# Natural Gas Use in Distributed Generation

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# What is Distributed Generation?

- Small scale generation resources
  - less than 25 MW
- Located at or close to the load
  - Customer
  - Utility
  - Third party
- Retail market play

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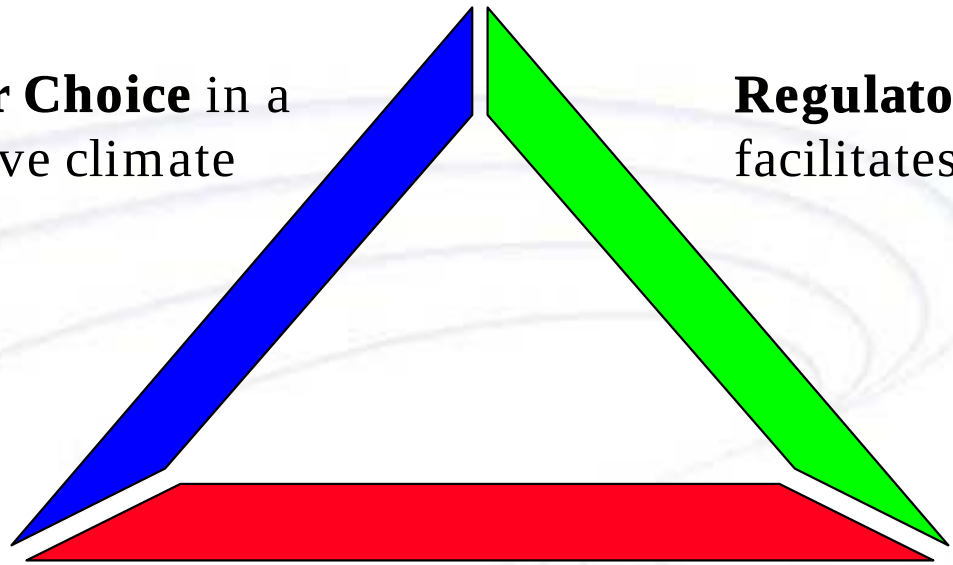
# The New Energy Market

**Customer Choice** in a competitive climate

**Regulatory Change** facilitates competition



**Product Portfolio** enables customer & provider choices

*The basis of the new business is providing value with customer-focused solutions*

# Why the Interest in On-site Power?

- Restructuring is opening access to the electric grid system
- Customers have greater awareness of energy costs and options
- Technology improvements enhancing performance & economics
- ESCOs & ESPs opening path to market
- Federal and state government taking action

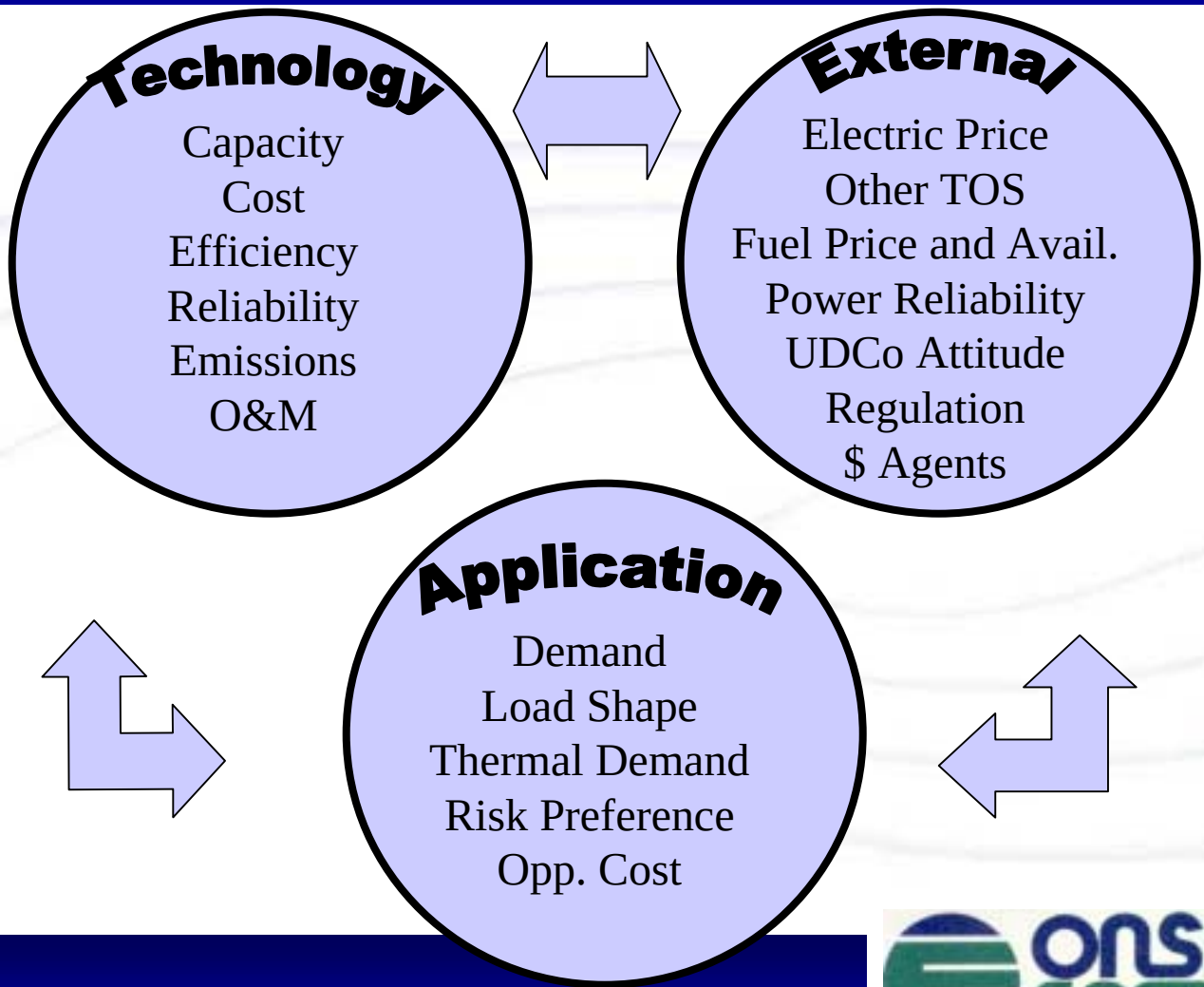
# Opportunities for Wide Range of Stakeholders

- Customers
  - Productivity
  - Energy cost
  - Reliability
  - Flexibility
- Electric Utilities
  - Deferral of T&D investments
  - Grid Management
  - Customer retention
- Gas Companies
  - New load
  - Load management
  - New energy service
- Local Governments
  - Attract new manufacturing and other businesses
  - Maintain competitiveness

# Policy Maker Interest

- Increased energy efficiency
- Reduced environmental impact
- Climate change mitigation (CHP)
- Improved reliability of the grid
- Lower energy costs
- Customer choice

# Building an Economic Model



# Technology Options

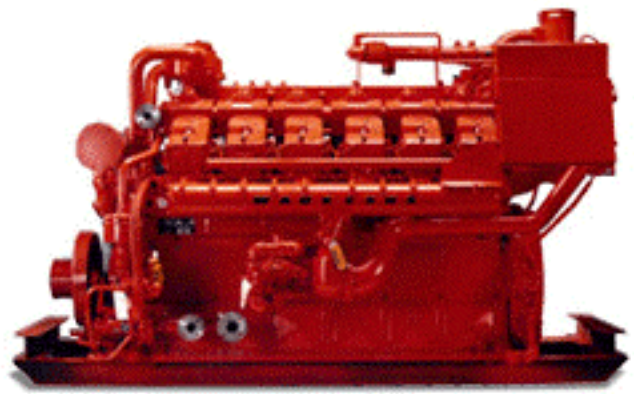
| | *Status* | *Size* | *Efficiency (%)* | *Installed Costs ($/kW)* | *O&M Costs ($/kWh)* |
|---|---|---|---|---|---|
| **Reciprocating Engine** | Commercial | 30 kW - 20 MW | 30 - 38 | 500 - 1400 | 0.007-0.02 |
| **Combustion Turbine** | Commercial | 500 kW - 150 MW | 25 - 40 | 600 -900 | 0.003-0.008 |
| **Microturbines** | Commercial | 25 kW - 300 kW | 20 - 30 | 600 - 1000 | 0.003-0.01 |
| **Fuel Cells** | 1996 - 2010 | 3kW - 3MW | 36 - 60+ | 1900 - 3500 | 0.005-0.010 |

# Small Gas Turbines

- Size range: 500 - 20,000 kW
- Electric  efficiency (25-40%)

# Reciprocating Engines

- Size Range: 30 - 6,000 kW
- Electric efficiency: 30 - 38%



# Microturbines

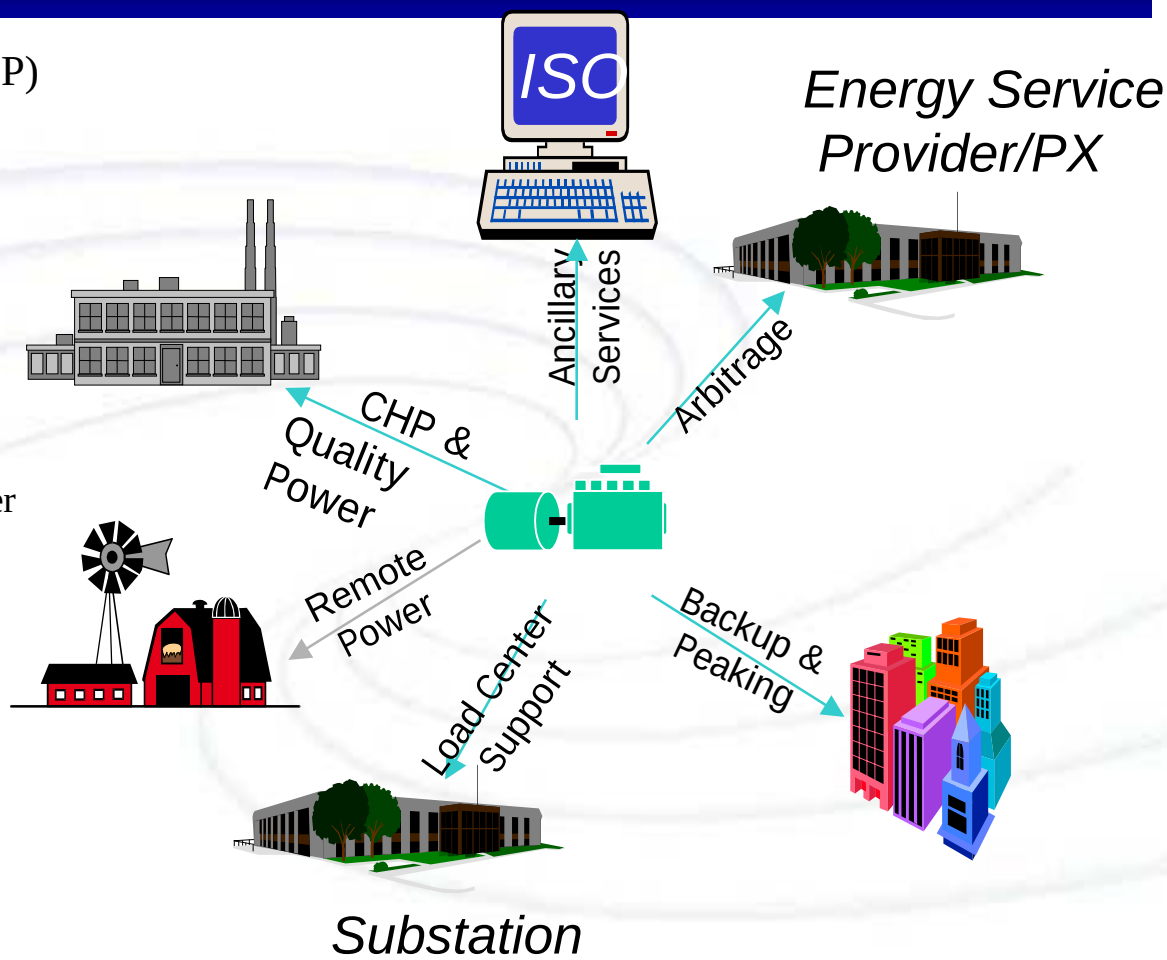
- Size range: 25 - 300 kW
- Electric efficiency: 20 - 30%

# Fuel Cells

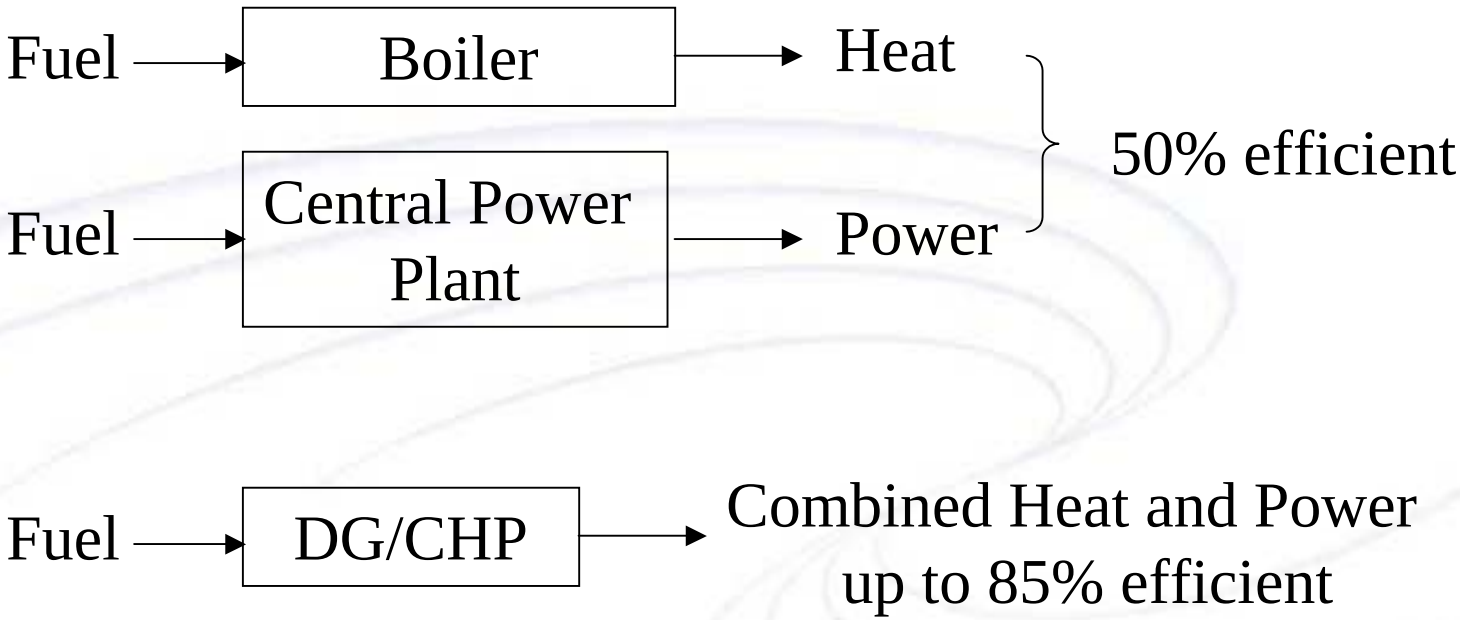
- Size range:  3 - 3,000 kW
- Electric efficiency: 40-70%
- Residential units promised for 2003

# DG Applications

- Combined Heat and Power (CHP)
  - Established market, with renewed interest
- Peakshaving and Peak Sharing
  - Potential growth market
- Premium Power
  - Ultra-high reliability and power quality
- Standby
  - Currently a diesel market
- Mechanical Drive
  - Chillers, refrigeration, air compressors



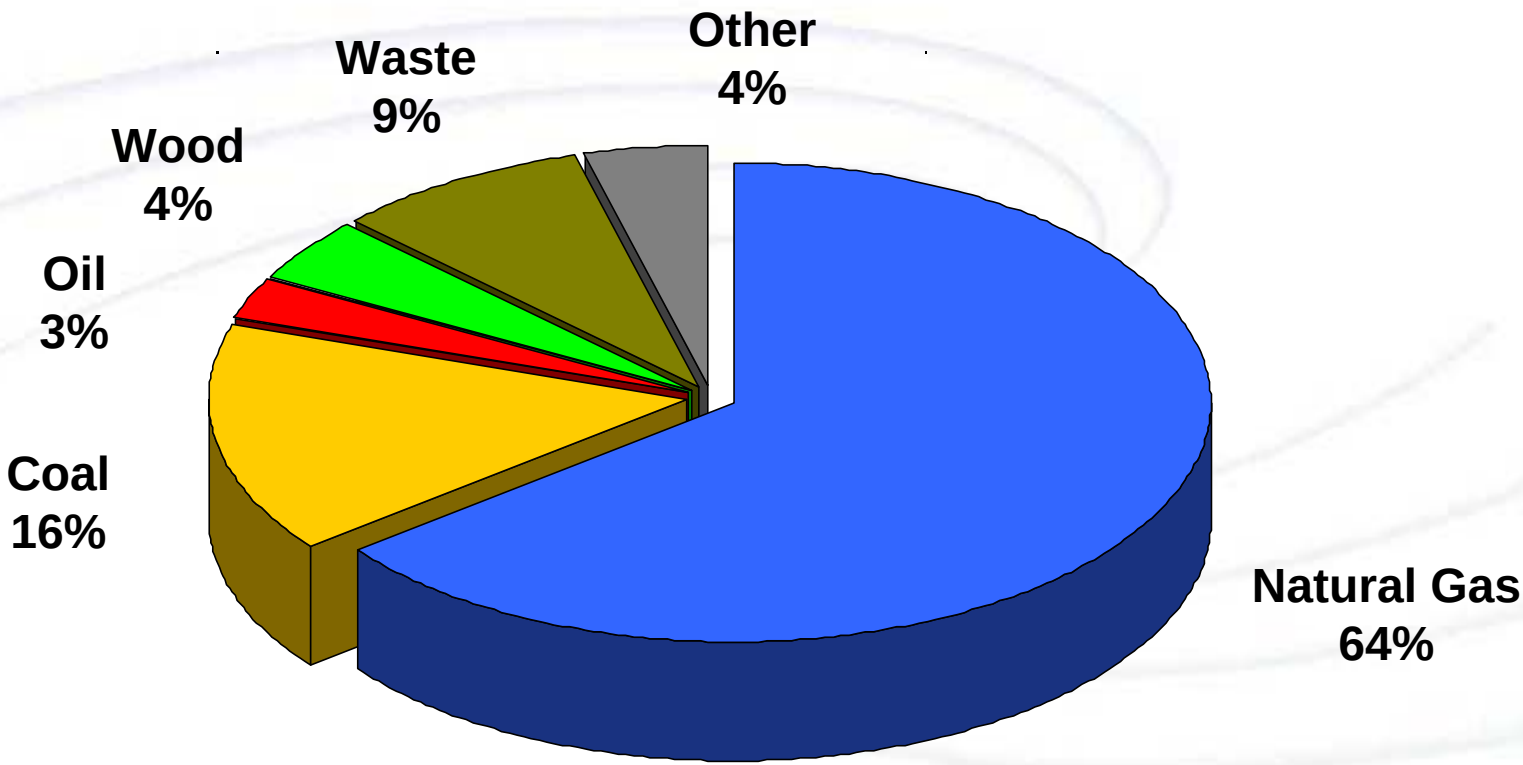
# CHP Efficiency Advantage




CHP systems sequentially produce electricity, thermal or mechanical energy. Sites have coincident thermal demands. Thermal energy is typically LP/HP steam, hot water. CHP boasts energy utilization efficiencies up to 85%

# Natural Gas Is the Preferred Fuel for CHP

- **Existing CHP Capacity: 52.8 GW**




*Source: Hagler Bailly, OSEC*

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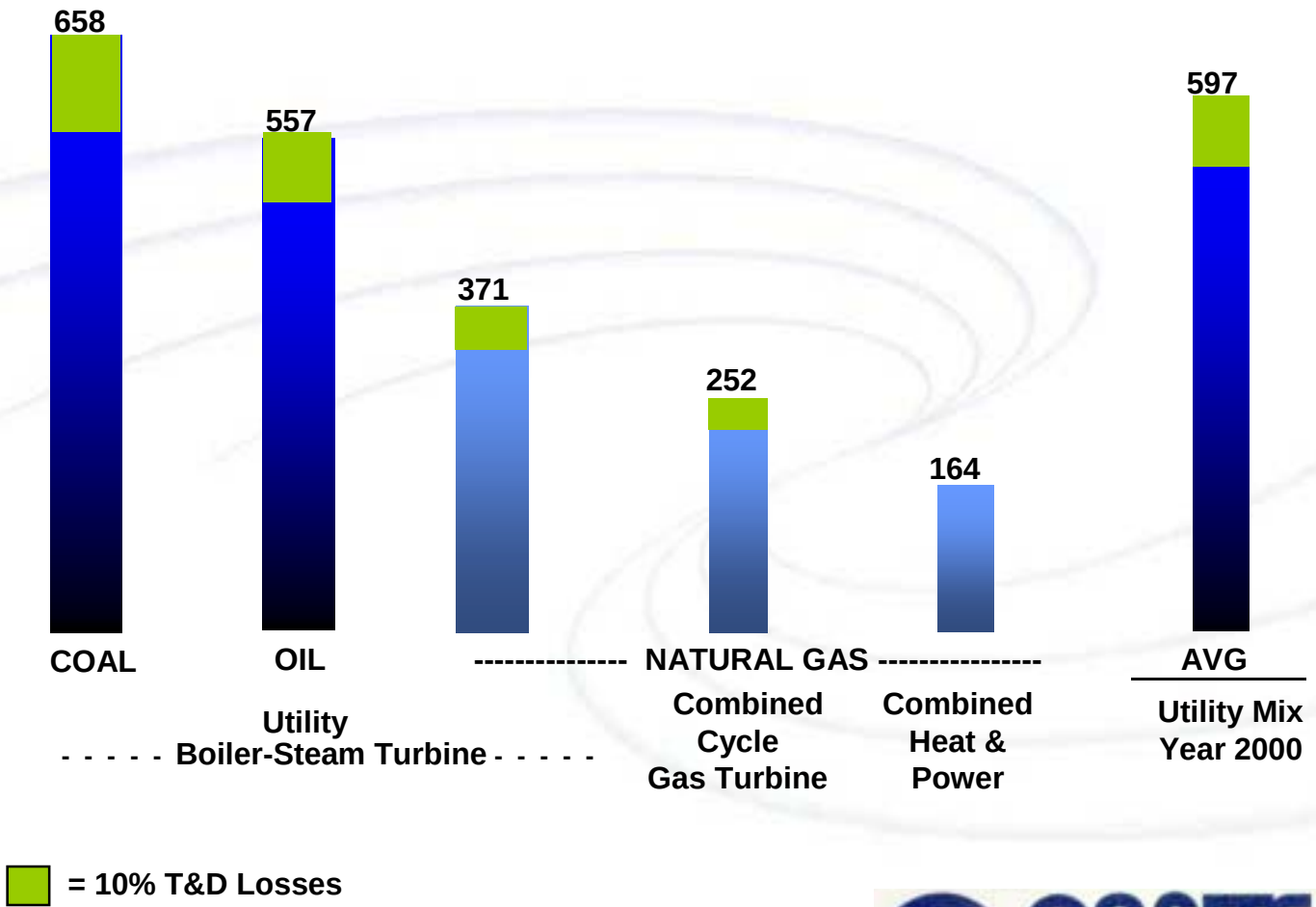
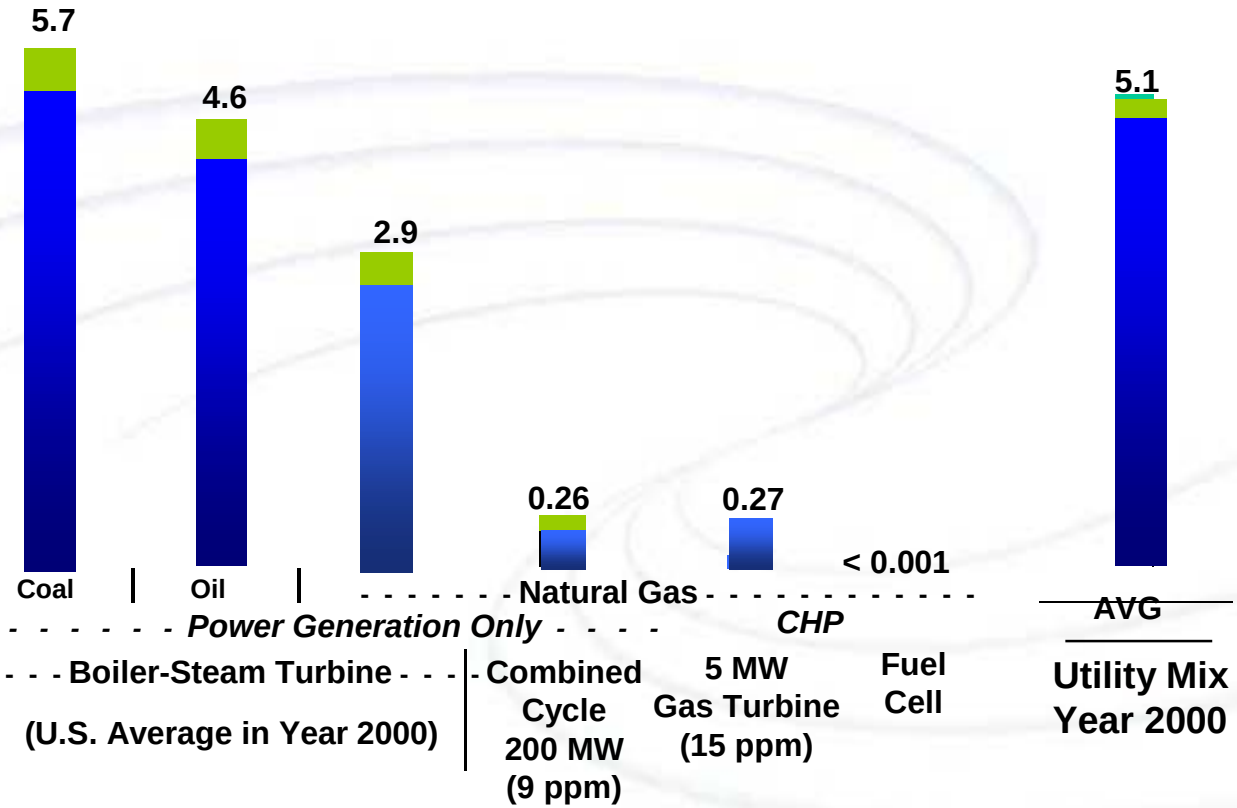
# Global Warming Implications of CHP
## (lb/MWh of Carbon Equivalent)



# $NO_X$ Implications of CHP
## (lb/MWh of $NO_X$)



# DG Urban Profile – INGAA Foundation

- Need for New Capacity
  - Residential Growth
  - "New Economy" Industrial and Commercial Markets
- Constrained Power Delivery System
  - DOE POST Report highlights Reliability Concerns
- Environmental/Air Quality Environment

# DG Urban Profile – INGAA Foundation

- Electric Rate Structures Favorable to DG
  - Standby and Backup
  - Applicability of  Competitive Transition Charges
  - Clear Price Signals to Customers
- Availability of Natural Gas
- Regulatory Incentives
  - PBR
  - Recognition of all DG Value Streams

# DG Urban Profile – INGAA Foundation: Potential Emissions Reduction[1]

| | Chicago, Illinois | Austin, Texas |
|---|---|---|
| **Potential $NO_x$ Reduction** (Thousand tons per year) | 12.7-31.2 | 1.7-2.9 |
| **Potential $SO_2$ Reduction** (Thousand tons per year) | 49.5-127.1 | 3.4-5.5 |
| **Potential $CO_2$ Reduction** (Thousand tons per year) | 73.0-5,580.0 | 246.0-1,069.0 |

[1]Emissions reductions are relative to statewide existing utility power generation capacity. Assumed T&D losses are 5% for baseload and 10% and 7% during peak for Chicago and Austin respectively.

*Emissions reductions are maximized through the utilization of combined heat and power (CHP)*

# DG Offers Value for Growth Industries

- New Demand for Power from “Internet Economy”
- Current Power Grid may not Provide Power Needs of the new Internet-Based Economy
  - E-procurement, web-based enterprises and other IT industries require 99.9999% power reliability
  - “Growth in internet-quality power is expected to account for 40% of the increase in total US power demand by 2010” - BOA Securities

# GTI 2000 Baseline Projection: DG Capacity (MW)

| | 1998 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| **Industrial Cogeneration (<25 MW)** | 5,430 | 5,837 | 7,609 | 8,684 | 9,369 |
| **Industrial Electric Generation** | 13,031 | 14,230 | 17,017 | 19,783 | 23,018 |
| **Commercial Cogeneration (<25 MW)** | 1,474 | 1,615 | 2,205 | 3,162 | 4,315 |
| **Commercial Electric Generation** | 7,398 | 7,818 | 9,107 | 10,961 | 14,040 |
| **Other DG** | 7 | 24 | 707 | 2,620 | 5,616 |
| **TOTALS** | 27,340 | 29,524 | 36,645 | 45,210 | 56,358 |
| **GAS DEMAND (Trillion Btu)** | 1166.5 | 1207.1 | 1353.0 | 1553.8 | 1878.0 |

# Environmental Regulatory/Permitting Issues

- Requirements differ from region to region
- Time-consuming permit process
- Lack of technology information and universally accepted standards
- Emission standards can be a moving target

*The overall environmental benefits of natural gas-fueled DG are generally recognized, but at the same time individual units must be deployed under a permitting process that places economic burdens on DG and threatens to depress market opportunities*

# Barriers and Challenges to DG

- Deferral rates and practices by utilities
- High standby/back-up power costs
- Overly strict interconnect requirements
- Stranded Cost recovery on kWh generated
- Environmental benefits not recognized in permitting process
- Siting and permitting delays/uncertainties
- Non-core customer investment – this may change

# Conclusions

- Market Conditions and Trends Favor DG
  - Technologies,  Customer Choice, Energy Costs
  - Environmental Fundamentals
- ESCOs & ESPs Providing Alternative Paths to Market
- Federal and State Initiatives Beginning to Recognize DG Benefits and Addressing Barriers
- Current Electric Utility Resistance and Regulatory Roadblocks Hinder Widespread Implementation
- Niche Markets & Applications Evolving Around Specific DG Features
- Once Enabling Market Drivers Adequately Evolve, DG Implementation will be Robust

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