



## Cornell University

International Sustainable Campus Network:  
Best Practices – Future Challenges

April 2008

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## Aerial of Ithaca Campus



- “any person...any study”
- Ithaca, New York – 11 units
- Medical – New York City & Qatar

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## Cornell University



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- 20,400 students
- 2,600 faculty
- 11,200 staff

## Arecibo Observatory

### Isle of Shoals



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## Conference Themes

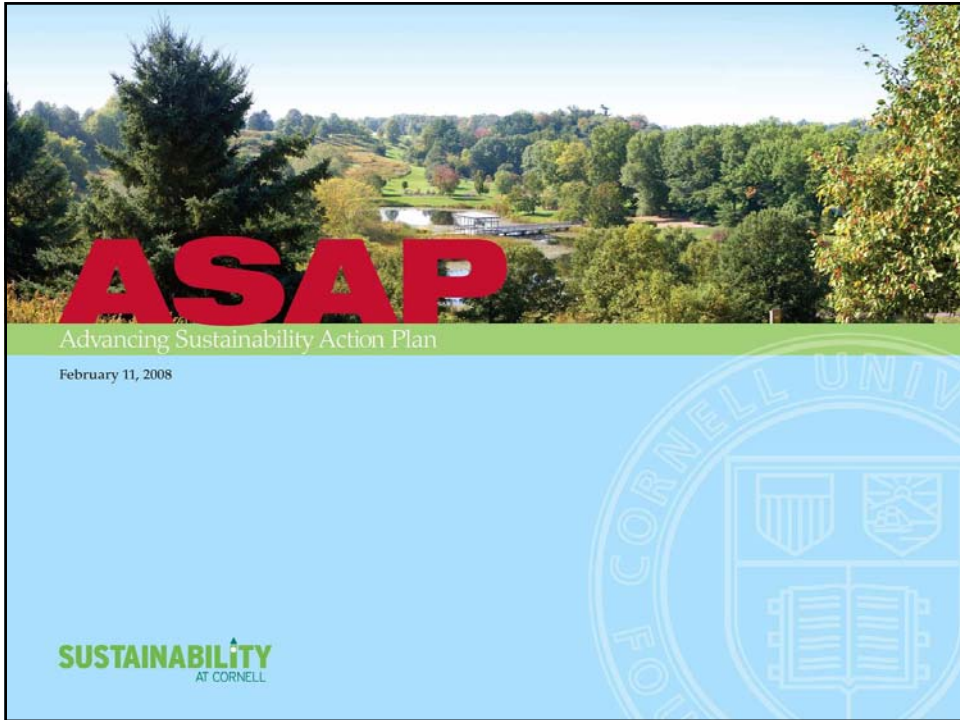
- Standards and Best Practice
  - Environmental Management System
  - Metrics
  - Energy Conservation
- Financial and Decision Mechanisms
  - Capital investments
  - Operating and maintenance
  - Endowment
- Sustainability Change Management
  - ASAP – Advancing Sustainability Action Plan



## Cornell Center for a Sustainable Future

- An “Academic Venture Fund” established by President Skorton
- Promotes and advances collaborations across Cornell through:
  - Research programs
    - Energy conservation and efficiency
    - Biodiversity
    - Sustainable development
  - Faculty hires and retention
  - Outreach and public engagement
- Brings together many existing campus programs





## Composting



- Dining waste, agricultural waste
- 20,000 tons per day



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## Renewable Energy at Cornell – Prior to 2000

### Co-generation

- 30 million kW-hr/year or 12 % of campus
- Built in 1986, 8000 kW total
- Two back-pressure steam turbines



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### Hydroelectric Plant

- 4 million kW-hr/yr or 2% of campus
- Rebuilt 1981
- Controls upgrade in 2008 will increase annual production by 20%

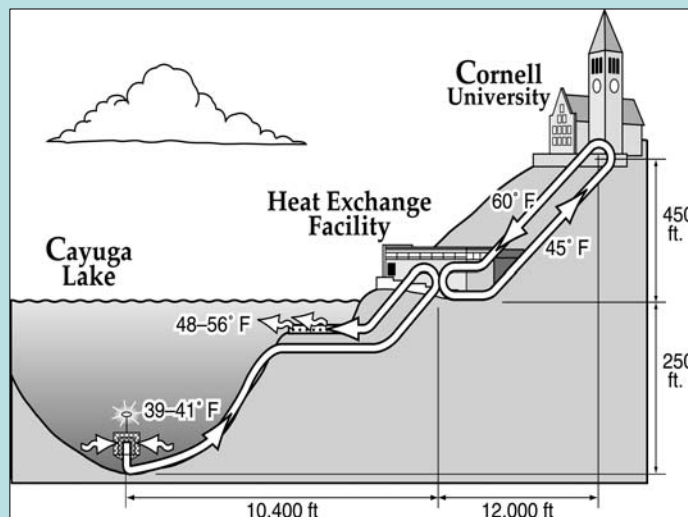
## Lake Source Cooling

- Saves 25 million kW-hr/year, 86% below previous
- Start up year 2000, “renewable” cooling
- 18,000 + tons capacity @ .1kW/ton



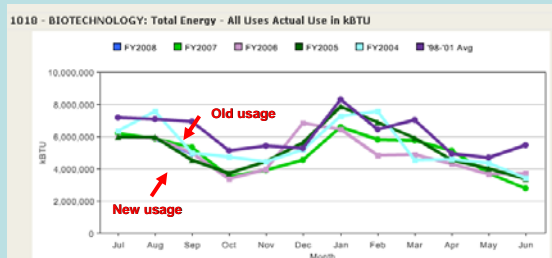
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## Lake Source Cooling Process



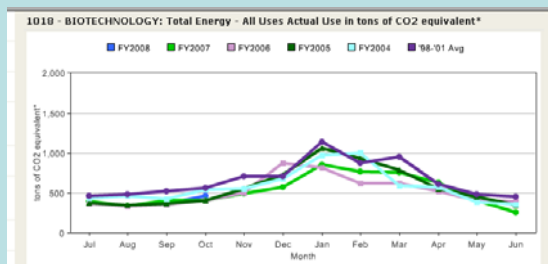
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## Metrics



- Web Accessible Building Level Data
  - Current
  - Historical
  - Tabular & graphic
  - Submetering

- Total BTUs
- Chilled Water
- Steam
- Electric
- Cost
- Carbon equivalent



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## Energy Conservation Initiative

- Total estimated project cost \$25M - \$30M
- Energy savings \$7M - \$8M annually
- Simple payback goal ~ 5 – 7 years
- 20% saving goal ECI 2008 to 2012

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## Energy Conservation Initiative

- Lighting – fixture conversion and occupancy sensor controls
- Updating of controls and control logic
- Air flow control and room temperature based on occupancy
- Air flow control based on fume hood sash position
- Two new staff added in 2004 to manage central mechanical room conservation
- Annual results: \$350k cost, ~\$900k some
- Significant changes/results with good customer feedback
- Four staff to manage occupied space controls

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## Combined Heat & Power Project

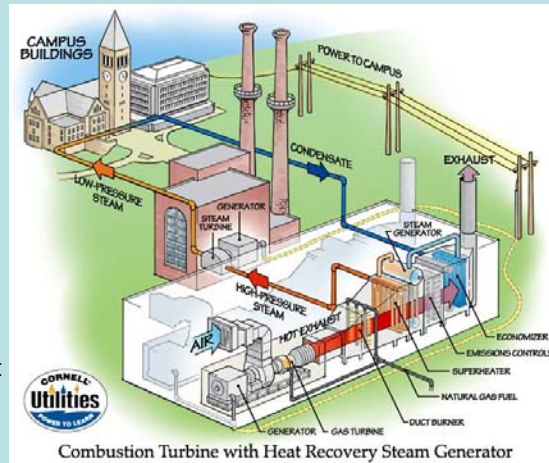
- Project Scope
  - Two (2) combustion turbines (15,000 kW x 2)
    - Produce ~ 70% of kWh
  - Heat Recovery Steam Generators (HRSG)
    - Produce ~ 50% of steam
  - Substation renewal
- Project cost ~ \$82 Million
  - Building addition at existing heating plant



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## Combined Heat & Power Project

- Project benefits:
  - Highly efficient (70%+)
  - Electrical reliability
    - “Islanded” operation
  - Emissions reductions
    - CO<sub>2</sub> 70,000 tons/yr
    - NO<sub>x</sub> 250 tons/yr
    - SO<sub>2</sub> 800 tons/yr
  - Fuel flexibility and lowest life cycle cost
- In service Fall 2009



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## Greenhouse Gas Reduction Initiatives

- 2001
  - KyotoNOW! initiative begun by students
- 2001-2006
  - Aggressive conservation and planning
- 2006
  - Announce Combined Heat and Power Project
  - KyotoNOW! asks for Beyond Kyoto Goal of climate neutrality
- 2007
  - American College and University Presidents Climate Commitment

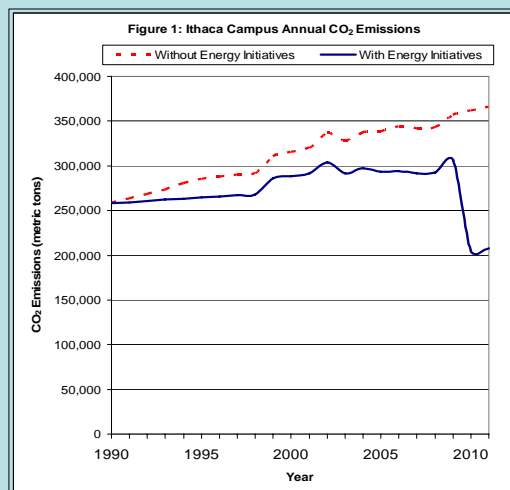
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## Cornell's Carbon Footprint

- Cornell has inventoried CO<sub>2</sub> since 2001
  - Annual energy “Fast Facts” and CO<sub>2</sub> forecast
  - Direct (fuel) and indirect (electric) emissions
  - Web accessible
- Until 2008 for central utilities only
- 2.5 trillion BTU's/yr since 1990 (fuel & elect)
- ~275 thousand tons CO<sub>2</sub>/yr

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## CO<sub>2</sub> Impact – Past and Planned



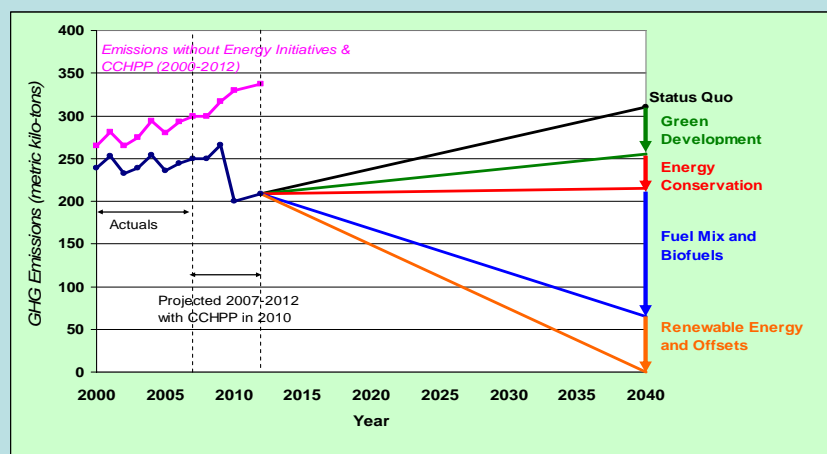
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## Climate Action Plan

- Supply side energy:
  - Test burn biofuel in CHP boilers
- Energy use in buildings:
  - Energy budgets and enhanced modeling
- Laboratory ventilation rates:
  - Evaluate standard and options to reduce
- Prepare Climate Action Plan

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## Attaining Climate Neutrality



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