



Ice Storage for Commercial Buildings

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TECHNOLOGIES™



→ Agenda

Transition to “Grid-interactive Efficient Buildings”

Off-Peak Cooling

Chilled Water Storage vs Ice Storage

Investment Tax Credit for Energy Storage

Financial Example & Utility Rates

Summary

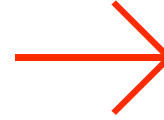


Presented by Mike Filler,
*Sustainable Systems
Commercialization*

→ Storage is Key to Sustainability and Grid Resiliency



What's
missing?



Storage for
dispatch ability



TES can
increase use
of renewables
by up to 50%*

→ “Grid-interactive Efficient Buildings”



EFFICIENT

Persistent low energy use minimizes demand on grid resources and infrastructure



CONNECTED

Two-way communication with flexible technologies, the grid, and occupants



SMART

Analytics supported by sensors and controls co-optimize efficiency, flexibility, and occupant preferences



FLEXIBLE

Flexible loads and distributed generation/storage can be used to reduce, shift, or modulate energy use

→ We Will Need Both Types of Batteries



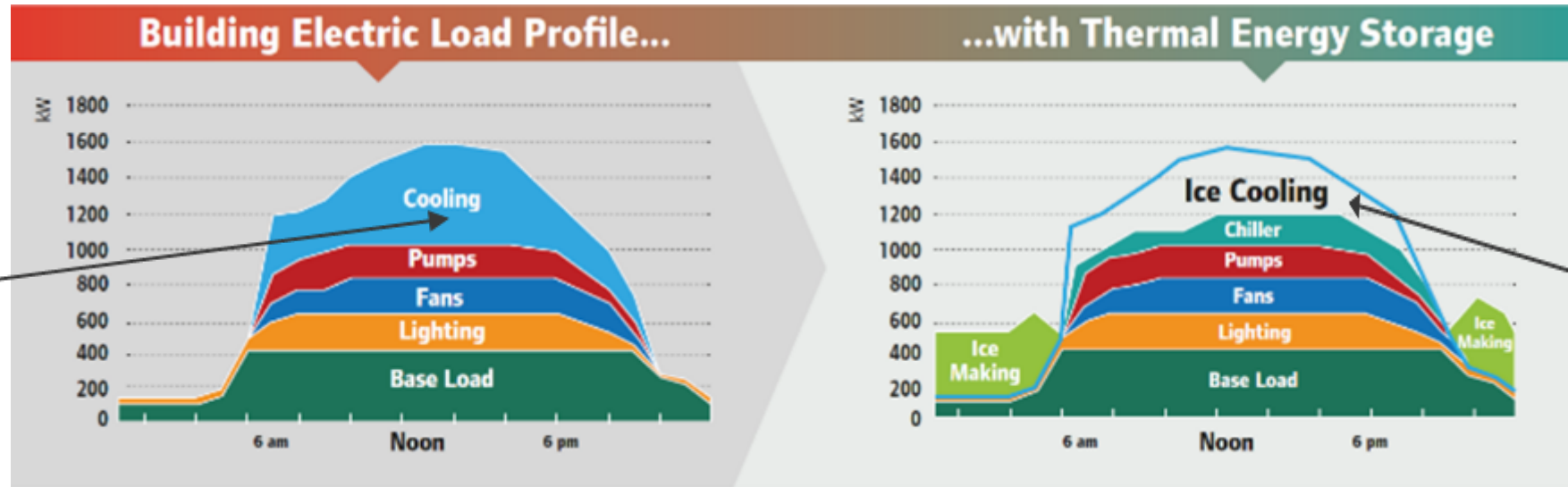
Electric Batteries



**Thermal Batteries:
More Affordable**



→ Shift Demand by Cooling with Thermal Storage



Air-conditioning can account for over 40% of the summer peak-day load

Reduced need for peaking plants & other redundant grid infrastructure

Thermal storage meets grid challenges

- Addressing **critical** utility/grid peaks
- Avoid **expensive** and **high-emission** peaker plants
- Supporting **advanced grid services** and **demand response**



→ Chilled Water Storage vs. Ice Storage



40F supply/60F return...20 Btu/lb or 46 kJ/kg



144 Btu/lb or 334 kJ/kg

→ Ice Storage in Commercial Buildings



What is it?

- A chiller plant enhanced with thermal energy storage.

What does it do?

- Chiller plant operates like a battery, charging energy storage tanks (filled with water) when excess or inexpensive energy is available.
- And discharging when demand or cost is high, or when the utility asks for the discharge to occur.

→ **Key Features**

Ice-Enhanced Chiller Plant

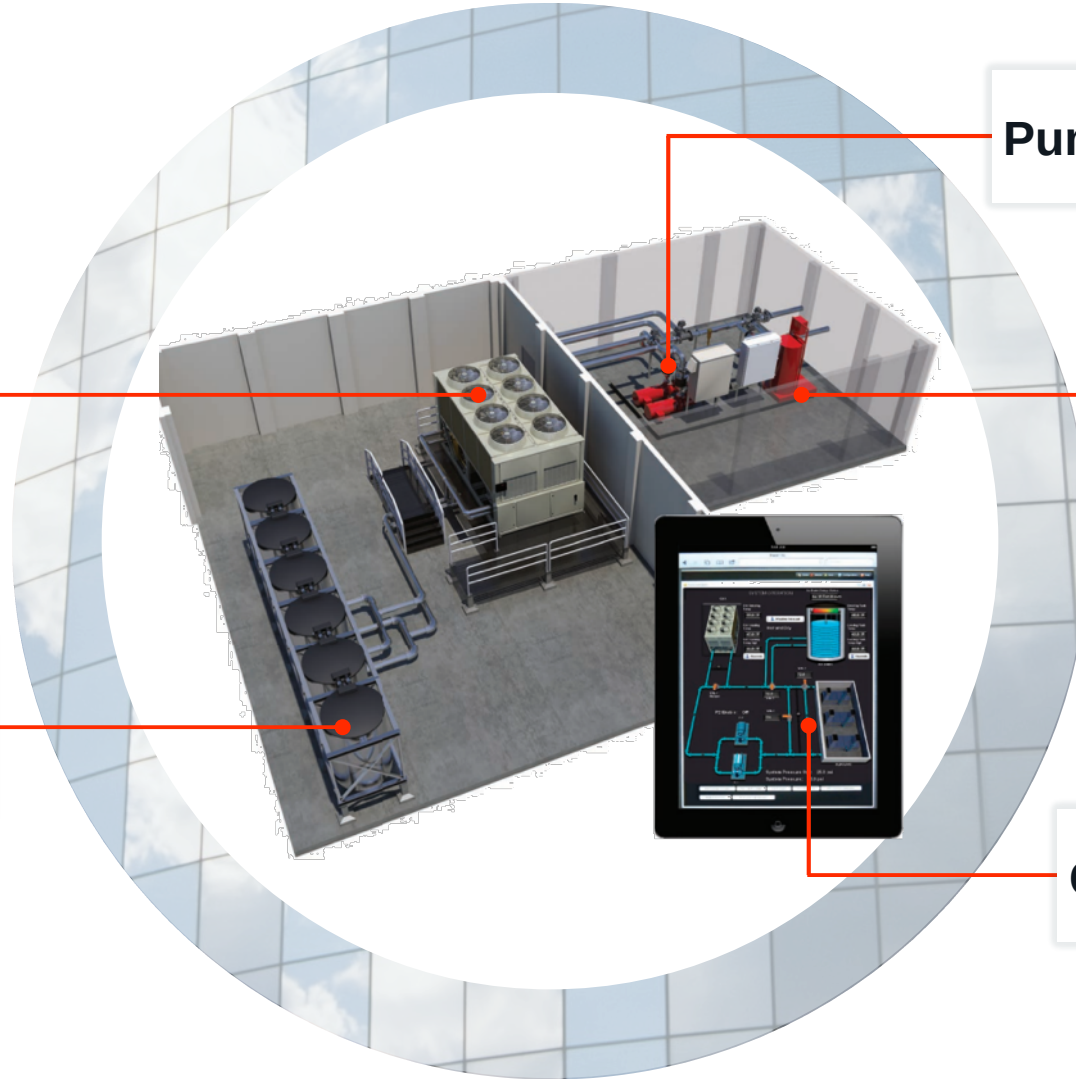
Ice-making chiller

Pumps

Glycol management system

Thermal energy storage tanks

Controls



→ Modular Ice Storage Tanks

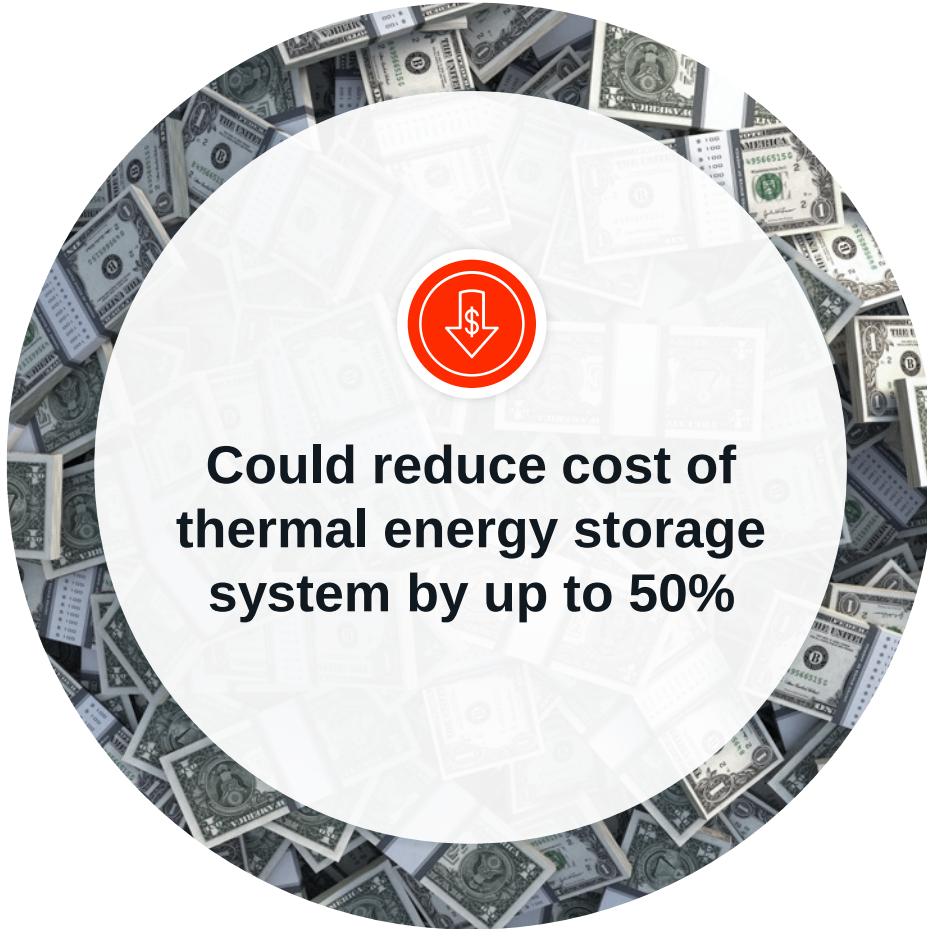
How does it work?

At the heart of the system is the ice storage tank

- Contains water and changes water to ice or ice to water, depending on the application
- Just one tank has the capacity to cool six homes
- Two tanks fit in a parking spot



→ Financial Incentives



The Inflation Reduction Act of 2022 included the first federal incentive for thermal energy storage

- Federal tax credits
- Federal tax deductions
- Additionally, local utilities may offer their own rebates and incentives, enabling building owners to “double dip” into financial support that slashes the cost of their thermal energy projects

→ Clean Electricity Investment Tax Credit (ITC)

Section 48E of the US Tax Code

- Long-standing **investment tax credit** for **private** and **non-taxable** entities
- Historically for qualified “energy property,”
incl: solar, geothermal heat pumps, combined heat and power, and more

Key details about the ITC:

- **Tax credits of up to 50% of the cost** for energy property projects
- Expanded to addt'l technologies, incl. **thermal energy storage property** defined as property comprising a system which:
 - (I) is directly connected to a **heating, ventilation, or air conditioning system**,
 - (II) removes heat from, or adds heat to, **a storage medium for subsequent use**, and
 - (III) provides energy for the heating/cooling of the interior of a **residential/commercial building**
- New Rules added in 2025 from One Big Beautiful Bill Act
- Timeframe base credit rates apply:
- **Thermal energy storage: Available through 2032 with phase down thereafter**

Section 48E Investment Tax Credit (ITC)

Base Rate 6%

Increased Credit Amount* 5X multiplier

Meets Domestic Content Requirements** 2% or 10%

Meets Energy Communities Requirements*** 2% or 10%

Total Potential Credit Value Up to 50% with Bonuses

*Increase Credit Amount: must be less than 284 tons (**OR**) meet prevailing wage and apprenticeship requirements. **Domestic Content: i.e., materials/components made in the USA

***Energy Communities: See most recent map at <https://arcgis.netl.doe.gov/portal/apps/experiencebuilder/experience/?id=a2ce47d4721a477a8701bd0e08495e1d>

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→ 2025 Final Guidance from IRS

TreasReg 1.48E-2(g)6(ii) Thermal energy storage property—

...However, consistent with §1.48-14(d), if thermal energy storage property, such as a heat pump system, includes equipment, such as a heat pump, **that also serves a purpose in an HVAC system** that is installed in connection with the thermal energy storage property, the taxpayer's qualified investment with respect to the thermal energy storage property includes the total cost of the thermal energy storage property and HVAC system less the cost of an HVAC system without thermal storage capacity that would meet the same functional heating or cooling needs as the heat pump system with a storage medium, other than time shifting of heating or cooling. See §1.48-14(h) for application of the **Incremental Cost Rule**.

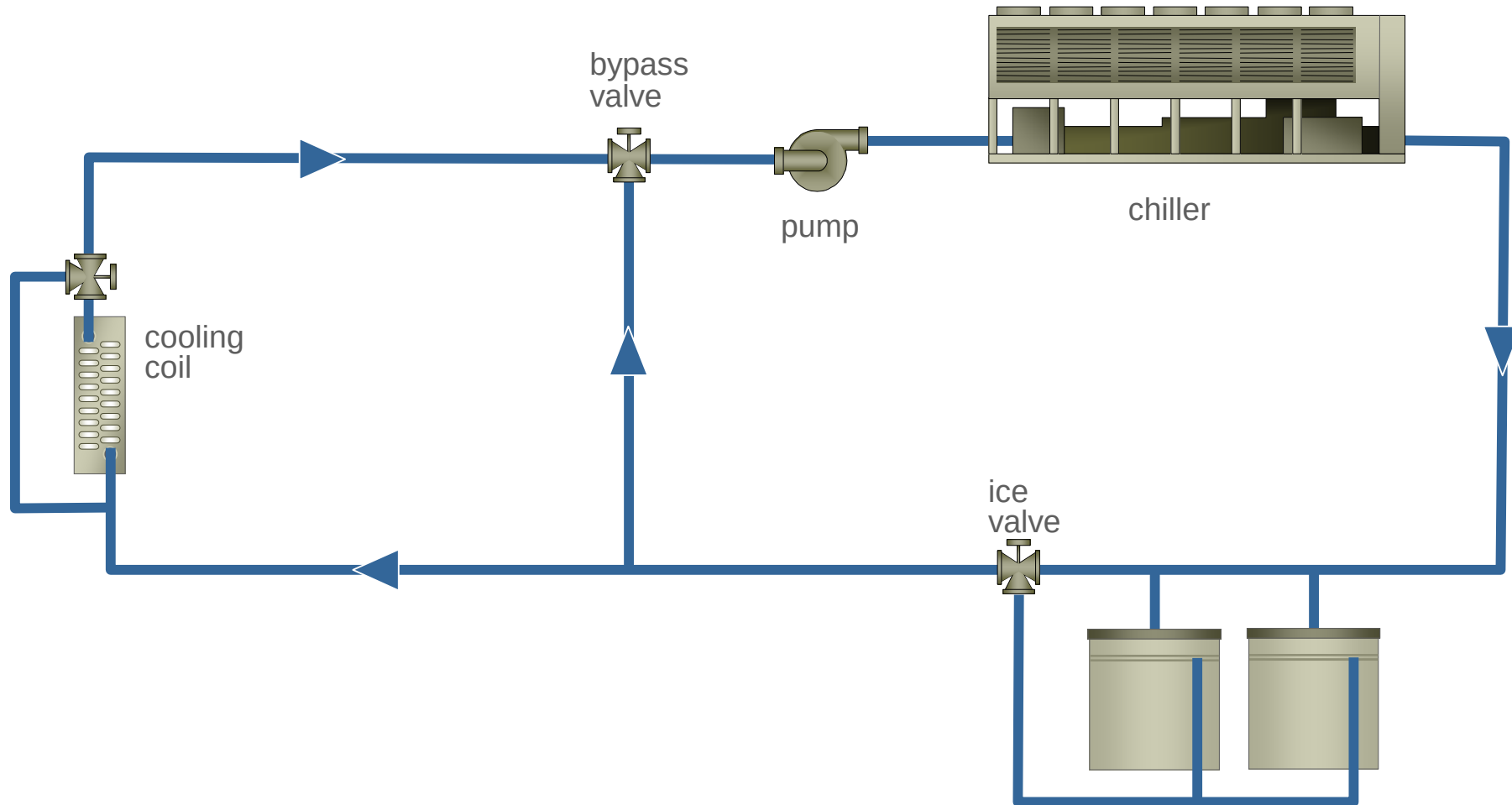
A thermal energy storage property will be deemed to have the purpose of substantially altering the time profile of when heat added to or removed from the thermal storage medium can be used to heat or cool the interior of a residential or commercial building if that thermal energy storage property is capable of storing energy that is sufficient to provide heating or cooling of the interior of a residential or commercial building for a **minimum of one hour**.

→ Local Utility Incentive Examples

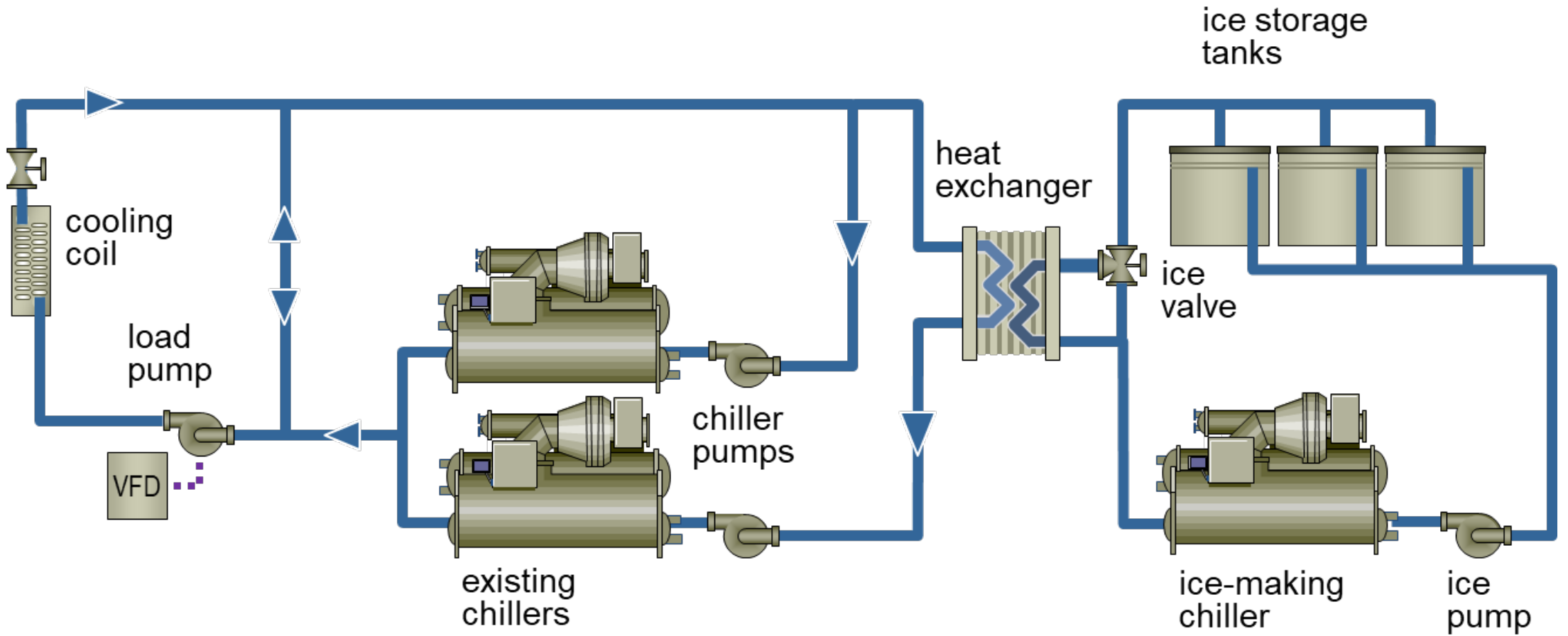
- Austin Energy: \$350.00 *per peak kW reduced*
- AEP Texas: \$350.00 *per peak kW reduced*
- Duke Energy Florida: \$300.00 *per peak kW reduced*
- Arizona Public Service Company: \$30 *per Ton-Hour*
- *More incentives can be found at [UtilityGenius](https://www.utilitygenius.com/)*



→ Simplified Layout of Cool Thermal Storage



→ Adding Thermal Storage to a Large Chiller Plant



→ Let's Consider an Example...

A Few Assumptions

- Medical Office Building with operating hours of 7 AM to 7 PM
- Peak Load of 600 tons

Estimated Utility Rate for Florida Power & Light GSLDT-1

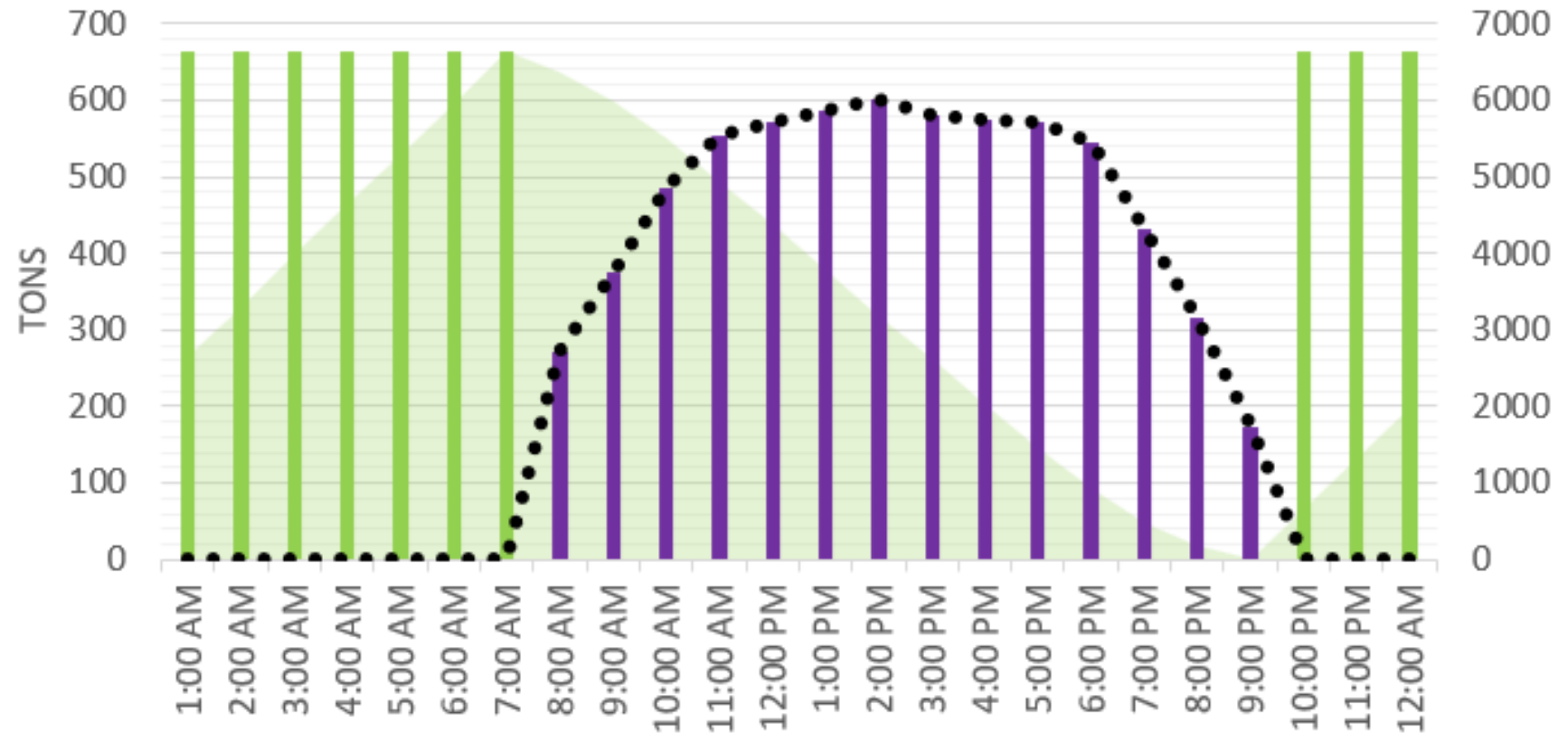
- General Service Large Demand TOU; 500 - 2,000 kW; Secondary Voltage
- Summer on-peak demand charge of \$14.26/kW
- Summer consumption on-peak charge of \$0.03771/kWh
- Summer consumption off-peak charge of \$0.01572/kWh
- Riders and other charges: \$3.3 per max kW, \$0.03285/kWh on-peak, \$0.02961 off-peak
- Summer on-peak window is 12-9 PM, April – October
- Custom incentive up to \$200/kW within payback period guidance

Federal Tax Incentive Estimate

- Investment Tax Credit of 40% of incremental TES system components/costs

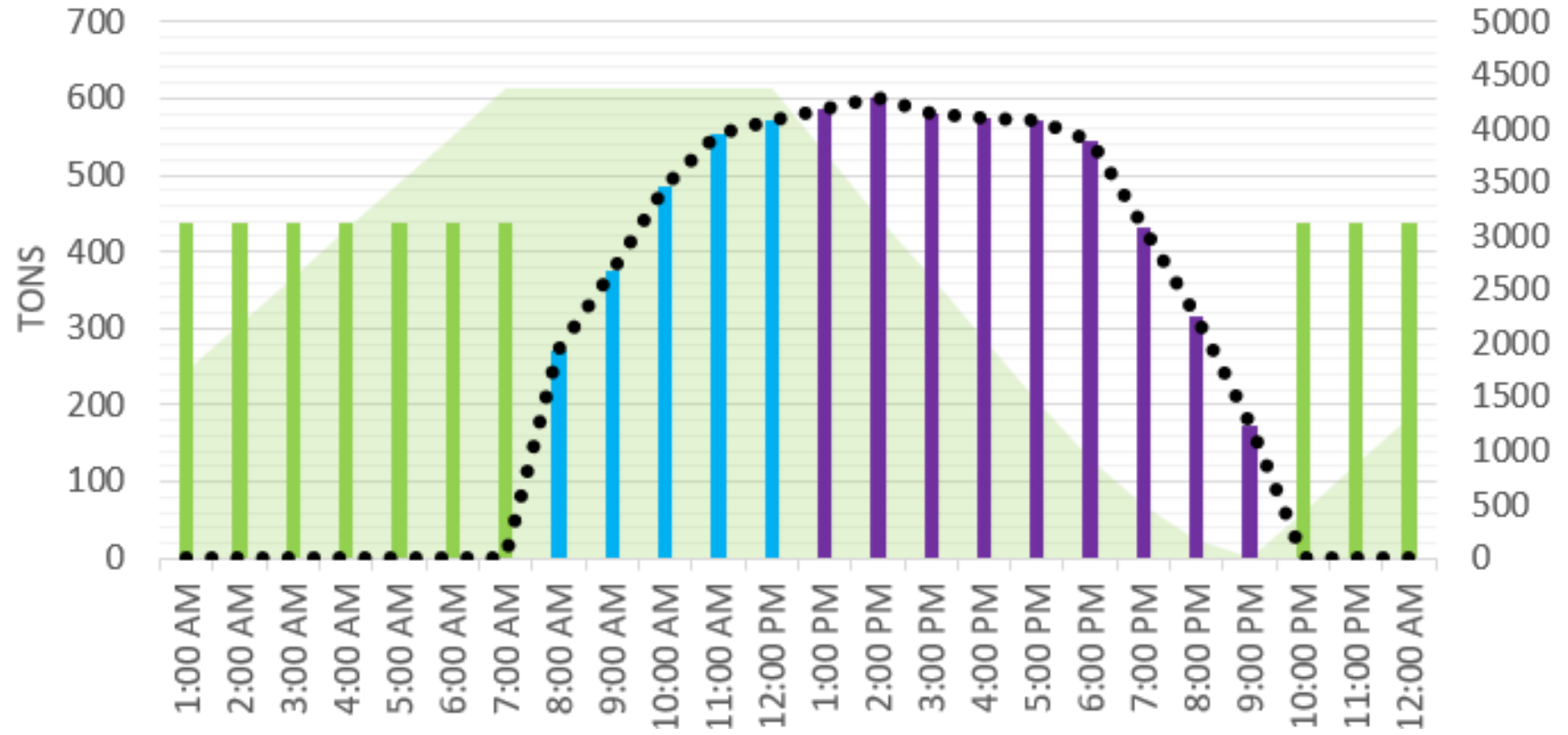
→ Load Profile for Office with Full Storage

- 663 tons in ice-making (~1,000 nominal tons)
- 6,628 ton-hours of TES
- Chiller On-Peak kW = 0



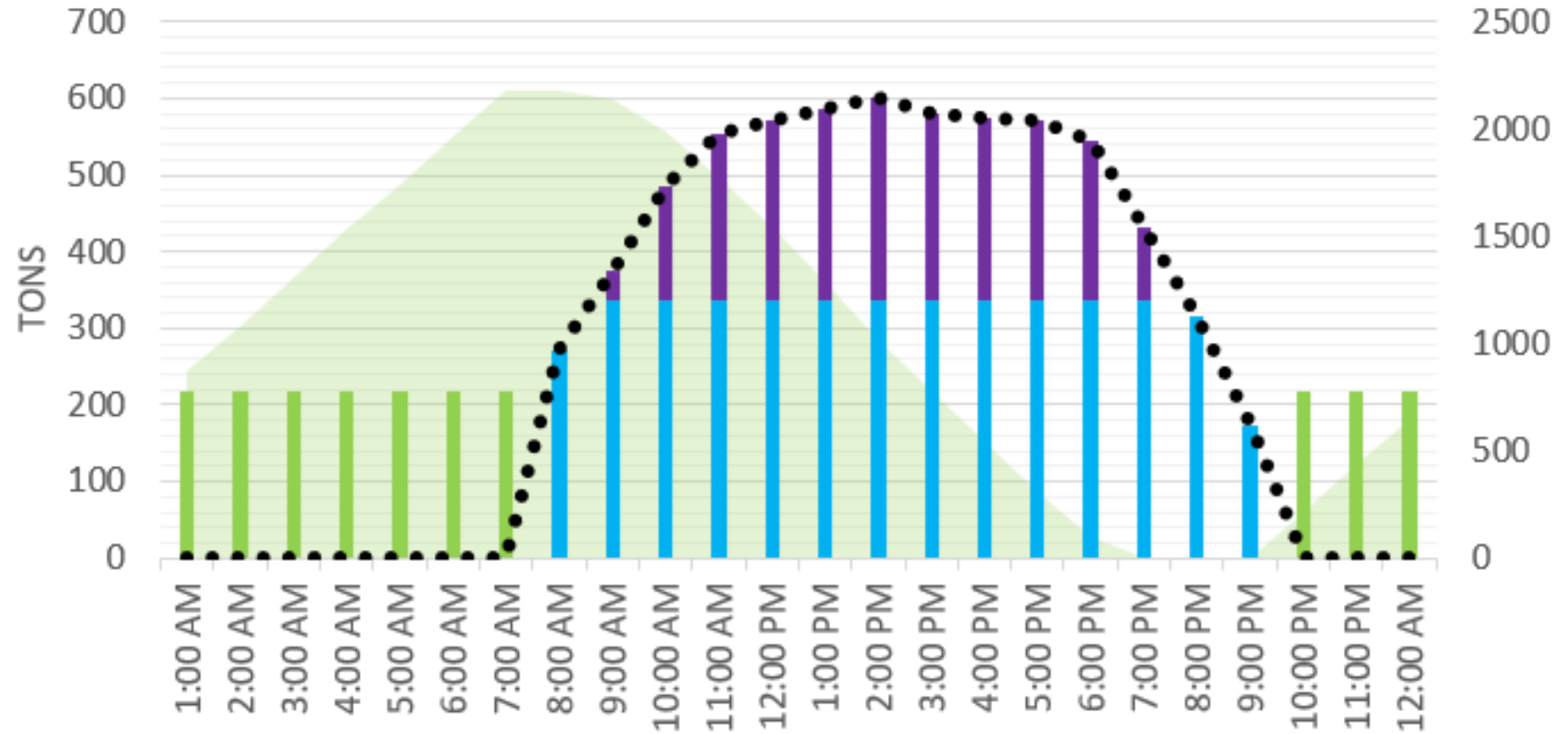
→ Load Profile for Office with Full Storage 12-9 PM

- 438 tons in ice-making (~655 nominal tons)
- 4,374 ton-hours of TES
- Chiller On-Peak kW = 0



→ Load Profile for Office with Partial Storage

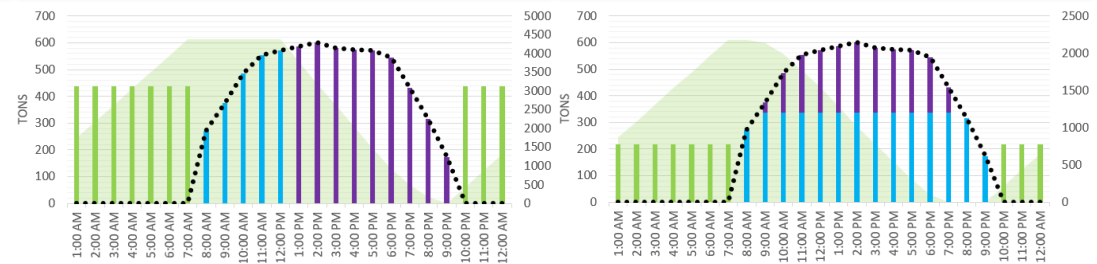
- 219 tons in ice-making (~340 nominal tons)
- 2,181 ton-hours of TES
- Chiller On-Peak kW = 437



→ Financial Estimates

Let's take a closer look

	Conventional	9 Hours' Full Storage	Partial Storage
Chillers	(2) 300-ton AC	(2) 340-ton AC	(1) 340-ton AC
Ice Components	N/A	(29 tanks) \$1,224k	(15 tanks) \$736k
Utility Cost*	\$154k	\$38k	\$99k
First Cost	\$1,200k	\$2,584k	\$1,416k
Tax Credit (40%)	\$0	\$(490k)	\$(294k)
FPL Utility Rebate ?	\$0	\$(144k)	\$0
Revised First Cost	\$1,200k	\$1,950k 6-Yr Payback	\$1,122k



* Annual electric utility costs for the chillers.

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CASE STUDY

Shooting Star Casino Mahnomen, Minnesota

CHALLENGE

- Upgrade needed to improve IEQ for 400,000 sq. ft. while cutting energy costs
- Reduce operational workload for staff
- Reduce GHG emissions to reflect commitment to sustainability
- Minimize effect on casino operations during upgrade

SOLUTION

- System included ice storage tanks, new chillers and RTUs

RESULTS

- Thermal Energy Storage expected to cut energy costs by up to 35% annually
- Received more than \$290,000 rebate from local utility



CASE STUDY

Distillery in Shelbyville, Kentucky

CHALLENGE

- Required significant cooling for distillation loads and faced high peak electrical loads and demand costs due to fluctuating cooling needs.

SOLUTION

- Air-cooled chiller, ice storage tanks, and a custom ice completion module for building ice during off-peak hours.
- New building automation system

RESULTS

- Downsized chiller from 200 tons to 40 tons by shifting demand— lower first cost and lower noise
- Energy cost savings of \$20,000-\$30,000 per year
- Reliable process cooling at the required temperature





CASE STUDY

Jefferson Community College Watertown, NY

CHALLENGE

- Needed to improve comfort and centralize cooling for 8 campus buildings by replacing inefficient, aging systems, all on a limited budget and without costly electrical upgrades.

SOLUTION

- Ice-Enhanced Air-Cooled Chiller Plant—providing 200 tons of peak cooling capacity utilizing a 90-ton nominal chiller plus ice storage
- System optimizes energy use and monitors performance remotely using building automation

RESULTS

- Nearly doubled cooling capacity, improved comfort, reduced noise, avoided costly electrical upgrades, and lowered utility bills—all aligned with the college's sustainability goals.

→ More Flexibility, Less Money



Provides demand flexibility and can reduce reliance on grid during peak hours (thus reducing costs)



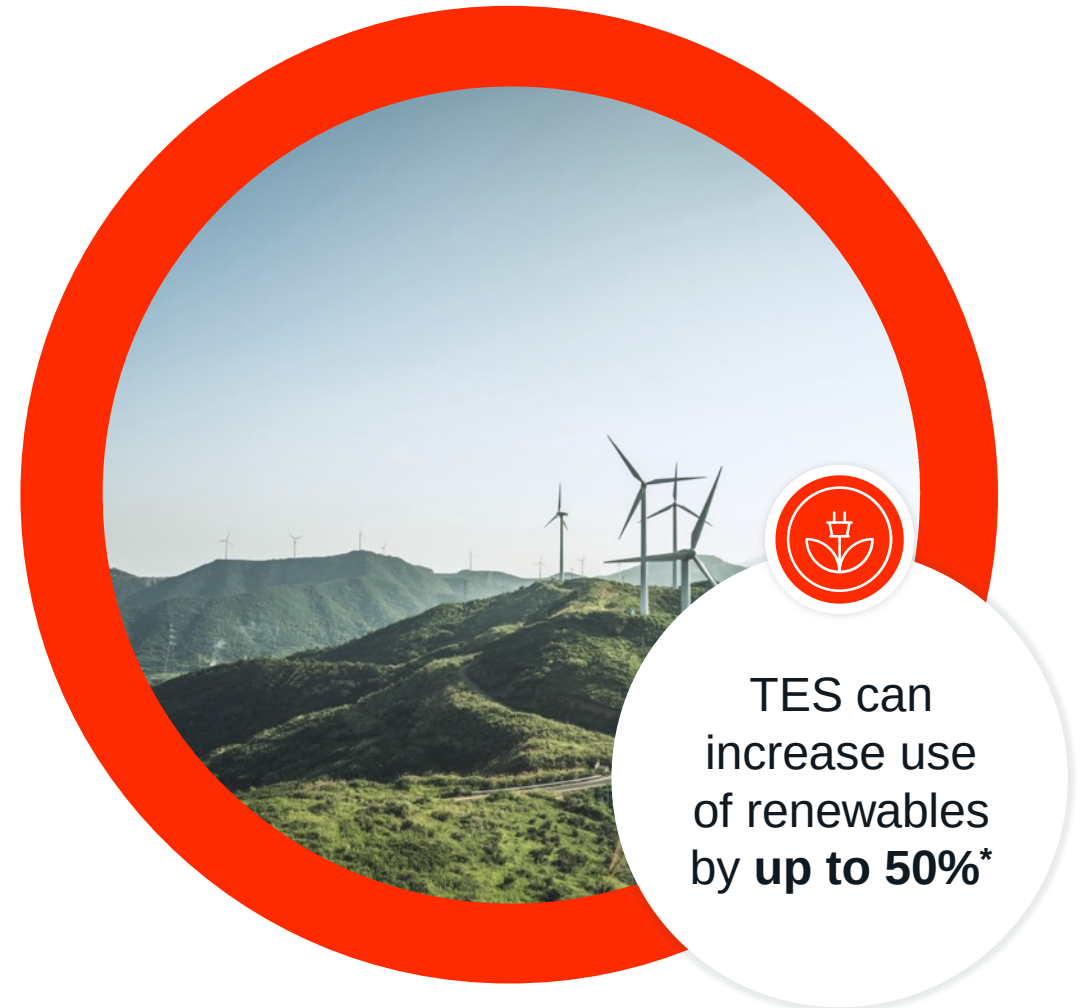
Enables renewable energy and decarbonization



Offers reliable redundancy and assurance



Incentivized by utility programs, federal tax incentives and local funding programs



→ Questions?



Mike Filler

Let's Connect!
LinkedIn

