GovEnergy
www.govenergy.gov

GSA

Phoenix, AZ

August 3-6, 2008

On-Site Energy Systems Improve Reliability, Efficiency and the Environment

Ed Mardiat

Burns & McDonnell

GovEnergy
www.govenergy.gov

Presentation Overview

- Energy Security and Efficiency Mandates
  - Part of our Nation's Energy Solution
- Need for Increased Reliability
- Using Fossil Fuel More Efficiently and Environmental Sound Way
  - Fossil fuel our most abundant fuel source
- Integration of CHP Systems
  - Higher efficiency, lower emissions

DSB Report: Energy Security

"The final report concludes that the DoD faces two primary challenges: unnecessary high and growing battlefield fuel demand compromises our operational capability and ***critical missions at military installations and are venerable from loss of commercial power outage and inadequate back up power supplies****."*

Convergence and Alignment

Corporate Sustainability

"Embracing the complexity of sustainability calls for understanding it at a new level of consciousness." Mindsets in Action - Avastone Consulting

Federal Government Mandates

"Energy Efficiency in New Federal Buildings to Increase by 30%"

"National Security Agency Wants to Reduce or Exit Use of Power Grid"

"DOD-wide plan to get military facilities and agencies off the grid by 2025"

The Energy Independence and Security Act of 2007

"It represents a major step forward in expanding the production of renewable fuels, reducing our dependence on oil, and confronting global climate change." – George W. Bush

What's the Answer?

- Fuel Diversity
  - Fossil fuels are not going away anytime soon
- Improved Reliability
  - Integration of CHP systems
- Energy Efficiency
  - Chasing the BTU from beginning to end
- Environmental Stewardship
  - Efficiency drives environmental results

On-Site Hybrid CHP Systems

1. Reduce supply side pricing risk while maximizing demand side savings
2. Deliver higher efficiency for every BTU consumed
3. Produce useful thermal energy without additional consumption
4. Provide improved reliability and lower emissions than the commercial grid

Technologies May Include:

- Low Emission Gas Turbine Generators
- Natural Gas-Fired Engine Generator
- Heat Recovery Steam Generators
- Absorption Chillers – Direct/Indirect
- Electric Centrifugal Chillers
- Building Integrated Renewable Energy
- Thermal Energy Storage

CHP Increases Reliability

- Eliminate Power Outages and Poor Power Quality Caused by the Transmission and Distribution Grid
- On-Site Generation Technologies Provide High Reliability
- More than One Prime Mover Can Be Used
- Integrated Control Systems

CHP Reduces Emissions

- Recycling Waste Heat Reduces Total Fuel Required for Cooling, Heating and Power
- Natural Gas is a “Clean” Fuel
- CHP Prime Mover Technologies Have Lower NOx Than Traditional Stand-By Generators
- Can Meet Emission Standards Without Exhaust Gas Clean-Up

Why Consider On-Site CHP?

- CHP *"Best User" Profile* is:
  - Coincident electrical and thermal loads
  - 24 hour/day, 7 day/week, 365 day/year operation
  - Low Seasonal Variation in loads
  - High Power Reliability Needs
- Hospitals fit the *"Best User" Profile* for Combined Heat and Power applications

On-Site CHP at Hospitals

Cleaner Normal Power Local generation is anticipated to provide fewer sags and surges. Conversion from primary power to grid backup is measured in “cycles” rather than “seconds”.

More Backup Power Both Grid backups supply 100% of the Hospital’s needs; not just its Life Safety requirements; imagine no chillers or HVAC in August.

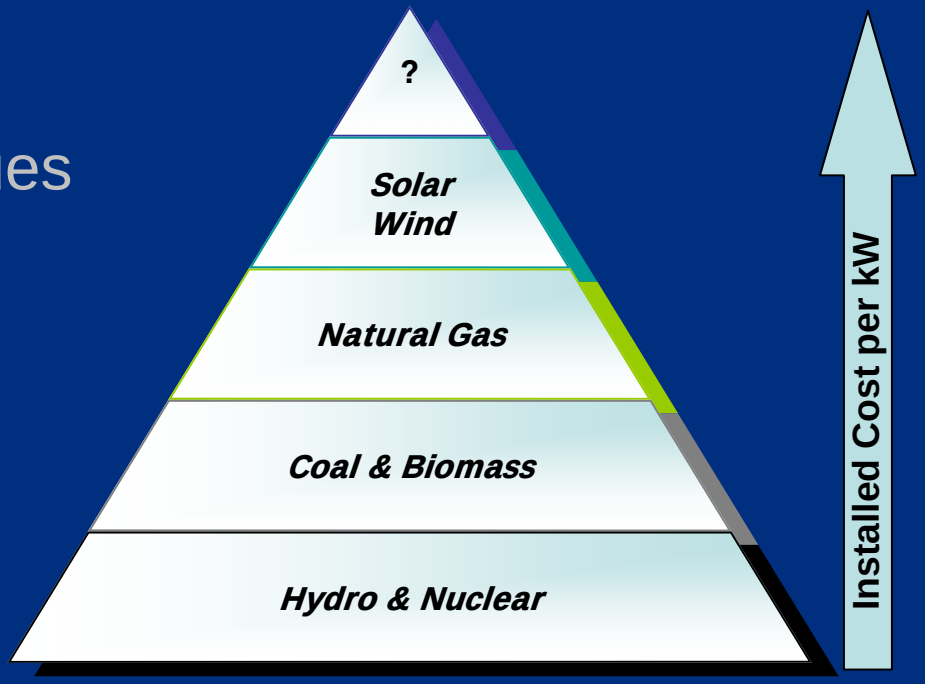
More Reliable Backup Power Probability of failure of the traditional Hospital “grid plus backup” is 67% according to Primen Perspective’s *R_X for Health Care Power Failures*, DE-PP-24, 11/2003

“Island” Power In the event of a grid failure due to natural, technical, or terrorist causes, this strategic community asset will remain in operation when we need it most.

Reliable Normal Power When a hospital converts to fully digital Medical Records, RFID/Bar Code Scan Drug delivery, Computerized Physician Order Entry, etc., ***health care delivery will stop if the “lights go out”.***

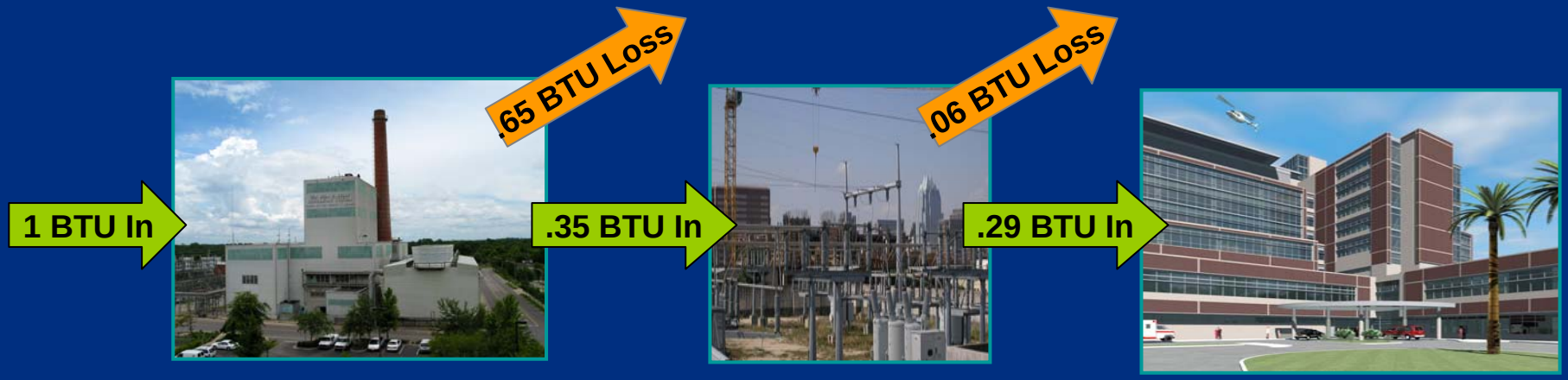
Generation Fuel Portfolio

- Renewable Energy
  - Cost and reliability issues
- Fossil Fuel
  - Our most abundant natural resource
  - New technology and applications
- Reemergence of Nuclear
  - Cost and time issues



Comparison Efficiency

Typical Power Delivery



Power Plant **Transmission System** **Hospital**

At a Coal Fired Power Station, about 35% of the primary fuel is converted into electricity; the remainder is lost "up the stack". An additional 6% efficiency drop occurs in transmission to the site. Overall, at the Hospital's meter, the result is roughly a *29% efficient primary fuel conversion to useful energy*.

Comparison Efficiency

Hospital Power Delivery

1 BTU In

.25 BTU Loss

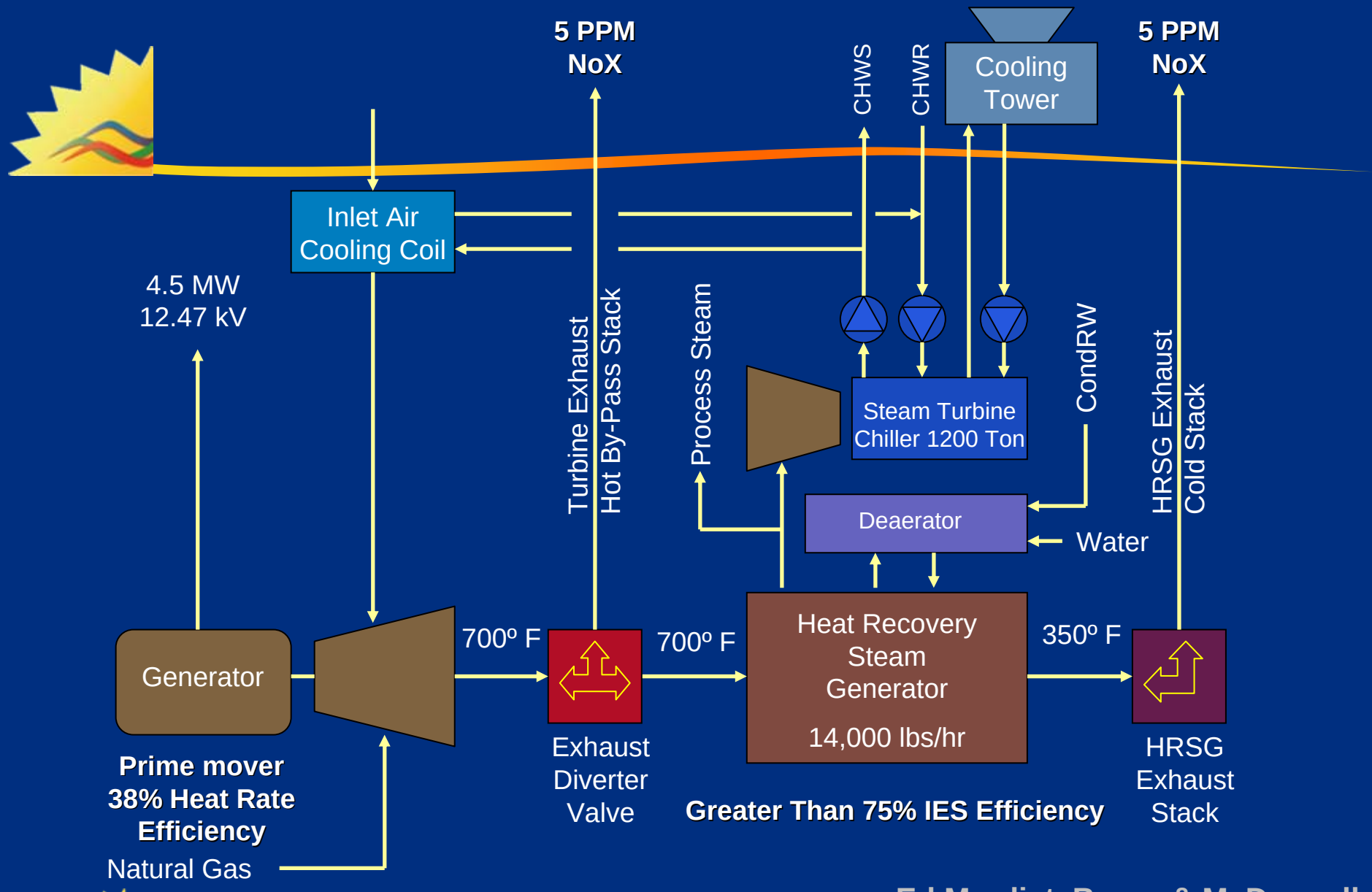
.75 BTU In

CHP Plant

Hospital

On-site CHP Energy Center at the Hospital will be *75% efficient at primary fuel conversion to useful energy.*

This is a *155% savings in primary energy utilization* compared to the Typical Hospital Power Service Model.



GovEnergy
www.govenergy.gov

recycling energy™ CHP It's time

Ed Mardiat, Burns & McDonnell

August 3-6, 2008

Energy Efficiency Comparison

Fuel Conversion Efficiency

- Utility @ 29% 1 kW=3,413 BTU 11,769 BTU
- CHP @ 74% 1 kW=3,413 BTU 4,612 BTU

Hospital Electric Load 31,950,038 kWH

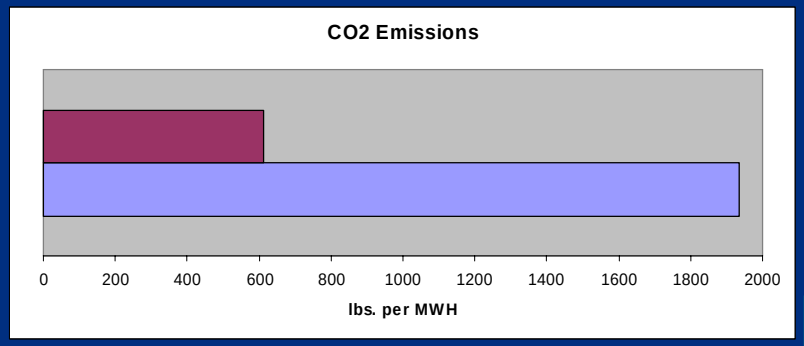
- Central Utility Plant (CUP) = 3.7602×10^{11} BTU
- CHP = 1.4735×10^{11} BTU

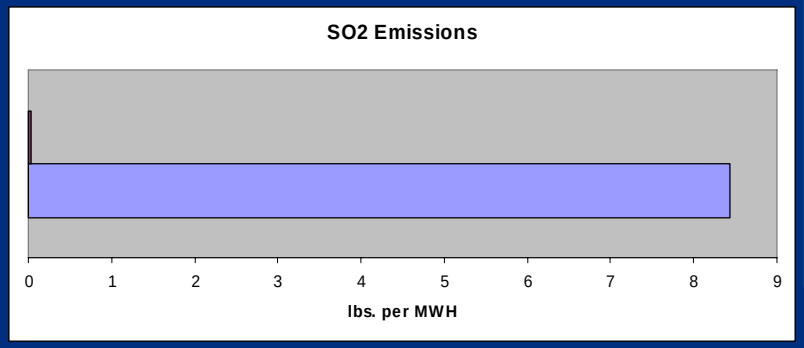
Result: ***A CHP uses 255% less energy than CUP fed from grid and serving the same load.***

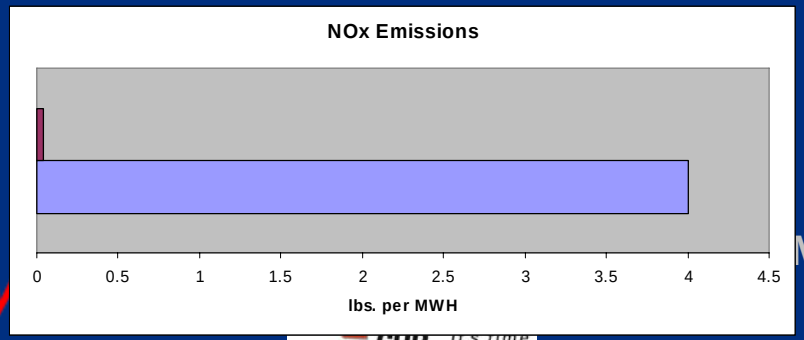
Environmental Comparison

Central Power Plants

CO2 1,937 lbs/MWh
SO2 8.44 lbs/MWh
NOx 4.02 lbs/MWh







On-Site Energy Center CHP Plant

CO2 615 lbs/MWh
SO2 0.003 lbs/MWh
NOx .043 lbs/MWh

Mardiat, Burns & McDonnell

Summary: CHP Systems

- Produce Cooling, Heating and Power at 70 to 80% Efficiencies
- Obtain “Free” Cooling and/or Heating By Recycling the Waste Heat
- Achieve Reliabilities of Near 100%
- Significantly Reduce SO_2, NO_x and CO_2 Emissions

CHP Resources

US DoE - Energy Efficiency and Renewable Energy: Distributed Energy Program at http://www.eere.energy.gov/de/

US EPA - Combined Heat and Power Partnership http://www.epa.gov/chp/

United States Cooling Heat and Power Association at http://uschpa.admgt.com

Would you like to know more about this session?

- Ed Mardiat
- Burns & McDonnell
- 9400 Ward Parkway, Kansas City, MO 64114
- emardiat@burnsmcd.com
- Don’t forget to fill out and drop off your session evaluations.