Energy & Utilities
at the
University of Virginia

Master Planning Council
May 10, 2006
Energy & Utilities at UVa

The Mission
Providing efficient, reliable, cost effective, and environmentally sound energy in support of the University’s educational, health care, and public service mission.

This mission is accomplished with appreciation for renewable and recoverable resources, dedication to environmental stewardship, and pride in the historical and cultural legacy of the facilities and Grounds.
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Goals and Objectives

- Economic
- Reliable
- Emergency Response
- Stewardship / Sustainability
  - Energy
  - Environment
  - Natural Resources
- People
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How is this done at UVa?

- Central Heating Plants & Steam Tunnels
- Central Chiller Plants & Distribution
- Electrical Substations & Underground Feeders
- Domestic Water Tanks, Pumps, & Piping
- Storm Water Streams, Ponds, Pipes
- Sanitary Sewer
- Central Monitoring and Control
- Trash & Recycling
- Energy Management Programs
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Advantages of Centralized Systems

- Lower Overall Capital Investment
- Lower Fuel Costs
- Multiple Fuels
- Reduced Maintenance Costs
- Increased NSF / GSF Ratio
- Higher Operational Efficiency
- Reliability
- 24 Hour Staffing
- Improved Grounds Aesthetics
- Continuous Monitoring and Control
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Disadvantages of Centralized Systems

- Higher Initial Capital Investment
- Distribution Losses
- Environmental Compliance Issues

Courtesy of IDEA
Capital Investment Example – O’Hill Dorms

- Central Chiller Plant (One building plus 3 to 4 chillers)
  - Building + chillers = $4.7 million
  - Piping = $3.5 million
  - Total = $8.2 million (construction cost)

- Stand Alone Chillers (Space in each dorm + 20 to 24 chillers)
  - Mechanical Space + Chillers = $9.2 million
  - Piping = $0
  - Total = $9.2 million (construction cost)
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Capital Investment Example – O’Hill Dorms

- Central Heat Plant Plant (built / no investment needed)
  - Piping + Auxiliaries = $4.1 million (total construction cost)

- Stand Alone Boilers (Space in each dorm)
  - Mechanical Space = $2.57 million
  - Boilers + Auxiliaries = $1.04 million
  - Piping = $0
  - Total = $3.6 million (construction cost)
Lower Fuels Costs Example

- Heat Plant Fuel
  - Plant fuel cost is $9.31/ MMBtu (50% gas)
  - What if we could have burned 90% coal?

- Stand Alone Fuel
  - Woody Dorm = $13.80. Copeley Housing = $14.30
  - What if all of UVa’s buildings were like Woody?
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**Metrics**

- Reduce or achieve a zero growth rate in heating / GSF.
- Reduce or achieve a zero growth rate in cooling / GSF.
- Reduce or achieve a zero growth rate in electricity usage / GSF.
- Reduce or achieve a zero growth rate in water usage / GSF or per capita.
- Manage the use of fuels to minimize costs.
- Meet or exceed state recycling mandate.
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Heating Plants Consumption Trends 1984 - 2004

BTUs per GSF

BTUs per GSF-HDD

Calendar Year
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Chiller Plants Performance

- Total Produced (mmBTU)
- Electricity Consumed (mmBTU)
- Average Use (BTU/GSF)
- Normalized Use (BTU/GSF-CDD)

Fiscal Year: 1998 to 2005

Graph showing trends and data points for energy and utility consumption over the fiscal years from 1998 to 2005.
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University - wide Electricity Consumption Trends 1980 - 2005

KWH per Gross Square Foot

Fiscal Year

1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005
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![Bar chart showing recycling trends over years](chart.png)
## Energy & Utilities at UVA

### Benchmarking – Heat Plants

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<thead>
<tr>
<th></th>
<th>University Profile</th>
<th>Private Profile</th>
<th>UVA Profile</th>
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<tr>
<td>Plant Age</td>
<td>51</td>
<td>49</td>
<td>46</td>
</tr>
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<td>Boiler Age</td>
<td>32</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>Dist. Miles</td>
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<td>20</td>
</tr>
<tr>
<td>GSF (million)</td>
<td>10</td>
<td>20</td>
<td>8</td>
</tr>
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<td>BTU/GSF-HDD</td>
<td>21</td>
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Source of data: International District Energy Association: [www.districtenergy.org](http://www.districtenergy.org)
## Energy & Utilities at UVa

### Benchmarking – Chiller Plants

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### Benchmarking – Fuel Costs

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<tr>
<th>Energy Type</th>
<th>C/U Profile</th>
<th>Utility/ESCO</th>
<th>Princeton Survey</th>
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<tbody>
<tr>
<td>Coal</td>
<td>$1.52</td>
<td>$1.34</td>
<td>$2.88</td>
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<tr>
<td>Oil</td>
<td>$4.39</td>
<td>$3.54</td>
<td>$2.81</td>
</tr>
<tr>
<td>Gas</td>
<td>$3.58</td>
<td>$3.10</td>
<td>$3.75</td>
</tr>
<tr>
<td>Electric</td>
<td>$12.54</td>
<td>$11.01</td>
<td>$14.05</td>
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## Benchmarking Rates

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<th>UVA Margin</th>
<th>Average C/U Margin</th>
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<tr>
<td>Energy Purchase</td>
<td>$715,000</td>
<td>$1,589,000</td>
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<tr>
<td>Rates</td>
<td>$7,522,000</td>
<td>$6,983,000</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$8,237,000</td>
<td>$8,527,000</td>
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<tr>
<td>Renewal</td>
<td>$4,300,000</td>
<td>?</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$12,537,000</td>
<td>?</td>
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Reliability

- Firm Capacity
- Combined Heat & Power / Emergency Power
- Looped and Interconnected Systems
Planning: Main Heat Plant

Multistory Entrance View

Front Entrance View

Main Street View

Health System West Parking View
Planning: Electrical Substations

Alderman Road Substation

East End Substation

North Grounds Substation

Cavalier Substation
Planning: North Grounds Plant
Domestic Water

Balz Pump House

Alderman Rd Pump House

RWSA Water Treatment Plant

OHill Water Tanks
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Financing New Infrastructure Needs

Historical Funding Sources for New Needs
- Construction projects if in direct support
- Capital Appropriation (Cavalier Substation)
- Connection Fees (cooling)
- Bonds (heat plant)
- Utilities Revolving Account (rates)
- Leveraging
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Financing Renewal of Infrastructure

Historical Funding Sources For Renewal

- Maintenance Reserve
- “Customers” (heat plant)
- Capital Appropriation (South Plant Chillers 2n3)
- Bonds (heat plant)
- Utilities Revolving Account (rates)
- Leveraging
Pros and Cons of Current Approach

- Historical success in getting state funding
- Competing needs for state funds: New buildings, deferred maintenance.
- Instability of state appropriations: Maintenance Reserve & Capital
- Fund Leveraging = multiple users benefit
- Challenge? Getting commitment from multiple sources.
- Year end zero balance issue.
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Issues

- Planning for Growth
- Aging Infrastructure
- Financing
  - First cost and ‘value engineering’ for a single building
  - Life cycle costing
  - Financing using a moving revenue stream
- Reliability
- Aesthetics
- Sustainability
  - LEED
  - Renewable energy / Buying ‘green’
  - Marketing / Celebrating Successes