



UNIVERSITY of
DENVER

FACILITIES MANAGEMENT & PLANNING

DU's authentic and innovative approach to carbon neutrality

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Learning Outcomes

- Utilization of utility budgets to fund energy savings projects
- Use of energy projects and renewable energy to meet GHG reduction goals
- Use of power purchase agreements to fund renewable energy projects

Overview

- University of Denver Campus Overview
- Energy and GHG Goals
- Utility Reserve Fund Structure and Results
- Green Fund Timeline and Structure
- Renewable Energy Challenges on Campus
- Power Purchase Agreement Process and Structure
- Carbon Neutrality Results
- Next Steps

Campus Overview

- Founded in 1864 as Colorado Seminary in then the Colorado Territory
- Great Private University dedicated to the Public Good
- 3.8 million square feet over 125 acres in the City of Denver
- 11,500 students & 3,800 staff/faculty
- Campus is a working Arboretum
- 5 Portfolio Building Categories:
 - Millennium, Legacy, Beneficial, Transition, Rental
 - Adding 6th Category: Advantage
- 18 of 88 Buildings on Central Plant (Sturm Hall)

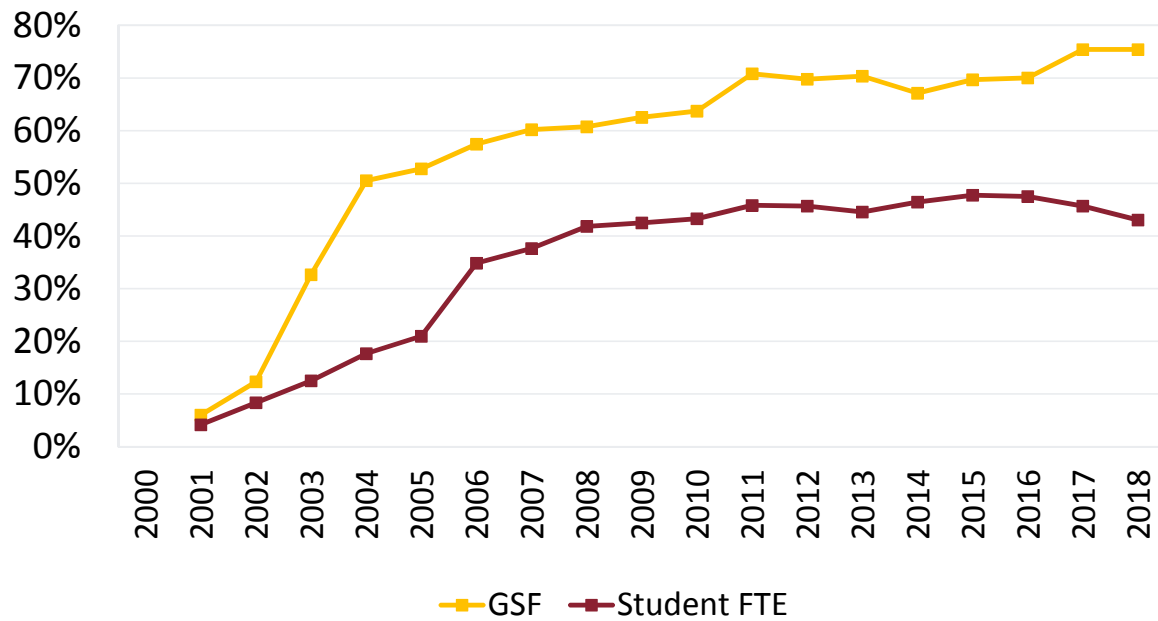


University Hall: 1892



Engineering/Computer Science: 2016

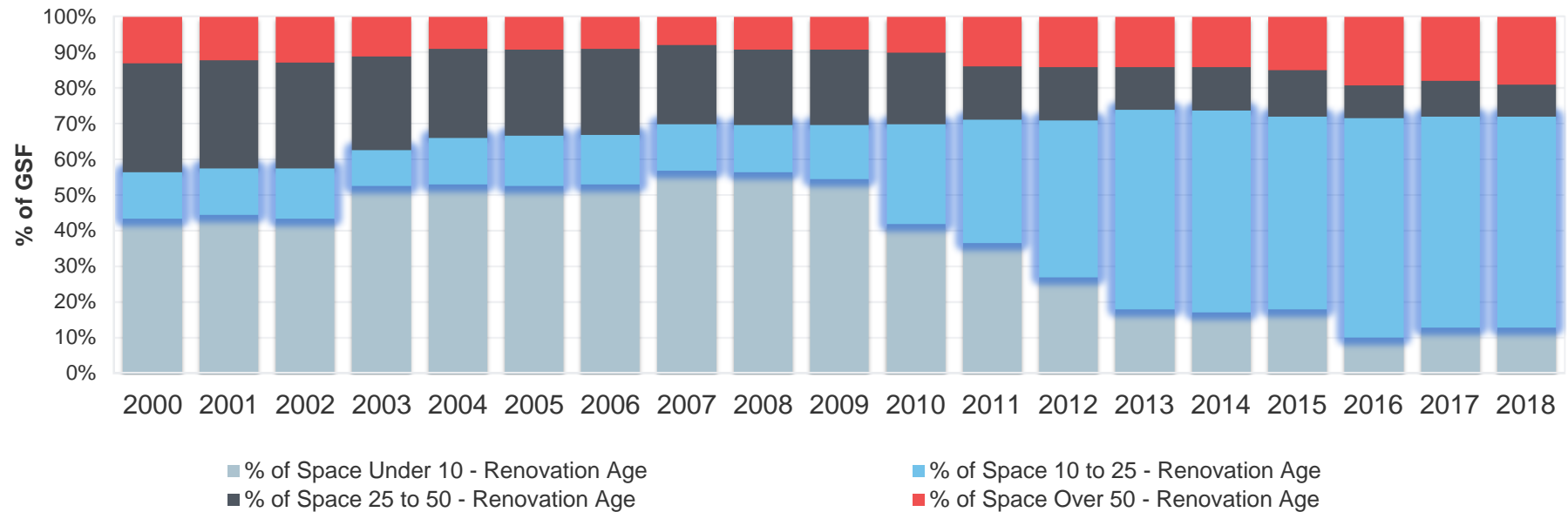
Change in Space and Users



Campus Age Profile Over Time

72% of campus has less than a 25-year renovation age

Square Footage by Renovation Age

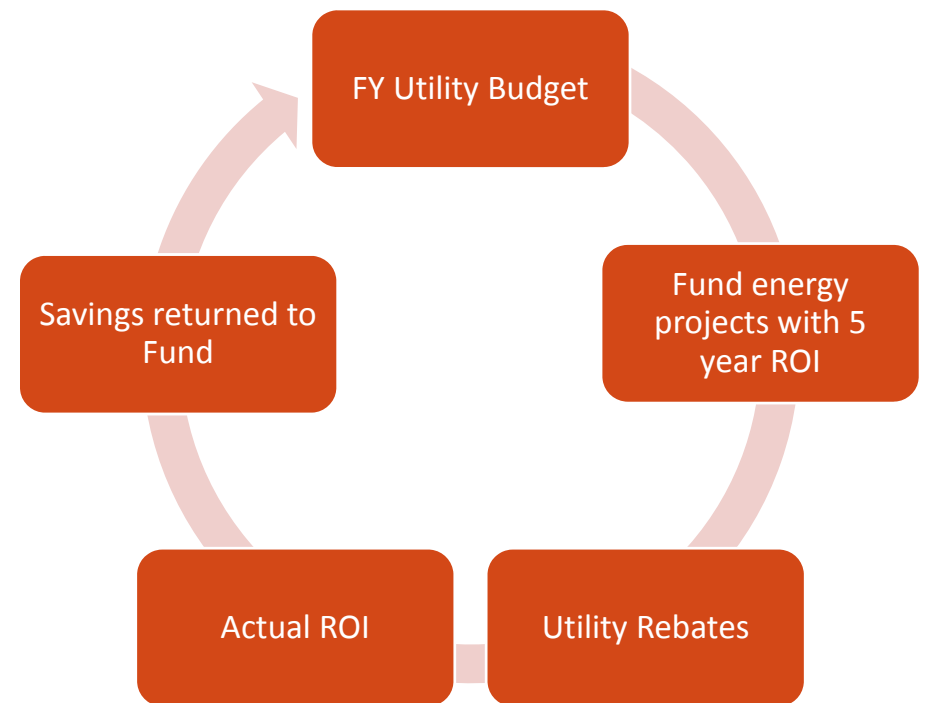


Energy and GHG Goals

- Carbon Neutrality by 2050
 - 24% reduction by 2020
 - 45% reduction by 2045
- Reduction of 500,000 in kWh annually
- 5-year payback for energy projects
- 5% on-site/20% off-site renewable energy production by 2025

Utility Reserve Fund Structure

- Fund established in 2009
- Initially seeded at \$1.9M
- Energy conservation projects
- ROI < 5 years required
- Revolving fund 2009 – 2016



Utility Reserve Fund Results

Energy Saving Projects - Cumulative Q2 FY19

FY18 and Prior – Completed									
Type	#	Construction Cost	Less Rebates	Net Investment	Annual Savings (@Prior Rates)			Average Payback (yrs)	
					Therms	Kwh	Amount		
Controls	15	\$ 406,687	\$ (126,882)	\$ 279,805	30,650	2,020,433	\$ 204,615	1.37	
Lighting	30	\$ 784,474	\$ (275,480)	\$ 508,994		3,118,252	\$ 278,559	1.83	
Mechanical	24	\$ 1,168,857	\$ (365,246)	\$ 803,611	88,318	2,337,517	\$ 252,086	3.19	
Survey	12	\$ 280,556	\$ (158,013)	\$ 122,543					
Totals	81	\$ 2,640,574	\$ (925,622)	\$ 1,714,952	118,968	7,476,202	\$ 735,260	2.33	

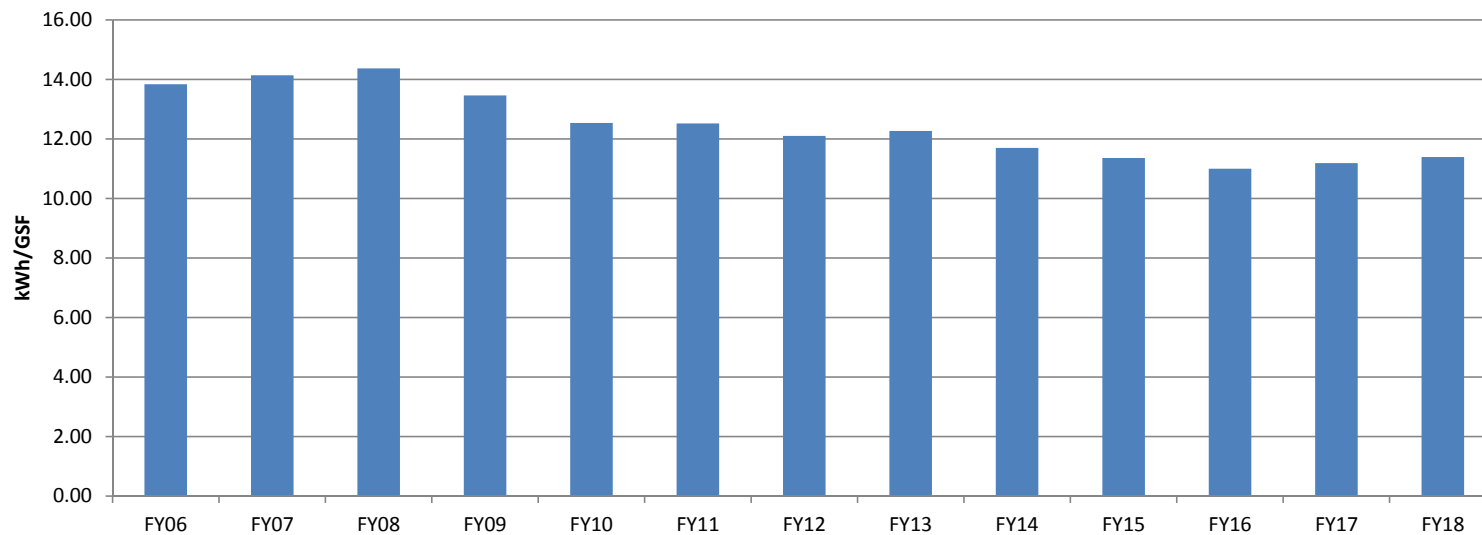
FY19 - Completed or In Progress									
Type	#	Construction Cost	Less Rebates	Net Investment	Annual Savings (FY17 Rates)			Average Payback (yrs)	
					Therms	Kwh	Amount		
Controls	0								
Lighting	2	\$ 491,415	\$ (70,240)	\$ 421,175		2,034,730	\$ 183,125	2.30	
Mechanical	0								
Survey	0								
Totals	2	\$ 491,415	\$ (70,240)	\$ 421,175		2,034,730	\$ 183,125	2.30	

Cumulative	83	\$3,131,989	\$ (995,862)	\$2,136,127	118,968	9,510,932	\$ 918,385	2.33	
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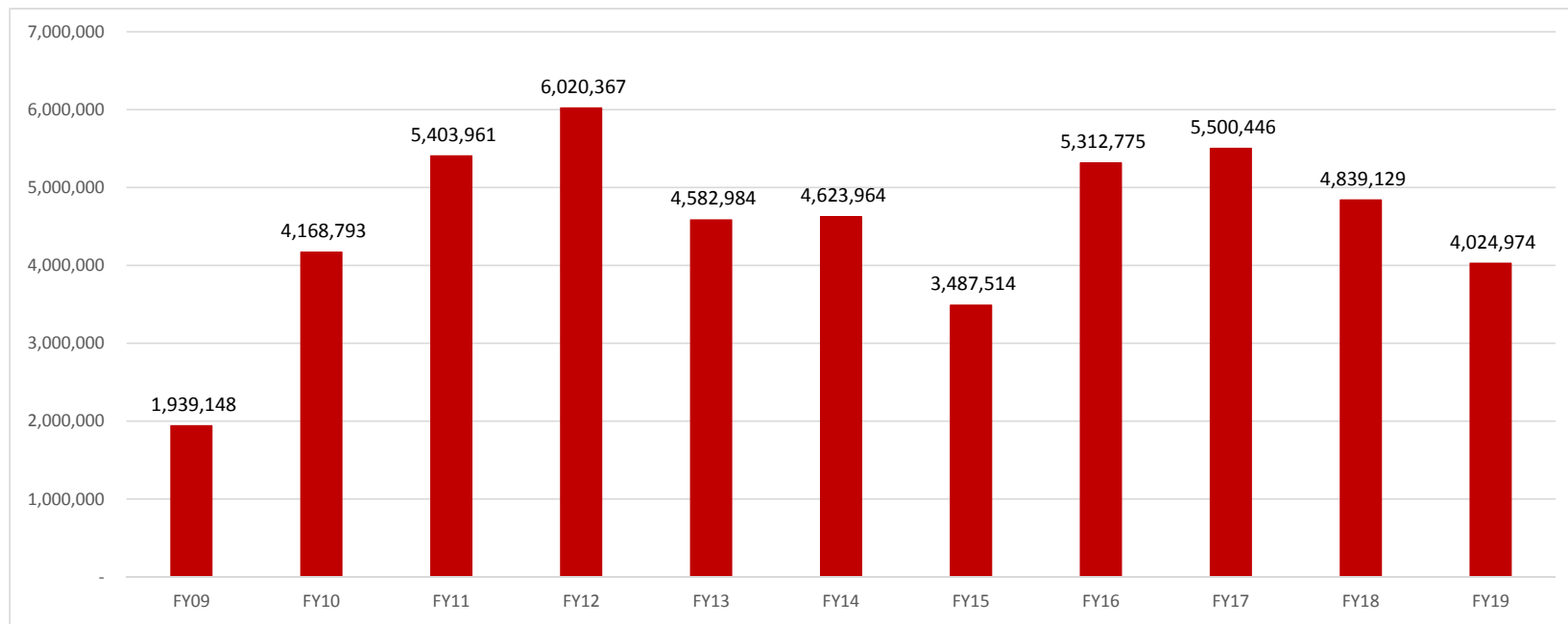
Analysis: Energy saving projects for FY19 will yield a 2.3 year payback, with a cumulative payback of 2.33 years.

Campus Electrical Consumption

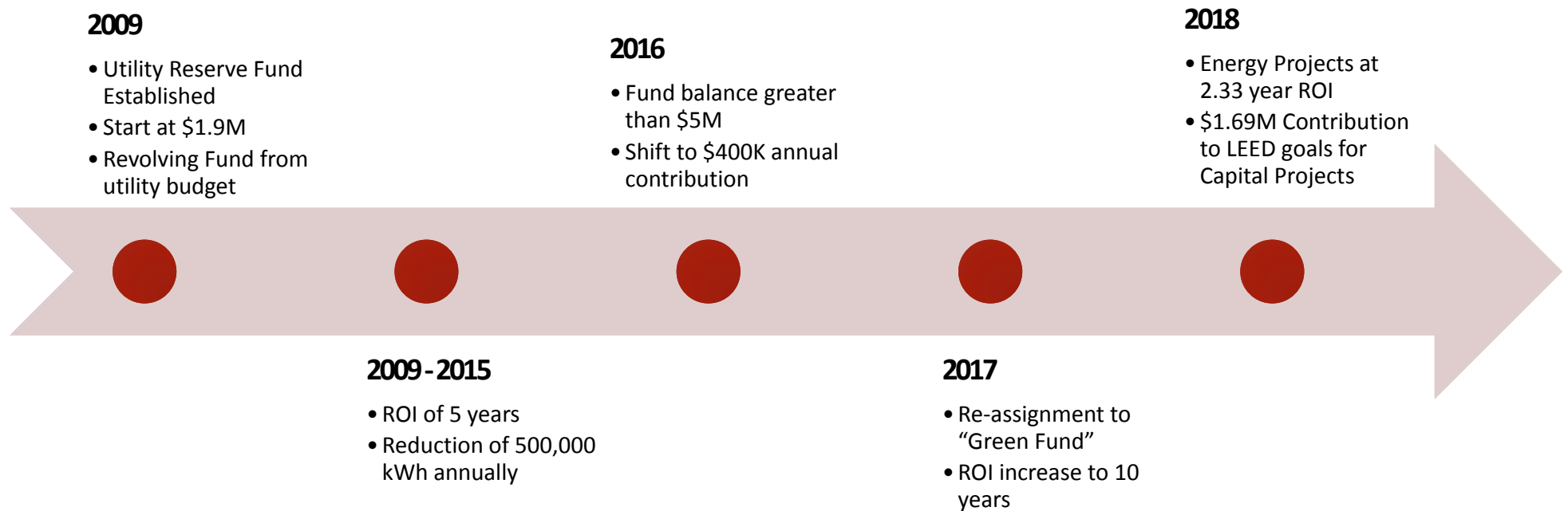
Average electrical consumption reduction 692,000 kWh annually, 2006 – 2018



Utility Reserve Fund Balance

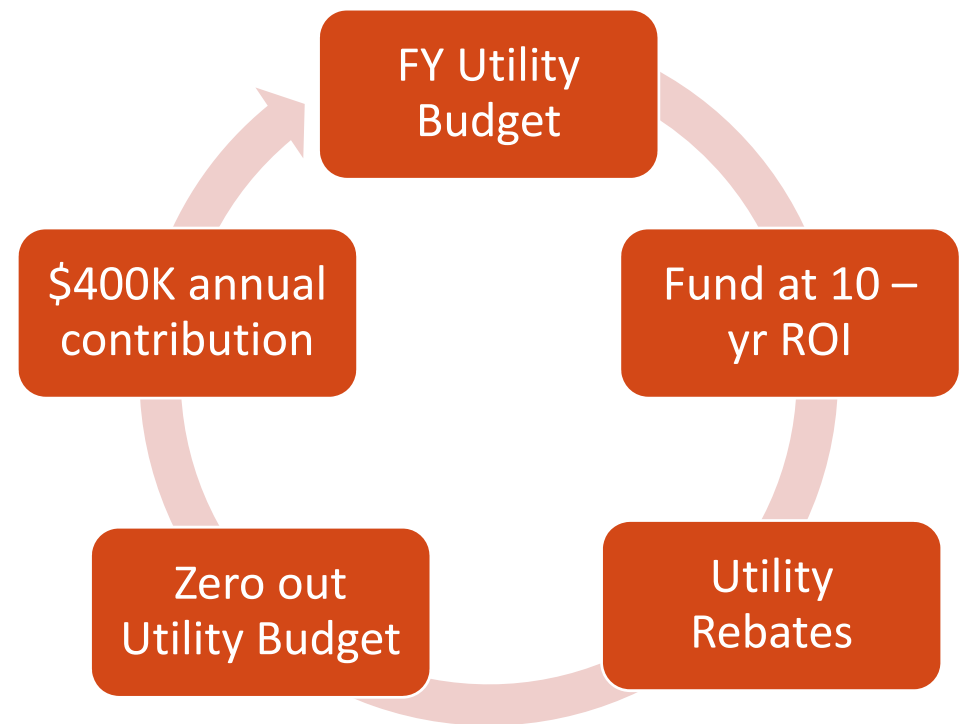


Utility Reserve to Green Fund Timeline



Green Fund Structure

- Utility Reserve Fund reassignment to Green Fund in 2017
- Energy and sustainability initiatives
- Revolving fund changed to fixed annual investment
- ROI increased to 10 years



Renewable Energy Challenges

- DU wasn't participating in any renewable energy programs
- Overcoming memory of early renewable investigation
- Limited campus and site availability
- Campus architecture and aesthetics
- Unfamiliarity with PPA structures
- On-site only a fraction of total need/load
- Timing with tax incentives and tariffs

What changed? **Student** advocacy and demand tipped the scale

Solar PPA Process

Oct 2017

- Colorado State University RFP
- Joined as Voting Member
- On and Off site

Apr - Jun 2018

- BOT Task Force
- Approval to begin negotiations
- On-site only

Dec 2018

- Contract Signed
 - 20-yr PPA
 - 2.2 MW
 - 18 Buildings

Jan - Mar 2018

- Interviews
- Selection
- BOT presentation

Jul - Nov 2018

- Due Diligence
- Due Diligence
- Due Diligence
- Legal Review

Jan - Jun 2018

- Final Design
- Interconnection Agreement
- Permitting

Power Purchase Agreement Structure



Power Purchase Agreement (PPA)

Pivot Energy is the PPA provider and manages the ownership, financing, installation, and maintenance of the rooftop solar energy systems across the DU campus over the 20-year term of the agreement.



Utility

Xcel Energy continues to produce and supply electricity transferred through its electric grid.



Solar PV Systems

The photovoltaic (PV) solar arrays are installed on 18 rooftops across campus with no upfront cost. The systems convert light from the sun into electricity for your facilities and will offset 7-8% of total campus electricity use.



University of Denver

DU pays Pivot Energy for the solar power produced oftentimes at a cheaper rate, resulting in savings. Additionally, DU will own 100% of the Renewable Energy Credits (RECs) produced by the systems, thereby reducing DU's carbon footprint by 3-4%.

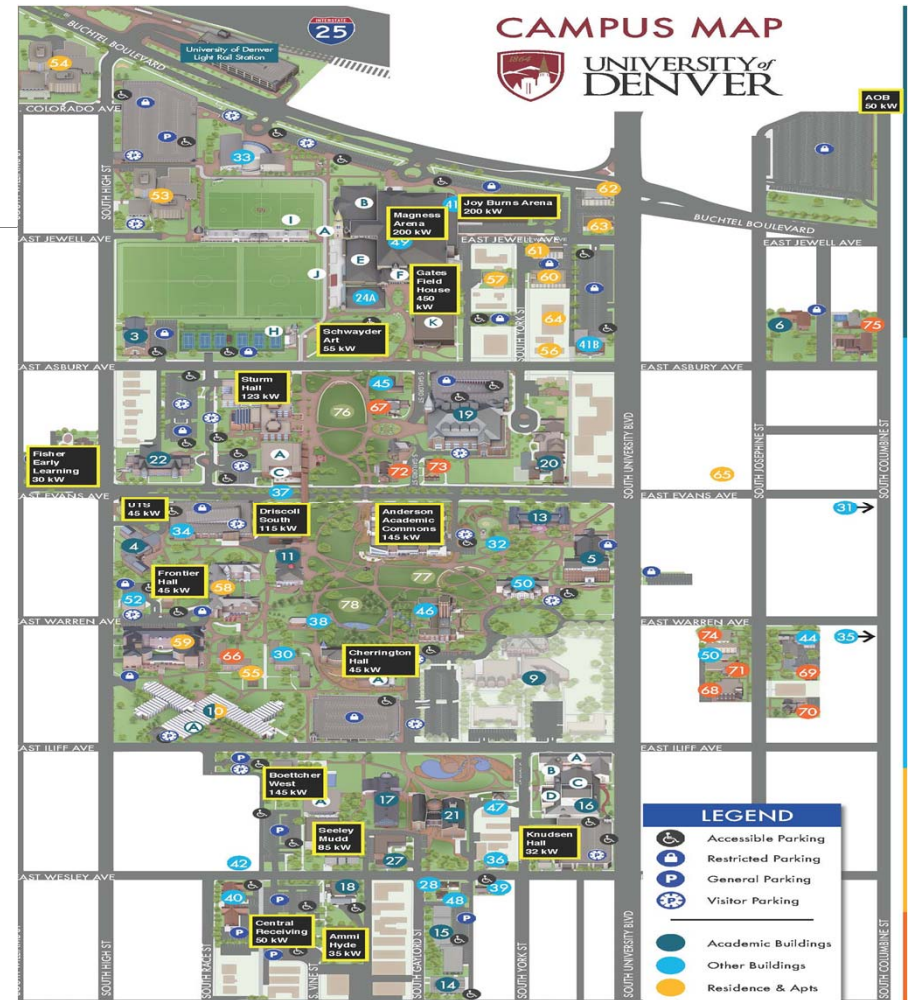


Any excess power (electricity that is not being used) is sent back to Xcel Energy's electric grid, further reducing your utility bill.

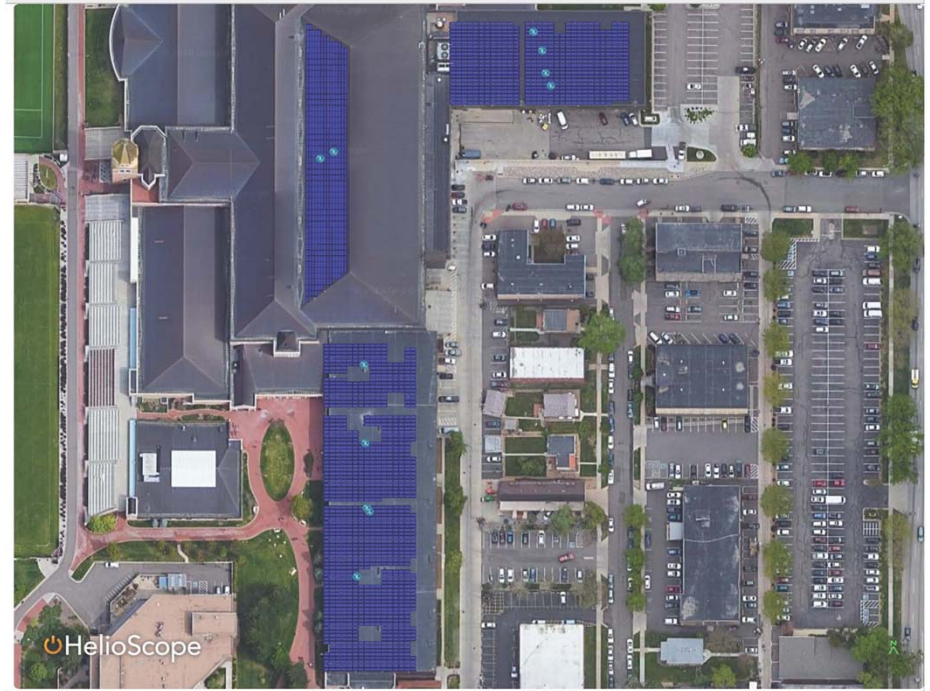
During the evening, when the sun is gone, you will draw energy from Xcel Energy's electric grid, so you are never without power.

Solar Locations

2019/2020 Project Completion	kW Size
Ritchie Center	748.11
Hampden Center	229.02
Anderson Academic Commons	189.09
Sturm Hall	116.16
Schwayder Art	54.87
UTS	26.4
Fisher Early Learning Center	19.8
Frontier Hall	56.76
Seeley Mudd	91.41
Boettcher West	154.77
Knudson Hall	26.4
Ammi Hyde	33
Central Receiving	26.4
Cherrington Hall	41.25
AOB	49.83
Driscoll South	109.56
2019 TOTAL	1972.83
2020 Project Completion	
Career Achievement Center	62.7
First Year Residence Hall	65.5
2020 TOTAL	128.2
All Sites	2101.03



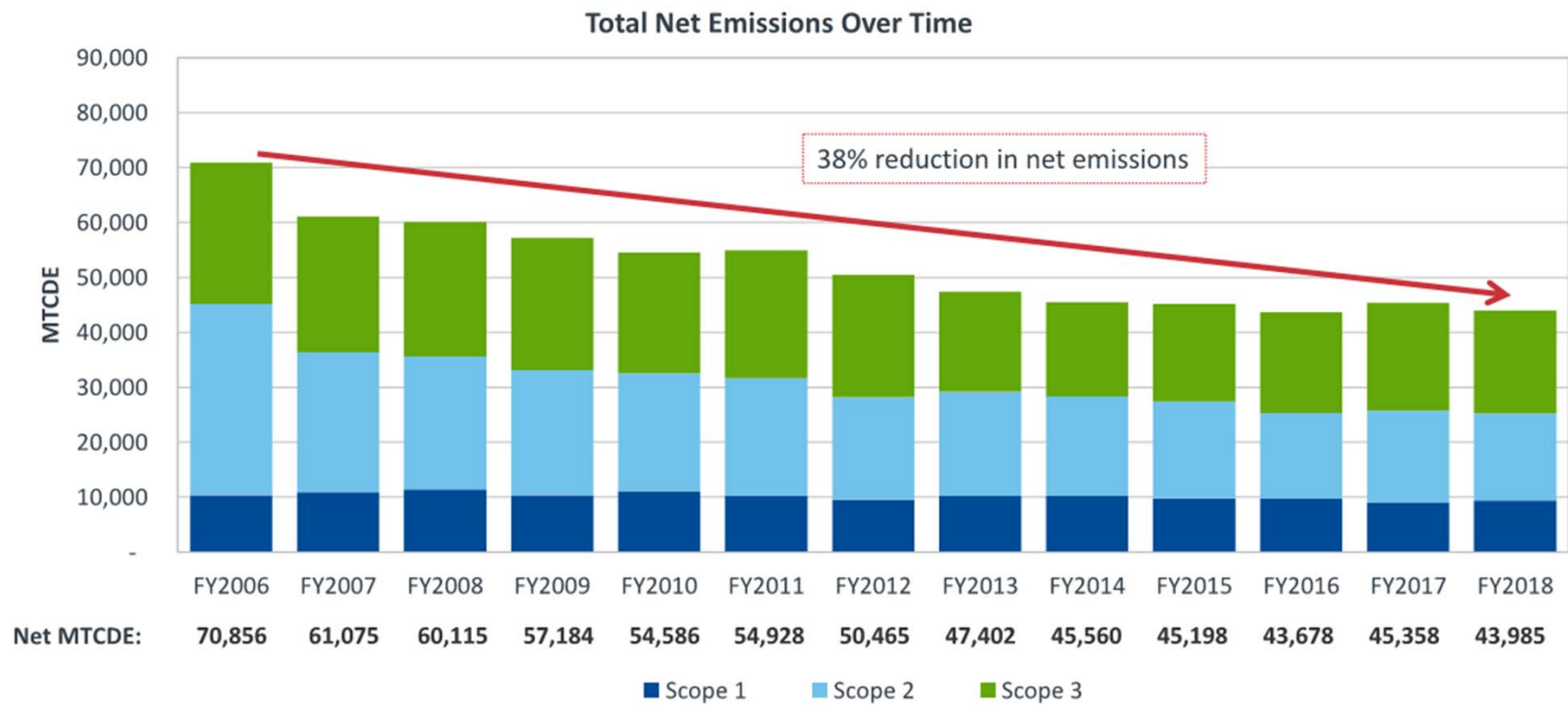
Rooftop Solar



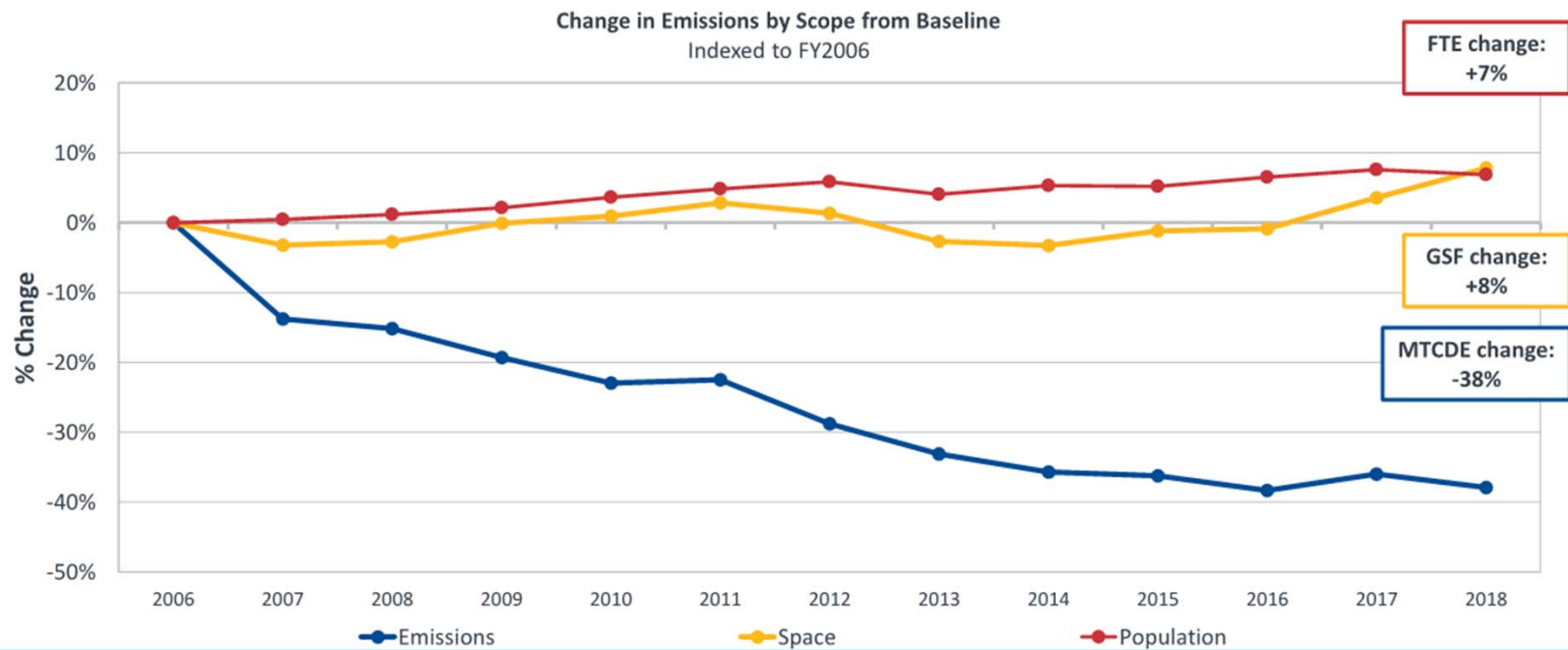
Solar Tree



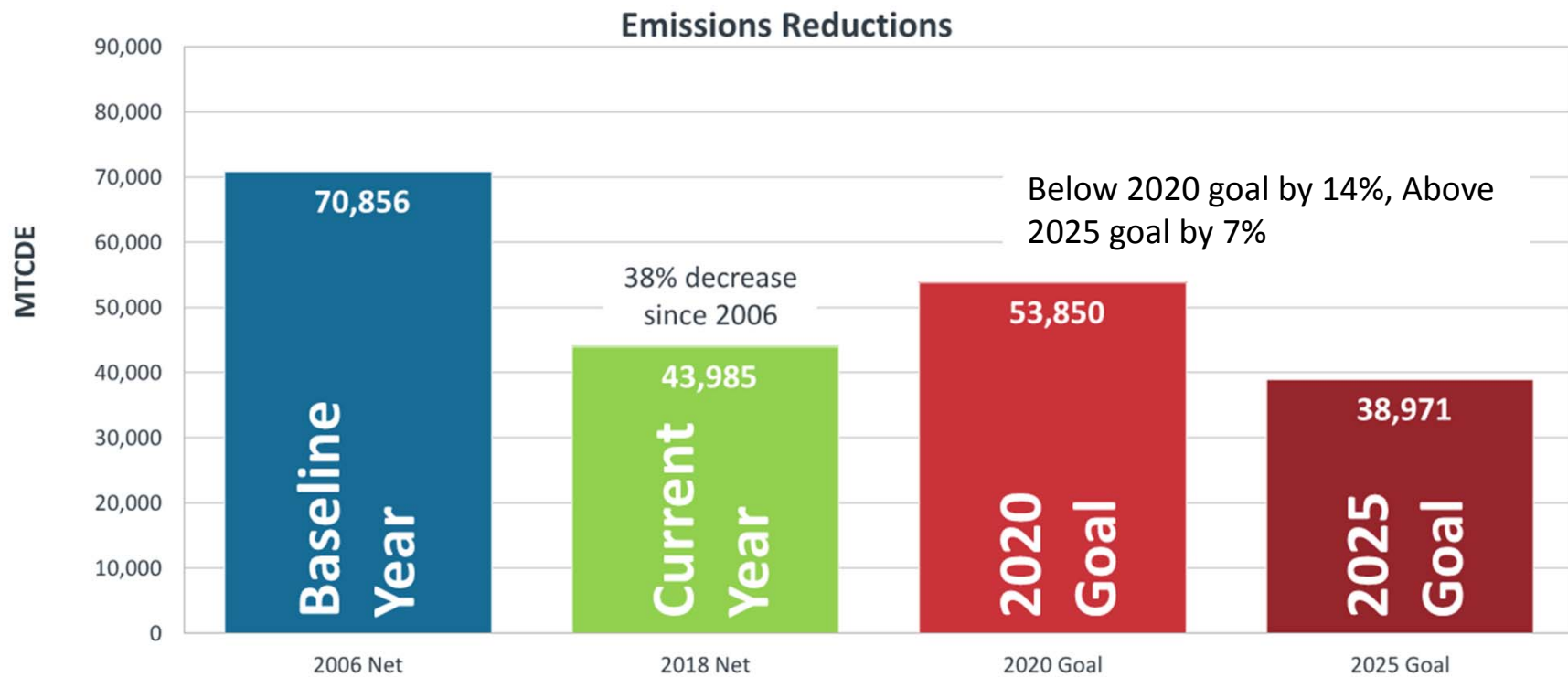
Carbon Neutrality Results



Carbon Neutrality Results



Carbon Neutrality Results



Next Steps

- Complete Solar PPA Project – 3-4% GHG reduction
- File for REC ownership
- Not pursuing off-site PPA – Xcel Energy commitment to carbon neutrality by 2050
- Address Scope 1 and 3 emissions
 - Natural gas consumption
 - Travel
 - Commuting
- Campus Growth: 3 new buildings (285,000 GSF) coming on-line in 2020
- Energy Master Plan for pathway to carbon neutrality

Proposed Campus





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Questions

