

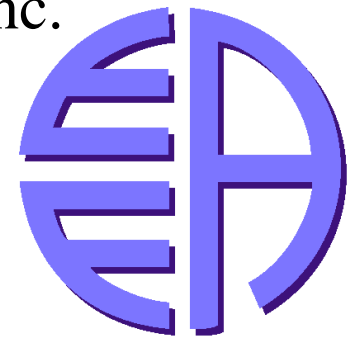
*Multi-Family Housing:
An Underserved Market for Combined Heat and Power*



The Potential for Combined Heat and Power (CHP)

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Combined Heat and Power

- CHP is an *integrated system* that:
 - ✓ Is located at or near the building or factory
 - ✓ Generates electrical and/or mechanical power
 - ✓ Recovers waste heat for heating, cooling or dehumidification
 - ✓ Improves total system efficiency
 - ✓ Can utilize a variety of technologies and fuels



Advantages of CHP

- CHP is more efficient than separate generation of electricity and heat.
- Higher efficiency translates to lower operating cost, (but requires capital investment).
- On-site electric generation reduces grid congestion and avoids distribution costs.
- Higher efficiency reduces emissions of all pollutants.
- Increased reliability and power quality can also add significant value.



CHP Systems

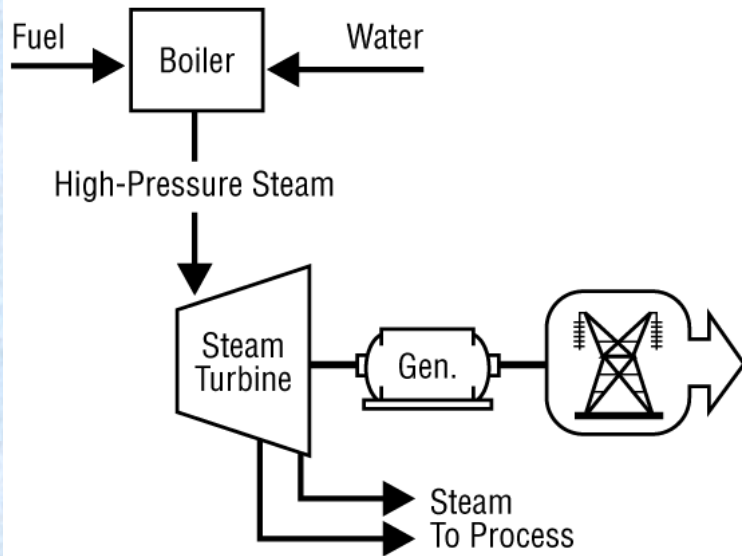
CHP systems include 2 or 3 basic pieces of equipment:

- Electrical generator
 - ✓ Reciprocating engines
 - ✓ Gas turbines
 - ✓ Steam turbine
 - ✓ Fuel cells
- Heat recovery – steam, hot water
- Thermally activated technologies (if cooling, space conditioning, or dehumidification is needed)

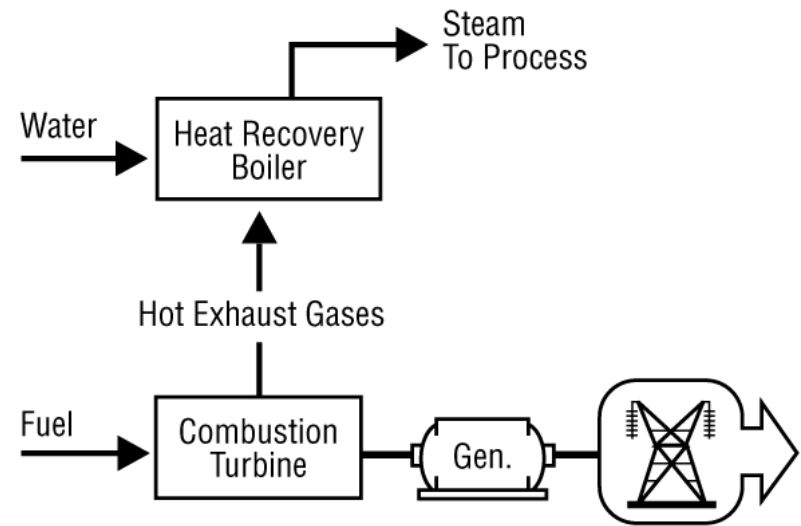


Typical CHP Systems

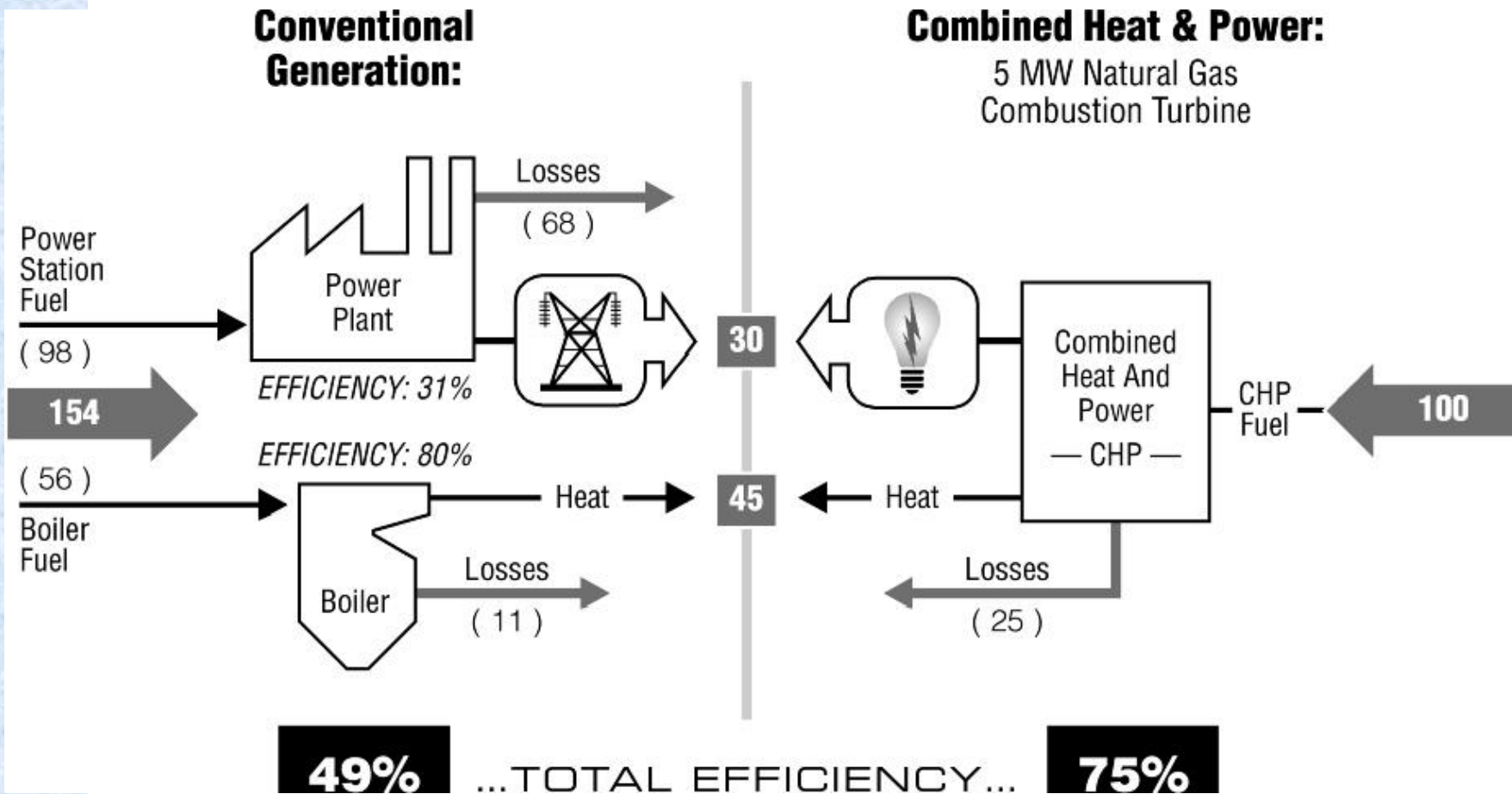
Steam Boiler/Steam Turbine:



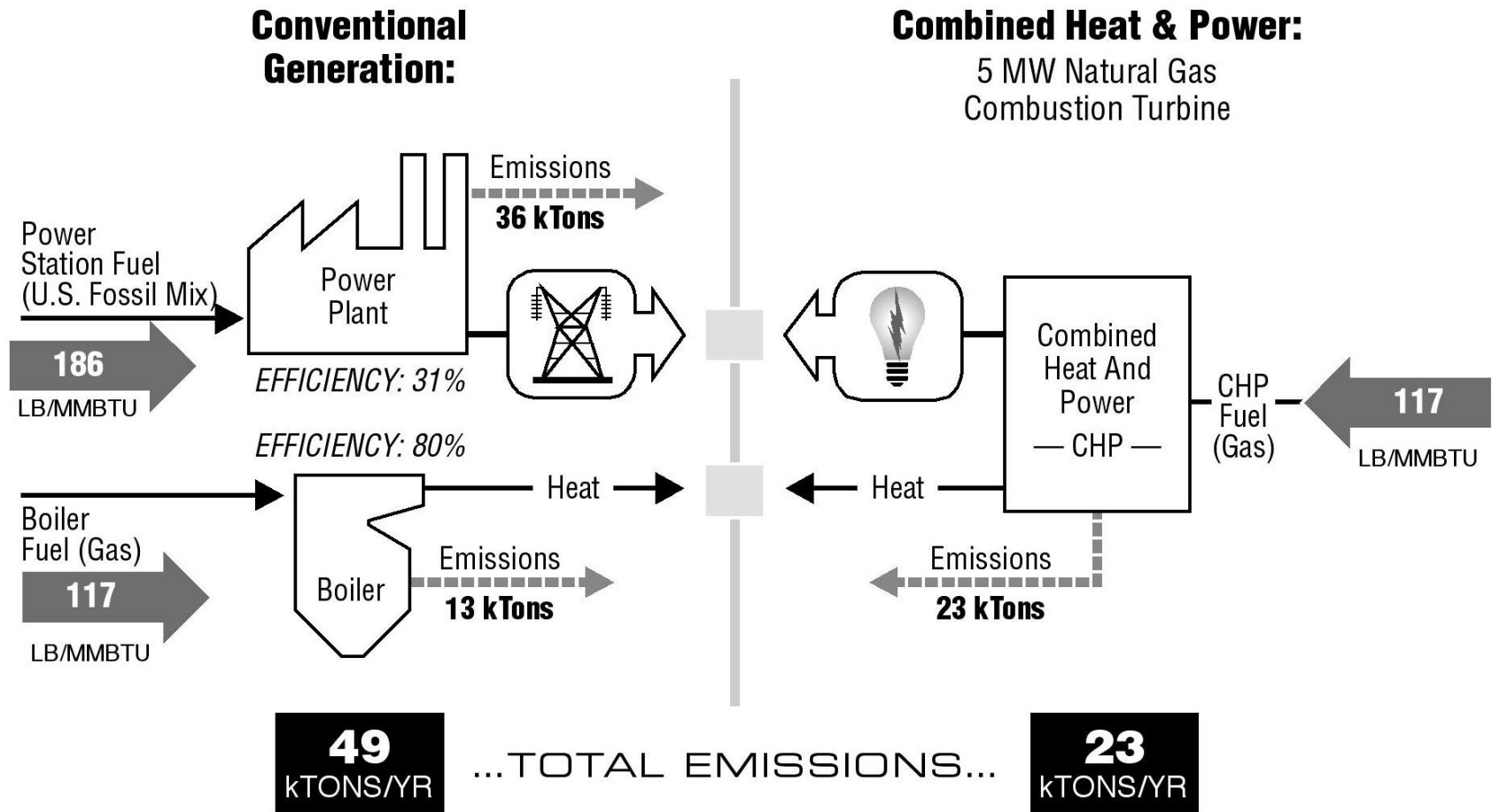
Gas Turbine or Engine/Heat Recovery Unit:



Efficiency Advantages of CHP

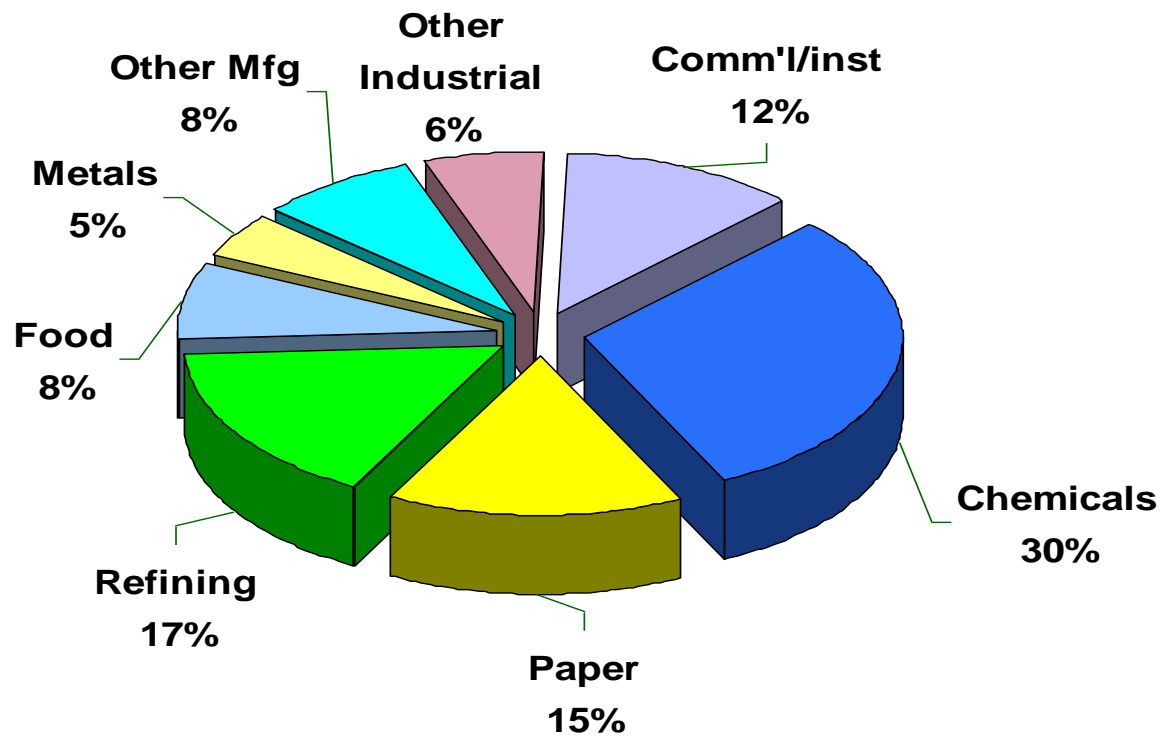


Environmental Benefits of CHP- CO2



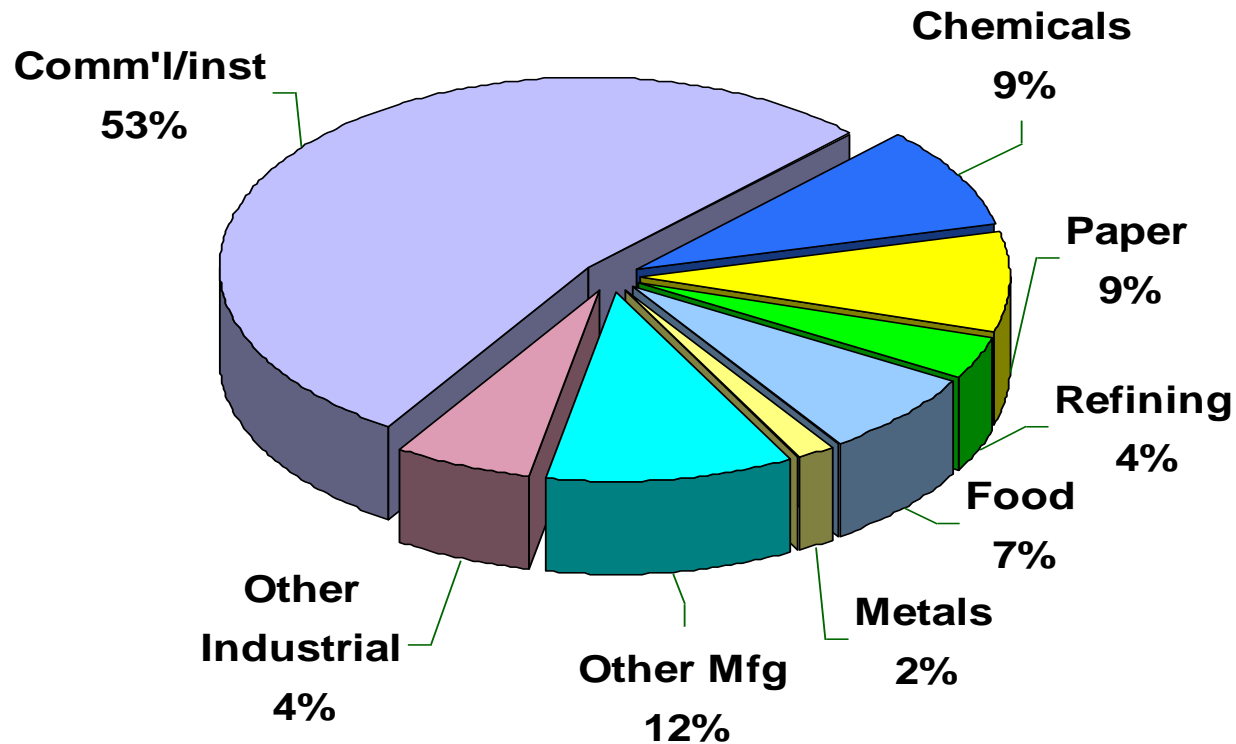
Existing CHP Capacity is 8% of total electric generating capacity in the United States

- Existing CHP Capacity (2005) = 82,400 MW



CHP Is Used in a Wide Variety of Applications

- Existing CHP Capacity (2005): 2,960 sites

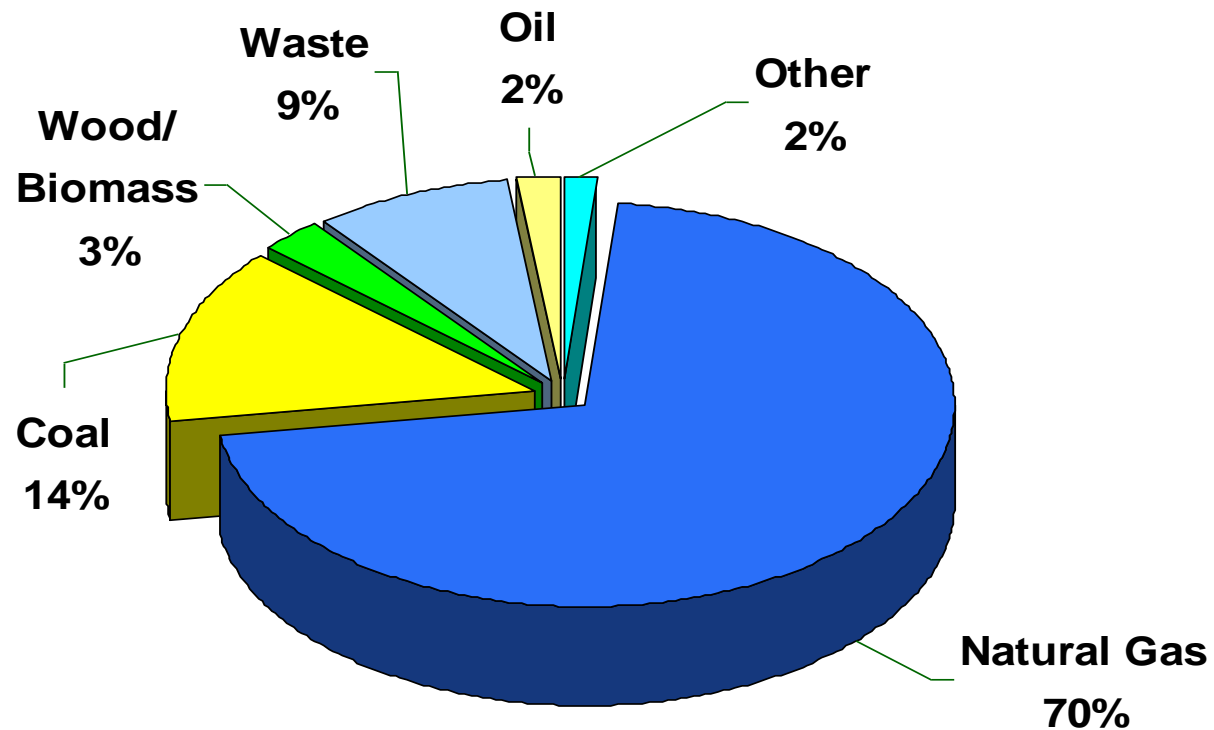


Source: EEA



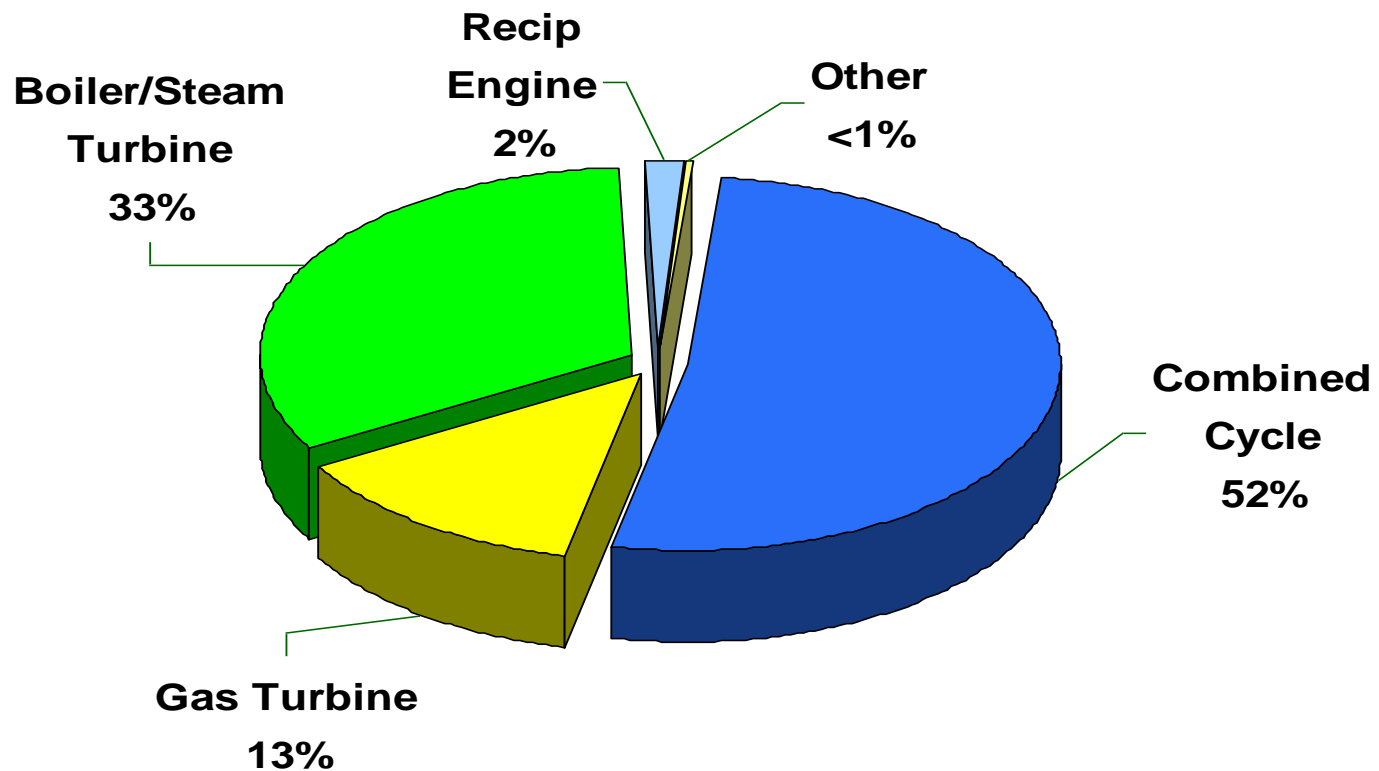
CHP Uses a Wide Range of Fuels

- *Existing CHP Capacity (2005): 82,400 MW*



....And a Wide Range of Technologies

- *Existing CHP Capacity (2005): 82,400 MW*



Source: EEA



Current CHP Profile

- 82,400 MW at 2,960 sites
- Average capacity is 28 MW
- Median capacity is 2.2 MW
- Two thirds of installed capacity is in systems greater than 100 MW
- Existing CHP saves over 3 quads of fuel each year
- Existing CHP eliminates over 200 million tons of CO₂ emissions each year



Existing CHP in MultiFamily Applications

- Apartment Buildings
 - ✓ 150 sites, 70.4 MW capacity
 - ✓ Recip engines, microturbines and boiler/steam turbines
- Nursing Homes/Assisted Living
 - ✓ 129 sites, 24.1 MW Capacity
 - ✓ Recip engines, microturbines and boiler/steam turbines



Potential for Additional CHP in Apartments

CHP System Size	150 kW	500 kW	1,500 kW
Apartments/Building	100 - 200	200 - 500	> 500 (avg 875)
Number of Buildings			
Private*	19,804	12,084	1,030
Public**	<u>2,322</u>	<u>1,100</u>	<u>95</u>
Total	22,126	13,184	1,125
CHP Potential	3,320 MW	6,590 MW	1,690 MW

Total Potential

11,600 MW

* National Multi Housing Council data for 2003

** Housing and Urban Development report, CHP for Multifamily Housing, April 2005



Potential for Additional CHP in Nursing Homes

CHP System Size	100 kW	500 kW	1,500 kW
Nursing Homes	5,800	4,800	565
CHP Potential	580 MW	2,400 MW	850 MW

Total Potential

3,800 MW

Source: EEA estimates



Constraints on Realizing the Full Potential

- Need centralized hot water systems
- Centralized space heating and cooling further helps
- Centralized electric metering can be a plus
- Access to fuels
- Numerous site conditions
- Institutional and market barriers to CHP



Realizing the Full Potential for CHP will Depend on Changes.....

- To regulatory treatment,
- To rate design and grid interconnect,
- To CHP technology cost and performance, and
- To user attitudes



If You Need Additional Information

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