

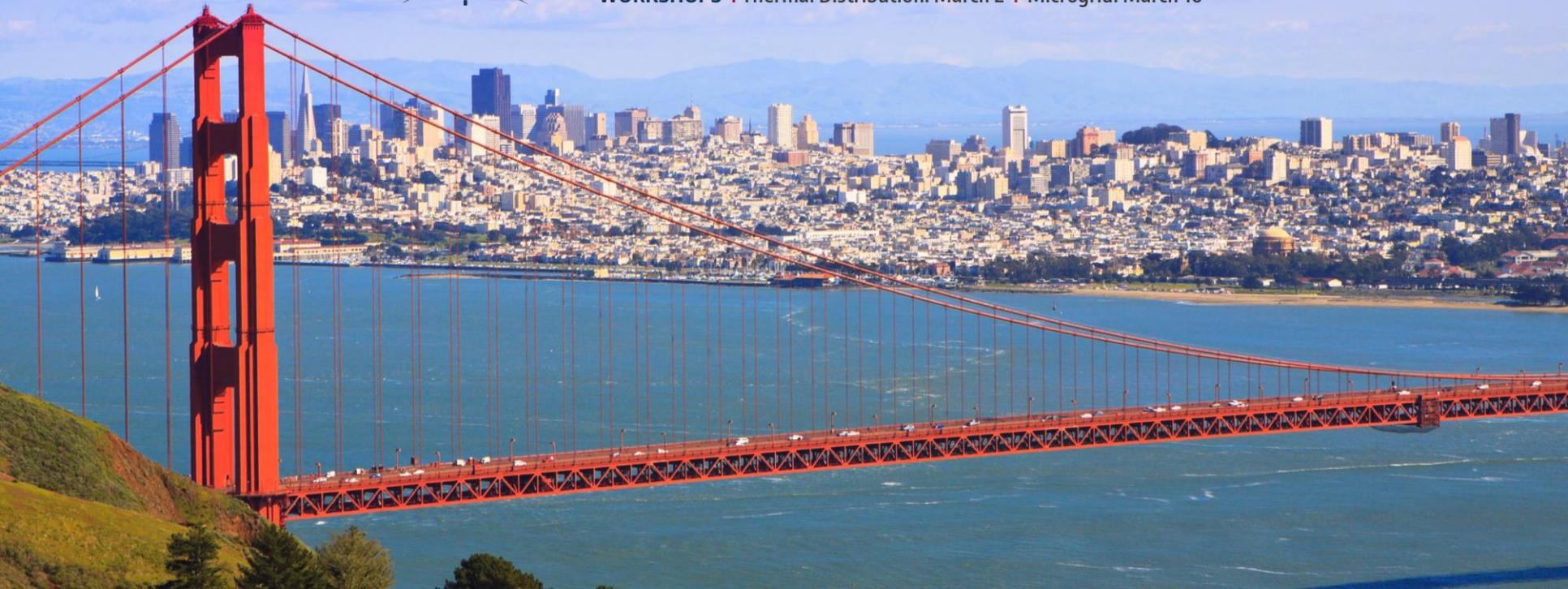


# CampusEnergy2021

BRIDGE TO THE FUTURE

Feb. 16-18 | CONNECTING VIRTUALLY

WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16





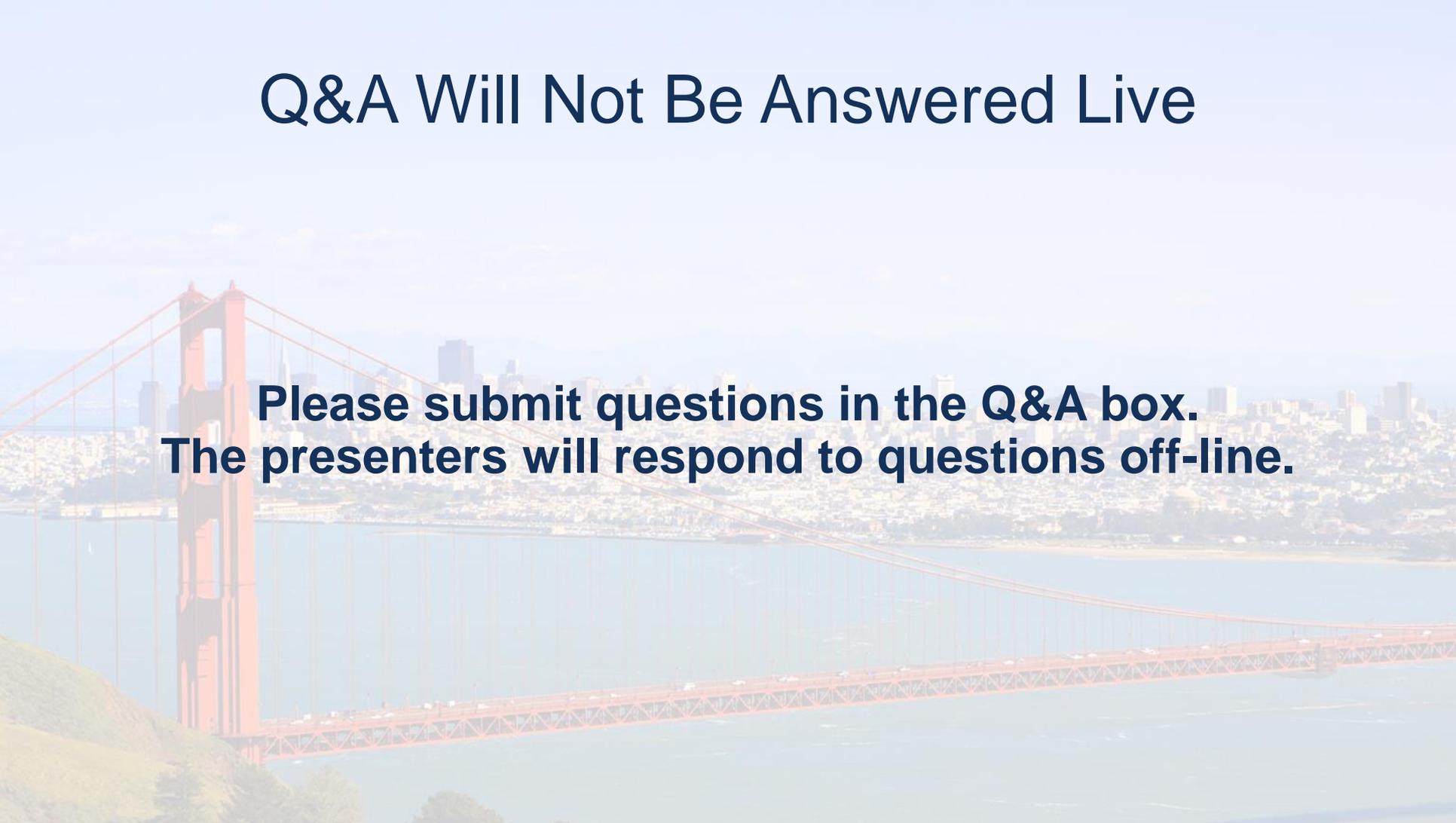
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## **Domino Effect: The Importance of Understanding the Big Picture when Sustainability Planning**

**Justin Grissom, P.E.  
Nathan Ninemire, P.E**

# Q&A Will Not Be Answered Live

**Please submit questions in the Q&A box.  
The presenters will respond to questions off-line.**



# Keeping Sustainability in Perspective

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- ▶ Utilities / Facilities Core Mission
- ▶ Defining Sustainability and Resiliency
- ▶ Finding a Balance
- ▶ Case Studies – What Are Peers Doing?
  - Princeton University
  - Bucknell University

# Utilities/Facilities Core Mission

- ▶ **Immediate and Ongoing:**
  - Support and enhance educational mission reliably
  - Create an environment that allows students to strive
- ▶ **Long Term Need:** Serve sustainably

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# Defining Sustainability and Resiliency

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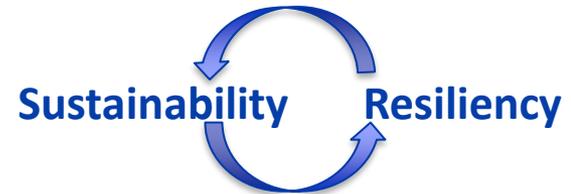
## Sustainability \*

- ▶ the quality of being able to continue over a long period of time
- ▶ Planning now for long term goals

## Resiliency \*

- ▶ the ability...to return to its usual shape after being bent, stretched, or pressed
- ▶ Planning now for responding to threats to our ability to meet long term goals

\* *Cambridge Dictionary Definitions*



# Sustainability Road

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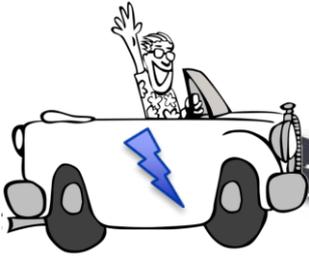
NOW

FUTUR

E

# Sustainability Road

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SUSTAINABILITY  
PLAN

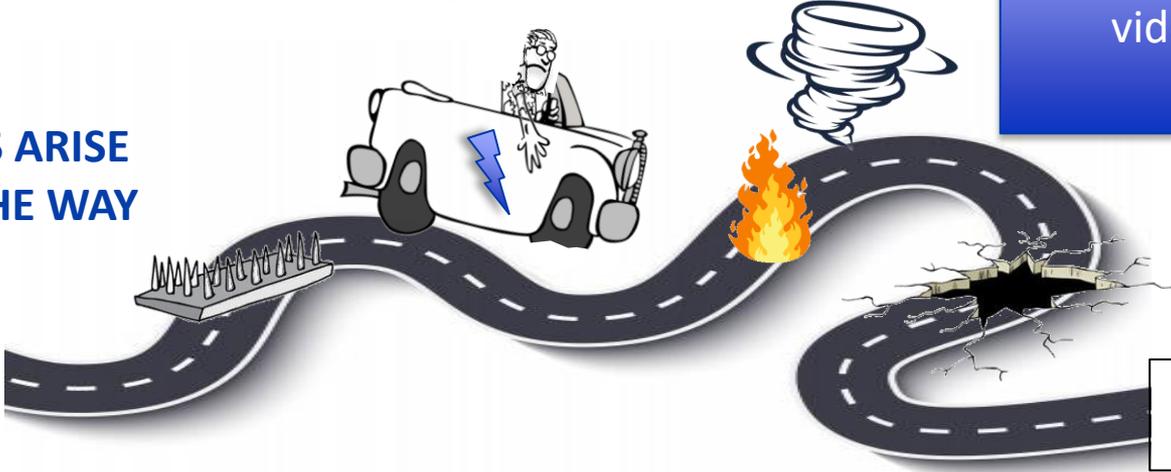
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# Sustainability Road

NOW WHAT?

HAZARDS ARISE  
ALONG THE WAY



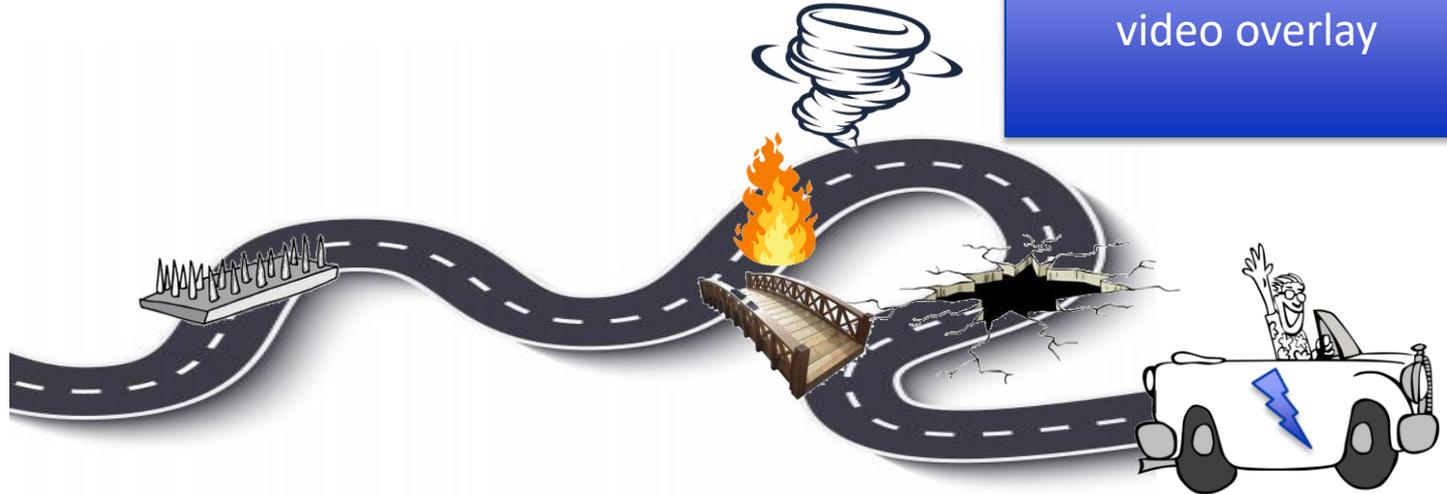
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# Sustainability Road

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***Resiliency planning is for mitigating risks that could compromise your ability to meet long term sustainability goals.***

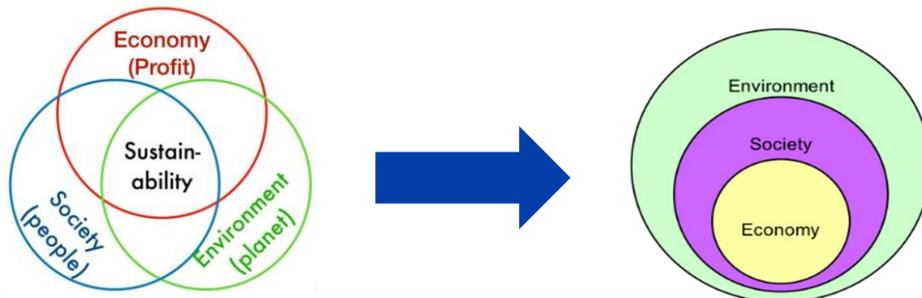
# Finding a Balance

Plan for long-term outcomes but use shorter term protections

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## ► FIRST: Establish long-term sustainability goals

- Reduce or eliminate carbon
- Provide reliable service / core mission
- Avoid negative externalities
- Triple bottom line



# Finding a Balance

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Plan for long-term outcomes but use shorter term protections

- **SECOND: Plan for ways to prevent operational disruption (resiliency) that would prevent you from getting to the long-term.**
  - Bridging technologies or fuels to get you to the future (future-proofing).
  - Equipment and/or fuel diversity.
  - Design for operational flexibility.
  - Be “directionally correct”

**Example: Princeton Met Student/Society Needs During Superstorm Sandy**

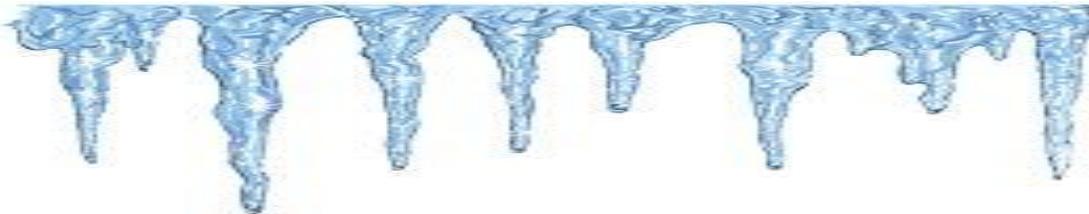
# EXAMPLE: Resiliency Failure

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## University Sustainability Efforts

- ✓ University commits to carbon neutrality.
- ✓ Plan to deploy wind/solar, buy “green power”, and use energy storage.
- ✓ Transition to full electrification (no scope 1 emissions).
- ✓ Focus on efficiency projects to reduce consumption.

## Event Occurs: The Next Great Ice Storm



*No sun. No wind.  
Energy storage depleted.  
Grid supply is down.*

# EXAMPLE: Poor Outcomes

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## Outcome

- ✘ Campus power and heating limited to standby generators
- ✘ Don't meet basic needs of students (welfare or safety)
- ✘ Stakeholders asking why utilities department can't keep the lights/heat on

**There's a better way...**

# Another Approach

- ✓ Fossil fuels as “bridge”
- ✓ Fuel and equipment diversity
- ✓ Energy storage
- ✓ Efficiency improvements
- ✓ Renewables as part of “portfolio”
- ✓ Consider RECs, PPA, or virtual PPA

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# Peer Case Studies

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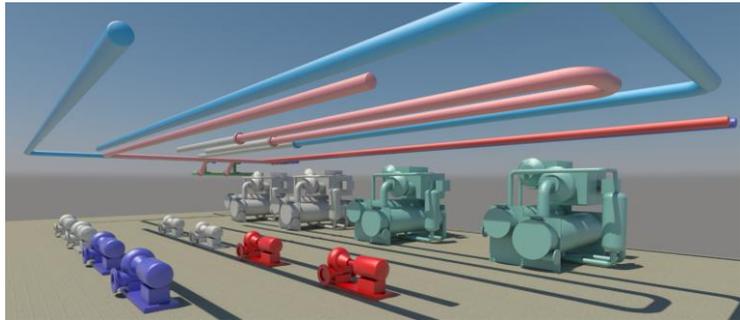
Princeton University	Bucknell University
<b>Key Stats</b>	
<ul style="list-style-type: none"><li>• 8,300 students, ~9.5MM SQFT</li><li>• 300 kpph steam capacity</li><li>• 15 MW CHP</li><li>• 20,000 ton Chiller Plant, TES</li></ul>	<ul style="list-style-type: none"><li>• 3700 students, ~3MM SQFT</li><li>• 210 kpph steam capacity</li><li>• 4.8 MW CHP, 1.2 MW STG</li><li>• 3100 Chiller Plant, TES</li></ul>
<b>Sustainability Initiatives</b>	
<ul style="list-style-type: none"><li>• 2050 Carbon Neutrality</li><li>• Large Scale PV on Campus</li><li>• Reduction of Fossil/Use of Biofuels</li></ul>	<ul style="list-style-type: none"><li>• 2030 Carbon Neutrality</li><li>• Sustainability Work Groups</li></ul>

# Princeton's Balance

- Steam to hot water heating conversion
- Heat pump chillers
- Installation of geexchange well fields
- Hot and cold TES
- REC purchases
- Future biofuels
- Continued CHP (near-term)



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# Bucknell's Balance

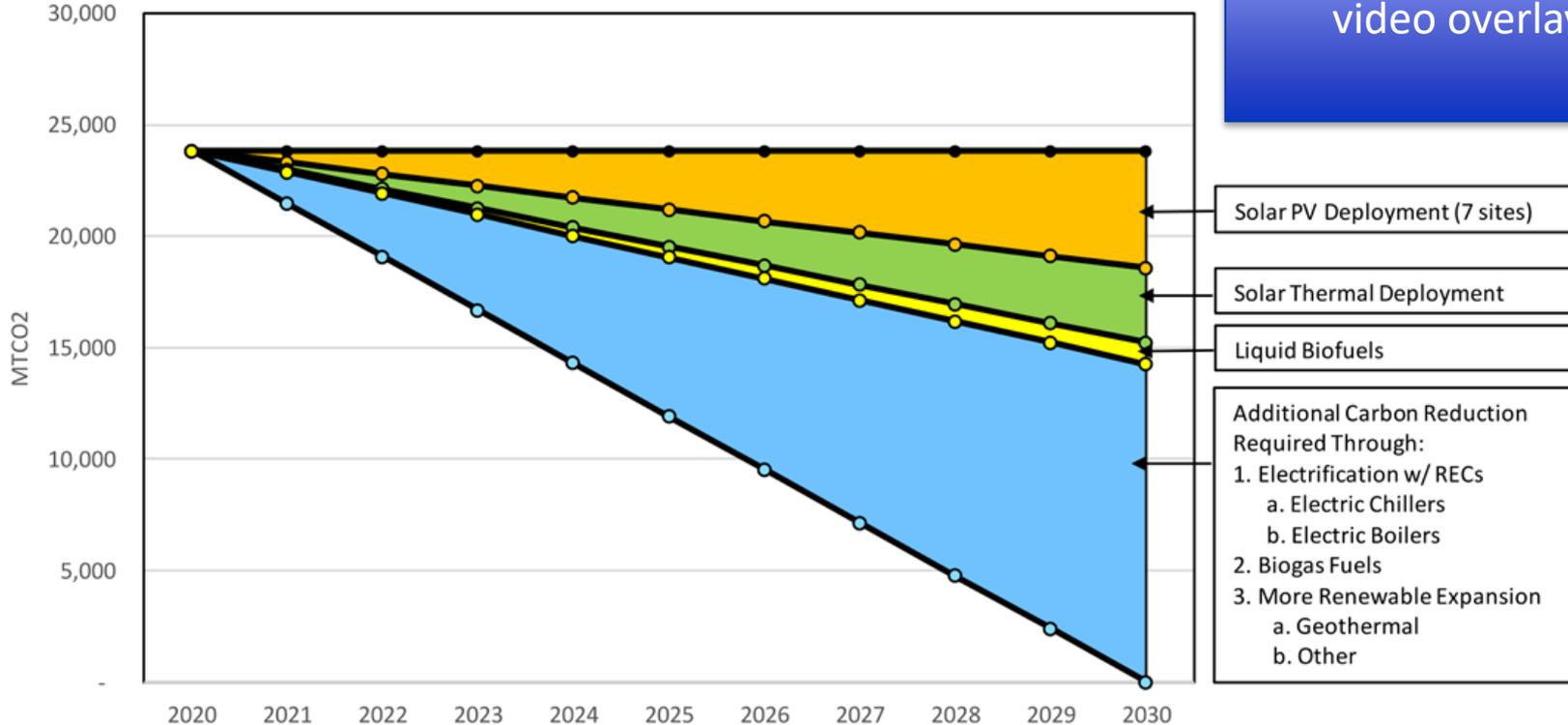
- Energy efficiency projects
- Solar PV (and potential solar thermal)
- Partial electrification / electric chillers
- Chilled water TES
- Utility service provider collaboration, REC purchases
- Continued CHP (near-term)
- Future potential: Steam to hot water heating, geothermal, biofuels, microgrids



**Bucknell**  
UNIVERSITY

# Bucknell University – One Concept

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# Things to ask when energy sustainability planning

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- ▶ Do sustainability plans compromise my ability to meet my core mission?
- ▶ Are energy-related sustainability plans supporting resiliency, reliability, or flexibility to serve given future operating challenges (weather events, terror, fuel shortages, etc)?
- ▶ Have efficiency improvements been adequately pursued?
- ▶ Do sustainability plans allow adequate transition times for “bridging” and allow for flexibility to adapt to future technologies?
- ▶ Do sustainability plans allow for fuel/energy diversity and energy storage?
- ▶ Do sustainability decisions burden future costs in a way that may not be sustainable?
- ▶ Have the social benefits of REC’s/PPA’s been considered?

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