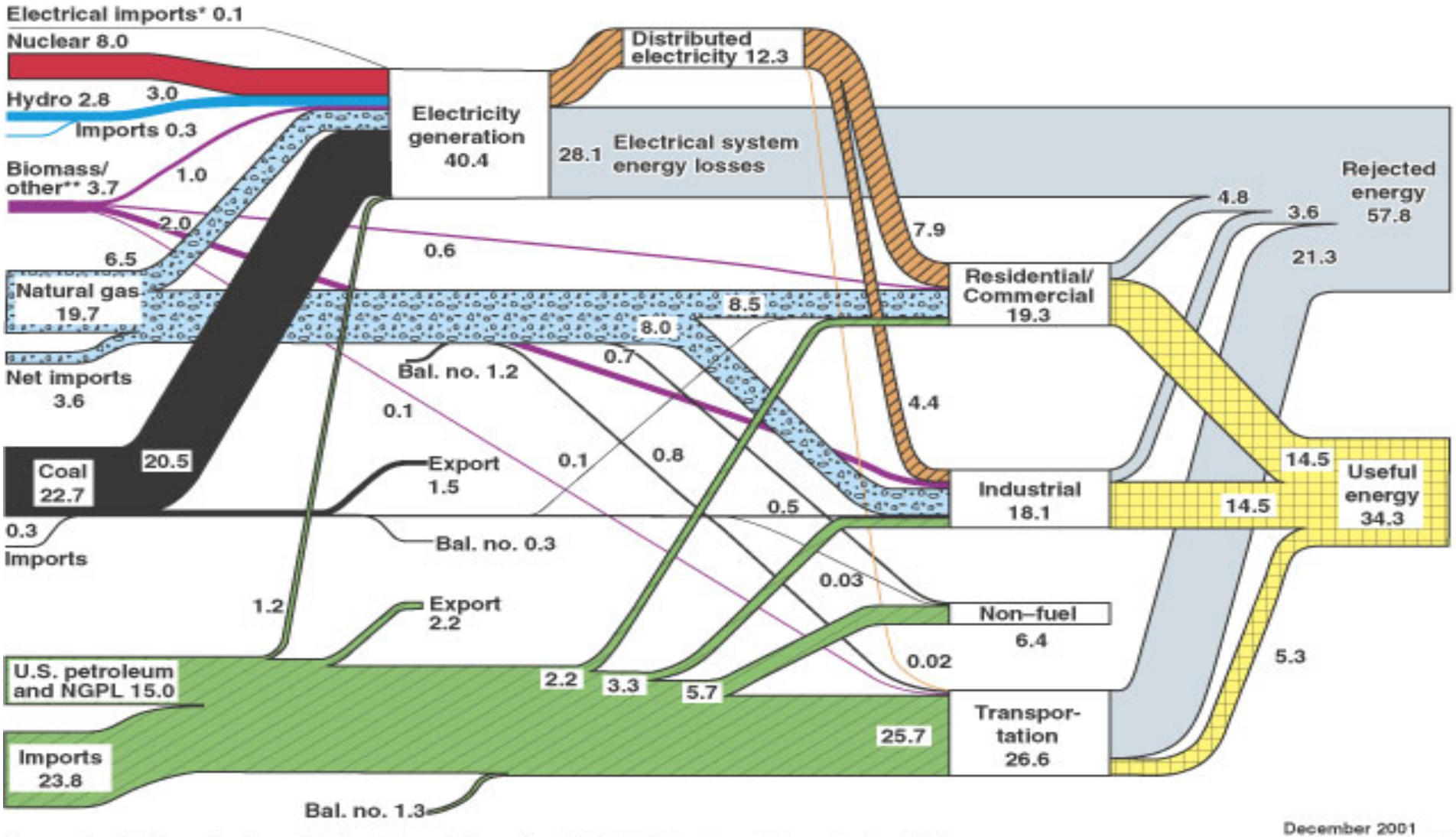
Gulf Coast CHP Applications Center

New Orleans, Louisiana
July 28, 2005

HARC HOUSTON ADVANCED RESEARCH CENTER

Clean and Renewable Energy Group

U.S. Energy Flow Trends – 2000
Net Primary Resource Consumption 98.5 Quads



Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2000*
*Net fossil-fuel electrical imports
**Biomass/other includes wood and waste, geothermal, solar, and wind.

December 2001
Lawrence Livermore
National Laboratory

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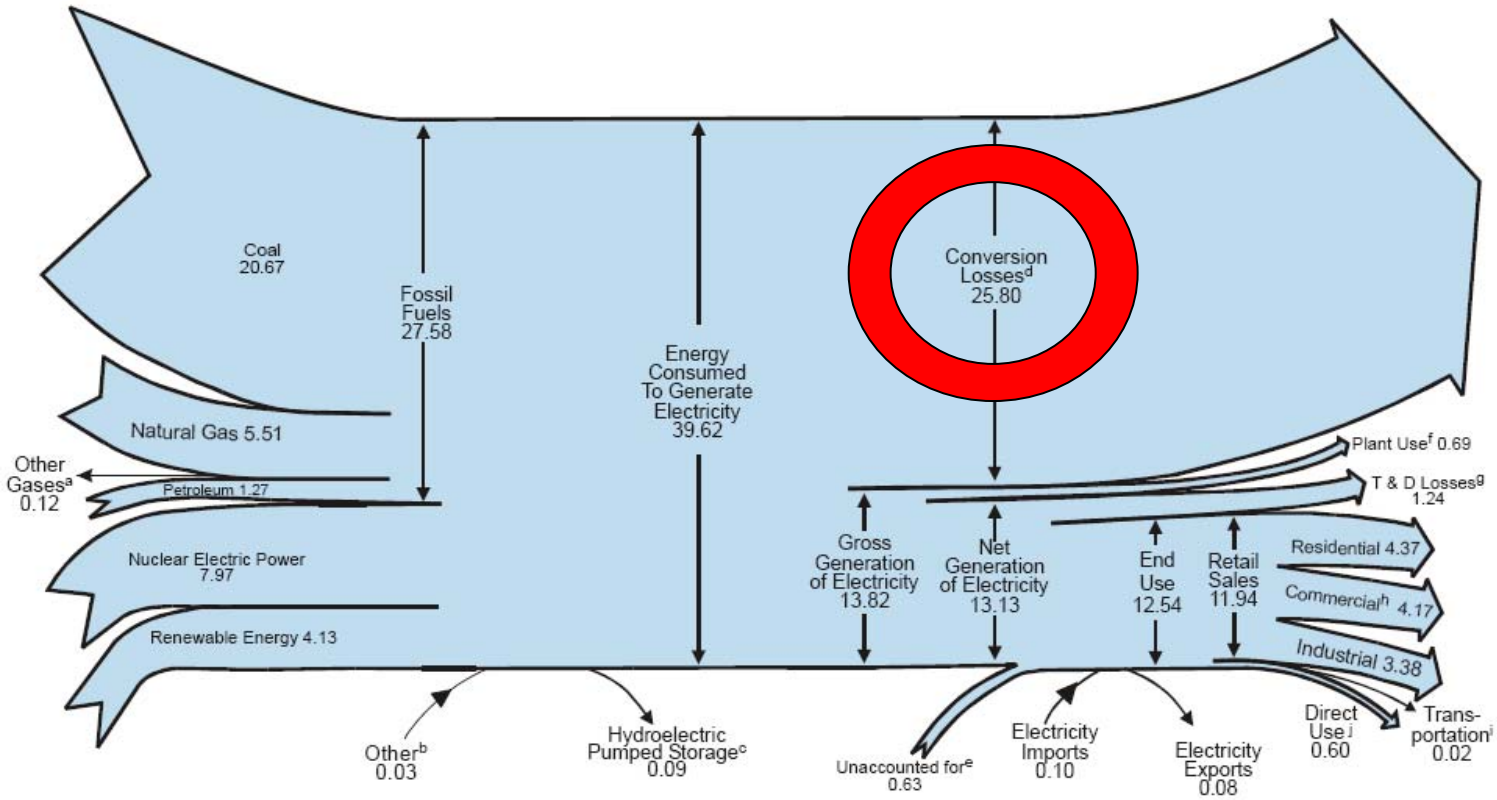
Waste is Costly!

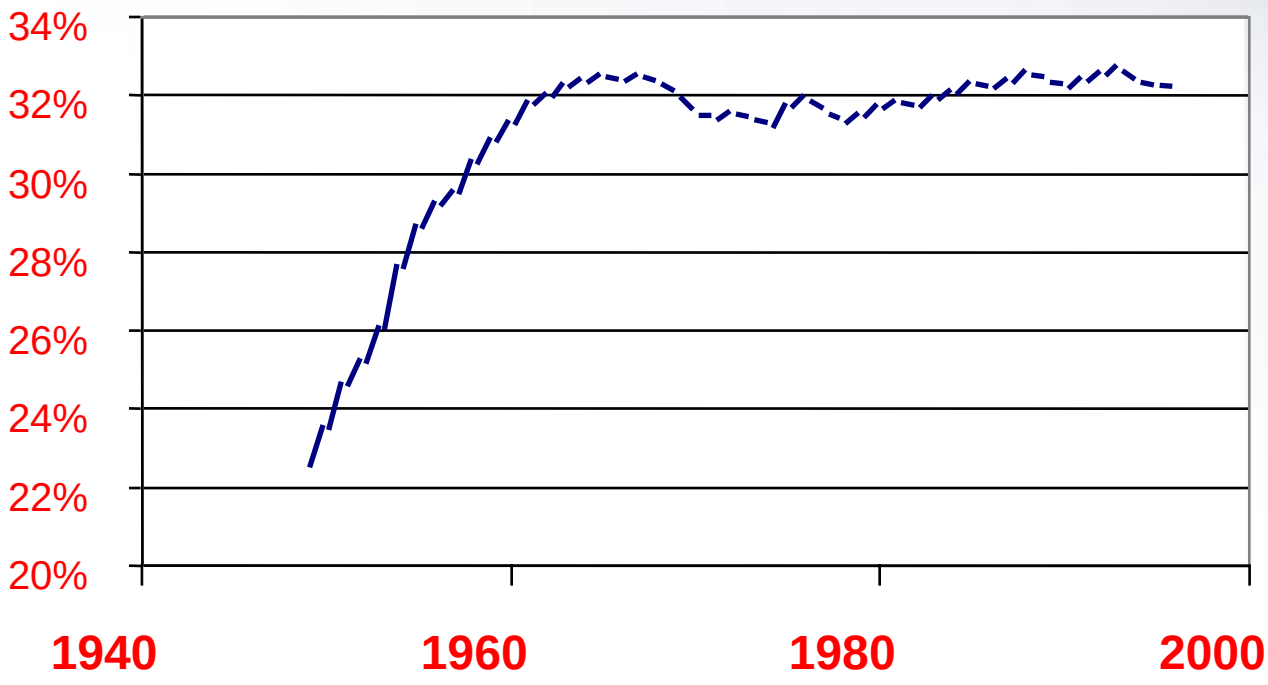
Diagram 5. Electricity Flow, 2003
(Quadrillion Btu)



[a] Blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.
[b] Batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.
[c] Pumped storage facility production minus energy used for pumping.
[d] Approximately two-thirds of all energy used to generate electricity. See note "Electrical System Energy Losses," at end of Section 2.
[e] Data collection frame differences and nonsampling error.
[f] Electric energy used in the operation of power plants, estimated as 5 percent of gross generation. See note "Electrical System Energy Losses," at end of Section 2.
[g] Transmission and distribution losses (electricity losses that occur between the point of generation and delivery to the customer) are estimated as 9 percent of gross generation. See note "Electrical System Energy Losses," at end of Section 2.
[h] Commercial retail sales plus approximately 95 percent of "Other" retail sales from Table 8.9.
[i] Approximately 5 percent of "Other" retail sales from Table 8.9.
[j] Commercial and industrial facility use of onsite net electricity generation; and electricity sales among adjacent or co-located facilities for which revenue information is not available.
Note: Totals may not equal sum of components due to independent rounding.
Sources: Tables 2.1b-2.1e, 8.1, 8.4a, and A6 (column 4).

The Need For CHP in the USA

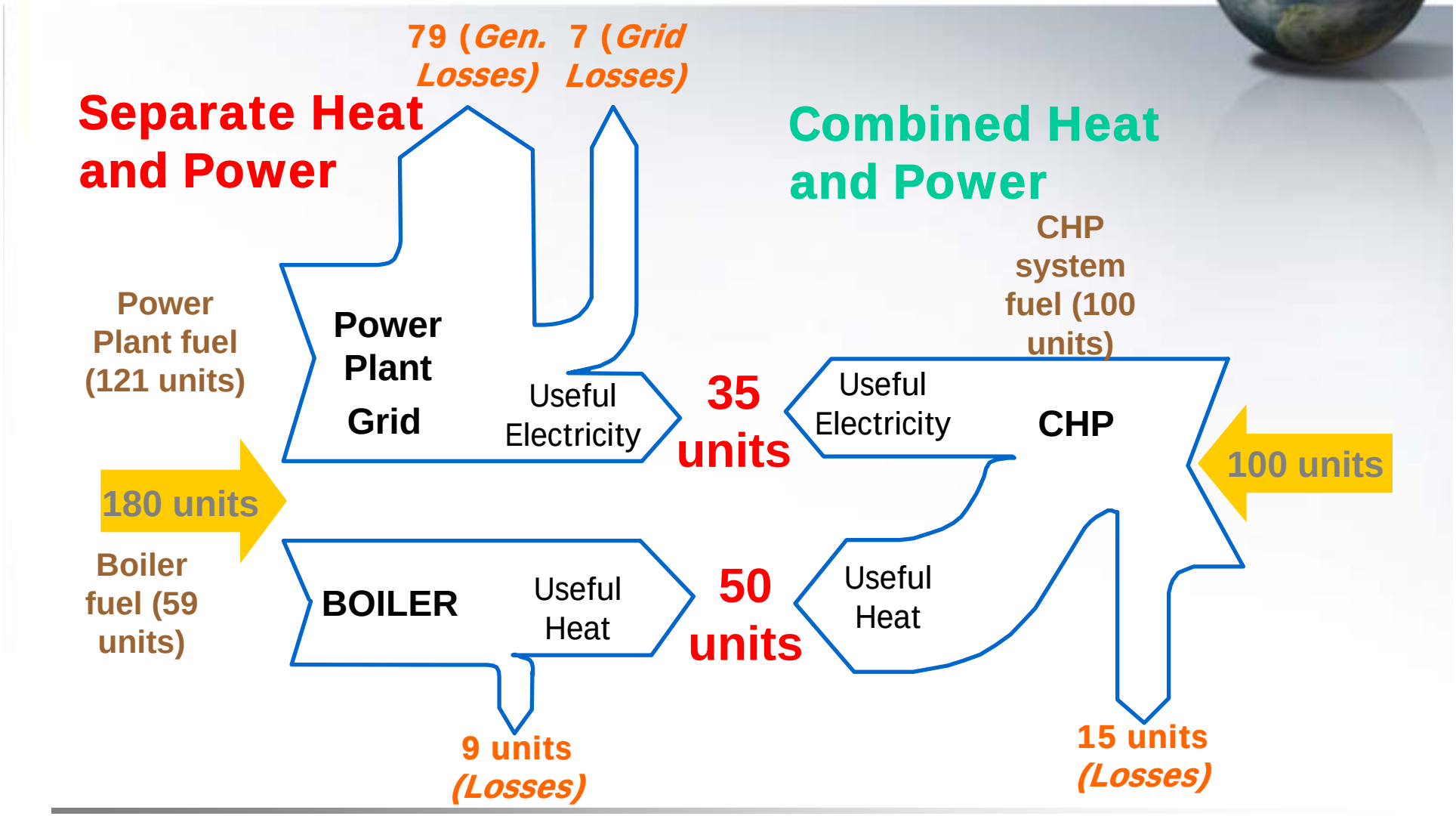
Stagnant Efficiency of U.S. Electric System



Fossil Electric Generation Efficiency (at plant, W/O T&D)

Source: EIA, Annual Energy Review 1996

CHP: the "Crown Jewel" of Distributed Generation

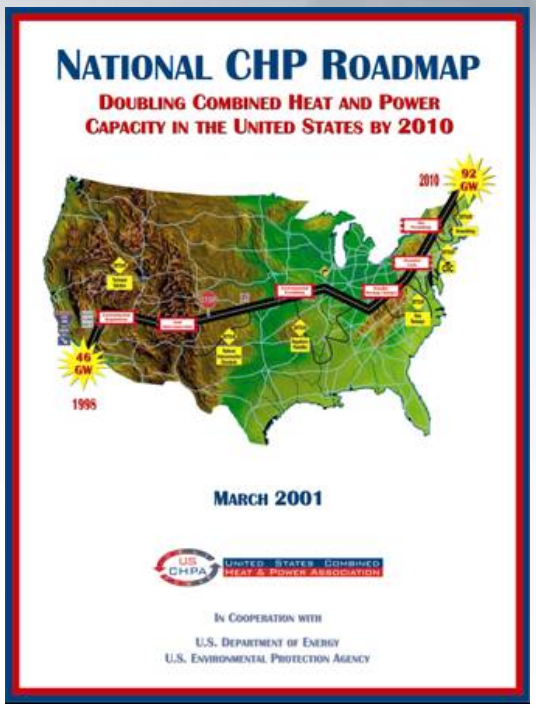


Why CHP? Why Not!

1. **Improved fuel efficiency (fuel economy)**
2. **Improved power quality/reliability**
3. **Improved energy cost predictability**
4. **Reduced emissions per unit of useful output**
5. **Reduced grid congestion (deferred T&D investment)**
6. **No Ratepayer Investment Required (generation or T&D)**
7. **Reduced system vulnerability**
8. **Short lead-time, off-the-shelf, modular technology**
9. **Reduced land-use impacts**
10. **Eliminates line losses**
11. **Optimizes scarce natural gas resources**
12. **Creates new high-tech manufacturing sector of the economy**
13. **Supports competitive electric industry market structure**

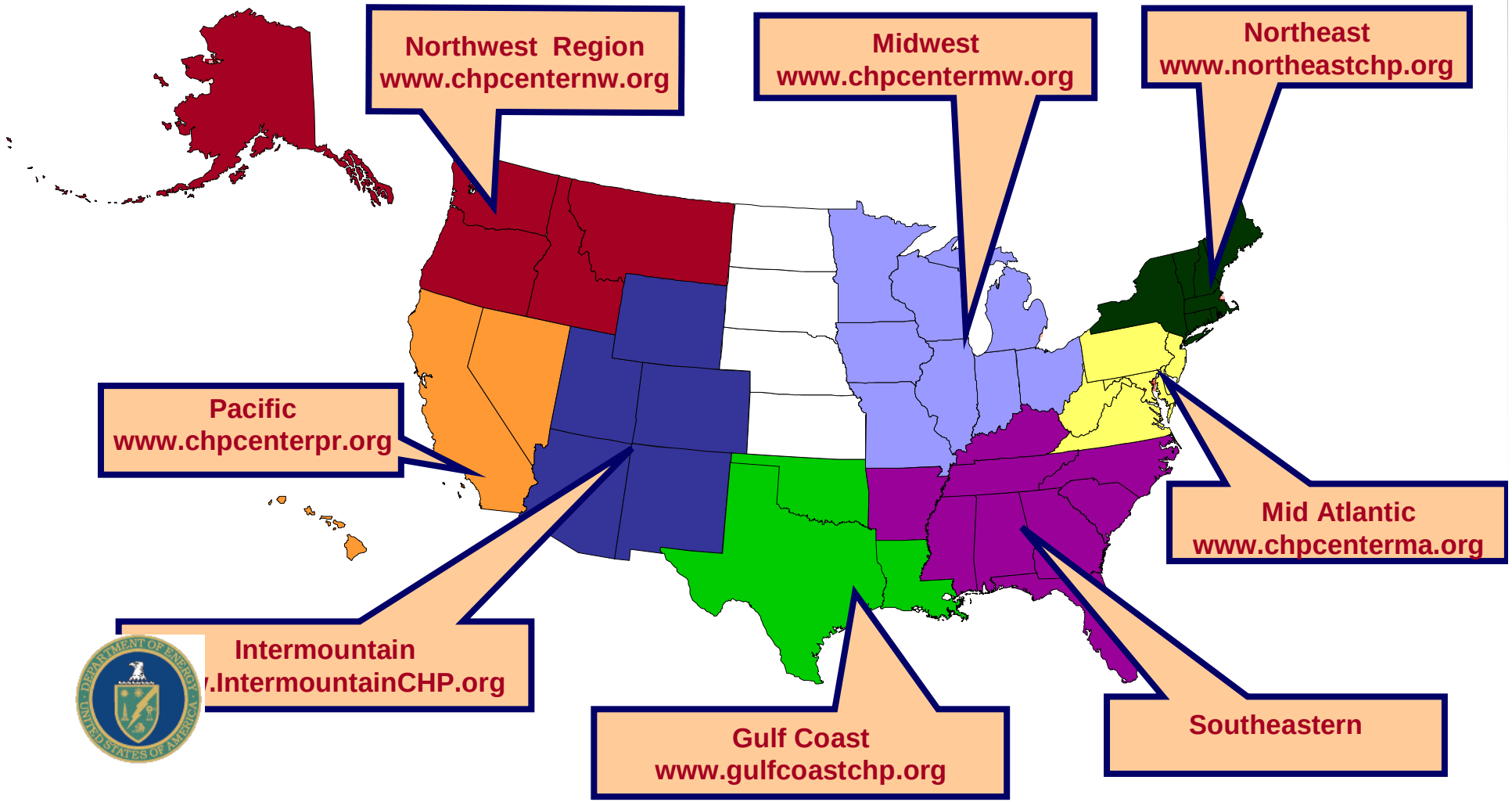
National CHP Strategy

- 92 GW of CHP by 2010
- Deploy CHP Applications Centers (RACs) to develop regional strategies:
  - Educate end-users and stakeholders about CHP
  - Provide technical assistance to adopters, developers, and regulators
  - Provide project specific support



Regional Application Centers

The regional application centers will promote combined heating and power (CHP) technology and practices, serve as a central repository and clearinghouse of CHP information, and identify and help implement regional CHP projects.

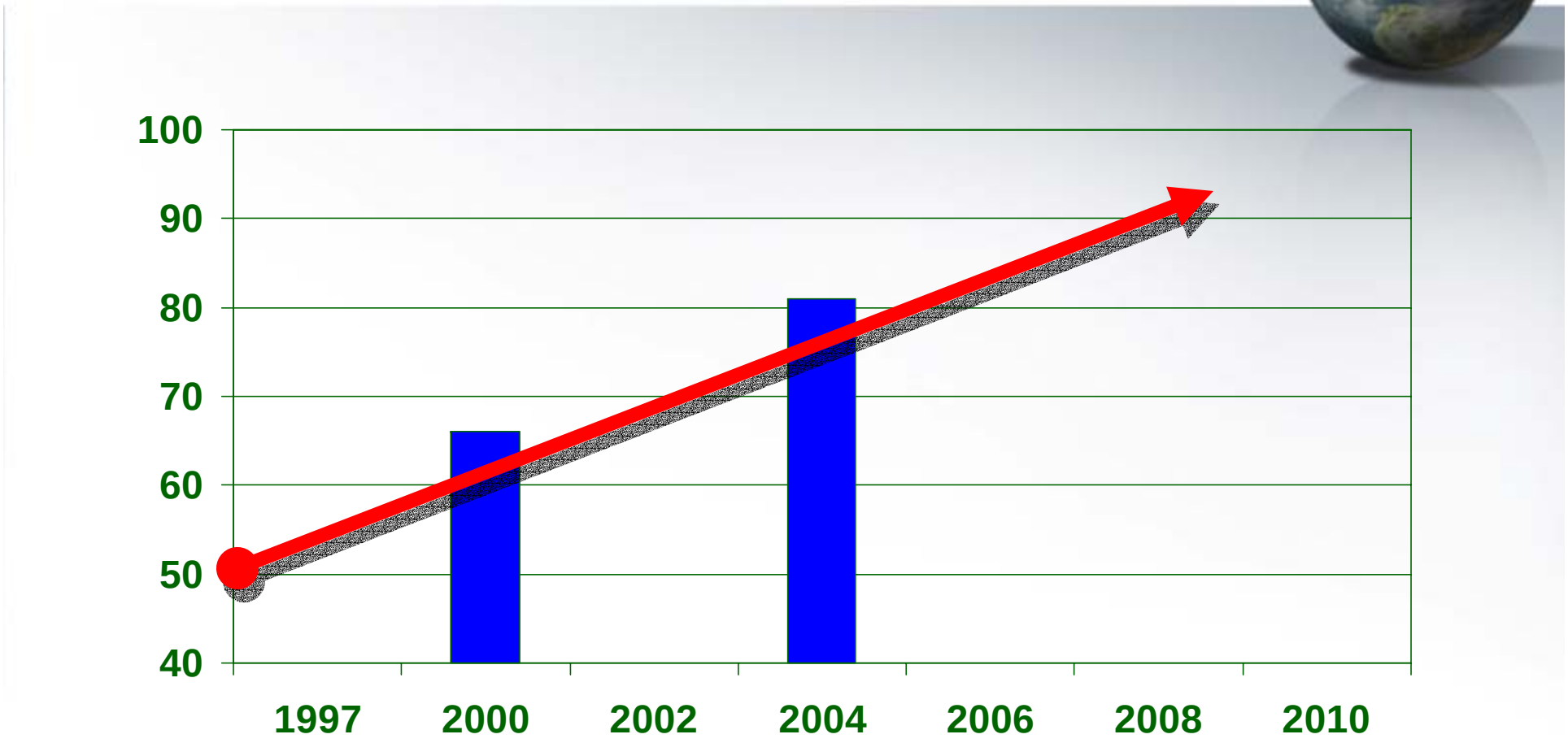


Gulf Coast Regional CHP Applications Center

- Established Jan 1, 2005
- Located at HARC in the Woodlands, Texas
- Serves Louisiana, Oklahoma, & Texas
- Website: www.gulfcoastchp.org

Roadmap Workshop held April 26-27, 2005

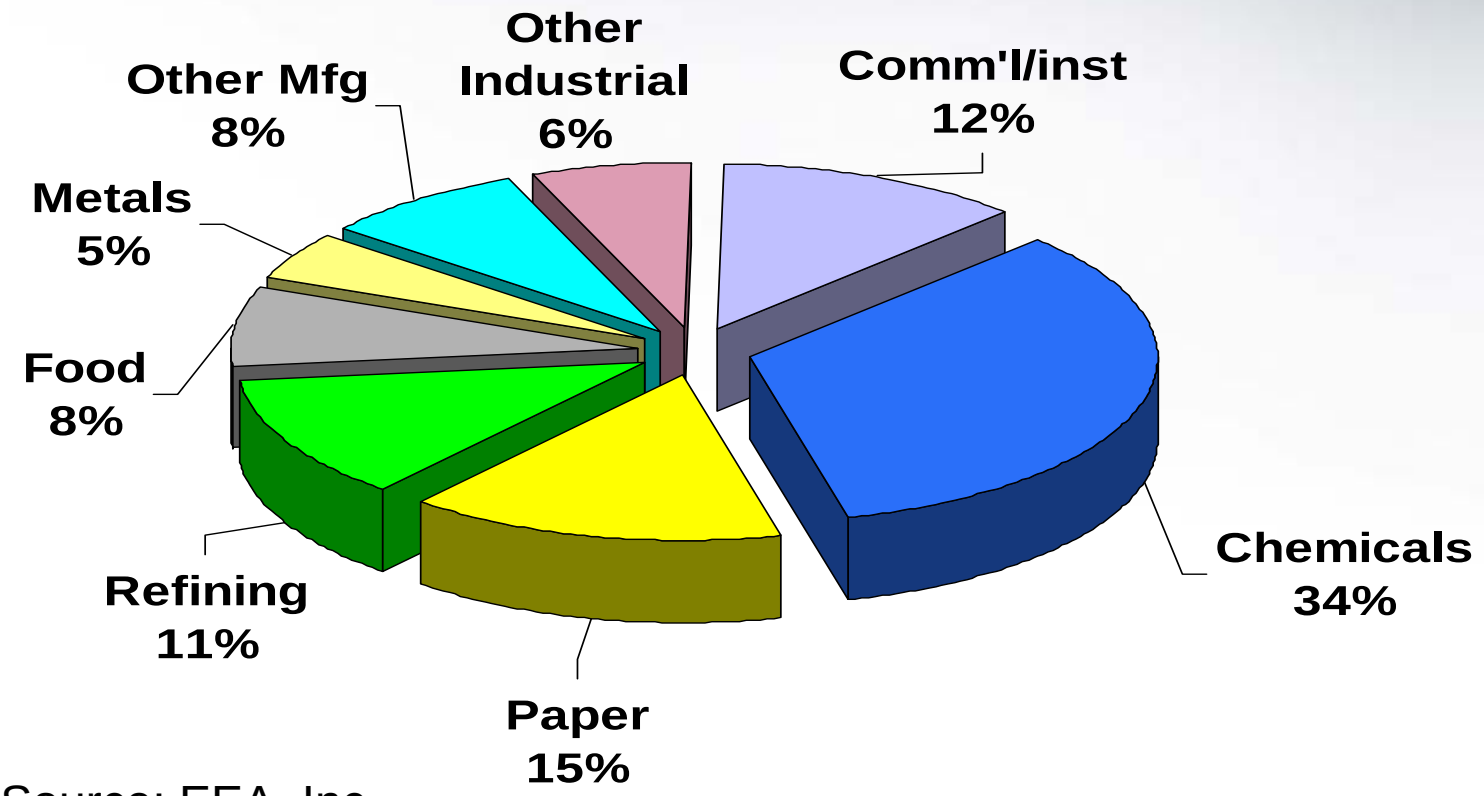
Progress – 81 GW in 2004



Source: EEA, Inc.

Industrials Represent Close to 90% of Existing CHP

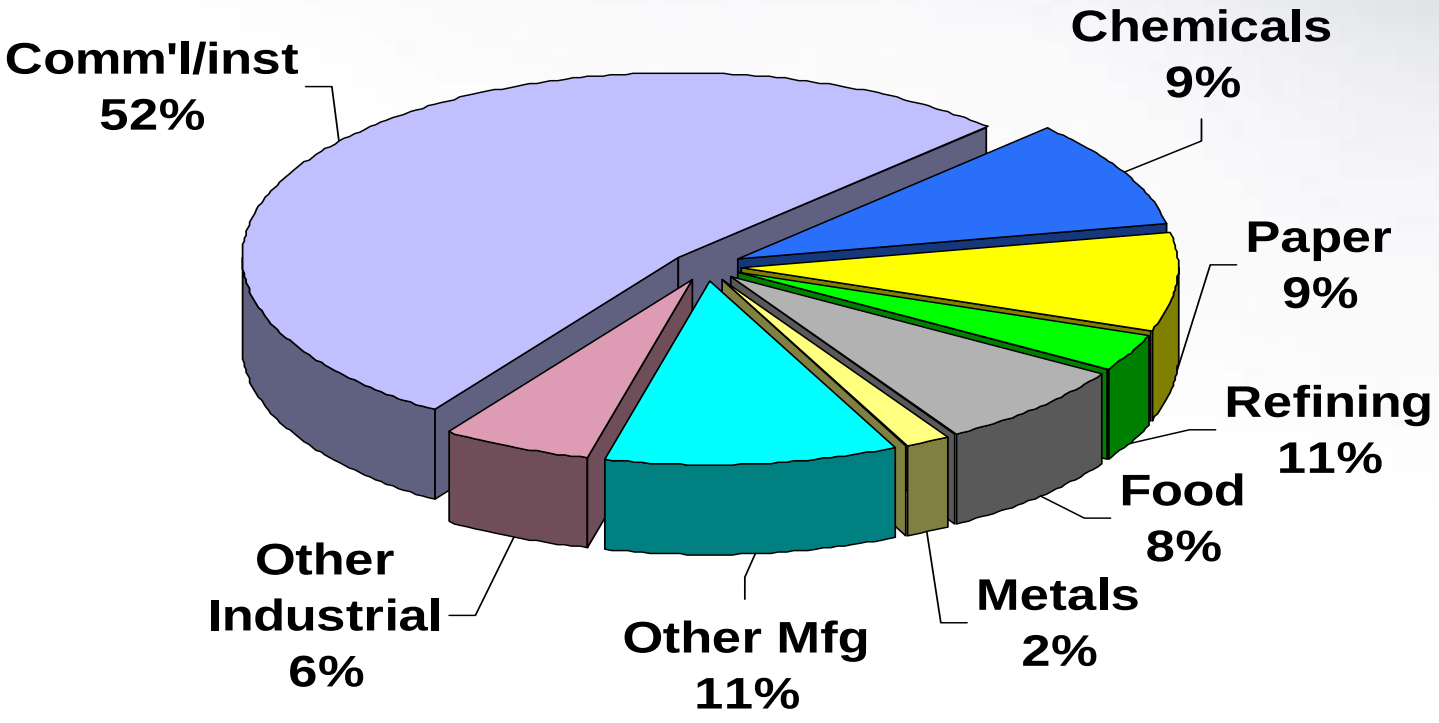
- *Existing CHP Capacity (2004): 80,905 MW*



Source: EEA, Inc.

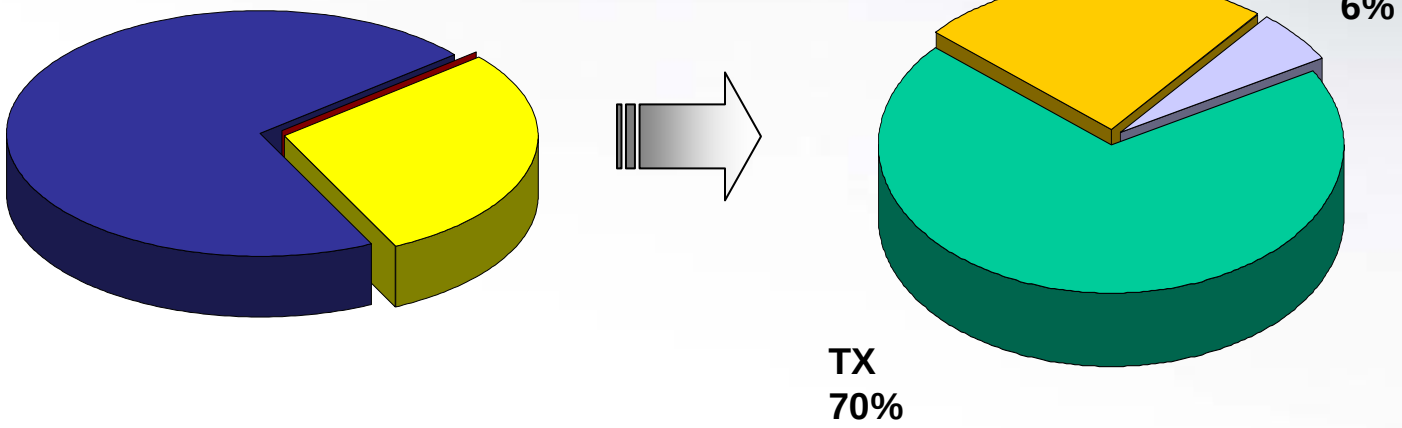
But Over 50% of the Installations are Commercial/Institutional

- *Existing CHP Capacity (2004): 2,845 sites*



Source: EEA, Inc.

The Gulf Coast Region Represents 29% of Existing CHP Capacity



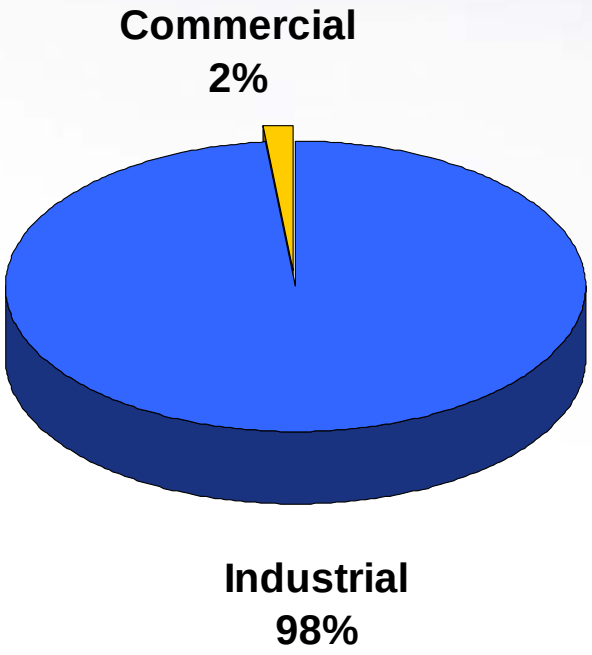
U.S. = 80,905 MW
2,845 sites

Gulf Coast = 23,365 MW
213 sites

Source: EEA, Inc.

Industrials Represent 98% of Existing CHP in the Region

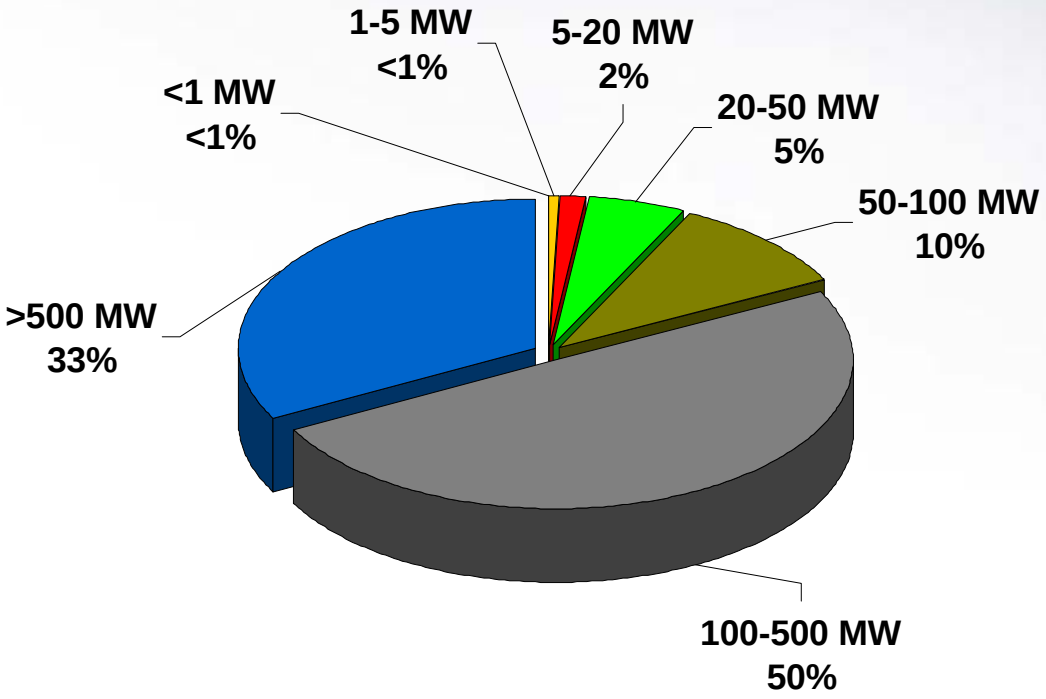
- *Existing CHP Capacity (2004): 23,365 MW*



Source: EEA, Inc.

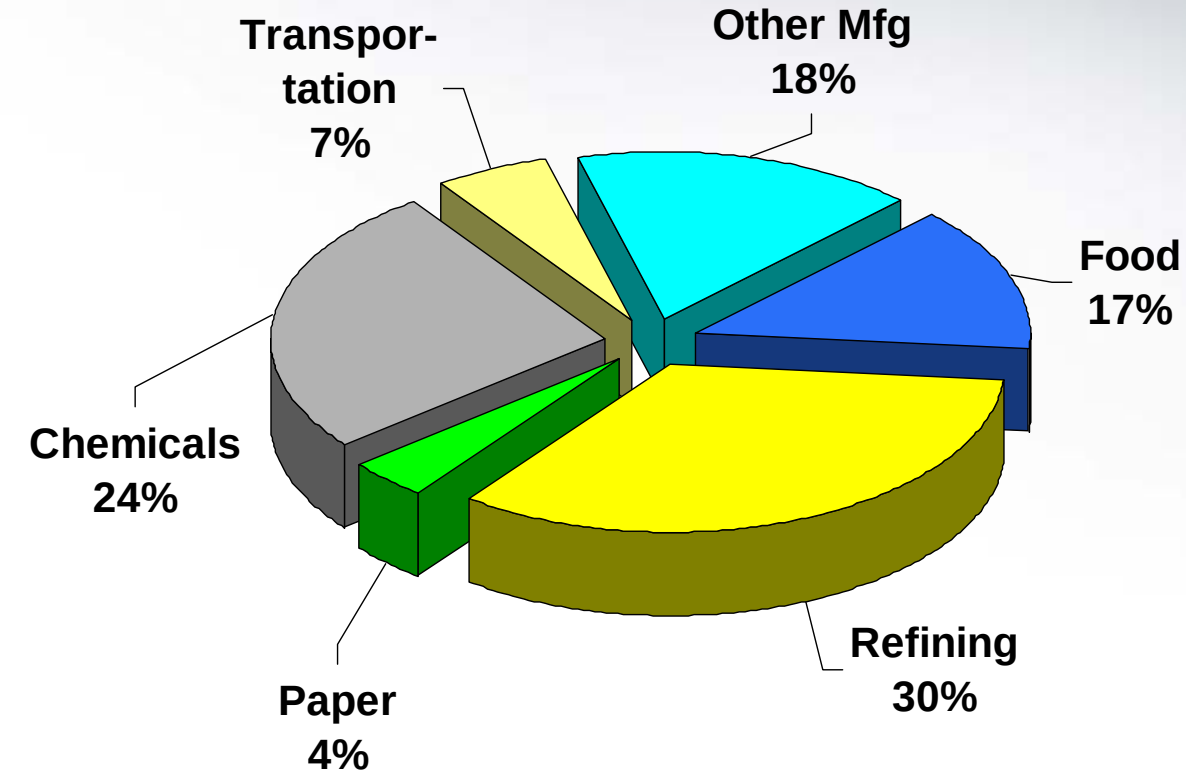
Large Systems (>100 MW) Represent 83% of the Region's CHP Capacity

- *Existing CHP Capacity (2004): 23,366 MW*



Source: EEA, Inc.

The Potential for CHP at Industrial Facilities is over 11,000 MW



Source: EEA, Inc.

49% of the CHP Potential Is Below 5 MW in Size

	CHP Potential, MW			
	< 1MW	1-5 MW	5-20 MW	>20 MW
Commercial	3,738	2,619	1,831	544
Industrial	1,099	2,184	3,158	4,631
	4,837	4,803	4,989	5,175

Source: EEA, Inc.

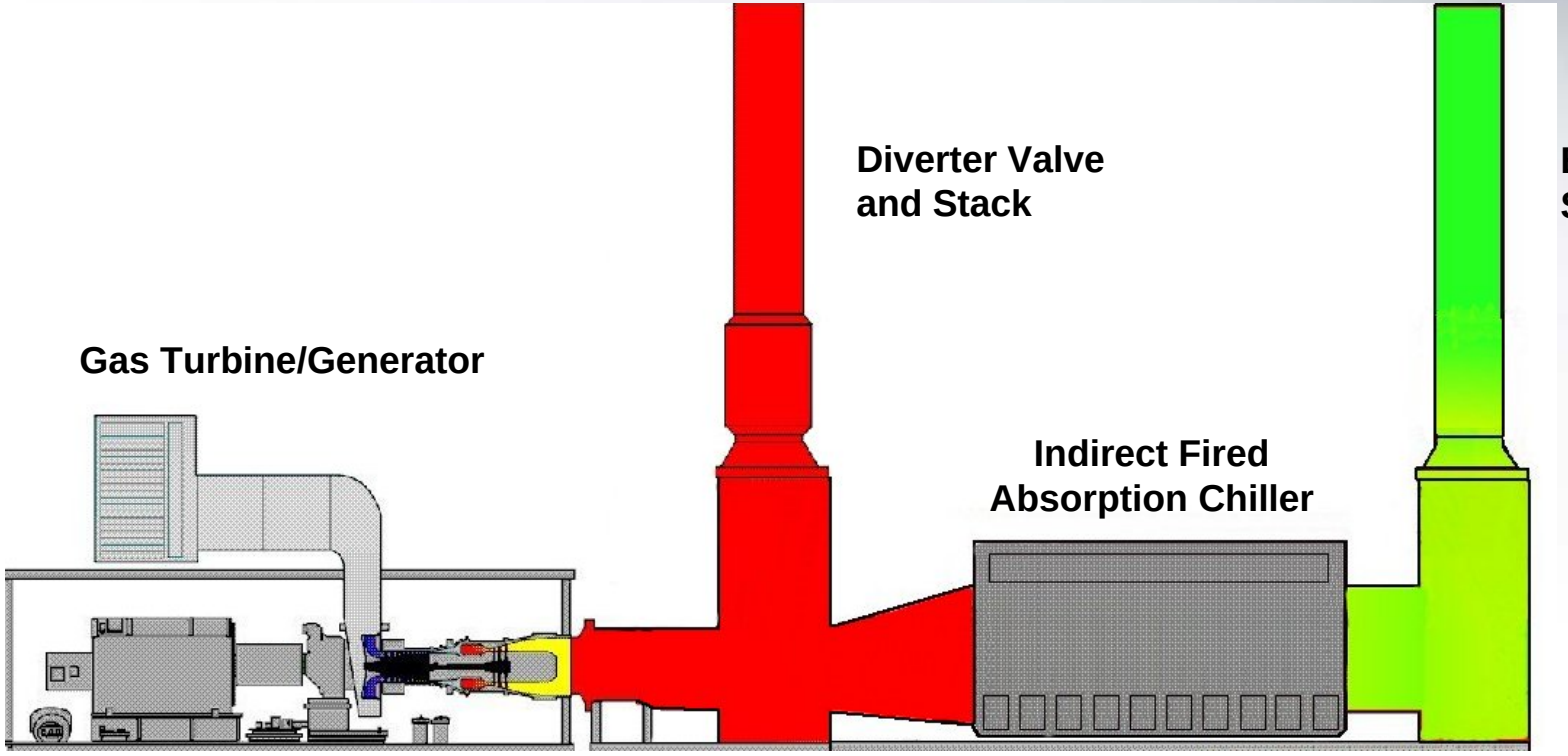
Gulf Coast RAC Priority Areas

- Institutional Buildings
  - Hospitals, universities, prisons, government bldgs
  - Leverage CHP into Green Building protocols
  - Use thermal energy primarily for cooling (CCHP)
  - 1- 20 MW prime mover
- Medium Industrial
  - < 20 MW prime mover
- Large Industrial
  - Waste heat recovery
  - Boiler replacements and NOx compliance
  - Repowering existing CHP

The Domain
Austin, Texas

- Connected to Austin Energy's grid and to an existing District Cooling system
  - Provides 4.5 MW & 2500 tons of chilled water (44 F)
- Features:
  - Low emission gas turbine generator (Solar Turbines)
  - Two-stage indirect fired absorption chiller utilizing the turbine generator exhaust (Broad USA)
  - Packaged "skid mounted" by Turbine Air Systems
- Performance: Efficiency is 88.8% (LHV)

CHP System Elevation View



HEB Grocery Store
San Antonio, Texas

- An existing 77,782 square foot supermarket.
  - Capstone micro-turbine (60kW)
  - Single effect Broad absorption chiller (18 tons)

HEB Grocery Store
San Antonio, Texas

Goal

- reduce refrigeration costs

Method

- use the absorption chiller to provide sub-cooling to low and moderate temp refrigeration racks using thermal energy produced by the microturbine

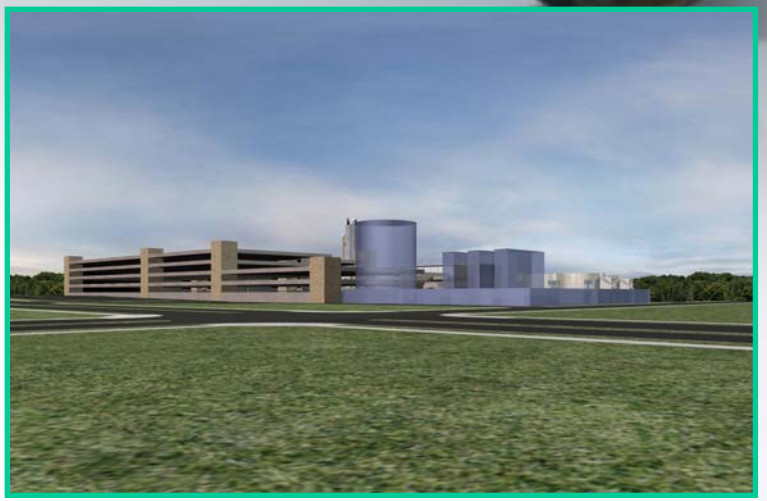
Result

- for each ton of cooling supplied by the absorption chiller, compressor demand is reduced by 1 - 1.5 kW for medium temperature racks and 2 - 2.5 kW for low temperature racks.

Refrigerated Display Cases

One of Four Subcooling HXs added to Racks

Dell Children's Hospital
Austin, Texas



- On-site energy is primary supply – the grid is back up
- Exceeds Texas Department of State Health Service's Life Safety power requirements
- Supports micro-grid
- Thermal to hospital and a new district cooling system
- Maximizes efficiency and environmental LEED credits with the goal of achieving the Platinum level
- Expected system heat rate near 5,000 Btu/kWh (beats best combined cycle power generation)

Get Involved!

- Participate in RAC activities:
  - Advisory Committee
  - CHP Summit Organizing Committee
  - Benefits & Barriers Study team
  - Institutional Buildings Study team
- Participate in non-RAC activities:
  - CHP “Initiative” – an ad-hoc, industry-led advocacy organization driving CHP issues in the region

For more information:

Daniel Bullock

Gulf Coast CHP Applications Center

(281) 364-6087

dbullock@gulfcoastchp.org

Thank You!