



CampusEnergy2021

BRIDGE TO THE FUTURE

Feb. 16-18 | CONNECTING VIRTUALLY

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





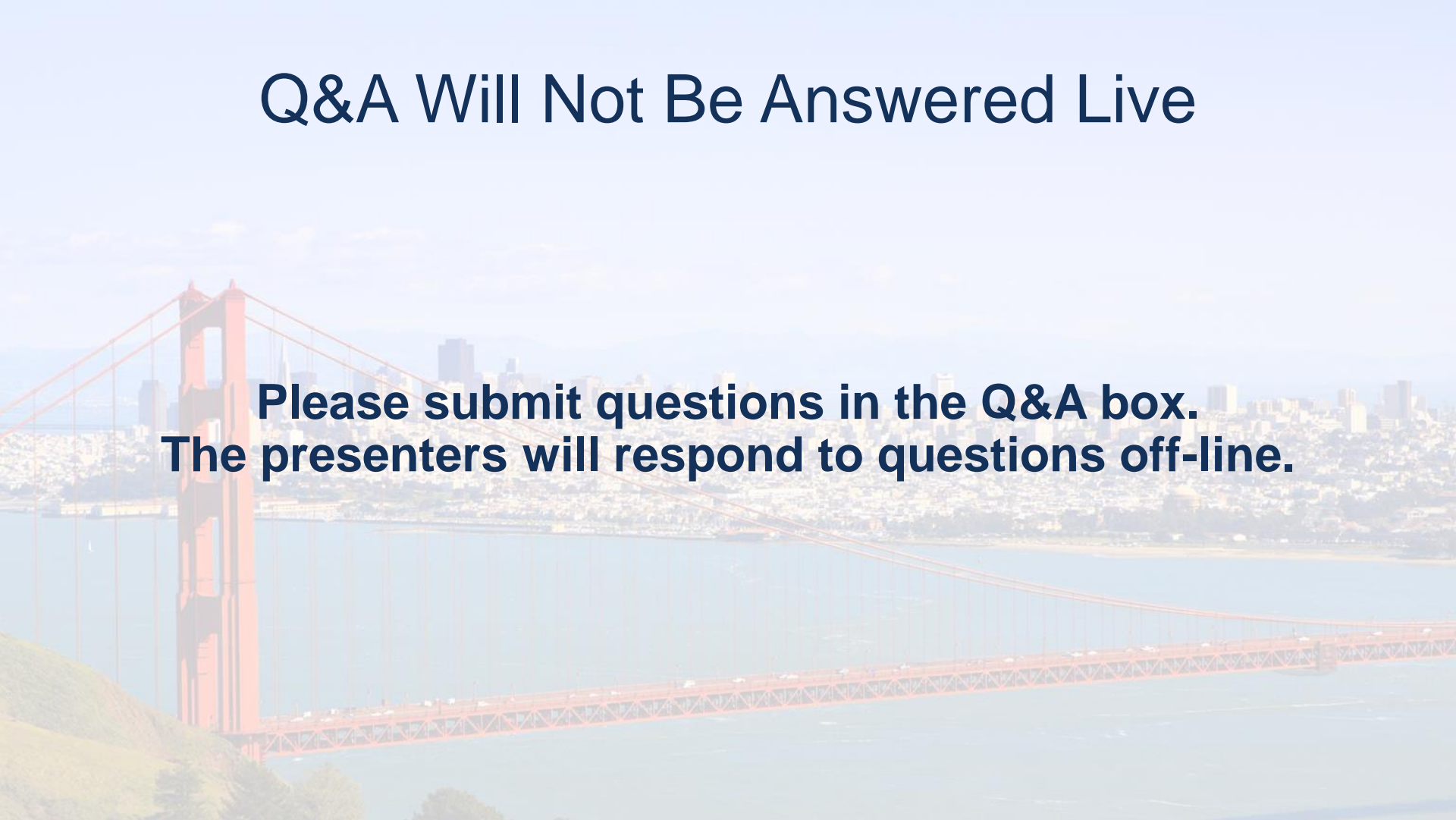
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Domino Effect: The Importance of Understanding the Big Picture when Sustainability Planning

**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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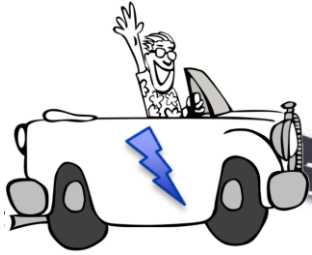


NOW

FUTUR
E

Sustainability Road

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**SUSTAINABILITY
PLAN**

**FUTUR
E**

Sustainability Road

NOW WHAT?

HAZARDS ARISE
ALONG THE WAY

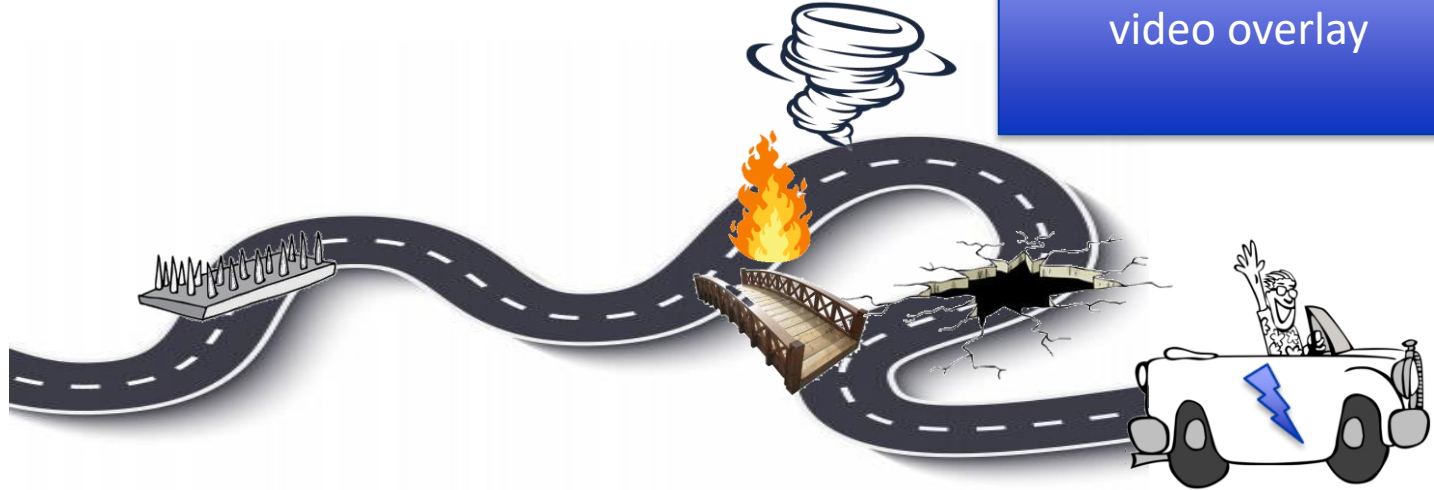


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Sustainability Road

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

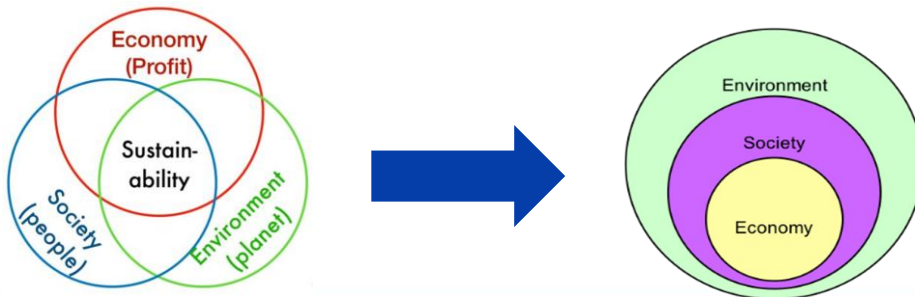
Finding a Balance

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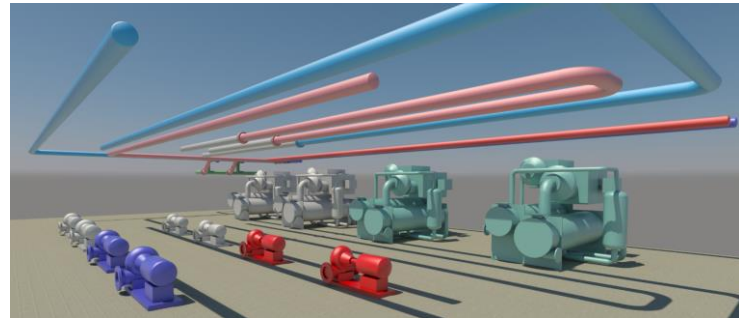
Princeton University	Bucknell University
Key Stats	
<ul style="list-style-type: none">• 8,300 students, ~9.5MM SQFT• 300 kpph steam capacity• 15 MW CHP• 20,000 ton Chiller Plant, TES	<ul style="list-style-type: none">• 3700 students, ~3MM SQFT• 210 kpph steam capacity• 4.8 MW CHP, 1.2 MW STG• 3100 Chiller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

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)

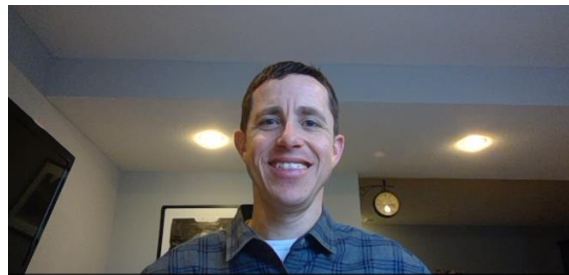


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Bucknell's Balance

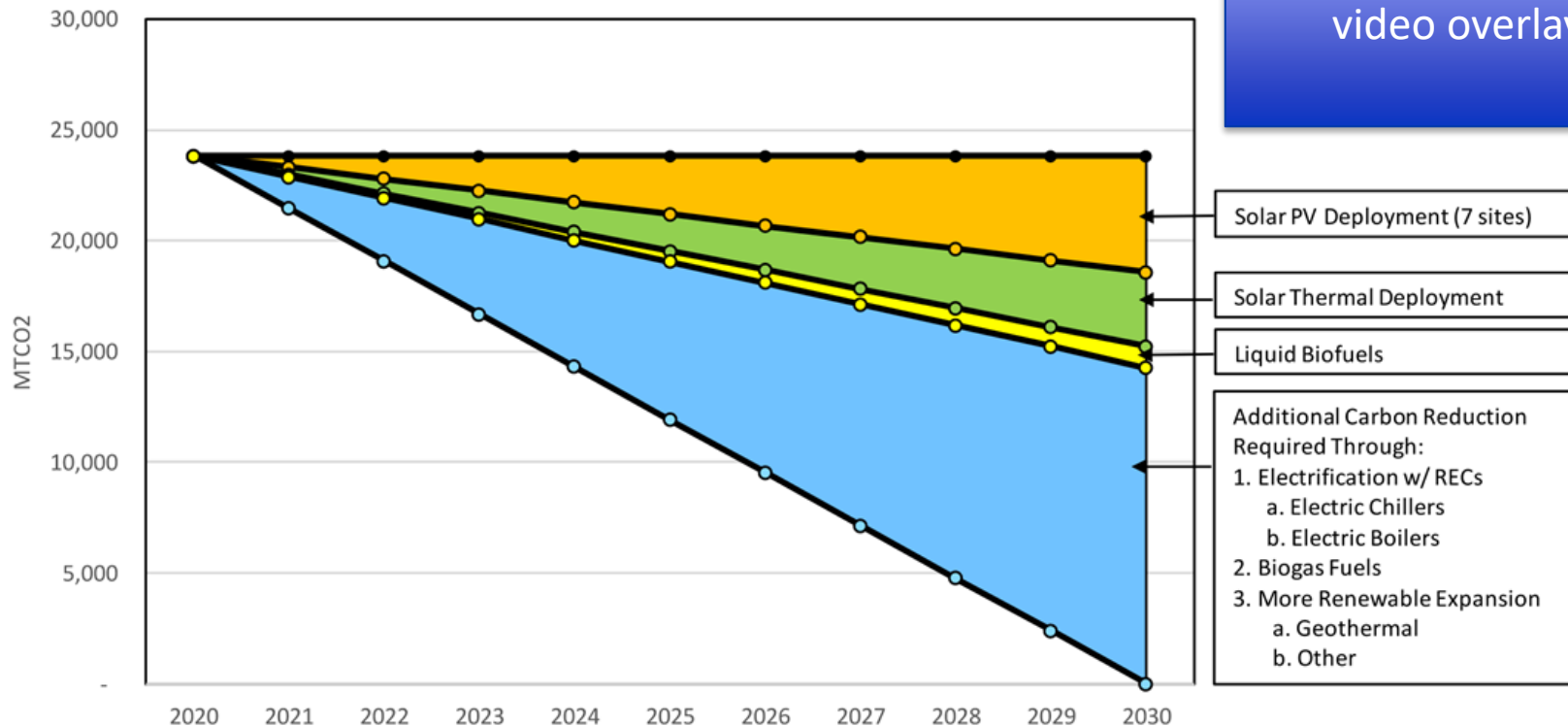
- Energy efficiency projects
- Solar PV (and potential solar thermal)
- Partial electrification / electric chillers
- Chilled water TES
- Utility service provider collaboration, REC purchases
- Continued CHP (near-term)
- Future potential: Steam to hot water heating, geothermal, biofuels, microgrids



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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