



Clean Efficient Energy from Micro-Cogeneration

*Energy that is **E**cologically Sound and **E**conomically Prudent*

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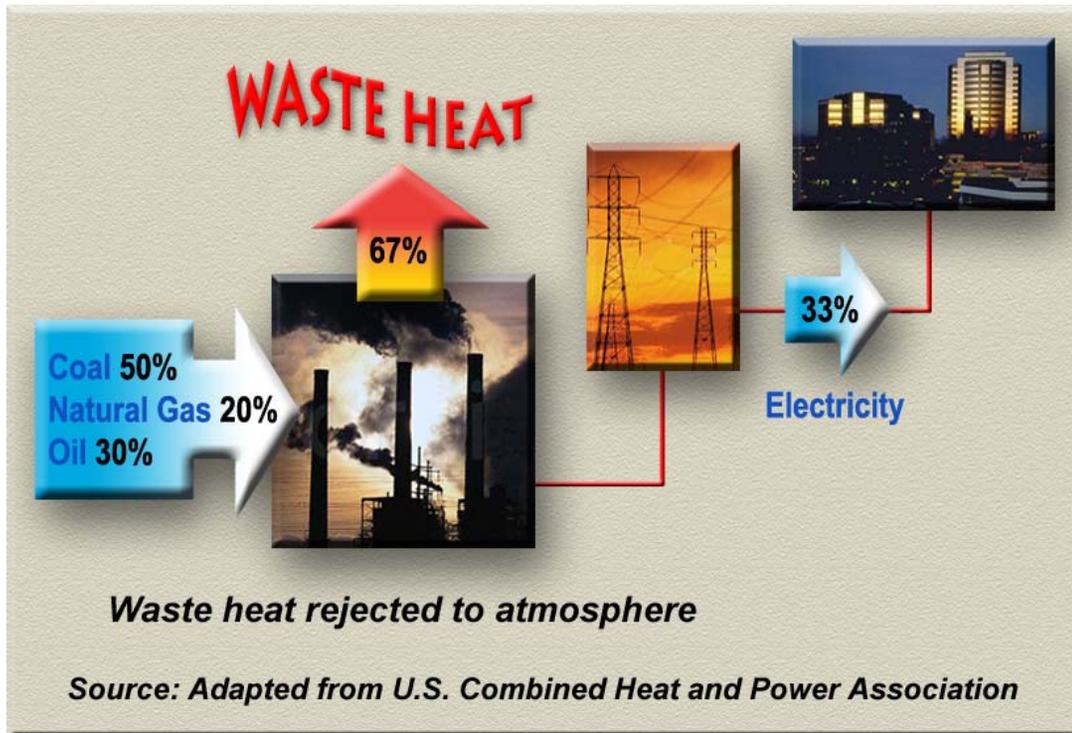
CHP Topics

- What is CHP?
- How is MicroTurbine Based CHP Different?
- What Are the Benefits?
- What is the Value Proposition?
- Is It Your Time to Act?



TRADITIONAL SYSTEM

Central plant power generation

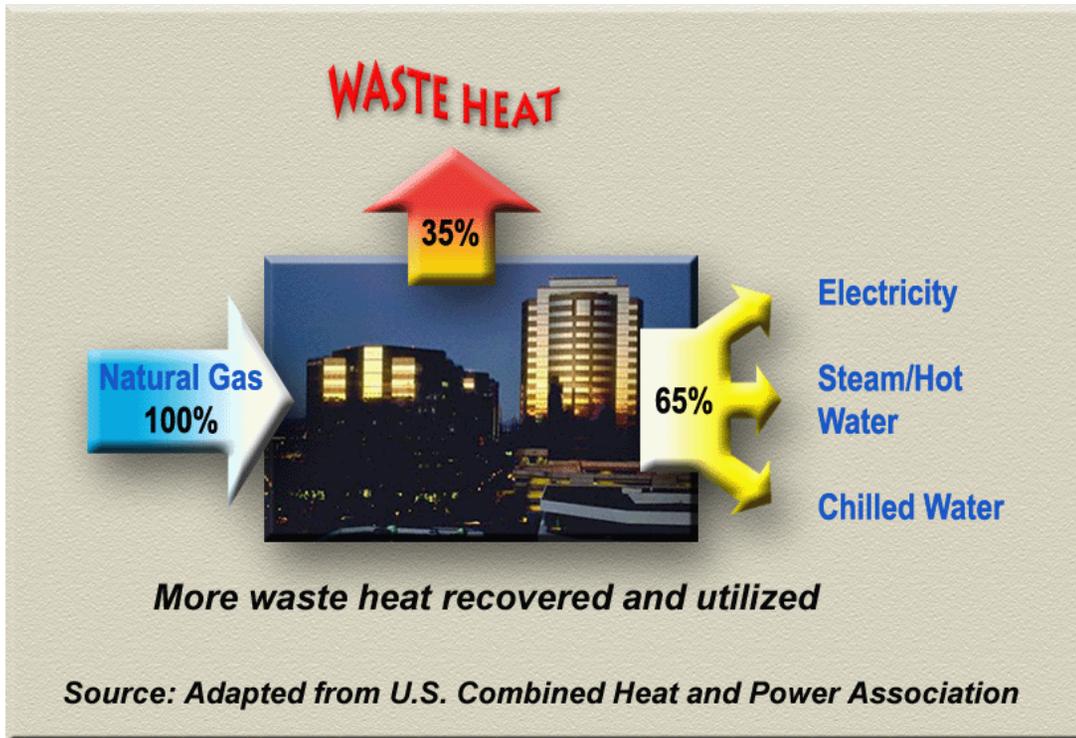


Disadvantages:

- Lost efficiencies
- High pollutants
- Single choice of electrical power



CHP – Combined Heat & Power



Advantages:

- High efficiency
 - Lower operational costs
- Environmental stewardship
 - Tax credits
- System choice
 - Option value



Cooling, Heating, & Power System

CHP *Cooling, Heating, & Power Systems.*
pre-engineered solution complete with
components powered by the exhaust
from other system components. Based on
this premise, efficiencies are magnified
and cost savings are achieved.



Microturbine Based CHP

Gas turbine engine



- **Proven technology**
 - > 4 million operating hours
- **Low emissions**
- **Conformance:** IEEE 519; NFPA 37 & 70; UL 795,1741,1995,2200; NYPSC DG



ABSORPTION CHILLER/HEATER



- Utilizes heat energy instead of electrical energy to produce chilled water
- Each 110 tons of A/C equates to 80-150 kW/hr of electricity
- Provides chilled water w/o the electric load when electricity is the most expensive



INTEGRATED CHP SYSTEM



C-60 (4-pack) MicroTurbine



Chiller/Heater



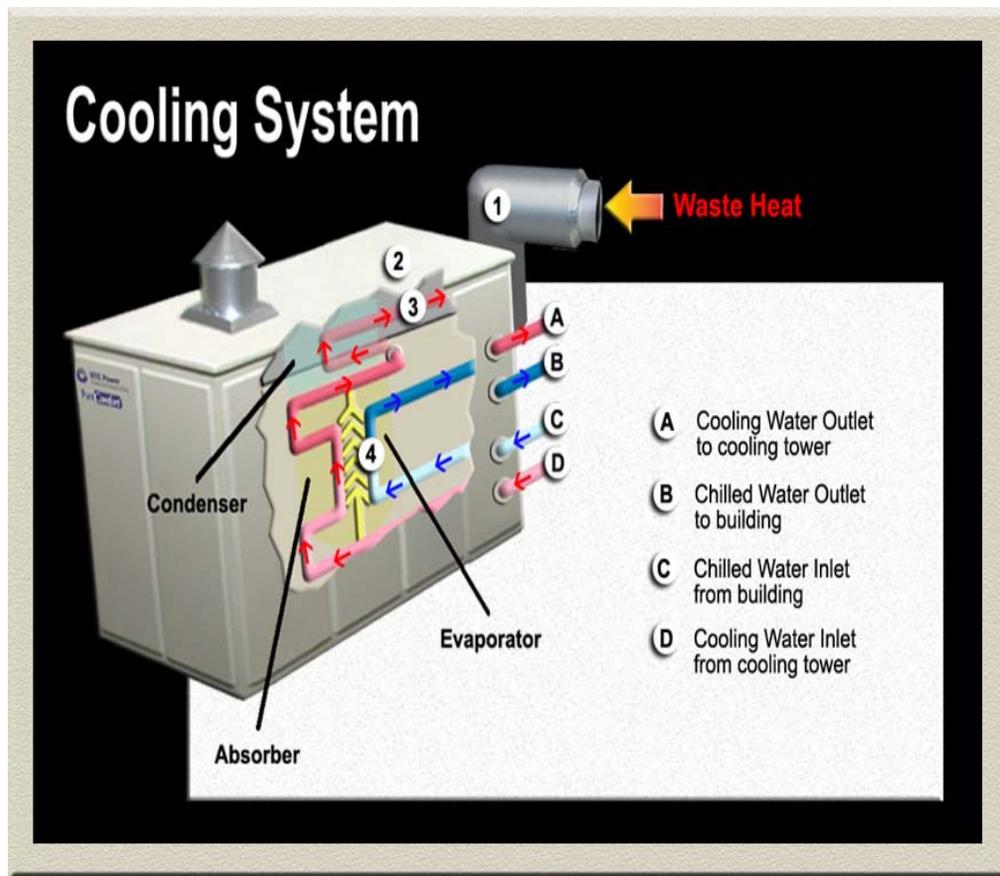
Integrated Power & Comfort

Provides:   

- ~240 kW electrical power
- ~110 tons of chilled water
- ~720-1600k Btus hot water



CHILLER - COOLING MODE

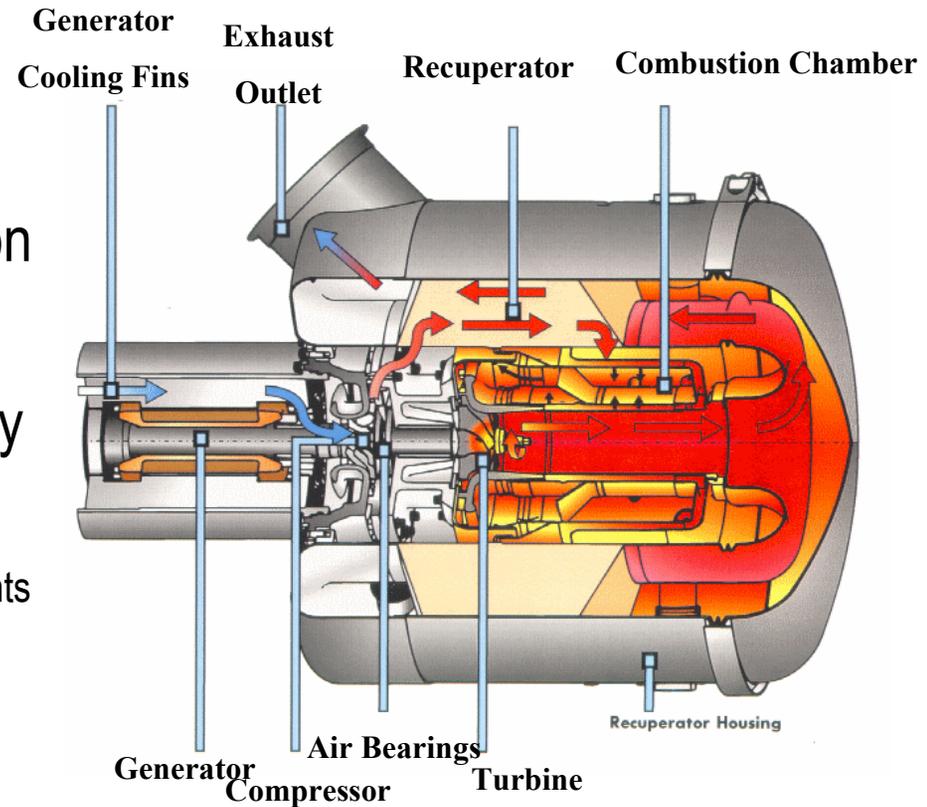


- 1 Waste heat from MicroTurbine exhaust provides the energy to vaporize water out of the working solution.
- 2 Through a series of heat exchangers in a two stage process, water vapor is provided to the condenser.
- 3 Heat is rejected from the condenser and the absorber to the cooling tower.
- 4 Vaporization of liquid water in the evaporator provides cooling to the chilled water loop in the building.



MicroTurbine Technology

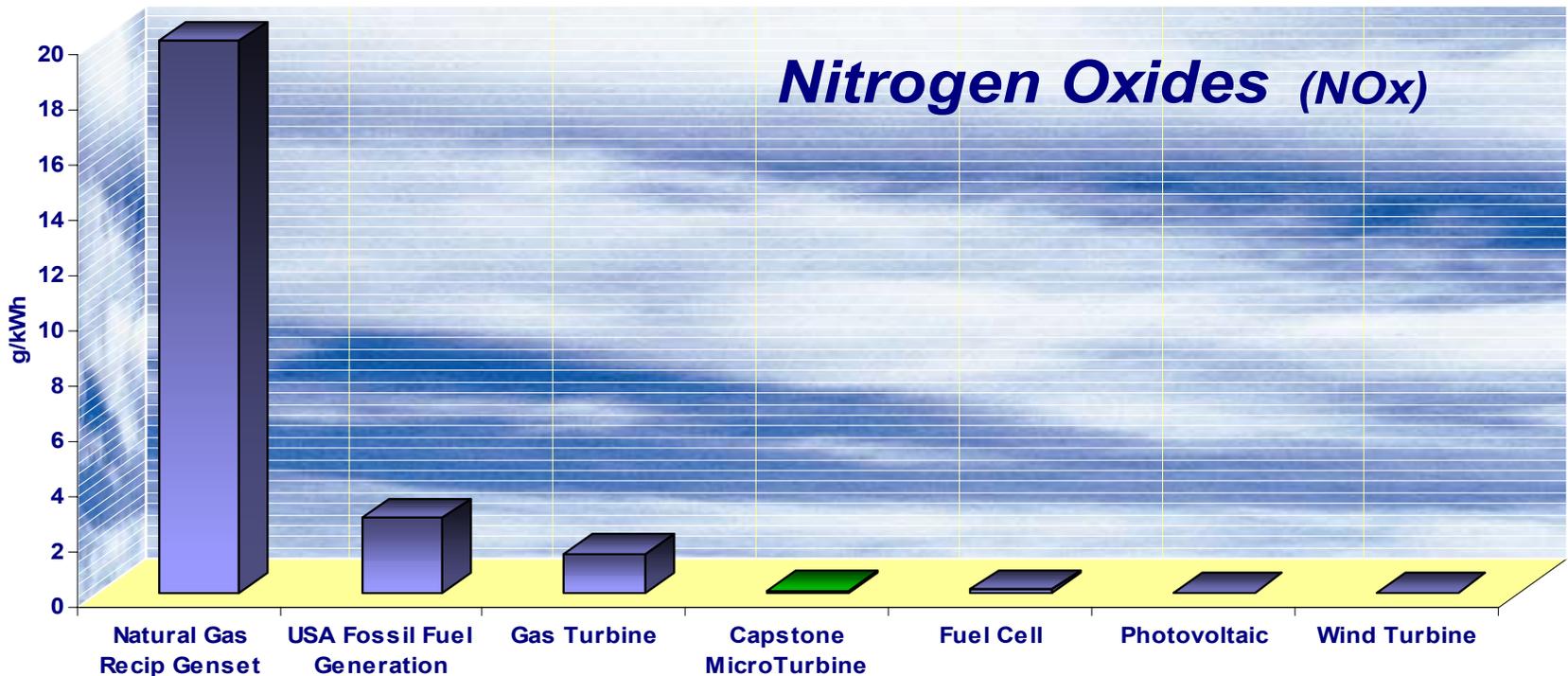
- Simple, low pressure ratio, low temperature, robust design
- Designed for automotive operation and cycles
- A single moving part supported by patented air bearings
 - Eliminates the need for liquid engine lubricants
 - Reduces maintenance costs
 - Increases system life
- Air cooling of the electronics
 - Eliminates need for liquid cooling systems
- Low exhaust and noise emissions
 - Less than 9 ppm NO_x (usually <2 ppm)





Ultra Clean Combustion

MicroTurbines approach the performance of zero-emission technologies, but at a fraction of the cost





INTEGRATED SOLUTION - BENEFITS

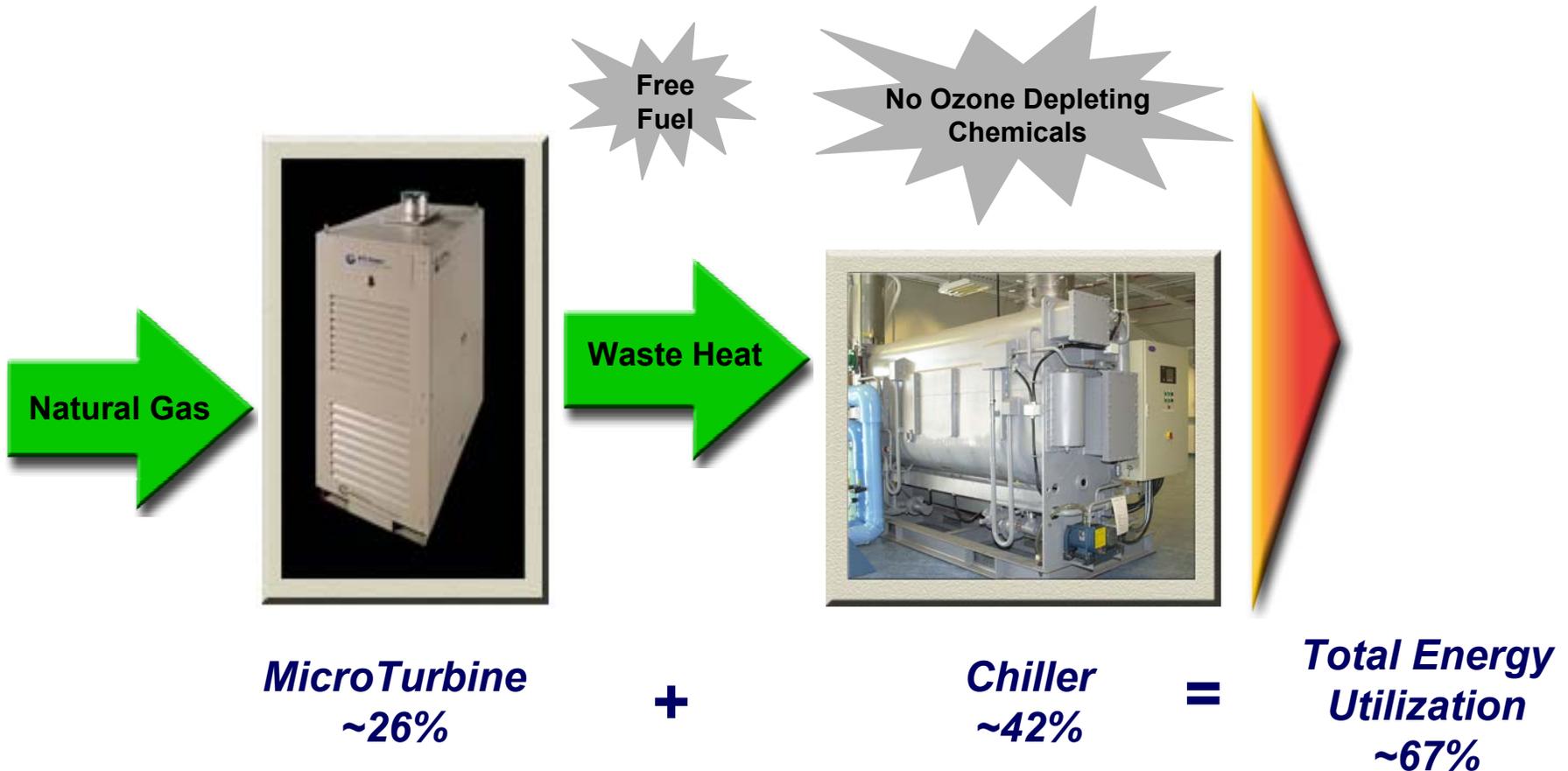


Dimensions (L x W x H) = 27' 2" x 13' 10" x 10'

- Lower operating costs
 - On average, twice as efficient as grid power
- Back-Up Power Source
- Pre-engineered solution
- Potential financial incentives
 - Green product
- Reliable
 - Few moving parts

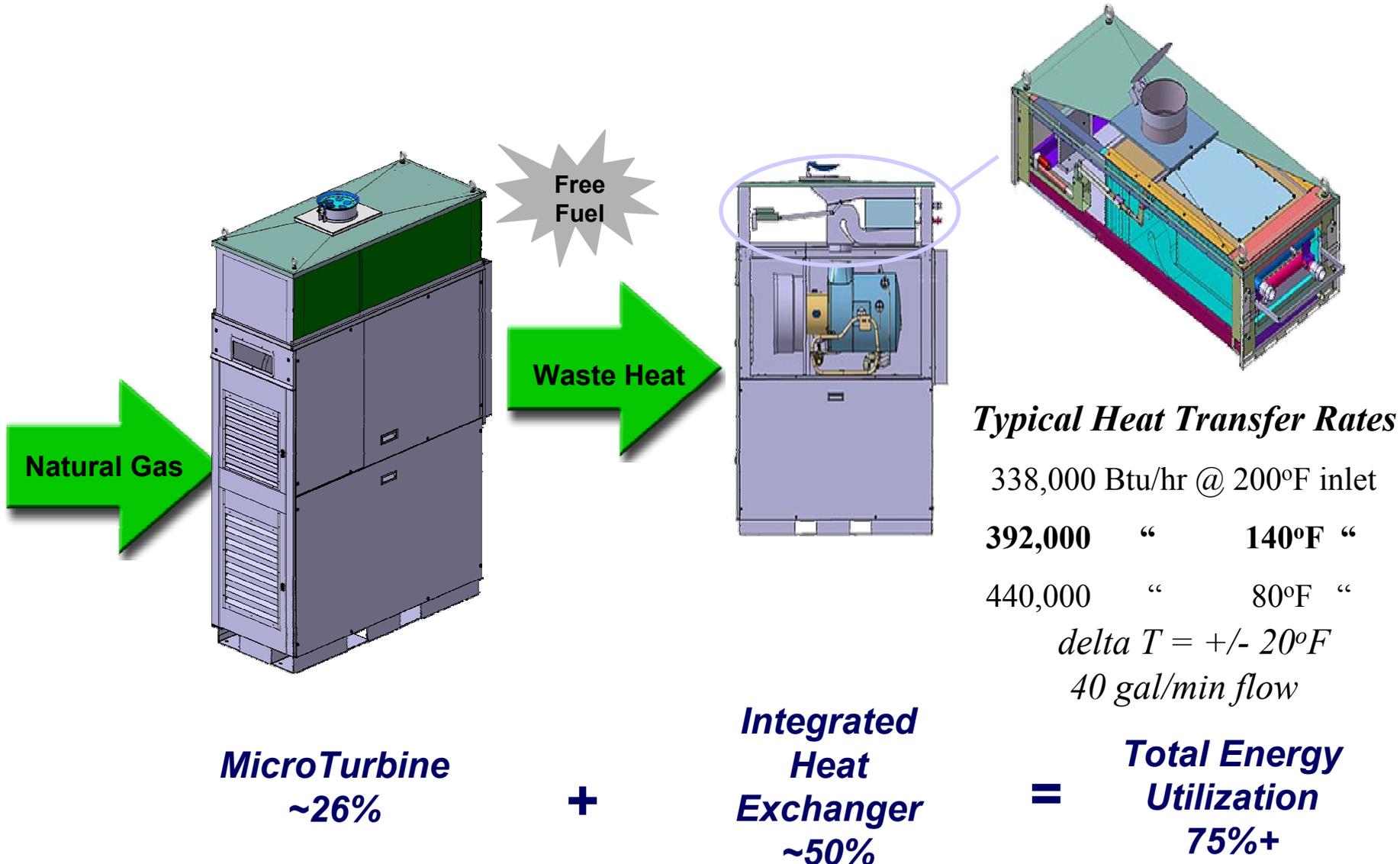


COOLING EFFICIENCY



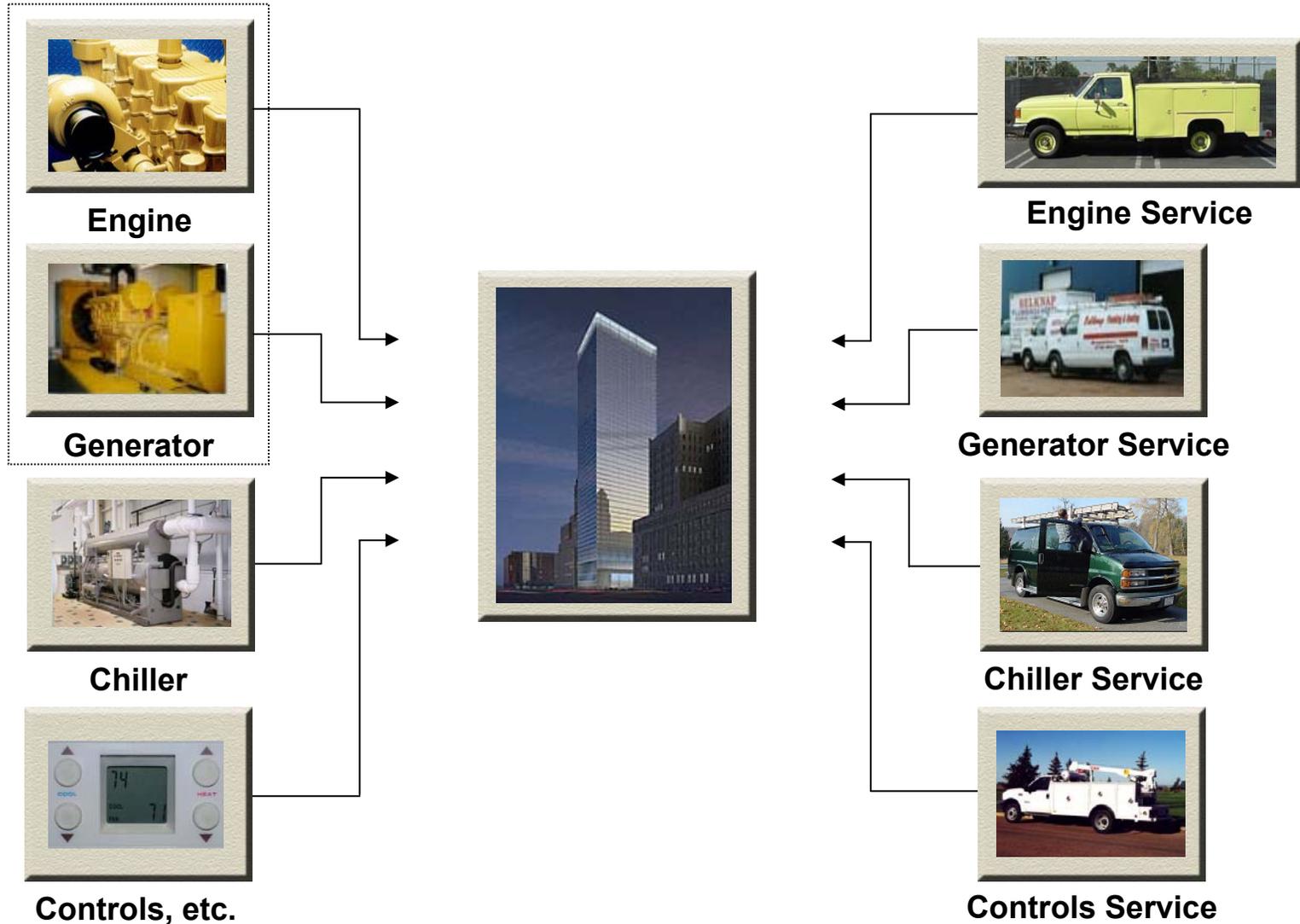


HEATING EFFICIENCY





STATUS QUO BUILDING MAINTENANCE MODEL



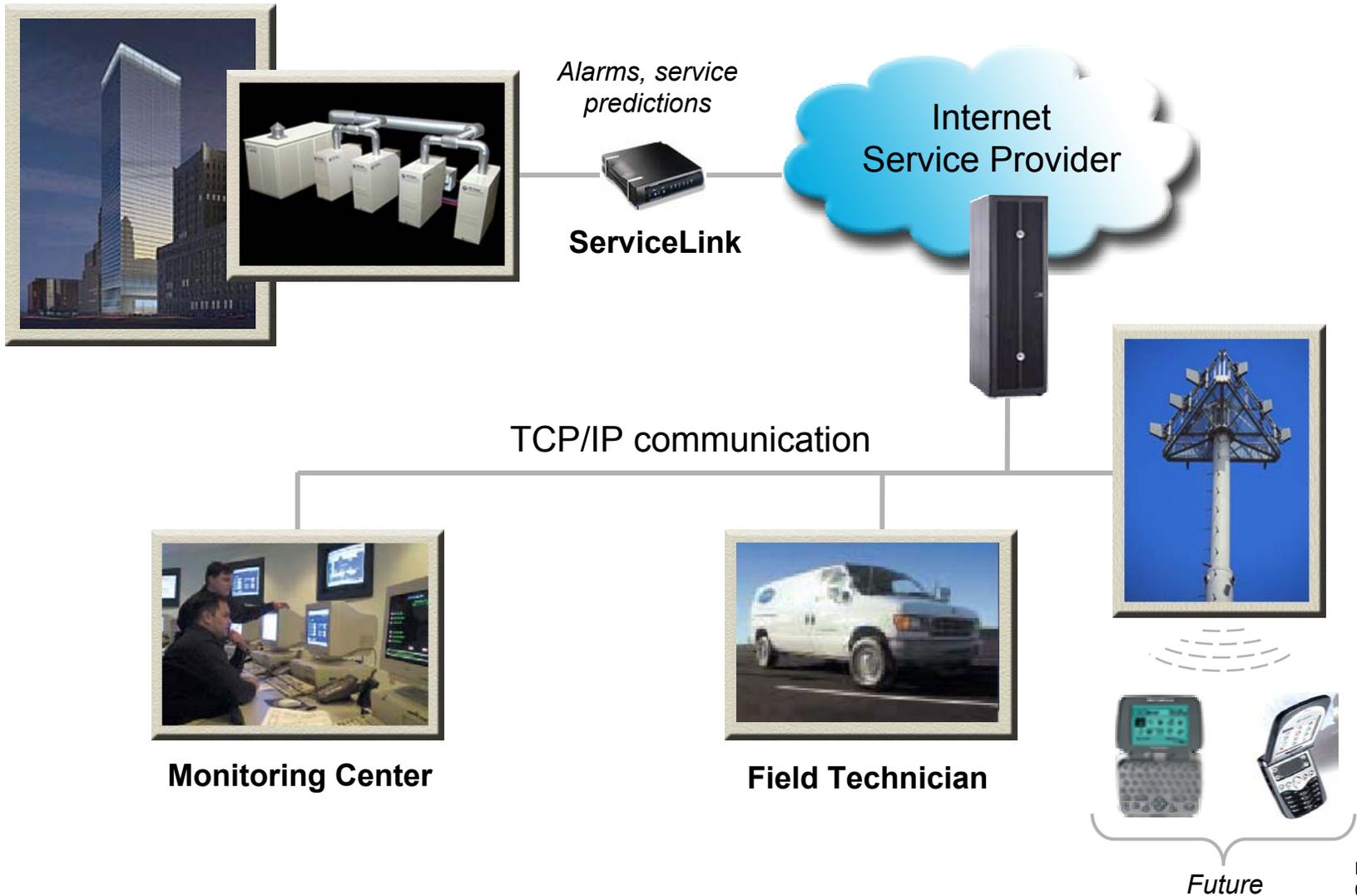


INTEGRATED CHP BUSINESS MODEL





MONITORING & MAINTENANCE





MAKE AN IMPACT



Sources: EPA & Statistical Abstracts of the United States

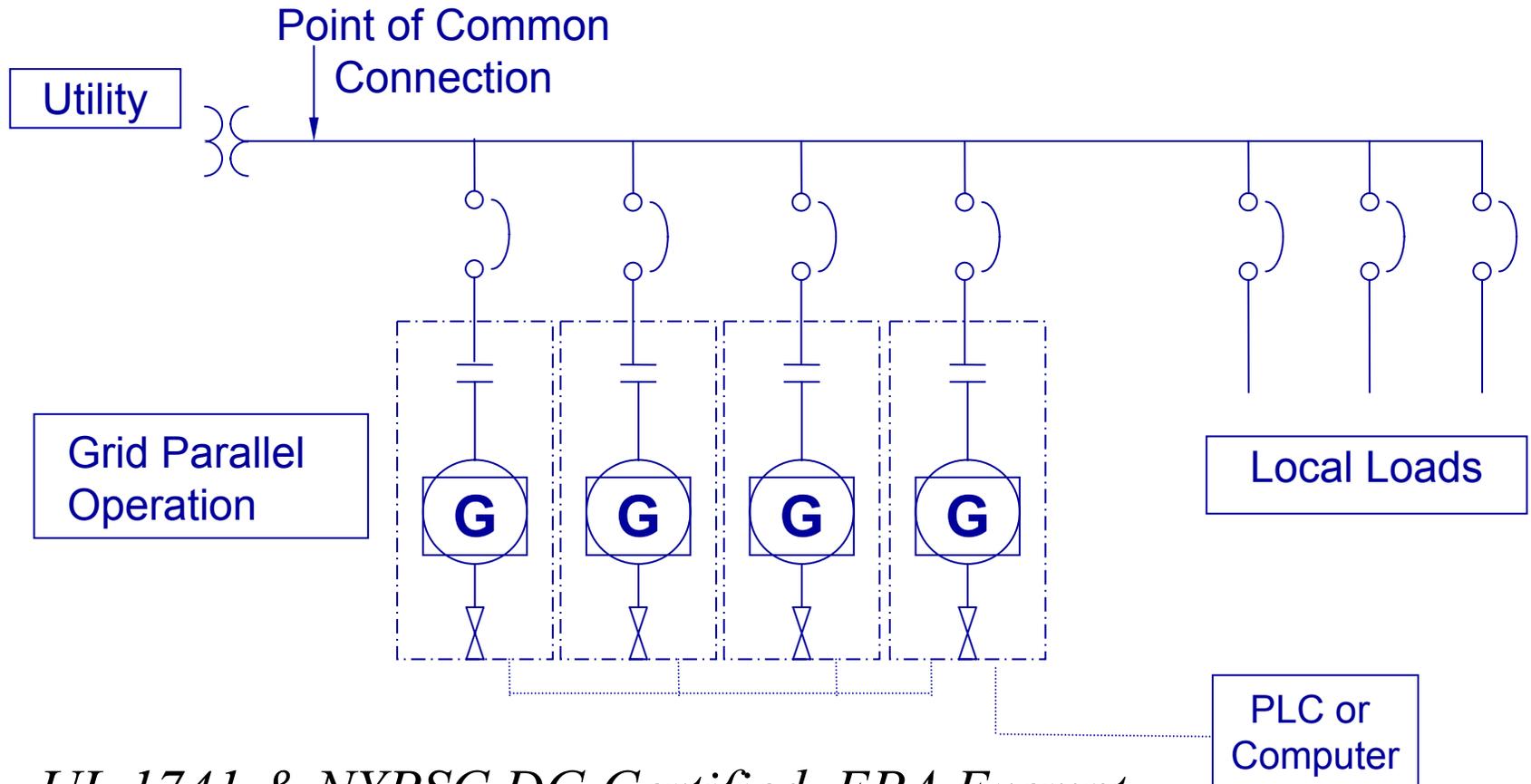
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Each installed PureComfort 240 produces 10,135 lbm/year less NOx than fossil fuel grid power, the equivalent of taking more than 260 average passenger cars off the road.





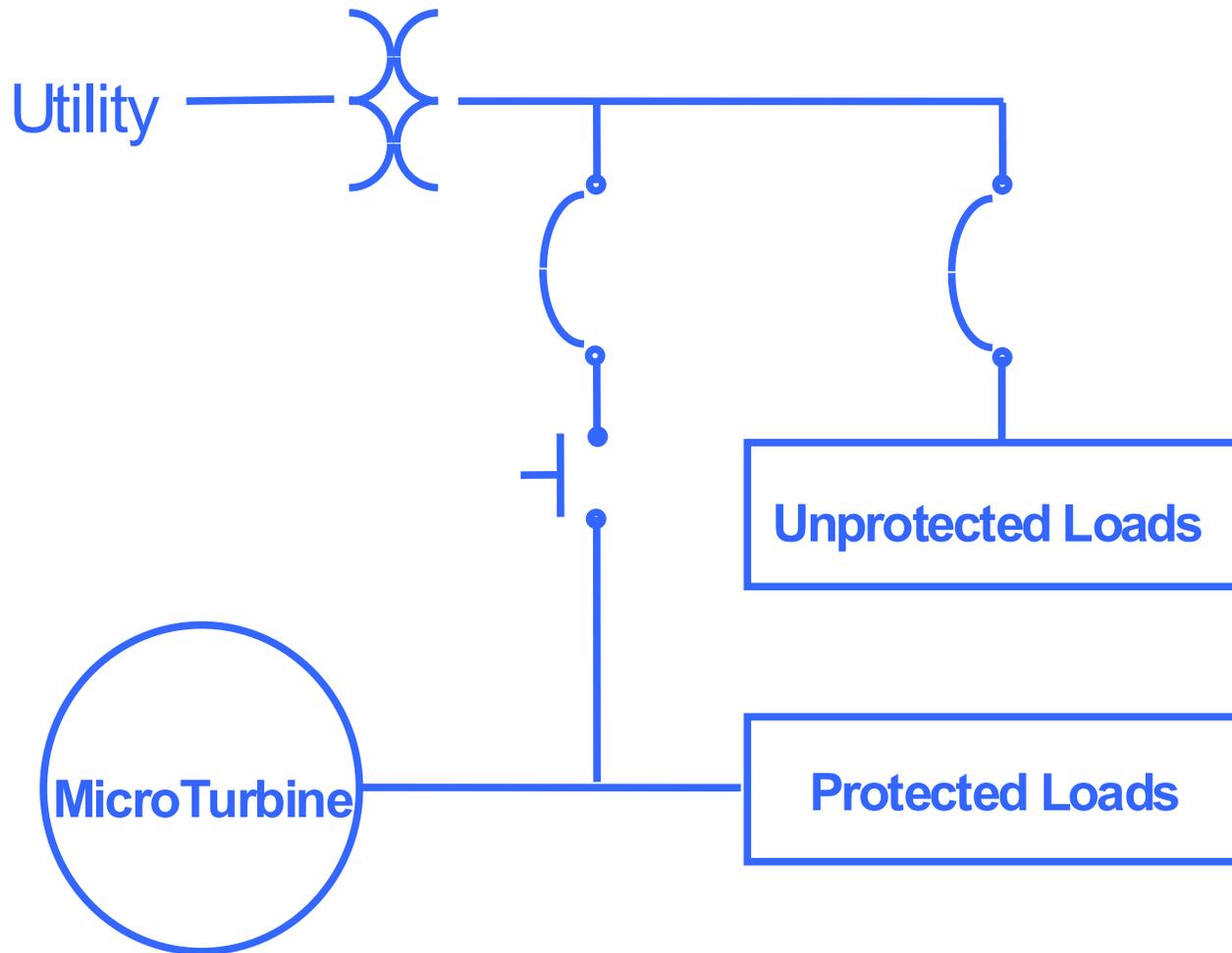
Microturbine MultiPac



UL 1741 & NYPSC DG Certified, EPA Exempt

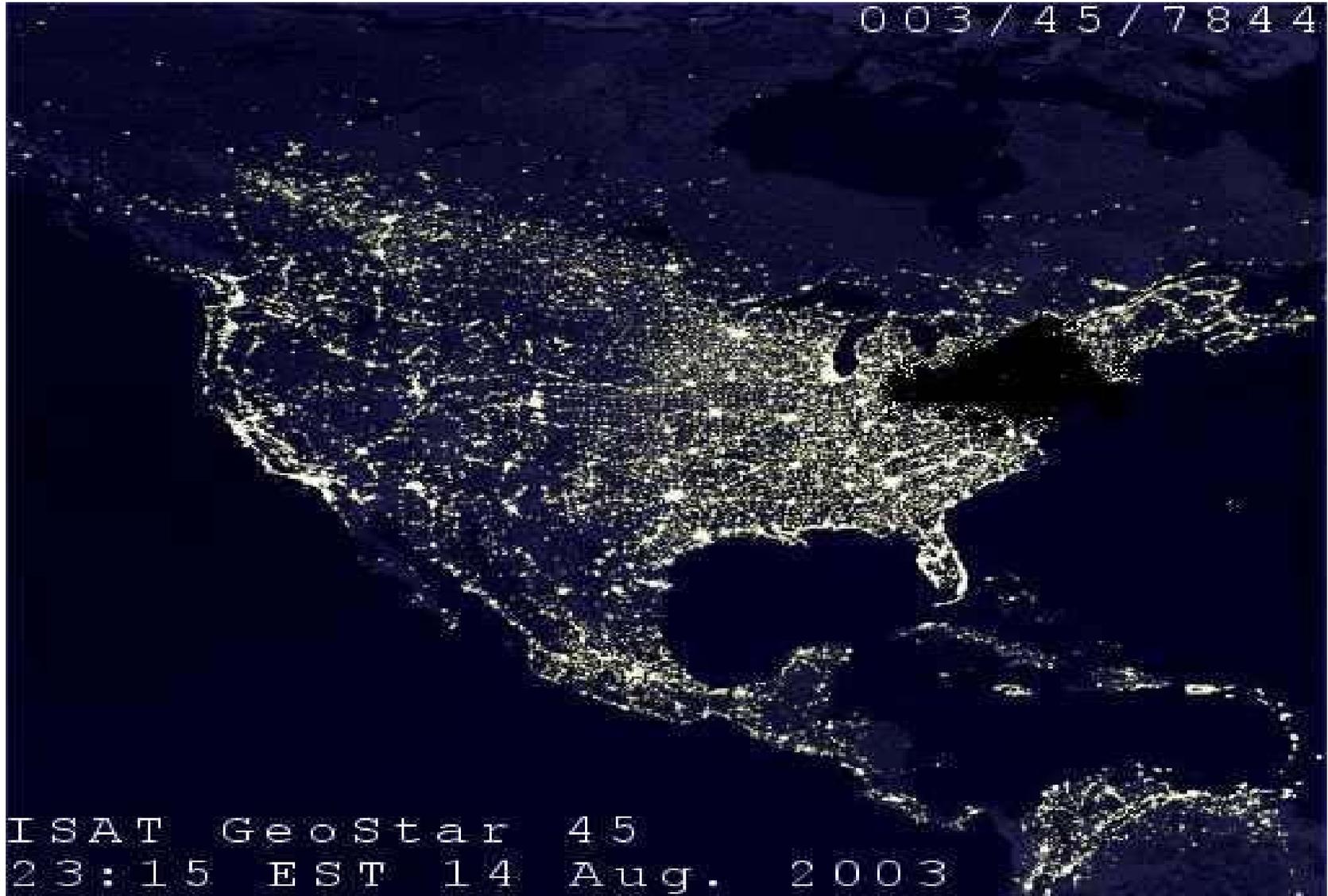


Dual Mode Configuration for backup power ...





... to have Power when you need it Most!



ISAT GeoStar 45
23:15 EST 14 Aug. 2003



CHP Value Proposition Characteristics

- High Electricity to Fuel Cost Ratio
- Significant Run Time
- Avoided Capital Investment
- Low Maintenance Required
- Exhaust Heat Utilization
- Power Quality Critical
- Strict Air Quality Requirements
- Light Weight Important





Gas to Electricity Conversion

Fuel Price (\$/MMBtu)

- \$4.00
- \$5.00
- \$6.00
- \$7.00
- \$8.00

Equivalent Electric (w/o cogen)

- 5.66c/kWhr
- 7.07c
- 8.48c
- 9.90c
- 11.31c

When the heat is used, the effective electric generation rate is approximately half that shown above.

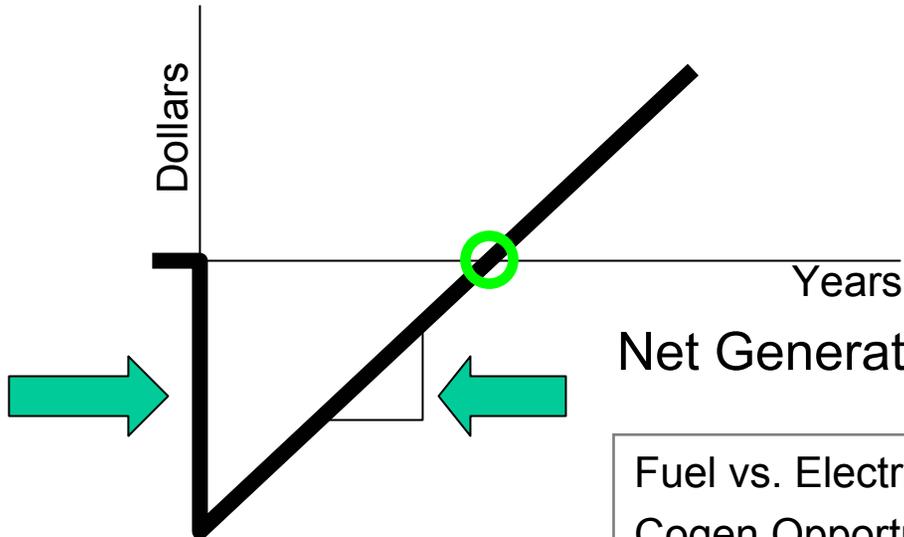


Quantifying CHP Value

Initial Capital
+ Installation
Installed Cost

- **Less "Offsets"**

- T&D Deferrals
- Standby Gen-set
- Power Quality
- Emissions Control
- Boiler Equipment
- Cooling Equipment
- Btu Reduction
- Government Grants



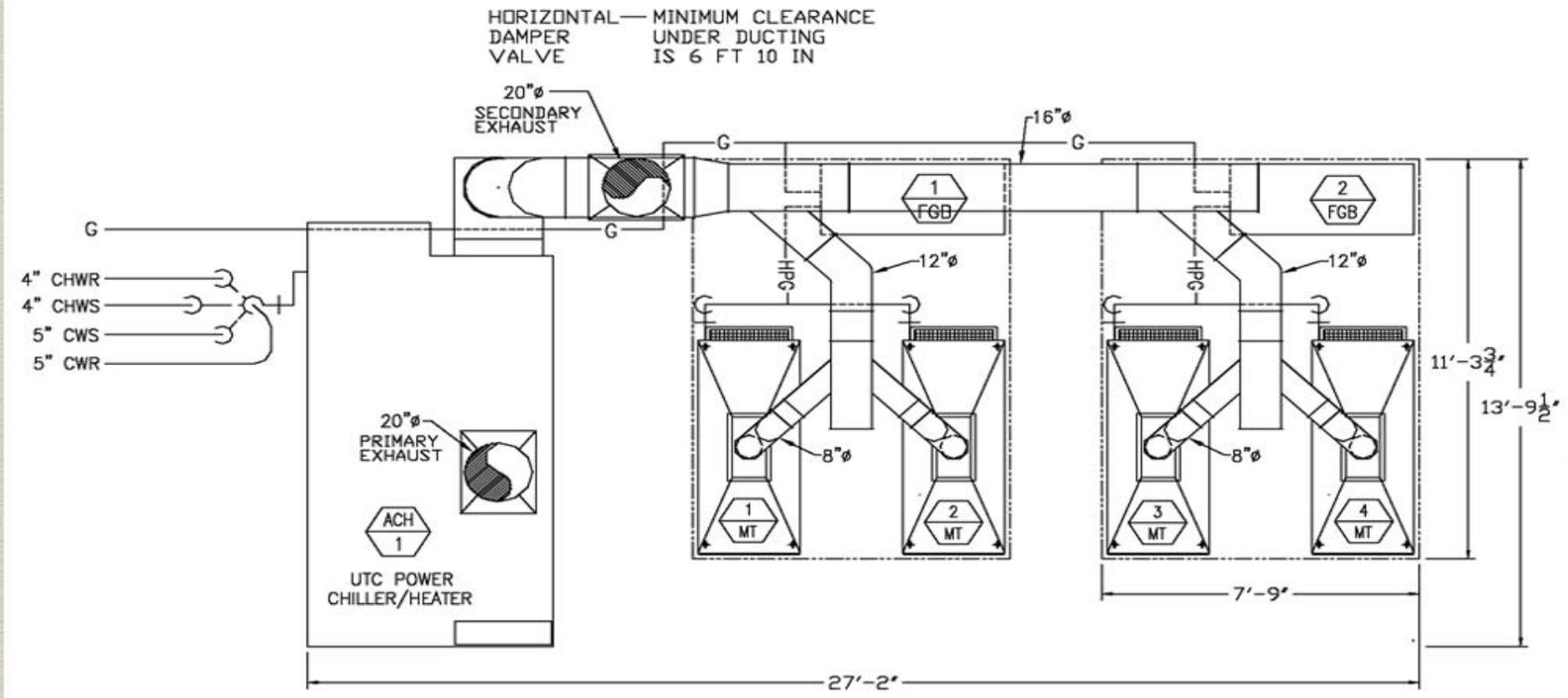
Net Generation Return

- Fuel vs. Electricity Costs
- Cogen Opportunities
- Maintenance Advantage
- Price Volatility Protection

= Net Cost to Owner



Footprint



Option #3



Clean Energy, Cooling & Heat

- Space Heating in Winter
- Air Conditioning in Summer
- Reliable Electric Power All Year Long



200 Ton Absorption Chiller

750 kW Capstone MicroTurbine Power

Installed Summer 2000



CHP VALUE



Changing the Paradigm of Clean Energy Generation



- Innovation via Technology for High Energy Efficiency
- Clean, Reliable & Back-Up
- Single Source for Service



Thank You for Your Interest

James Pfeiffer

Cooling Heat & Power
Solutions

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44 Units for Power & Drying