Updated Economics and Benefits of Steam Cooling

Charles Viemeister
Steam Cooling
The Situation

The Cooling Environment

Temperature in Central Park

Year 2006
Typical All Electric Response

Actual Electric Profile

Year 2006

KW
The Focal Point

Actual Electric Profile

Year 2006

2 Megawatts
Steam Cooling
The Value Proposition

Actual Electric Profile

Year 2006

kW
Steam Cooling
Monthly Demand Reduction

Benefits to Electric Demand Profile with Steam Hybrid Cooling

- Reduced Electric Profile
- Hybrid Cooling using Steam

July
## Installation Costs
### Existing Structures

<table>
<thead>
<tr>
<th>Electric to Electric</th>
<th>Electric to Steam</th>
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<td>Demolition</td>
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<td>Equipment</td>
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<td>Electric Infrastructure</td>
<td>Reconfiguration</td>
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<td>System Upgrades</td>
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<tr>
<td>Installation</td>
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Con Edison Steam Discount
Special Provisions D or E

- $2.00 / mlb discount
  - May to October billing
  - Applies to actual consumption amounts
  - Two year period
  - Con Edison may execute option of one-time payment of the net present value for term commitment by customer
The Use of Electric Infrastructure

Actual Electric Profile

Year 2006

2 Megawatts
Electrical Infrastructure $ per KW
Reference Data from RSMEANS

$10.78 /sqft  =  $988/kW x $2.16  =  $198/kW

10.9 watt/sqft  $10.78

Commercial Building
Construction Costs per SQFT

–Electrical  $10.78/sqft

Service & Distribution  $2.16/sqft

Building Electric Demand at Watts per SQFT

–Total  10.9 watts/sqft
NYSERDA Incentives
PON 1097

- $1,000 /kW reduced
  - Electric to Steam conversion
  - COP better than 1.02
  - Incentive Caps
    - 65% of cost to install steam system
    - Difference between electric and steam system installation
    - Project limit of $1,250,000 (recently raised from $1,000,000)

- $600 /kW reduced
  - Steam to Steam conversion
# NYSERDA Funding

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## NYSERDA PON 1097 Peak Load Reduction Program - Permanent Demand Reduction Incentives for **Steam Equipment**

<table>
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<tr>
<th>Cooling with Steam Tonnage at:</th>
<th>NYSERDA General Reimbursement Incentive @ $1,000 per kW reduced</th>
<th>Estimated Steam Installation Cost</th>
<th>NYSERDA Incentive Cap of 65% of eligible costs</th>
<th>Estimated Electric Installation Cost</th>
<th>NYSERDA Incentive Cap &quot;Not to Exceed&quot; Incremental &quot;Reference Electric&quot; vs. Steam Installation Cost</th>
<th>NYSERDA Facility Maximum Incentive Cap</th>
<th>PON 1097 Estimated Project Funding</th>
</tr>
</thead>
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<tr>
<td>1,125</td>
<td>$618,750</td>
<td>$1,895,625</td>
<td>$1,232,156</td>
<td>$1,080,000</td>
<td>$815,625</td>
<td>$1,250,000</td>
<td>$618,750</td>
</tr>
</tbody>
</table>

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**NYSERDA factors for Cap on Incentive**
Free Cooling Proposition

Typical Steam Customer Electric Profile

Year 2006
Free Cooling Proposition

Typical Electric Profile

Year 2006
Free Cooling Proposition

Typical Electric Profile

Year 2006
Free Cooling Proposition

Typical Electric Profile - Cooling

Year 2006
Free Cooling Proposition

Typical Electric Profile - Temperature Response

Year 2006
Free Cooling Proposition

Typical Steam Profile - Temperature Response

Year 2006
Free Cooling Proposition

Typical Steam Profile - Temperature Response

Year 2006
Free Cooling Proposition

Tower Size Factor

Approach (deg F)

CT Size Factor

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Free Cooling Proposition

500 hours more of daytime free cooling

Approach (deg F)

Tower Size Factor

Approach reduced over 5 degrees
Some Statistics Seen in Past Hybrid Cooling Proposals

- 245 – 1,485 kW reduced
  Annual summer electric peak demand savings
- $200,000 - $1,000,000
  NYSERDA PON 1097 Permanent Demand Reduction Incentive
- 4% - 24%
  Building’s internal electric service capacity Recovered
Steam Cooling Project Considerations

• Opportunity
  ▪ Aging electric cooling plant
  ▪ Major renovation
  ▪ New construction
  ▪ Tenant electric load growth

• Incentives and Funding
  ▪ NYSERDA incentives – up to $1,000/kW reduced
  ▪ Con Edison 2 yr discount - $2.00/mlb for summer cooling load
  ▪ Electric demand bill reduction – estimated NPV $1,100/kW
  ▪ Free Cooling expanded savings period - estimated 500 hours
  ▪ Avoided Electric Infrastructure Costs – estimated $198/kW
The Environmental Benefit

Emission Comparison at Peak Electric Demand Periods
Electric vs Steam Cooling

- CO₂ lbs / ton-hour
- NOₓ lbs / ton-hour

Electric Cooling
Steam Cooling

CO₂: 1.5 lbs / ton-hour
NOₓ: 0.005 lbs / ton-hour
## Hybrid Cooling Benefits

| Alternative Energy Source | Benefit from the reliability of Con Edison Steam  
|                          | Use a cost effective energy in peak periods  
|                          | Pay only for energy consumed  
|                          | Build on your steam connection  
| Avoids electric demand charges at peak rates | Dispatch load to lower cost energy source  
|                          | Operate to a level electric demand target  
|                          | Obtain financial incentives for load reductions  
| Societal benefit of lower emissions during summer ozone alert periods | 18% less fuel energy used in District Steam compared to conventional generation  
|                          | Lower emission rates of NOx, SO₂, CO₂, and particulate matter  
|                          | Remove CFC Refrigerant when using steam absorption chillers  
| Alleviates electric capacity at peak periods for alternate use | Redirect kVA to growing tenant needs  
|                          | Generate internal spare electric capacity  
|                          | Improve delegation of emergency power  
|                          | Reduce risk of straining electric service (internal and neighborhood)  

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Typical All Electric Cooling

Actual Electric Profile

Year 2006
Steam Cooling

Electric kW of an Existing Hybrid Steam Cooling Customer

- Year: 2006
- Data Plot:
  - x-axis: Months (1 to 12)
  - y-axis: Electric kW (0 to 8000)
  - Graph shows variation in kW usage throughout the year.
Steam Story Competition
Become a steam legend in your time. Talk steam: your story could take you places

• Submit your story to Con Edison by COB Friday, November 30, 2007
• Entries prescreened for compliance with IDEA criteria
• We provide technical writing assistance for the best three steam tales
• We will submit the papers to IDEA
  – 99th Annual Conference and Trade Show
• Stories selected by IDEA
  – Travel expenses* and registration fees for you to attend the Conference.
• Should none be selected we will still send one of the finalists
• The three finalist papers can be used for regional conferences
2007 World Energy Congress
Congress is held every 3 years

• Three papers submitted for consideration
  – Managing Steam Demand In The Digital Age: How To Control Efficiency, Accuracy And Costs
    – Author:
      – **Ken Savelli**, Chief Engineer, Park Tower Management, LTD
    – Author:
    – **Stephen Mosto**, President, Mosto Technologies, Inc.
2007 World Energy Congress Winning Paper

• “Hybrid Cooling With A Power Twist”
  – Author:
    – Ernest J. Biron, P.E.
      – Sales Manager for Carrier Corporation
      – Energy Services Group
      – Carrier Commercial Service