



Technologies for Federal Housing

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The Connecticut Juvenile Training School (CJTS)

- Juvenile detention facility
 - Six buildings totaling 227,000 SF on 35 acres
- CJTS Energy Center
 - 13,200 SF building outside the fence
 - Supplies all electricity, space heating and cooling
- Ameresco's Role
 - Design/build energy center
 - Long-term Operation & Maintenance





Making the Deal

- Engineer, Procure, and Construct (EPC) Contract
 - Fixed scope and price
- Operations and Maintenance (O & M) Agreement
 - 20-year term, 10-year renewal
 - All staffing, maintenance, repairs
 - Indexed fuel price
 - Guaranteed performance



Financing the Deal

- Project financing arranged through State Treasurer's Office
 - 30-year term
 - Tax-exempt interest rate
- DOD Grant
 - Fuel cells



The Schedule

- Building constructed during fall and winter 2000
- Simultaneously, equipment vendors filled long lead time orders
- Energy Center functional use date of September 2001
- All milestones achieved successfully





CJTS Energy Center

- Free-standing building outside high-security area
- CHP plant provides all electricity, heating and cooling
 - Fuel cells located outside





Electricity Supply

- 0.99+ reliability required for security
- Redundant power sources
 - Fuel cells (primary source)
 - Backup power from local utility grid
 - Gas-fired emergency generators





Fuel Cells (Primary)

- Six UTC Power PureCell™ power plants each with:
 - Input: 2,000 SCFH of natural gas
 - Output: 200 kW @ 480 VAC
- 37% electrical efficiency
- \$0.12/kWh @ \$12.00/Dth





The Grid (Secondary)

- 13,200 VAC
- 75 kW nominal import
- \$0.16/kWh
- Marginal reliability





Backup Generators (Tertiary)

- Two Caterpillar Model G3516 Package Gensets
- 1,040 kW each





Hot Water Supply

- Produced in Energy Center, distributed site-wide
- 12.7 million Btu/hour of installed capacity available
 - Up to 2.7 million Btu/hour from six fuel cells
 - Up to 10 million Btu/hour from two boilers
- Fuel cell waste heat
- Redundant fire-tube boilers are available



Hot Water Supply

- 450,000 Btu/hour recovered from each fuel cell
- 50% thermal efficiency
- Hot water used to preheat boiler water





Boilers

- Two Cleaver-Brooks packaged hot water boilers
- 5 million Btu/hour each boiler
- Natural gas fired
- Fuel cells preheat return water





Chilled Water Supply

- Produced in Energy Center, distributed site-wide
- 900 tons of installed capacity available
- Absorption chiller uses fuel cell waste heat
- Centrifugal chillers with VFDs operate during summer only





Chilled Water Supply

- Up to 450,000 Btu/hour recovered from each fuel cell
- Hot water used in Trane single-stage absorption chiller
- Maximum capacity 100 tons at 44°F





Chillers

- Two Trane CenTraVac™ high efficiency centrifugal chillers
- Adaptive frequency control
- 400 tons capacity each





Thermal Distribution Systems

Hot Water



Chilled Water





Electrical Switchgear

480 Volt Panel

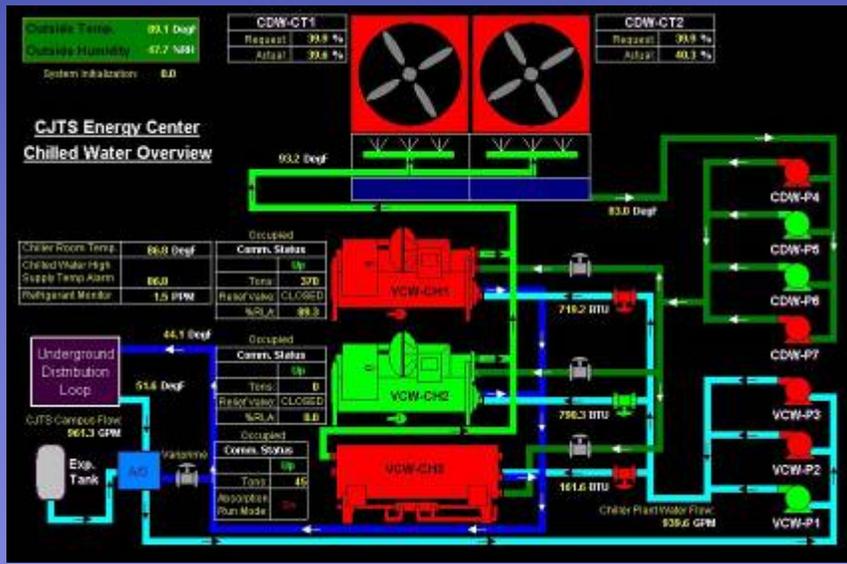
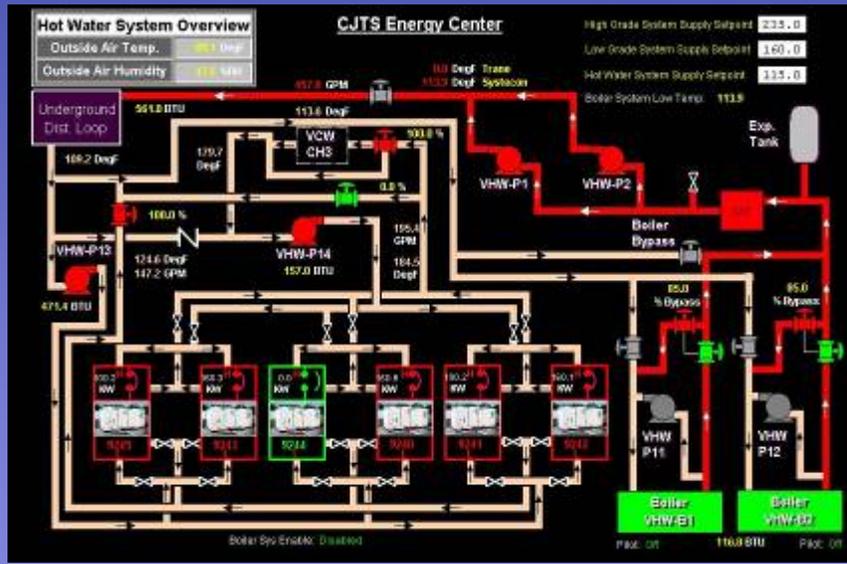


13,200 Volt Panel





Building Automation System



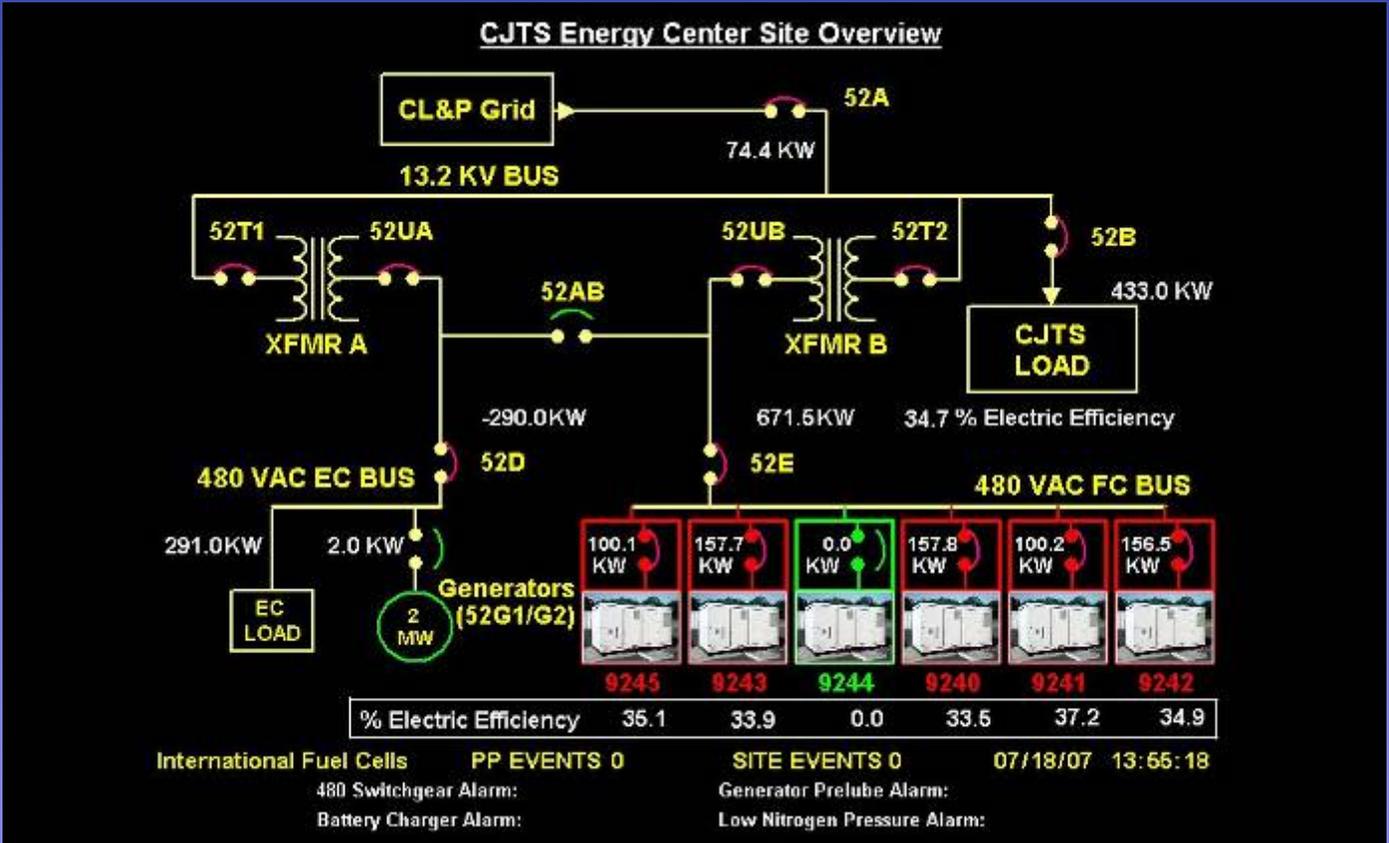
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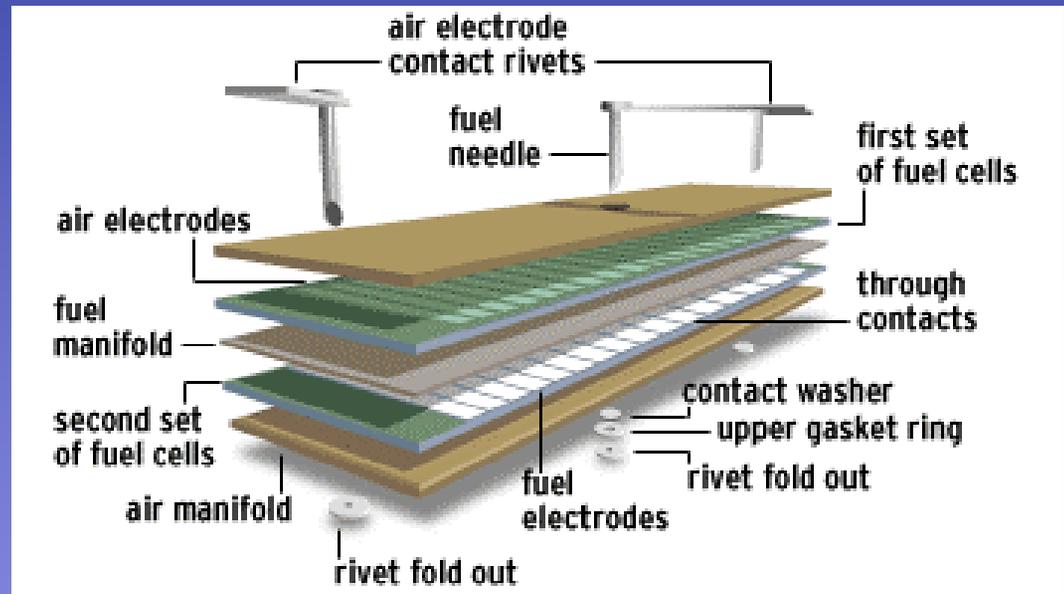
SCADA System





Fuel Cell Update

- Technology Review (How It Works)
 - Operates like a battery
 - Produces power from chemical reactions
 - Does not produce air pollutants
 - Operates as long as there is fuel





Fuel Cell Basics

- Contains 256 stacked graphite plates containing phosphoric acid (cell stacks)
- Natural gas is processed through an external reformer, converting it to hydrogen and carbon dioxide
- Chemical reaction between hydrogen and oxygen produces two hundred kilowatts of electricity at 480 volts



Benefits

- Utility Cost Savings
- Capital Funds Available for Other Use
- Reduction in On-going Maintenance Costs
- Energy Services Company (ESCO) Managed Project



Environmental Impacts

- Each PureCell power plant generates 498 lbs/MWH of CO₂
 - 76% less than a coal-fired central utility plant
 - 72% less than a petroleum-fired plant
 - 60% less than a gas-fired plant
- Low NO_x and SO_x emissions
- Equivalent to 164 acres of forest saved and 147 cars removed from the road



Current Subsidies

- CT
 - 90% of installed cost up to \$4,700/kW through CCEF
- NY
 - \$1,000 – \$2,000/kW through RPS
- CA
 - \$2,500/kW for natural gas units
 - \$4,500/kW for ADG units
 - Self Generation Incentive (SGI)
- Federal
 - \$1,000/kW up to 30% of installed cost through investment tax credits



Lessons Learned

- Innovative approaches can bring unique projects to life
- Fuel cells are commercially available and can be used in suitable applications
- Long-term build/operate contracts can provide economic solutions to government needs
- Green power is still somewhat more expensive than conventional power
- The future is bright for the environment and for alternative power sources



Would you like to know more about this session?

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- Don't forget to fill out and drop off your session evaluations.



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New Orleans
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