimes Long, Cumbersome, and Costly*



Sources: John Nimmons & Associates and DPCA 1999 Survey



# Misconceptions

- **Poor/Middle Class Will Pay More as Customers “Unplug”**
  - **Shoulder Larger Share of T&D Costs and Other Stranded Assets**
- **Loss of Grid Sales**
- **Distributed Energy Will Displace New Low Emissions Central Station Generation**
  - **Increase Emissions in Urban Areas**

# Communications Needed

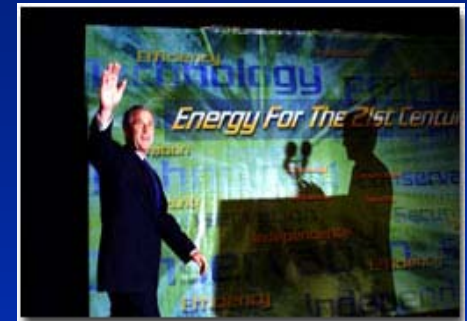
- **Important Role in Moderating Prices**
  - **Reduce Peak Loads in Critical Areas**
    - » **Reduces Grid Infrastructure Costs**
  - **Increasing Supply to Reduce Growth**
    - » **CHP at Best Could Displaced 10% to 15% of the Projected Growth**
  - **Meets Energy Needs at a Lower Cost**
    - » **Provides Part of Electricity Needs**
    - » **Better Utilizes Waste Heat**
    - » **Increases Overall Efficiency**

# Communication Needs

- **Decrease Grid Costs**
  - Improved Grid Utilization
  - Peak Shaving
- **Diversify Supply**
- **Positive Impact on Emissions**
  - Lower  $\text{No}_x$ ,  $\text{CO}_2$ ,  $\text{SO}_2$ 
    - » Over Most States Current Generation Mix
  - Excludes Diesel Fueled Generators

# National CHP/DR Commitments

- **National Energy Policy**
  - Enact an Investment Tax Credit
  - Promote Use of CHP – Especially in Brownfields
  - Energy Legislation to Remove Barriers
  - Permitting to Reward Efficiency Gains
- **U.S. DOE CHP Challenge**
  - Double National CHP to 92 GW by 2010
- **U.S. EPA CHP Partnership**
  - Grown From 18 to Over 100 Partners in First Year
  - Members: States, Municipalities, Industries, Utilities, Universities, Institutions, Suppliers, etc.



# CHP Is A Triple Win

- **Saves Money** --- **End User**
- **Energy Efficiency and Cleaner Environment** --- **Government**
- **Provides Business Opportunity** --- **Industry**