



An Energy Efficiency Workshop & Exposition  
Palm Springs, California

## ***Modular Technology for Large Integrated Energy Systems***



## ***The Journey of a CCHP Project***

- Fort Bragg Overview
- Honeywell Role at Fort Bragg
- Energy Management Strategy and Structure
- Central Heating and Cooling Plants
- CCHP Evaluation – Phase 1
- DOE Award
- Final? Cycle Design of Retrofit Project
- Conclusions



## *Fort Bragg Army Post*

- Mission
  - Home of 44,000 Soldiers
  - 82<sup>nd</sup> Airborne, Special Forces & Others
  - Simmons Army Airfield
  - Pope Air Force Base
- Public Works Infrastructure – Municipal Utility
- Energy Consumption
  - 450 x 10<sup>6</sup> kWh of electricity per year
  - 100 MW Peak Demand
  - 1.5 BCF of gas per year

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## *Honeywell Roll at Fort Bragg*

- Energy Savings Performance Contractor
- ESPC – TEAM Contracting Vehicle
  - Over \$51.6 million in improvement projects
  - Annual energy savings of over \$8.5 million
- Energy Strategy -Integrated Supply Chain Management
  - Reduce Energy Cost - Demand, Distribution, Supply
  - Manage Energy Risk – Both physical and financial
  - EO-13123 Energy Efficiency

**Improve the Quality of Life for Soldiers**

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## *ESPC Energy Supply Chain Initiatives*

- Demand-Side
  - HVAC, Controls, Lighting, On-site generation
- Distribution
  - Central heating & cooling plant modernization
- Supply-Side
  - Gas procurement, support utility contract negotiations, support utility rate intervention
- Energy Information System
  - Central Energy Control Cockpit
  - Monitoring, trending, analysis, fuel mgmt., RTP load management(markets, forecasting), M&V reporting

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## *Central Plant Operations*

- Plant modernization program
  - Chiller replacements
  - Controls/monitoring upgrades & integration
  - Primary/Secondary chilled water distribution
- Honeywell operates & maintains central heating and cooling plants.
- Candidates for CCHP - four plants
- 82<sup>nd</sup> Division Heating Plant Selected for CCHP– newest and largest

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## 82<sup>nd</sup> Heating & Cooling

- Thermal load –
  - Continuous Steam and hot water to 100 buildings and 3.1 million ft<sup>2</sup> (120 x 10<sup>6</sup>Btu/hr)
  - Chilled water load 500 tons (another 3,000 tons provided by 82<sup>nd</sup> Cooling Plant)
- Electrical connections, close to 3 primary circuits & a main substation
- Renovation & expansion program – Barracks and Admin. Bldgs.
- Four existing unreliable boilers



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## CCHP Challenges – *Modularity a Solution?*

- Capital Cost
  - Over \$1,000/kW construction cost
  - Plus NG piping, development, engineering, financing, O&M
- The spark spread
  - Competition – base load energy from central power plants
  - Natural gas price volatility
  - Natural gas LDC charges
- Technical complexity
- Government/DOD budgeting process – maintenance budget is last, utility bills are must-pay
- Monopoly (regulated) utility tariff structures and rules designed to discourage on-site generation

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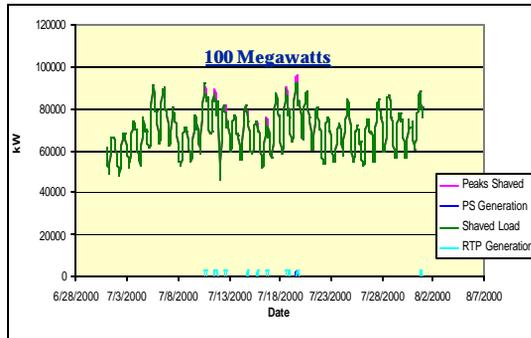
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**Peak Loads Due to Air Conditioning,  
The Real Challenge at Fort Bragg**

**July - Peak Loads**

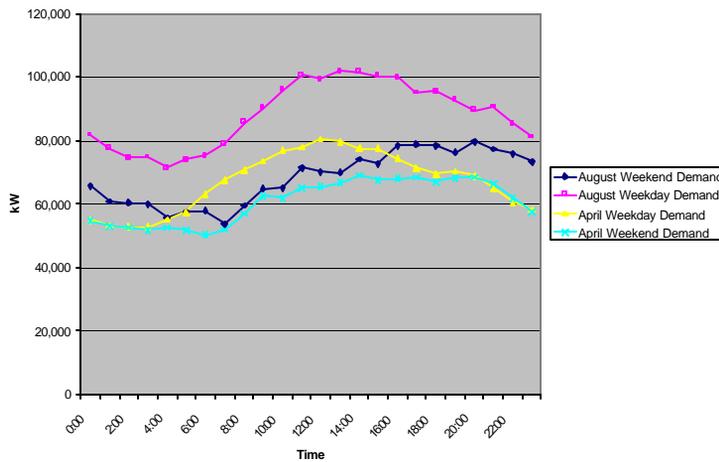


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**Summer, Spring Average Daily Profiles**



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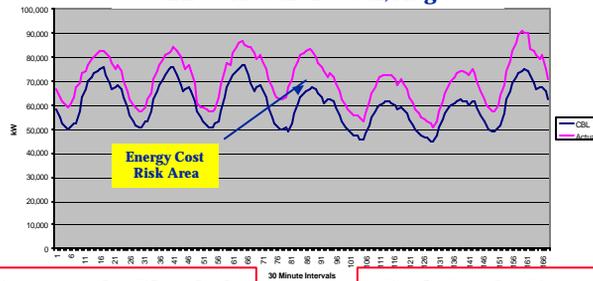
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## Real-Time Electricity

CBL vs. Actual - 1 Week, August



**Base Load – Blended  
Average - \$.042/kWh**

**Peak Load – Range  
\$.09/kWh - \$.90/kWh**

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## Fuel Procurement

### Dual Fuel Capability

#### Natural Gas

- Low Emissions
- Efficient
- Price Risk Management

#### Fuel Oil

- Emergency backup
- Allows interruptible gas
- Ceiling price for gas

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## Initial Evaluation Publication

### “CHP Demonstration Projects at Federal Facilities” The FEMP Role

#### Oak Ridge National Labs

- Steve Fischer
- Patrick Hughes
- CDH Energy
- Steve Carlson
- Hugh Henderson

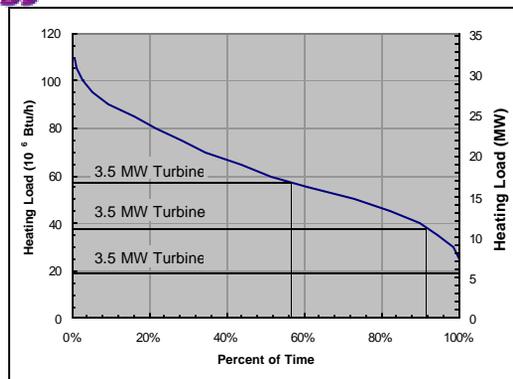
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## Initial Configuration & Heating Load Distribution



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## *Initial Configuration - Conclusions*

### **Thermal Load**

- **Hourly vs. Daily**
- **Uncertainty of future load**

### **Savings**

- **Electricity Demand**
  - **Contract vs. Use**
  - **The regulated version of RTP**



## *Final Configuration?*

- **Single 5 MW Turbine-generator**
- **HRS&G & Chiller**
- **Inlet Cooling**
- **Plant Controls Upgrade**

1. **Lower Capital Cost**
2. **Higher Savings**
  - **Demand reduction offsets growth**
  - **Baseload**
  - **Full Utilization of thermal load**





## *Reference Design Challenges*

- Applications for large, CCHP projects
- Standard design for retrofits
- Indirect fired absorption chiller – ductwork
- Absorption chiller cyclical loads
- Operational optimization
- Capital requirements
- Project complexity

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## *DOE - Integrated Energy Systems Focus*

- Self-funding combined heat & power
- Operational optimization
  - Forecasting & load management – currently operating
  - Fuel switching, cycle optimization – being developed.
- Chiller implementation – 1000 Ton
  - Indirect fired – ductwork, flue gas controls
  - Steam
  - O&M

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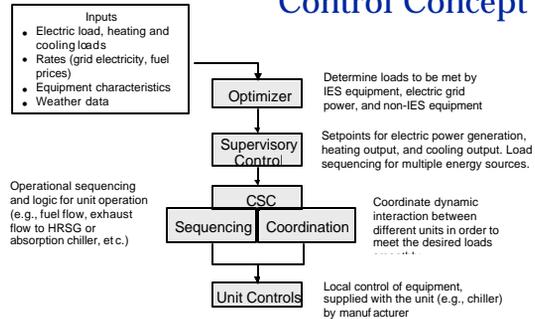
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## Optimization & Supervisory Controls

### Control Concept



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## Conclusions

### The Fort Bragg design is applicable at:

- Very large installations and/or
- Very large thermal loads

### Most large government facilities have limited thermal load and/or limited occupied hours

- Less than 2 MW baseload
- Heating & cooling demands track occupancy and temperature.

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## *Conclusions*

- **Integrated Energy Systems are critical for efficiency and risk management.**
- **Stand-alone retrofit projects are difficult to justify and implement as efficiency improvements, only.**
- **Integrated Energy Systems should be seriously considered when central plants are expanded or renovated.**

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## *Next Steps - Modular Design Study*

### **Marketing Study**

- **Most needed sizes**
- **User willingness to consider life-cycle cost in capital investments**
- **Gas market forecast**

### **Engineering & Cost Analysis**

- **Cycle design**
- **Recip vs. GT's**
- **Environment**
- **Packaging**
- **Optimization value**

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