



Combined Heat & Power

Efficient & Reliable Energy for the Future

Joe Allen
Director of Government Relations
Washington, D.C.

Solar[®] Turbines
A Caterpillar Company

Mining & Construction Equipment, Engines, Rail, Gas Turbines

\$42.6 billion* in sales
\$1.9 billion in R&D

**Distribution through
dealers to more than
200 countries in 23
time zones**

**Over 400 facilities
in 50 countries**



104,500 Employees

188 Dealers

127,000 Dir. Employees

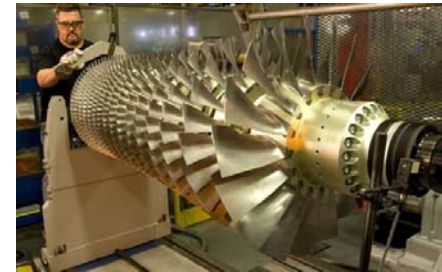
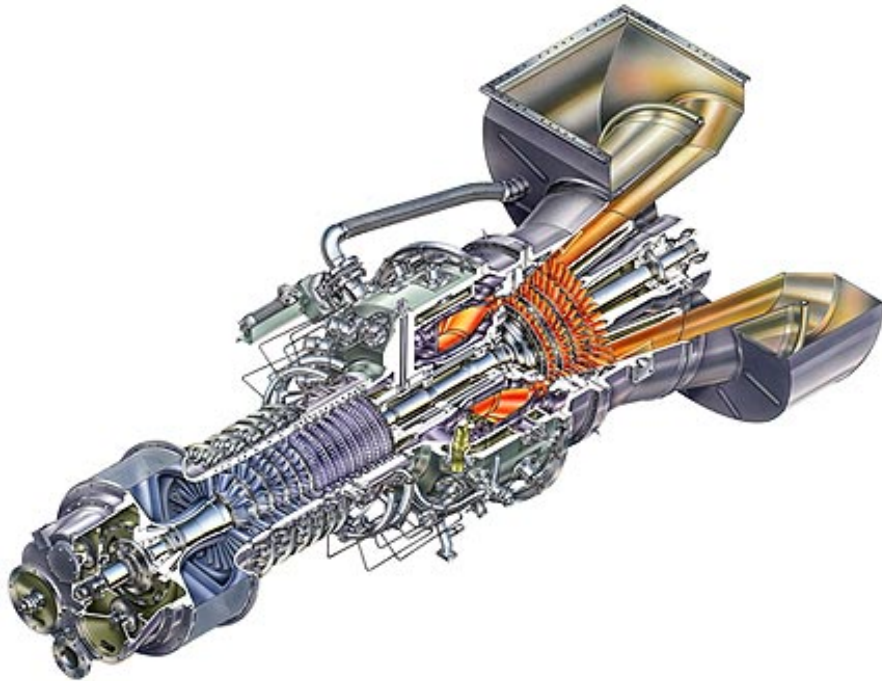
**Customer support is
central to Cat's
business model**



* 2010

Solar[®] Turbines

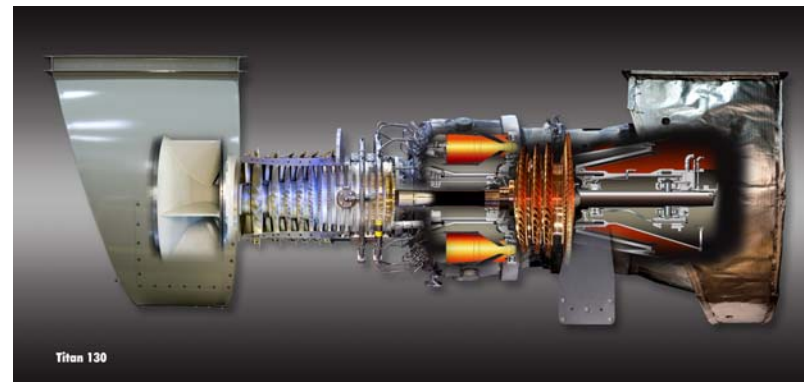
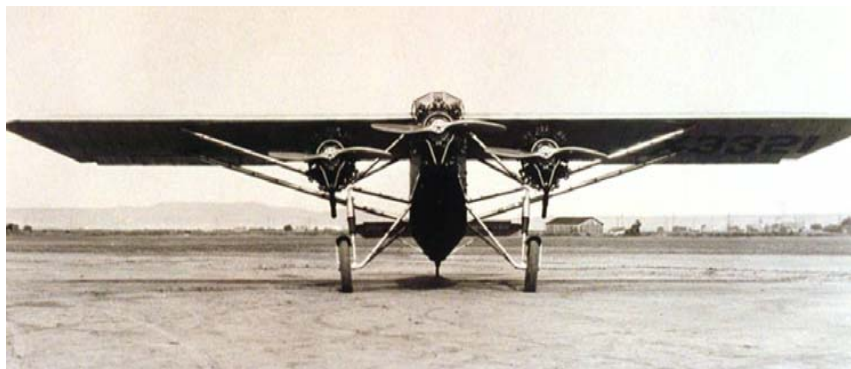
A Caterpillar Company



Founded in 1927 as the Prudden-San Diego Airplane Co.

Renamed “Solar Aircraft Company” in 1929

Evolved to Industrial Gas Turbines ... renamed Solar Turbines



*“Solar” ... because it’s **sunny** in San Diego*



Natural Gas & Renewable Fueled Gas Turbines

Established in 1927

Based in San Diego, CA

Subsidiary of Caterpillar

Over 7,400 Employees

Key Markets

- Power Generation
- Oil & Gas



Oil & Gas Production



Power Generation



Gas Compression

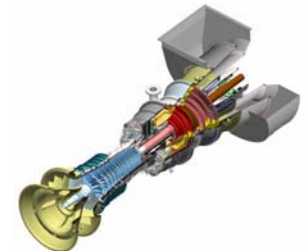
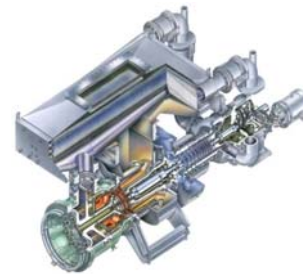
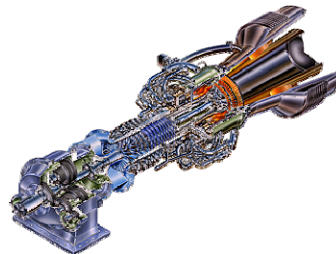


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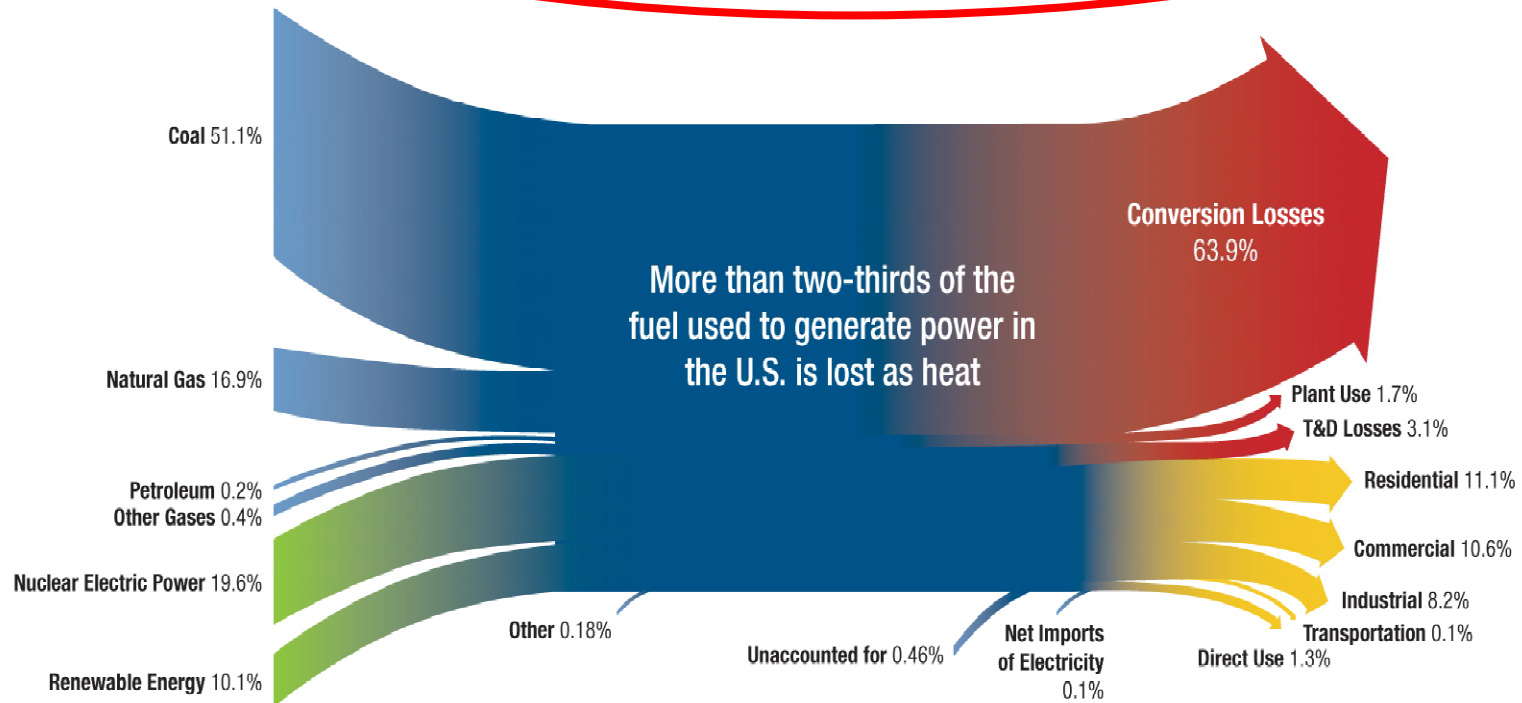
Largest manufacturer of industrial Gas Turbines (1- 22 MW size range)

Over 14,000 Units in 98 countries

70% of our products are exported from the U.S.



**Over 2/3 of Fuel Used to Generate Power
Is Lost as Heat**



CHP can capture much of this waste heat...

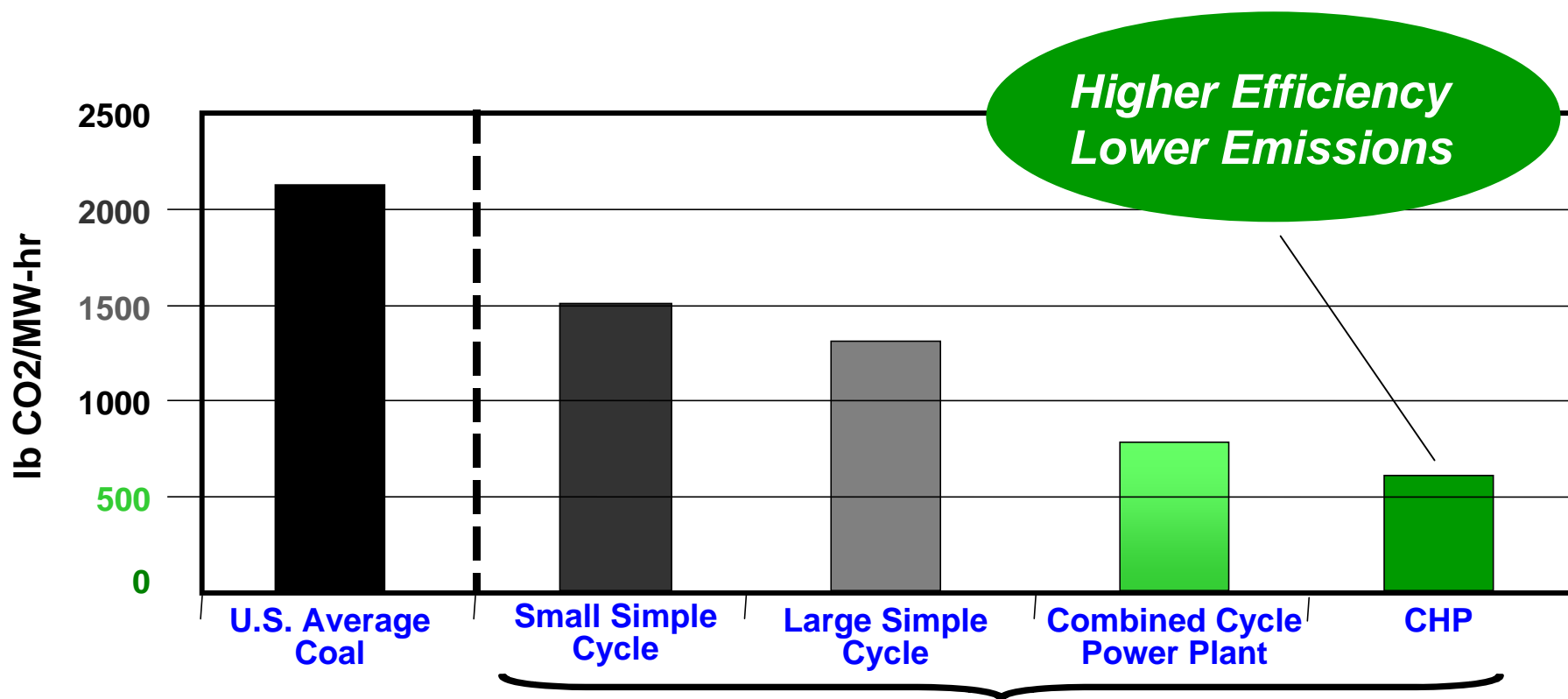
CHP is an integrated energy system that:

- Is located at or near a building, factory, or other point of use
- Generates electrical and/or mechanical power
- Recovers waste heat for heating, cooling or dehumidification
- Can utilize a variety of technologies & fuels



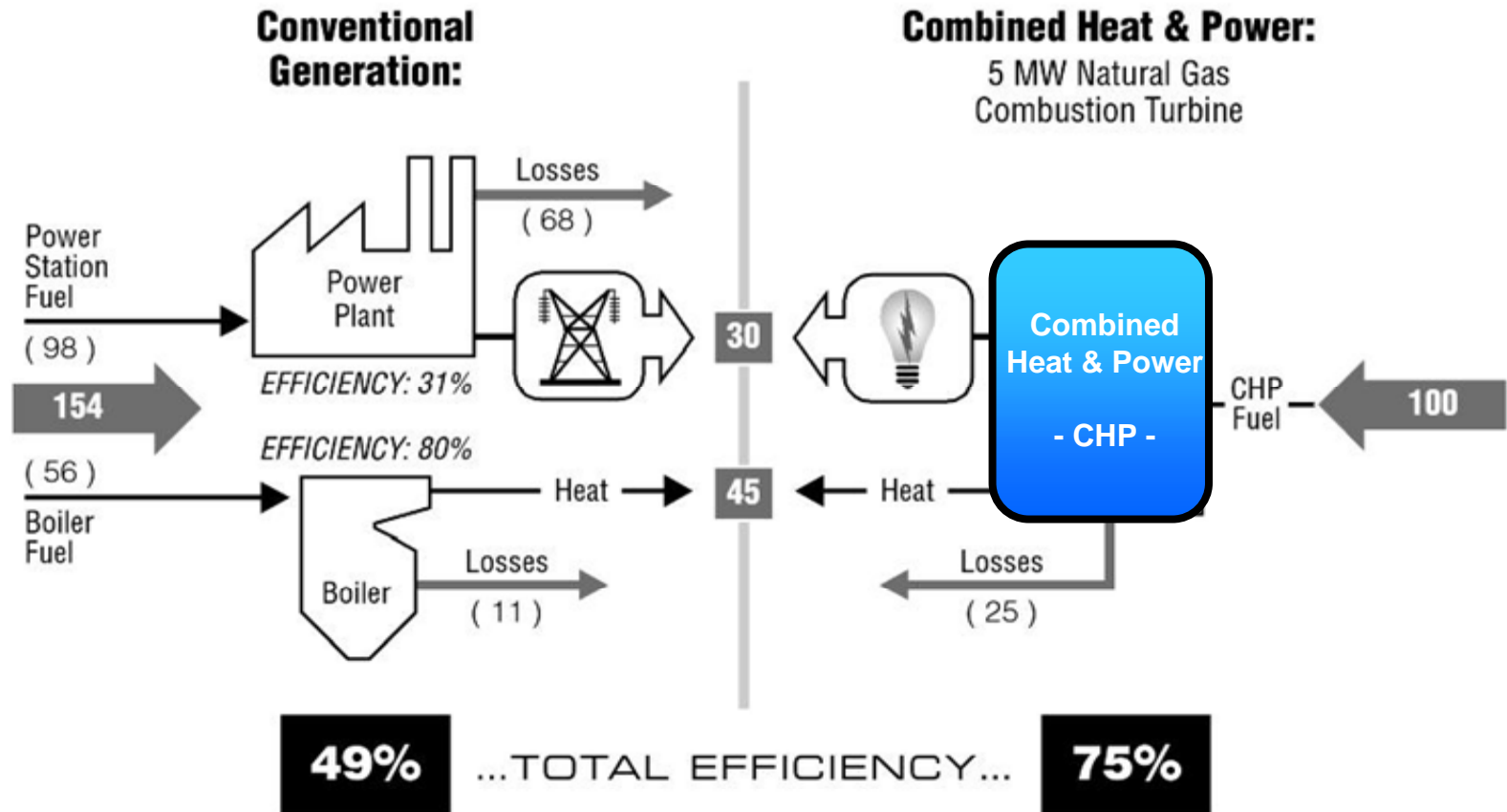
Natural Gas is the Least Carbon-Intensive Fossil Fuel

CHP is the Most Efficient Use of Natural Gas



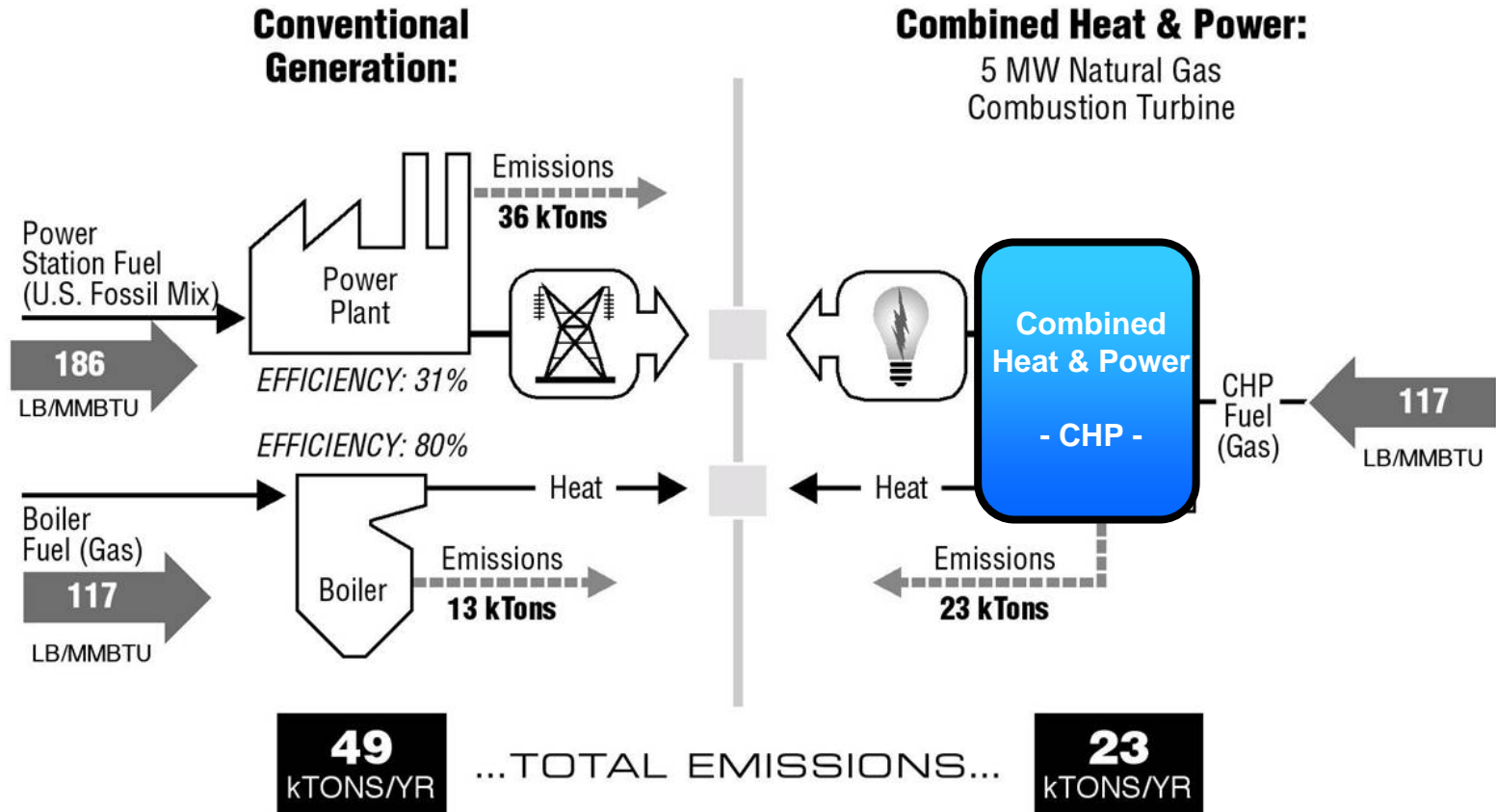
Coal = 208 lb CO₂/MMBtu (HHV)
Distillate Oil = 161 lb CO₂/MMBtu (HHV)
Natural Gas = 117 lb CO₂/MMBtu (HHV)

Natural Gas-Fired Gas Turbines



Source: ICF

Higher efficiency...



Source: ICF

Lower CO₂ emissions...

- ✓ Provides High Power Reliability
- ✓ Operates 24/7



Category	10 MW CHP	10 MW PV	10 MW Wind
Annual Capacity Factor	85%	22%	34%
Annual Electricity	74,446 MWh	19,272 MWh	29,784 MWh
Annual Useful Heat	103,417 MWh _t	None	None
Footprint Required	6,000 sq ft	1,740,000 sq ft	76,000 sq ft
Capital Cost	\$20 million	\$48 million	\$24 million
Annual Energy Savings	316,218 MMBtu	198,563 MMBtu	306,871 MMBtu
Annual CO ₂ Savings	42,506 Tons	17,824 Tons	27,546 Tons
Annual NOx Savings	87.8	23.6	36.4

Based on: 10 MW Gas Turbine CHP - 28% electric efficiency, 68% total efficiency, 15 PPM NOx
 Electricity displaces National All Fossil Average Generation (eGRID 2010) -
 9,720 Btu/kWh, 1,745 lbs CO₂/MWh, 2.3078 lbs NOx/MWh, 6% T&D losses
 Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

*Higher Efficiency
Lower Emissions
High Reliability*

Lower GHG Emissions

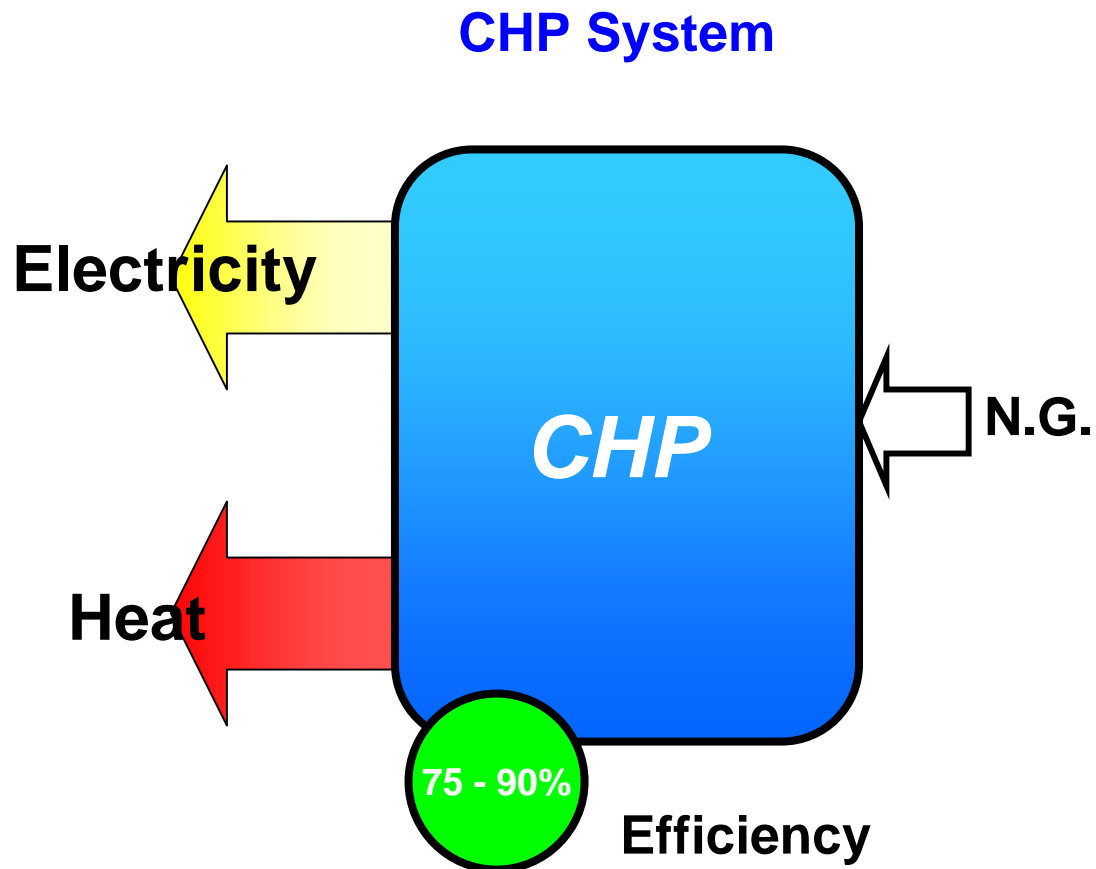
Lower NO_x & SO₂

High Power Reliability

Less Fuel Use

Low Operating Costs

Reduced T&D Corridor Congestion & Losses



Shands HealthCare Cancer Hospital

- Mercury 50 gas turbine (4.3 MW)
- Hospital heating & cooling
- 100% of electrical needs
- 75% total thermal efficiency
- EPA Energy Star CHP Award



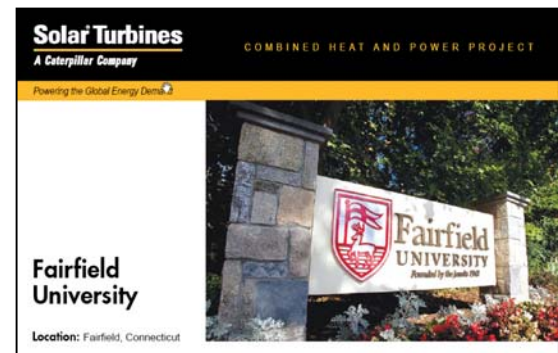
City of Russell / U.S. Energy Partners

- Two Taurus 70 gas turbines
- Ethanol Plant & Russell Municipal Utility
- 12 MW of electricity, 60,000 lb/hr of steam
- 72.8% total thermal efficiency
- EPA Energy Star CHP Award



Fairfield University

- MW Mercury 50 gas turbine (4.5 MW)
- 95% of electrical and 66% of hot water needs
- \$2.3M annual energy savings
- EPA Energy Star CHP Award





Bangladesh



Colombia



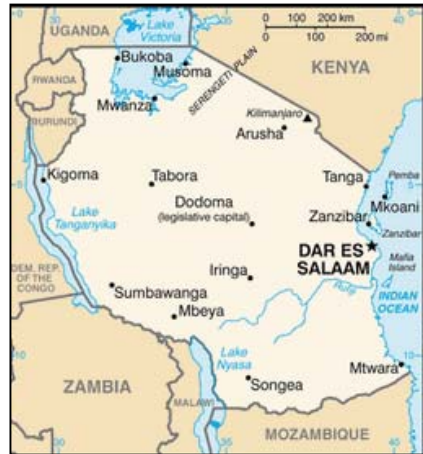
Kazakhstan



South Africa



Kenya



Tanzania



El Salvador



Mexico

1. **What are your Power Reliability goals?**
2. **What is the Efficiency of current Power Generation?**
3. **What are your CO₂ goals?**
4. **Do you have Interconnection Standards?**
5. **Is there good access to Natural Gas or Biogas?**





**Higher Efficiency
Lower Emissions
High Reliability**

