



An Energy-Efficiency Workshop & Exposition
Orlando, Florida

Microturbine Update

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Capstone Turbine Corp

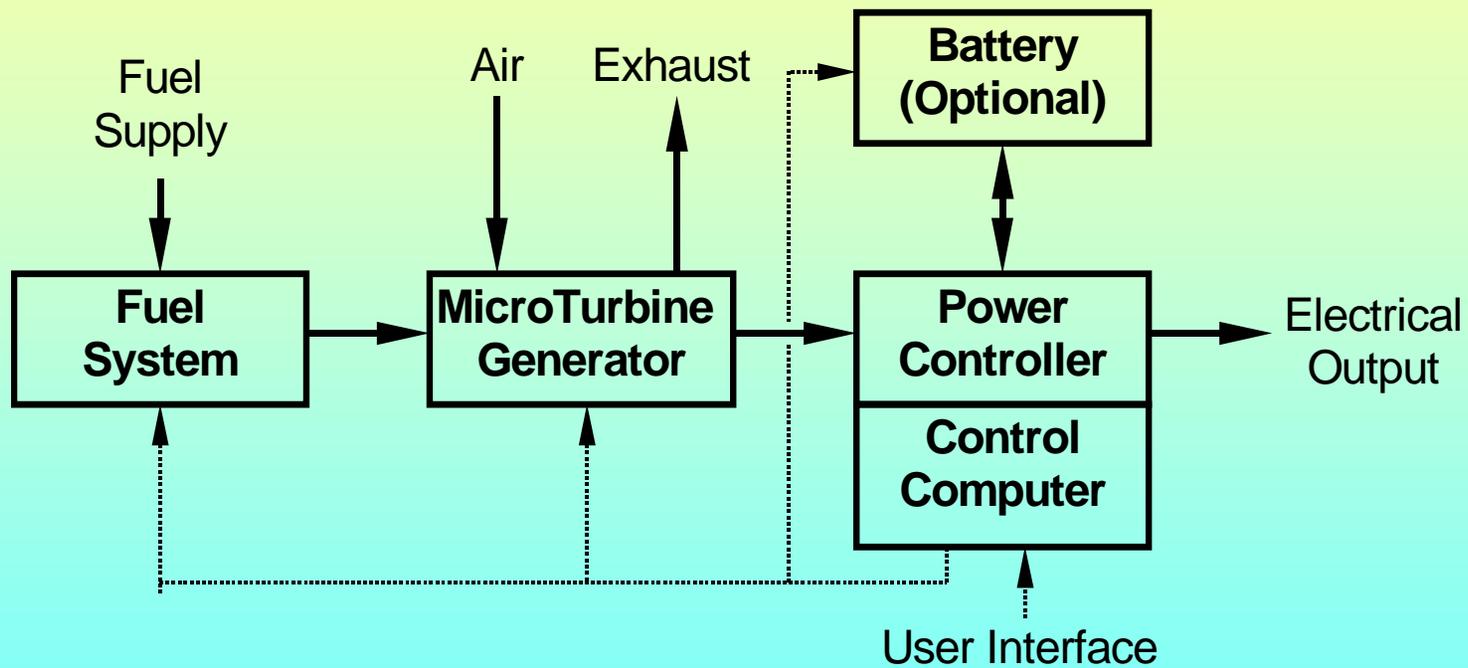


Discussion Topics

- Microturbine Overview
- Value Proposition
- Example Installations
 1. Harbec Plastics
 2. Faith Plating
 3. University of Maryland BCHP
 4. Boeing
- Q & A



Typical Microturbine System





Current Microturbine Offerings

- Ratings from 28kW to 250kWe
 - ✓ Most Manufacturers offer Integrated CHP Systems
- Manufacturers:
 - ✓ Capstone (UTC Power/Cummins)
 - ✓ Ingersoll Rand
 - ✓ Bowman (Kohler)
 - ✓ Elliott
 - ✓ Turbec
- Estimated:
 - > 3,000 Units Sold
 - > 5 Million Operating Hours
(that's 600 years!!)



Some Example Microturbine Products



Common Characteristics:

- Low Maintenance
- Very Low Emissions
Some <9 ppm NO_x and CARB Certified
- Simple Grid Interconnection
Some Certified for CA Rule 21





Distributed Generation

An Excellent Supplement to Centralized Generation



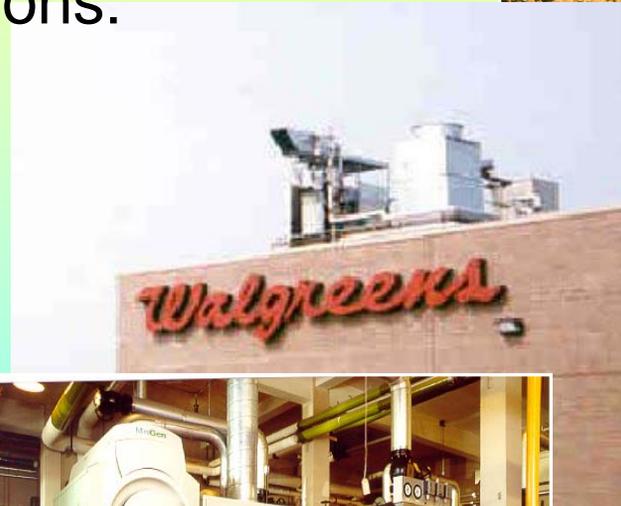
...but for distributed generation to become a true supplement, it must be safe, reliable, clean, simple, flexible and affordable.



The MicroCHP Opportunity

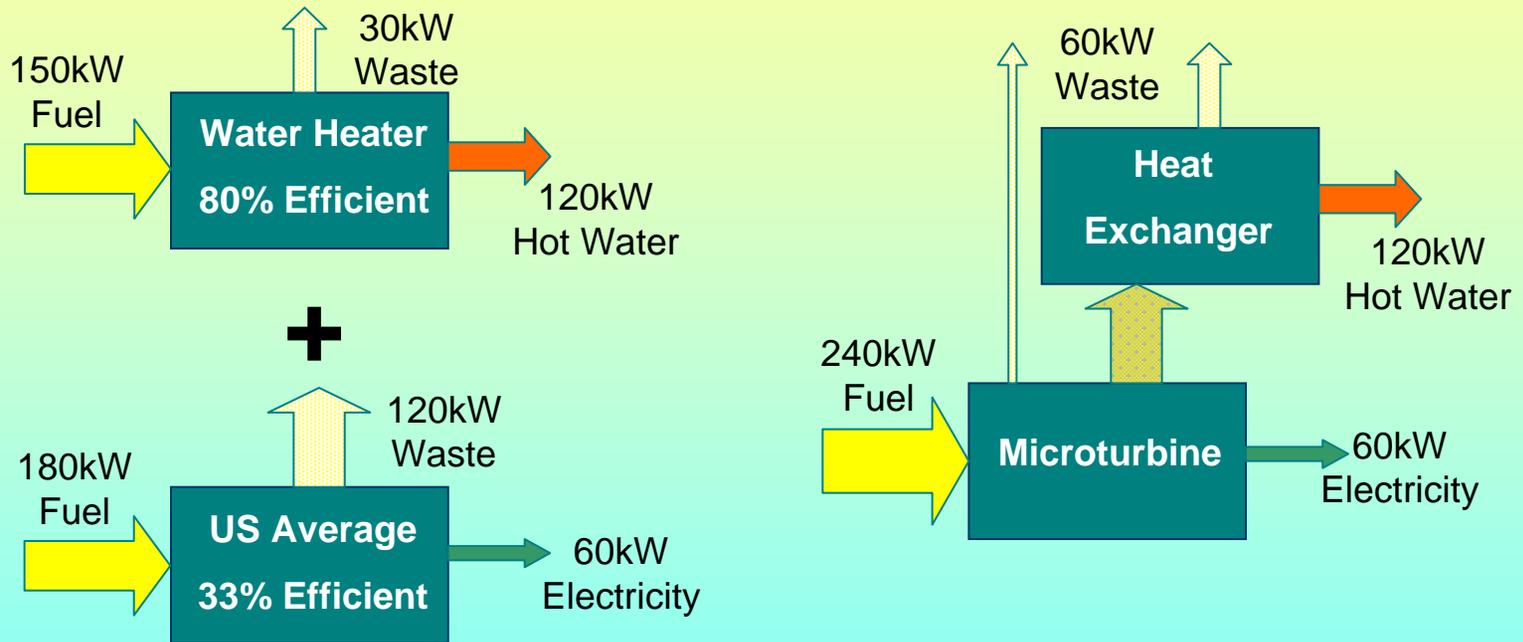
Three Major Applications:

- ✓ **Direct Exhaust**
- ✓ **Hot Water**
- ✓ **Cooling**





MicroCHP vs Traditional Systems



Traditional

- 57% Total Efficiency
- 0.2 lb/hr NO_x
- 120 lb/hr CO₂

MicroCHP

- 75% Total Efficiency
- 0.02 lb/hr NO_x
- 90 lb/hr CO₂



MicroCHP Payback Example

Example CHP Systems with the following Characteristics:

120kW Rated Output

110kW Avg. Electrical Output

220kW Thermal Load

5,000 hr per year Operation

Electric Utility Rates:

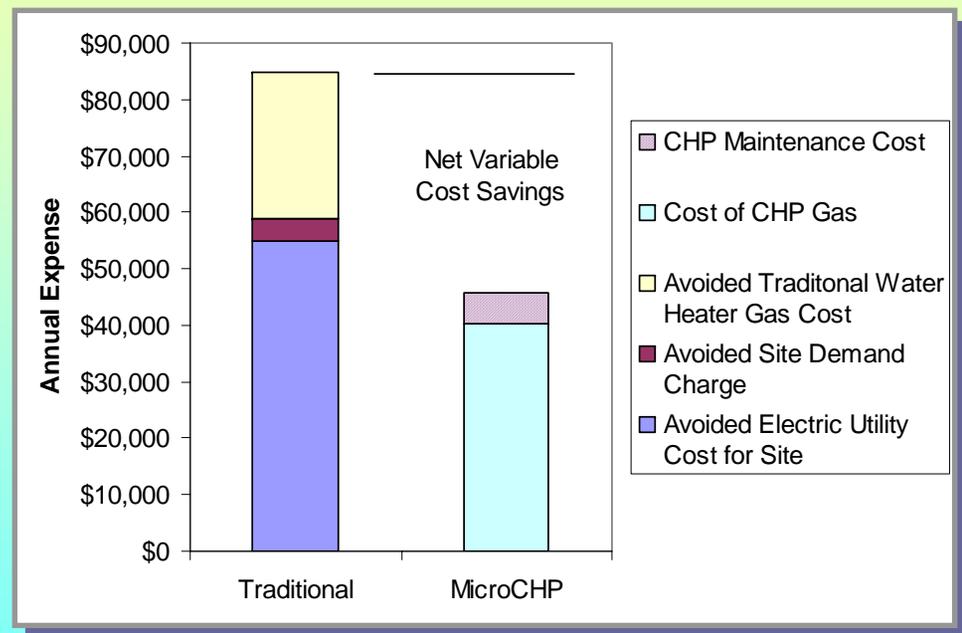
\$.10 per kWh

\$ 5 Demand

Gas Utility Rates:

\$5 per MM BTU

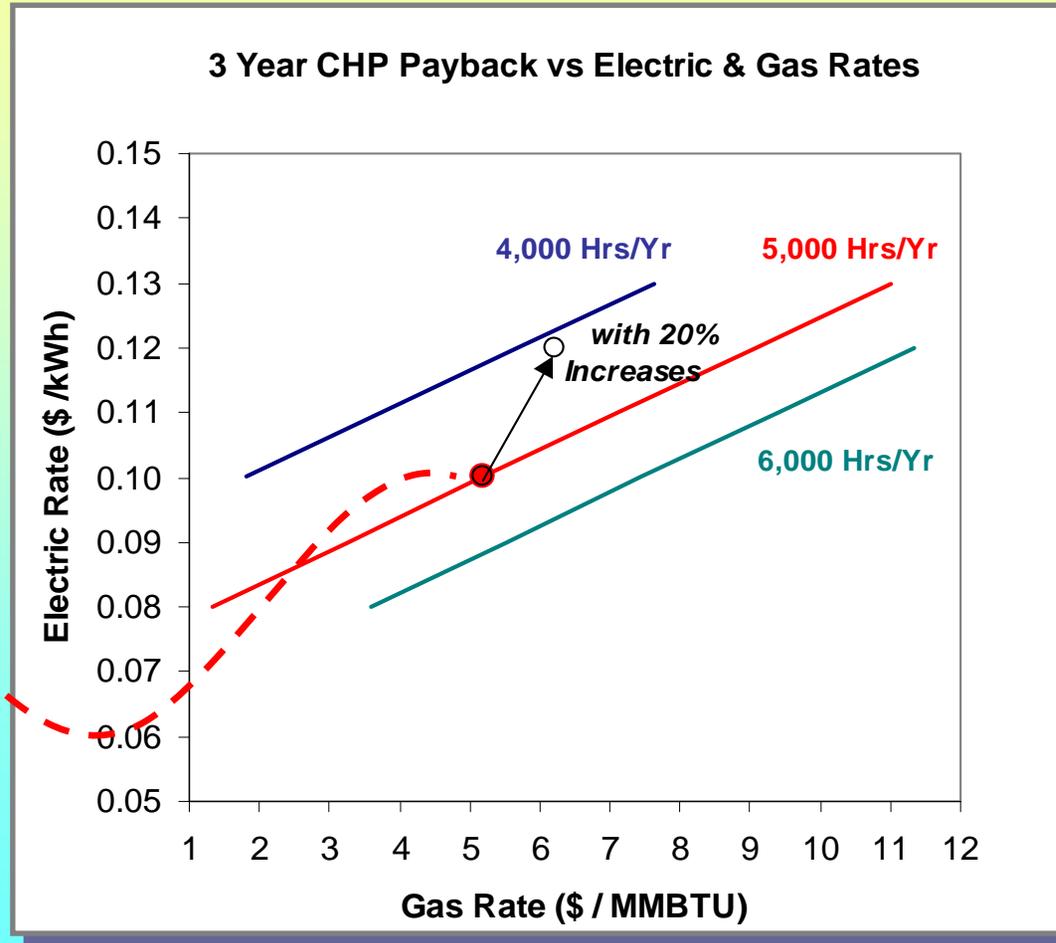
\$.01 per kWh Maintenance Cost



3 Year Payback !!



MicroCHP Rate Sensitivity



Previous Example :
\$.10 / kWh
\$ 5 / MMBTU



Harbec Plastics

Rochester, NY

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



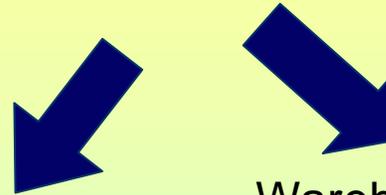
25 Capstone Model 330 MicroTurbines



Carrier Hot-Water Fired
Absorption Chiller



The Harbec Uses for Waste Heat



Office HVAC in Summer



Carrier Absorption Chiller Converts
210° Hot Water to 44°- 47°F Chilled Water

Warehouse Heating in Winter



Radiant Floor Heating
17,000' of 1" Diameter tubing



Faith Plating

- Worlds Largest Electroplater of Remanufactured Chrome Bumpers
- Website www.bumper.com
- 85 year old facility in Hollywood, CA





Energy Cloud with a Silver Plated Lining

- Reasons to Consider DG
 - Control Energy Costs
 - Improve Reliability
 - Meet Tough Environmental Regulations
- The Solution
 - Four Capstone C30 Microturbines with Heat Recovery
 - AB 970 Self Generation Incentive through SoCalGas





Proof is in the Plating

- Estimated \$48,000 per year energy savings (excluding the \$6,000+ savings for Sludge Drying)
- Increase Power Reliability
- Case Study by the DOE/ORNL and Energy Solutions Center

www.energysolutionscenter.com

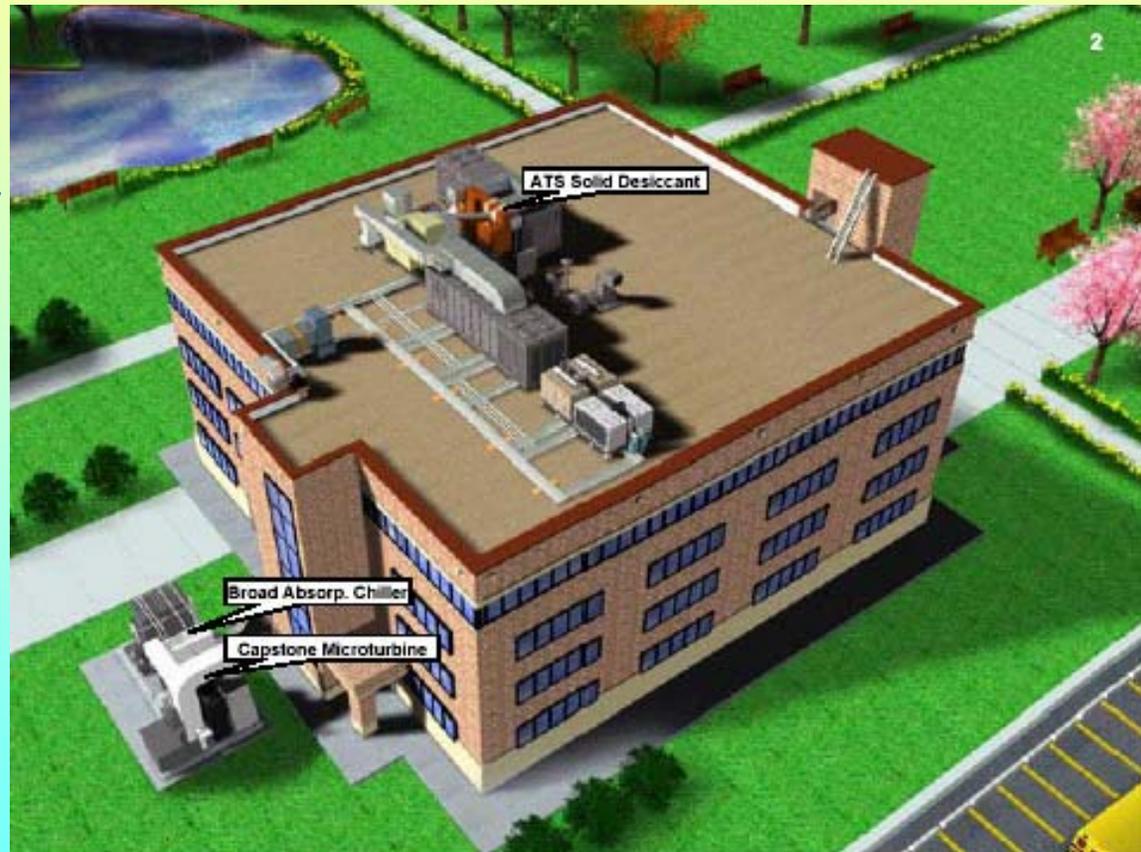




University of Maryland BCHP Demonstration

DOE/ORNL Project

Websites with more info:
www.cee.umd.edu/ceee/
www.bchp.org/vtour



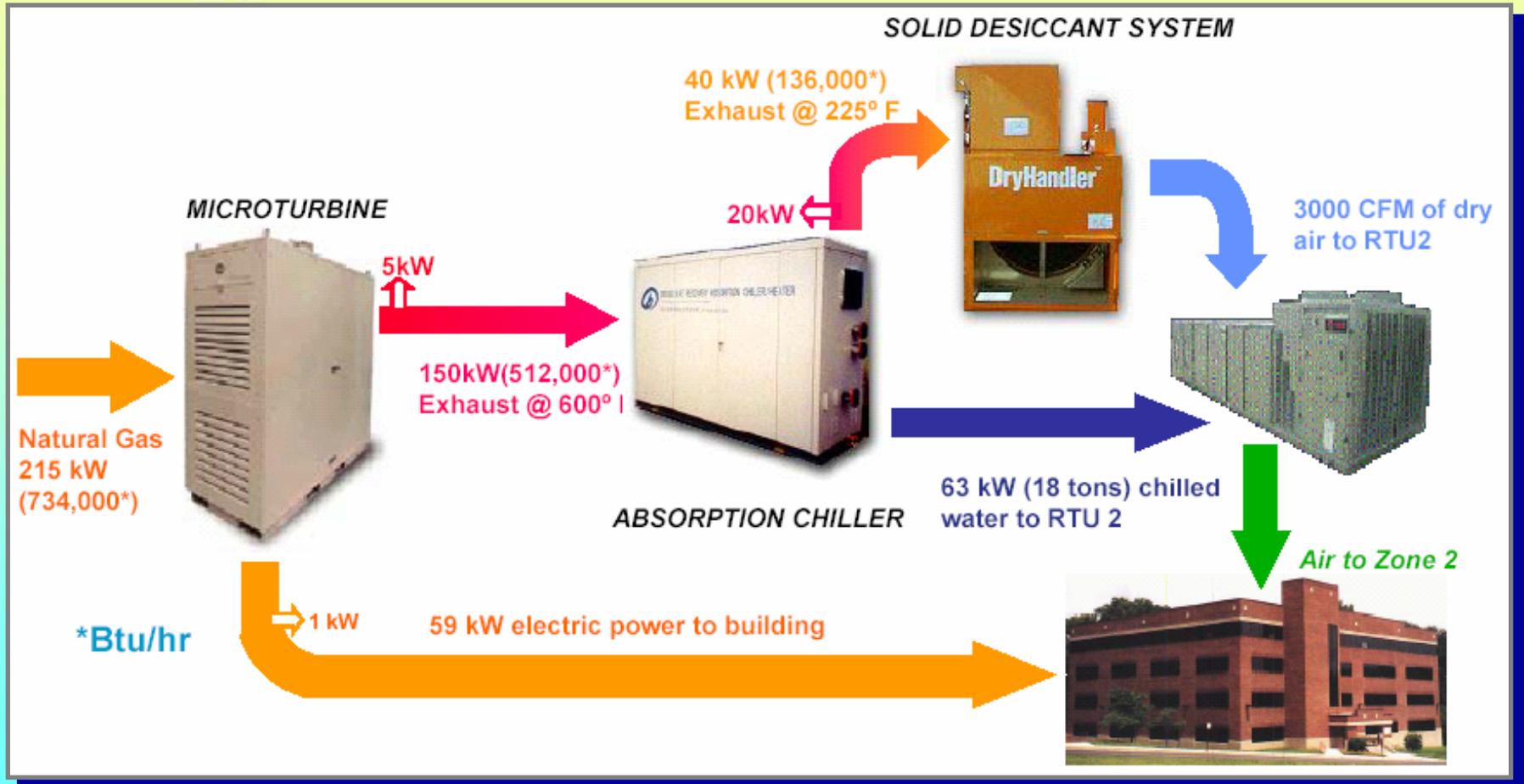
U of Maryland Administration Bldg – 50,000 ft²

August 17-20, 2003

www.energy2003.ee.doe.gov

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Major BCHP Components





Integrated Microturbine/Chiller System

UTC "PURECOMFORT" SOLUTION



Provides:

- ~240 kW electrical power
- ~105 tons of chilled water
- ~270 kW hot water up to 140°F



Boeing Telecom Installation

- Customer needed Reliable Power for Data and Telecom
- C30 Operates 24X7
- Advantages over Standby Genset
 - No Air Permitting Issues
 - Low Maintenance
 - Small Footprint
 - Quieter Operation
 - No Vibration
 - Higher System Availability





Question & Answer



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