

De-Carbonizing the Campus: Planning, Tools & Technologies

CampusEnergy2023

February 27 – March 2, 2023

Gaylord Texan Resort & Convention Center | Grapevine, Texas



INTERNATIONAL
DISTRICT ENERGY
ASSOCIATION

5C: Business Models & Financing

Utilizing Energy Performance Contracting (EPC) as a Campus De-Carbonization Tool

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Energy Performance Contracts (EPCs)



Design/build project with a performance guarantee



Turnkey solution



Delivers comprehensive utility savings



Third-party financing (optional)

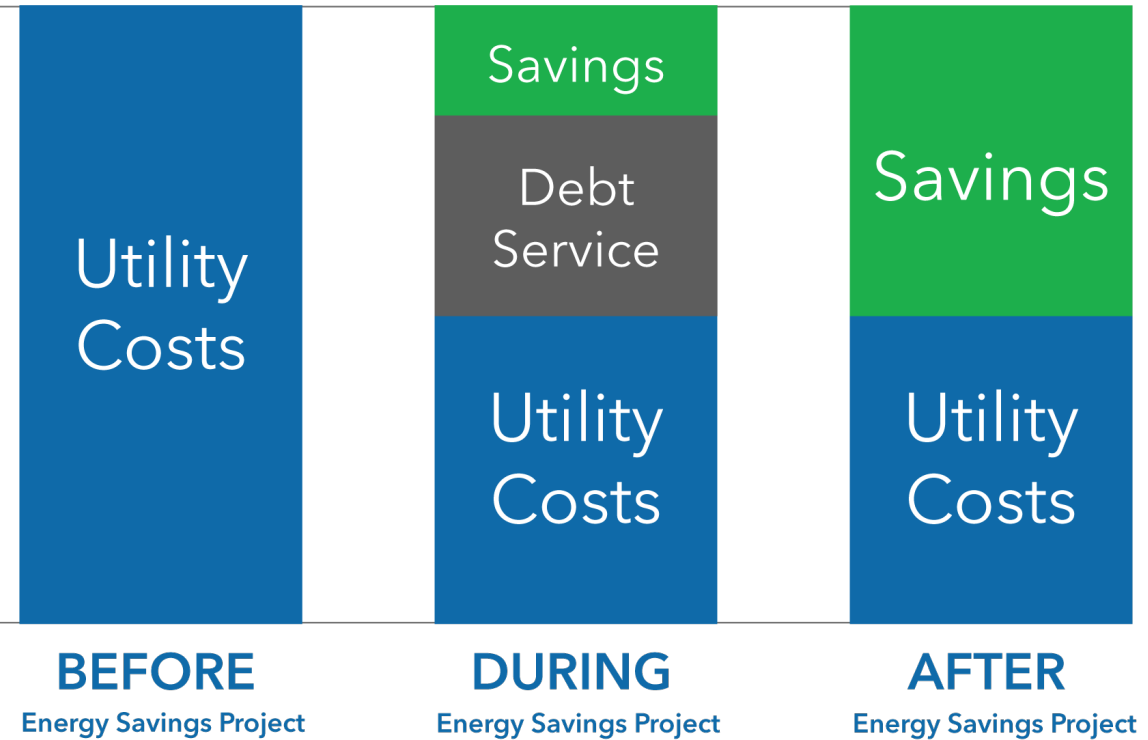


Single contract with Energy Services Company (ESCO)

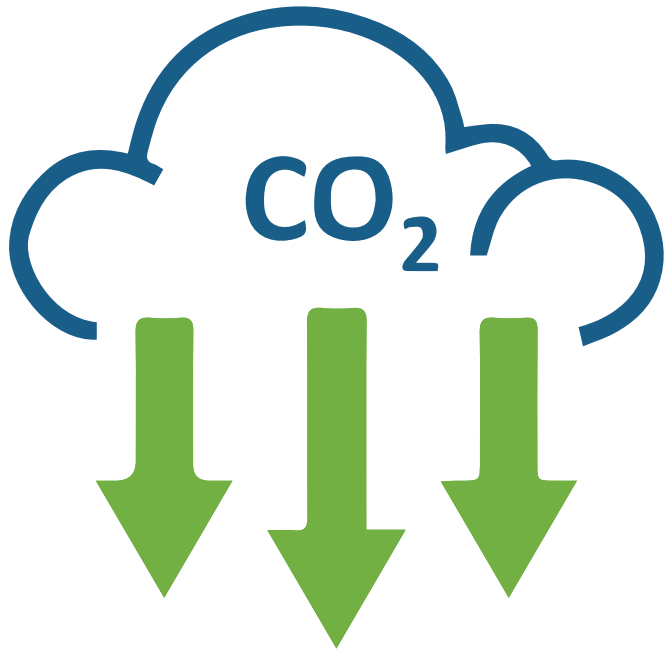


Project savings pay project costs

Customer Cash Flow



The Illinois Climate Action Plan (iCAP) – A Path to Campus De-Carbonization



Outlines the Vision and Goals to Meet the University's Commitment to Achieve Carbon Neutrality by 2050

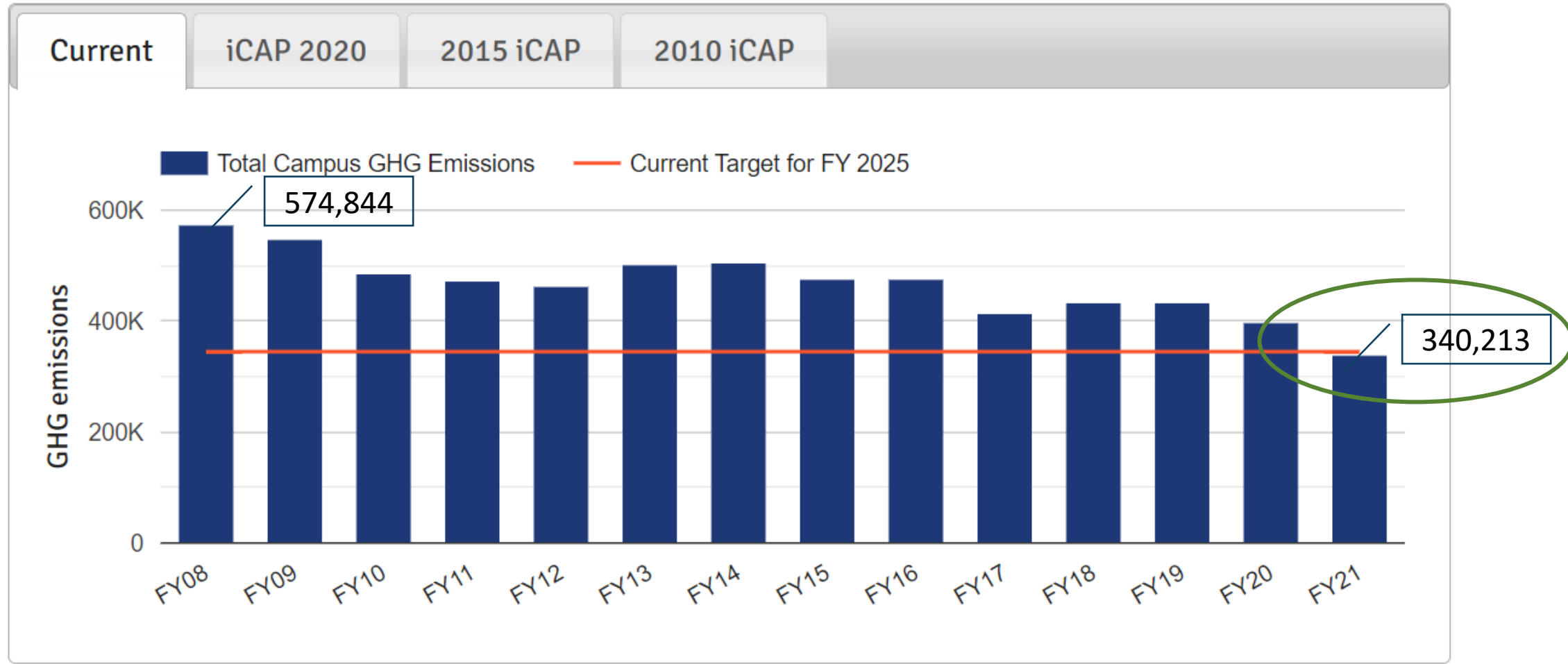
- Updated every 5 years (last update in 2020)
- 60% Energy Reduction by 2050 (from 2008 baseline)

Energy Management Plan (EMP)

- Retro-commissioning
- Re-commissioning
- Capital Projects
- **Energy Performance Contracts (EPC)**

2025 GHG Goal – 344,906

Total Campus GHG Emissions



2030 BTU/SF Goal – 167,000



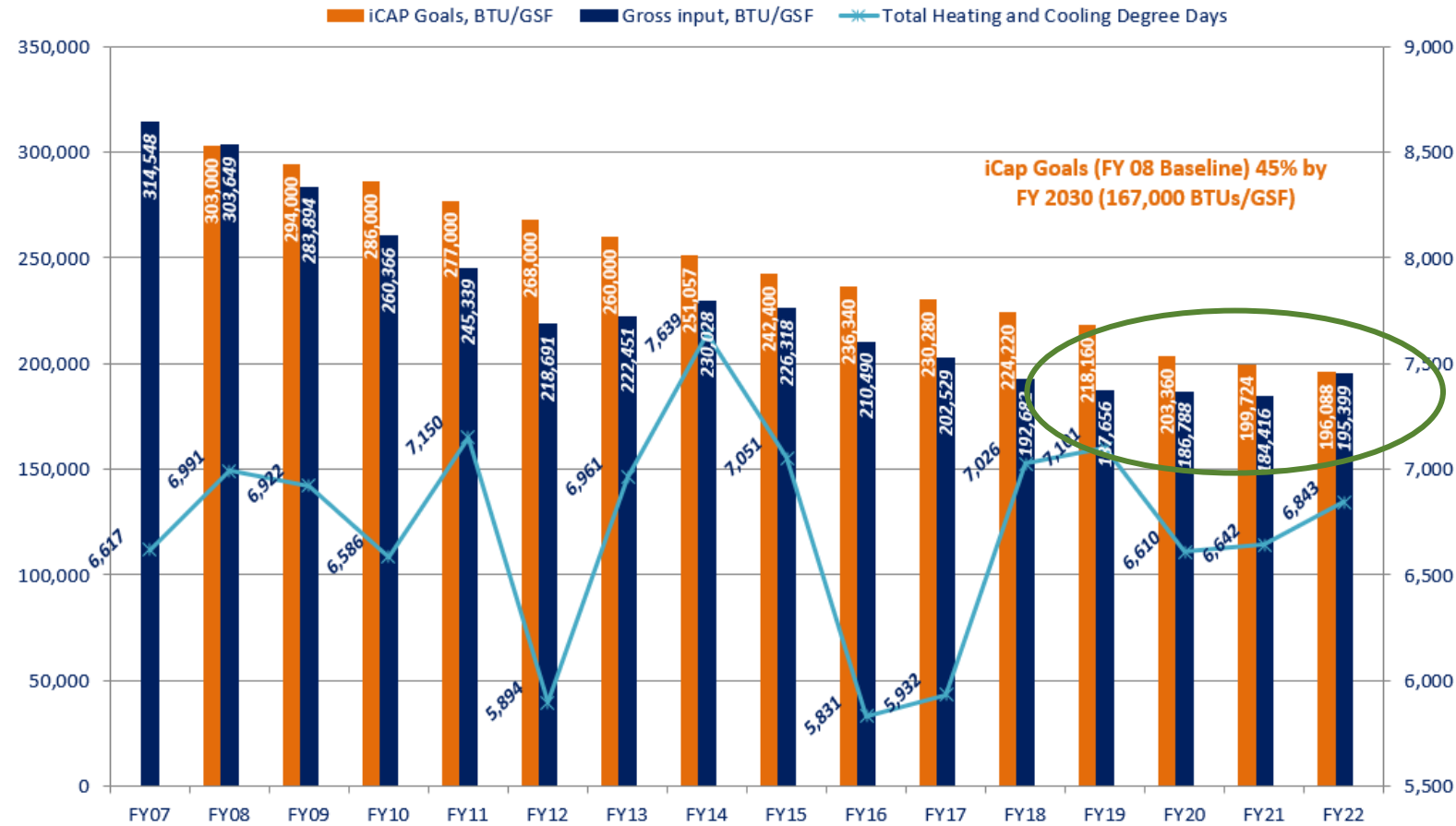
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Utilities & Energy Services Division Energy Utility Index (EUI)-BTU/GSF

FY2007 to FY2022

BTU/GSF

Degree Days



*Gross square feet (GSF) includes UIUC owned space in Champaign and Urbana and gross input EIU excludes BTUs for Petascale electricity.

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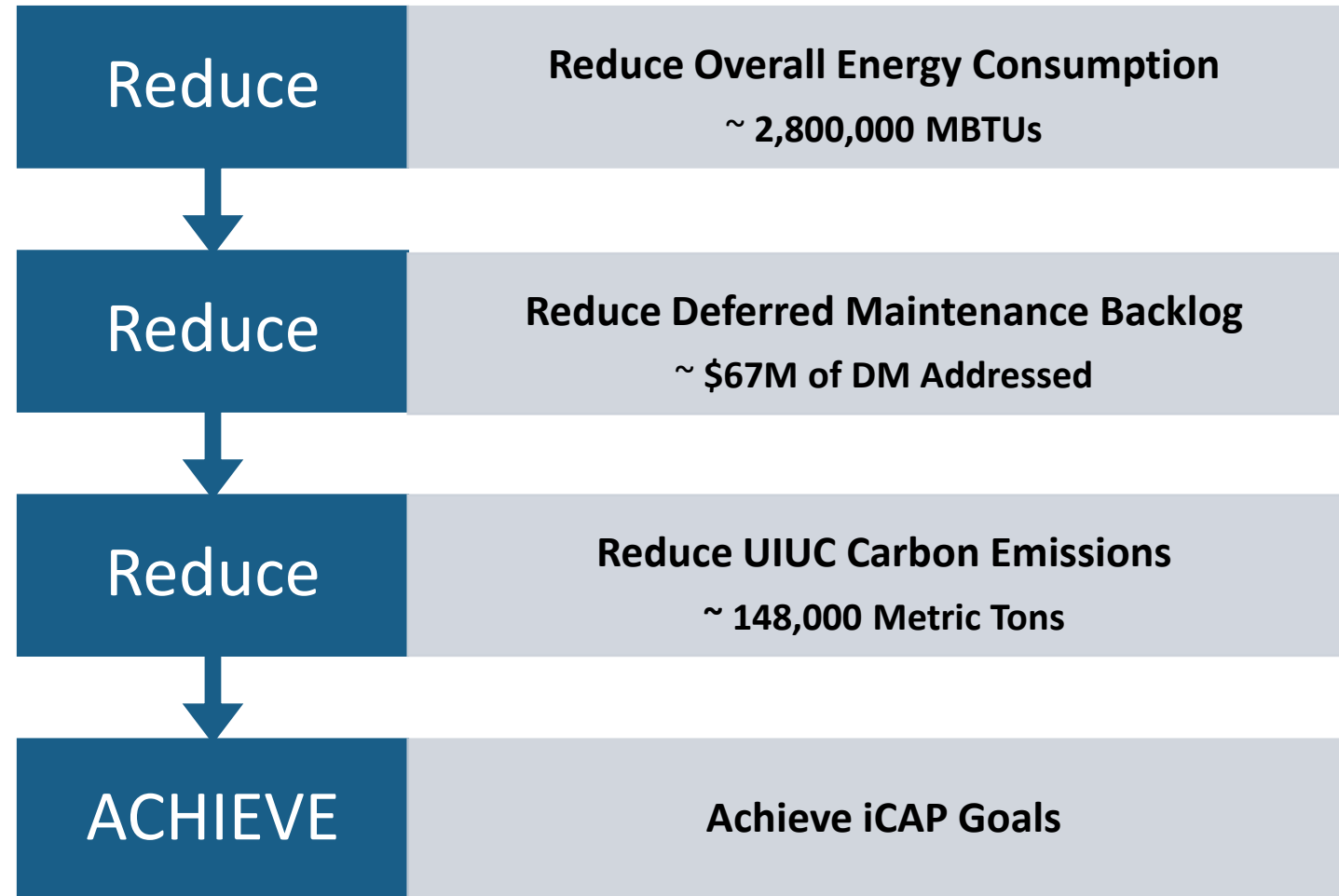
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UIUC EPC Project Summary – Past 10 Years

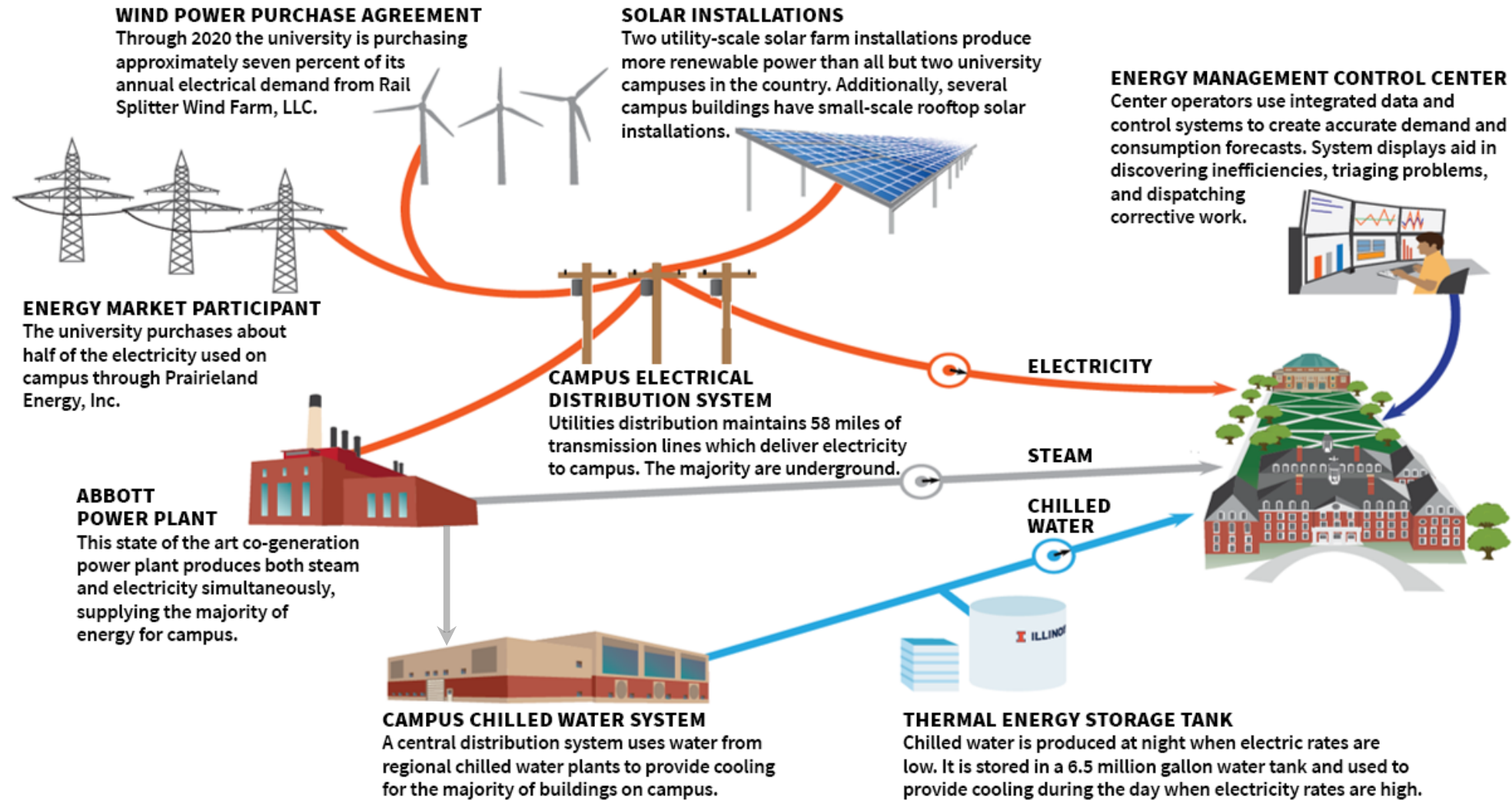
(Amounts in Thousands)						
Project Budget by Fund Source	EPC01 VetMed Ctr	EPC02 Oak St. Chiller Plant	EPC03 Eng Bldgs	EPC04 Abbott Int Cooler	EPC05 Lab Facilities	Totals
Fiscal Year Completed/Expected	2013	2013	2020	2018	2023	
UES Contribution existing funds		\$ 10,731	\$ 478	\$ 2,062		\$ 13,271
UES Contribution \$40M borrow			\$ 20,171		\$ 14,980	\$ 35,151
Def. Maint. (AFMFA, UA, Provost)			\$ 15,817		\$ 9,617	\$ 25,434
Matching (Provost/Dept./Grant)			\$ 4,103		\$ 8,000	\$ 12,103
External Borrow	\$ 21,262					\$ 21,262
Total Project Budget	\$ 21,262	\$ 10,731	\$ 40,570	\$ 2,062	\$ 32,597	\$ 107,222
First Year Energy Cost Avoidance	\$ 1,400	\$ 1,900	\$ 1,400	\$ 210	\$ 2,000	\$ 6,910
20 Year Energy Cost Avoidance	\$ 44,000	\$ 60,000	\$ 42,000	\$ 5,000	\$ 55,000	\$ 206,000
Def. Maint. Addressed (Est.)	\$ 25,000	\$ -	\$ 15,000	\$ -	\$ 27,000	\$ 67,000



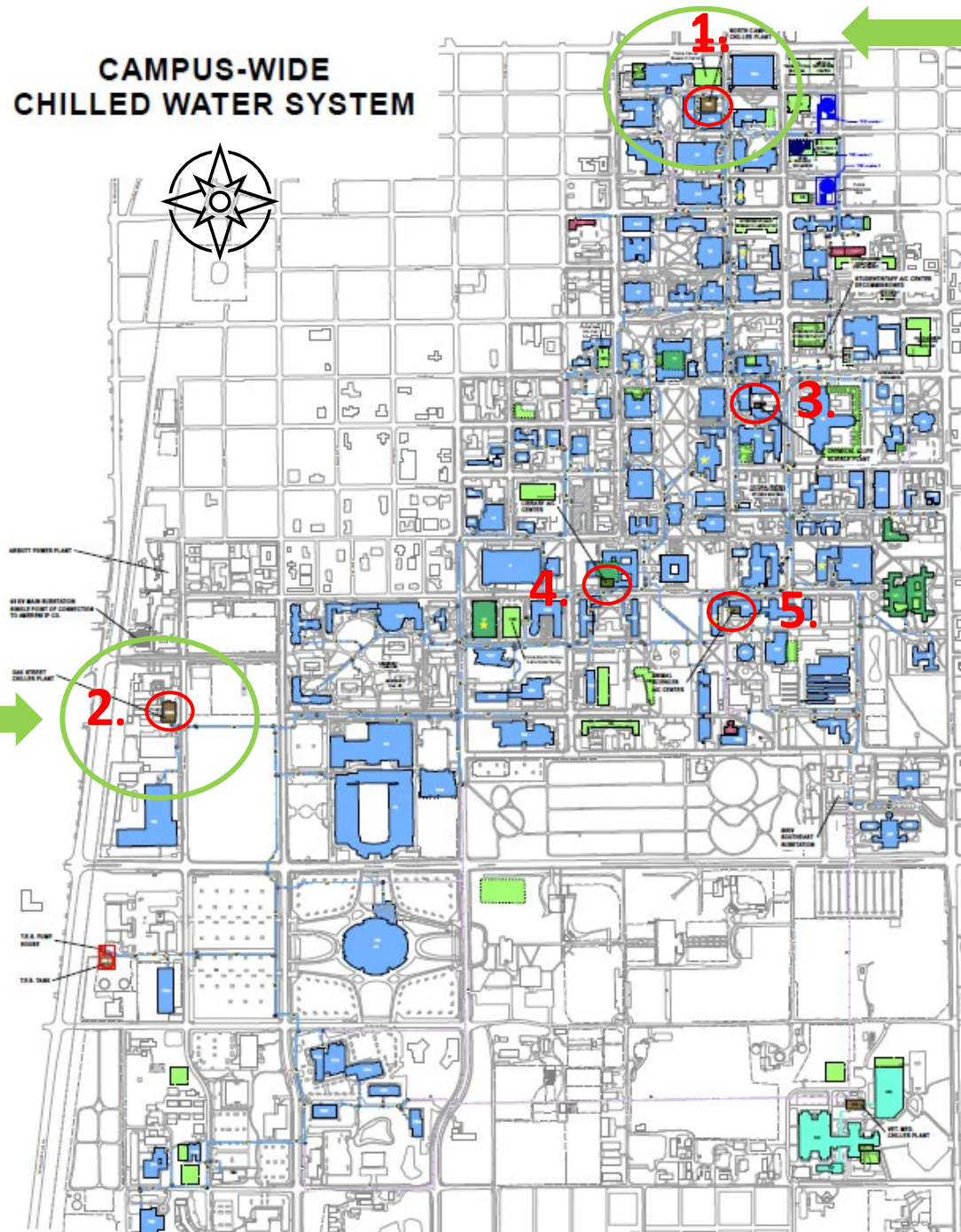
UIUC – EPC Project Goals & Progress to Date



The UIUC Energy Enterprise



Next EPC Project – Chilled Water System (CWS) Optimization





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EPC Project 006 – CWS Optimization

Chiller Plant	Chiller Type	Installed or Rated Capacity (Tons)	2022 Usable Capacity
Oak Street Chiller Plant (OSCP)	Electric Centrifugal & Steam Turbine Centrifugal	27,630	20,630
North Campus Chiller Plant (NCCP)	Electric Centrifugal	9,500	8,250
Library Air Conditioning Center (LACC)	Electric Centrifugal	3,200	3,200
Animal Sciences Chiller Plant (ASCP)	Electric Centrifugal	2,100	2,100
Chemical/Life Science Chiller Plant (CLSCP)	Electric Centrifugal	3,030	1,906
Subtotal Main Campus Chilled Water Plant Capacity		45,460	36,086

EPC Project 006 – CWS Optimization



Built in 2004

Oak Street Chiller Plant

Chiller 1
Chiller 2
Chiller 3
Chiller 4
Chiller 5
Chiller 6
Chiller 7

Machine Type

Steam Turbine Centrifugal
Steam Turbine Centrifugal
Electric Centrifugal
Electric Centrifugal
Electric Centrifugal
Electric Centrifugal
Electric Centrifugal

Capacity
5000 ton
5000 ton
2000 ton
2200 ton
5000 ton
2798 ton
5600 ton
27598 ton



Built in 1998

North Campus Chiller Plant

Chiller 1
Chiller 2
Chiller 3
Chiller 4
Chiller 5
Chiller 6
Chiller 7

Electric Centrifugal
Electric Centrifugal
Electric Centrifugal
Electric Centrifugal
Electric Centrifugal
Electric Centrifugal
Electric Centrifugal

1200 ton
1000 ton
1000 ton
2000 ton
1000 ton
2000 ton
1200 ton
9400 ton

EPC Project 006 – CWS Optimization

Optimization Scope of Work (SOW)

Condenser side optimization (variable speed pumps and towers) – Oak and North

Hydraulically balance loads between multiple plants – all 5 plants

Optimize chiller staging based on efficiency and campus hydraulics – all 5 plants

Variable evaporator flow – Oak and North

Chilled water temperature and differential pressure reset – Oak and North, matching the other systems online

Cloud connectivity for operator support, M&V, and fault diagnostics – Secure, remote access from anywhere for Oak and North; KPIs for all 5 plants; fault diagnostics for Oak and North; operator support for all 5 plants

Close decouplers - Oak and North

EPC Project 006 – CWS Optimization

Annual Savings Estimates – \$2.5M Investment



	Min Steam Chiller Run Time & Closed Decouplers	Existing Steam Chiller Run Time & Closed Decouplers
Electricity (kWh/yr)	3,747,612	6,877,615
Cooling Tower Water (gal/yr)	10,436,117	6,978,587
Steam (klbs/yr)	60,065	21,707
Total Savings (\$/yr) *	\$752,794	\$595,962
Carbon Reduction (mtons/yr)	7,730	7,179

* Excludes available utility incentives, grants and/or rebates



QUESTIONS

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Thank You!



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APPENDIX I – Conversion Factors

Source: USEPA Clean Energy

1.00	Therm=	0.00530	Metric Tons CO2
1.00	kWh=	0.00068955	Metric Tons CO2
1.00	Home per year	10.9700	Metric Tons CO2
1.00	Vehicle per year	4.7500	Metric Tons CO2

10.97 metric tons CO2 per home per year

4.75 metric tons CO2E /vehicle/year

0.005302 metric tons CO2/therm

6.89551×10^{-4} metric tons CO2 / kWh

Chiller Plant Efficiency

1.00 kW/ton

Steam Plant Efficiency

70%

Notes

1	kWh=	3,413 Btus
1	Mbtu Chilled Water=	1,000 Btus
1	Therm Gas=	100,000 Btus
1	Lb Steam=	970 Btus
1	klb Steam=	970000 Btus

@ atmospheric pressure