DISTRICT ENERGY DECARBONIZATION

CORNELL UNIVERSITY

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Facilities & Campus Services, Cornell University

JUNE 26TH, 2019
ELECTRIC: 35 MW<sub>e</sub> (PEAK)
STEAM: 90 MW<sub>th</sub> (PEAK)
COOLING: 90 MW<sub>th</sub> (PEAK)
LAKE SOURCE COOLING
DISTRICT COOLING DECARBONIZATION
LAKE SOURCE COOLING + PEAKING CHILLERS

METRIC TONS CO₂ E

LSC ONLINE
2000

ENERGY CONSERVATION INITIATIVE
FOCUSED INITIATIVE

BUSINESS AS USUAL

AVOIDED CARBON

11,000+
Metric Tons of CO₂ E

SOLAR FARM PPA
20 YEAR TERM

Annual carbon savings
LSC, Chillers, ECI, PPA
**DISTRICT ENERGY DECARBONIZATION**

**ELECTRIC, COOLING & HEATING**

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**BUSINESS AS USUAL**

- Lake Source Cooling
- Energy Conservation Initiative (Ongoing)
- Beyond Coal
- LED Lighting Upgrade
- Combined Heat & Power
- Solar Development
- Hydroplant Upgrades
- Engagement

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**AVOIDED CARBON TO DATE**

1.6 million METRIC TONS CO₂e

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- Montreal Protocol
- Kyoto Protocol
- Carbon Commitment Second Nature
- Acceleration Working Group (2050 To 2035)
- Public GHG Reporting
- Options Report

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**Our Projects**

- District Cooling CO2 metric tons
- GridElectric CO2 metric tons
- District Co-Gen CO2 metric tons

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**Other Drivers**
RECENT TOOLS
FOR CLIMATE ACTION PLANNING

CORNELL SUSTAINABILITY FRAMEWORK
"QUADRUPLE BOTTOM LINE"
RENEWABLES POWER

LAKE COOLS

EARTH HEATS

CORNELL CARBON NEUTRAL DISTRICT ENERGY
CURRENT & PLANNED
CORNELL EARTH SOURCE HEAT

*Diagram not to scale
CAMPUS CONVERSION TO ESH FROM STEAM

Central Campus

Existing Steam Loop

New Central Steam-to-hot water heat exchangers (backup to ESH)

East Campus

New Hot Water Loop

Earth Source Heat Exchanger

*Diagram not to scale
DECARBONIZATION – PAST TO FUTURE
CORNELL DISTRICT PROFILE

CARBON INTENSITY

2000 260,000 MTCO₂e
DECARBONIZATION – PAST TO FUTURE
CORNELL DISTRICT PROFILE

CARBON INTENSITY

<table>
<thead>
<tr>
<th>Year</th>
<th>Carbon Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>260,000 MTCO₂e</td>
</tr>
<tr>
<td>2018</td>
<td>165,000 MTCO₂e</td>
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2018
DECARBONIZATION – PAST TO FUTURE
CORNELL DISTRICT PROFILE

CARBON INTENSITY

<table>
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<tr>
<th>Year</th>
<th>CO₂e (MTCO₂e)</th>
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<tr>
<td>2035</td>
<td>~0</td>
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2035: CARBON NEUTRAL TARGET DATE

- CORNELL—OWNED LAND RENEWABLES, CONSORTIUM PPA, RENEWABLE ELECTRIC
- GRID ELECTRIC
- HIGH PERFORMANCE BUILDINGS
- STEAM TO HOT WATER
- EARTH SOURCE HEAT
- COMBINED HEAT & POWER, NATURAL GAS
- ON-SITE RENEWABLES
- BIOFUels
## OUR PLAN
### DECARBONIZING DISTRICT ENERGY

<table>
<thead>
<tr>
<th>DEMAND SIDE</th>
<th>SUPPLY SIDE</th>
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<tbody>
<tr>
<td>• North Campus Residential Expansion 750k GSF low temp hot water; robust EUI goals</td>
<td>• Partnering with NYSERDA to develop Hot Water system design</td>
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<tr>
<td>• Energy Conservation Initiative</td>
<td>• Department of Energy funded study of Earth Source Heat</td>
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<tr>
<td>• Study to determine building impacts associated with hot water conversion</td>
<td>• Partnering with renewable energy developers and other buyers (new projects)</td>
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</table>

### HUMAN SIDE

• Sustainable Cornell Council – Cornell’s 3rd generation of sustainability governance
CHALLENGES

ECONOMICS VS. ENVIRONMENT?

Make vs. buy power decisions when we do not need the heat

CARBON ACCOUNTING?

Accounting for upstream methane emissions from natural gas

EARTH SOURCE HEAT ALTERNATIVE?

Back-up plan for carbon neutral heat and power
THANK YOU

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