



**City of Dallas**

# **Energy Management for City Buildings**

**November 1, 2021**

**Environment and Sustainability  
Committee**

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Building Services Department**

# Presentation Overview



- **Background**
- **Comprehensive Environmental and Climate Action Plan (CECAP) Implementation**
- **Recommended FY2021-22 Solar + Storage Project Selection Criteria**
- **Potential Policy Considerations**
- **Next Steps**



# Background



- April 10, 2019, City Council adopted the Green Energy Policy (CR 19-0484) documenting the City of Dallas' commitment to:
  - Use clean and efficient energy
  - Purchase 100 percent renewable energy
  - Promote renewable energy projects and partnerships that reduce environmental impacts
- Resolution also provided for the establishment of an energy management program

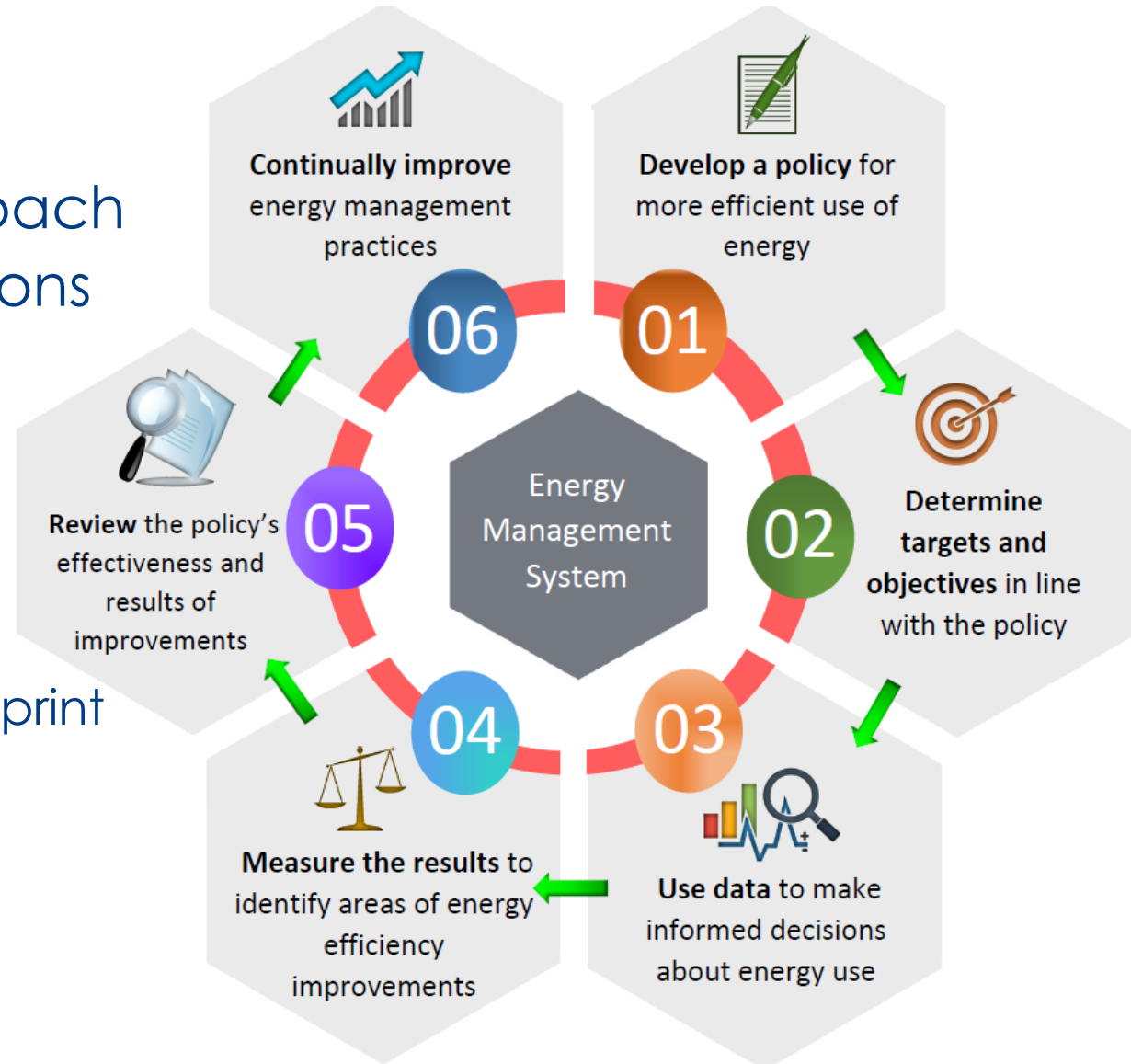


# Background



## Energy Management System

- Systematic, iterative approach to intentional energy decisions
- Largely based on plan-do-check-act model
- Anticipated results:
  - Reduced environmental footprint
  - Reduced energy costs





# Background



- Council adopted the “Comprehensive Environmental and Climate Action Plan (CECAP)” to reduce City of Dallas greenhouse gas emissions by 43% below 2015 levels by 2030 and 100% by 2050 to achieve carbon neutrality
- City entered 10-year, 100% wind-based electricity contract with TXU in 2019 (annually represents over **35,000 metric tons of CO<sub>2</sub> equivalent emissions avoided**)
- Dallas ranks #2 in annual green power use in EPA’s 2020 Green Power Partnership Top 30 Local Governments list and #28 on the Top 100 National Organizations (including local, state, and federal agencies as well as private sector entities)



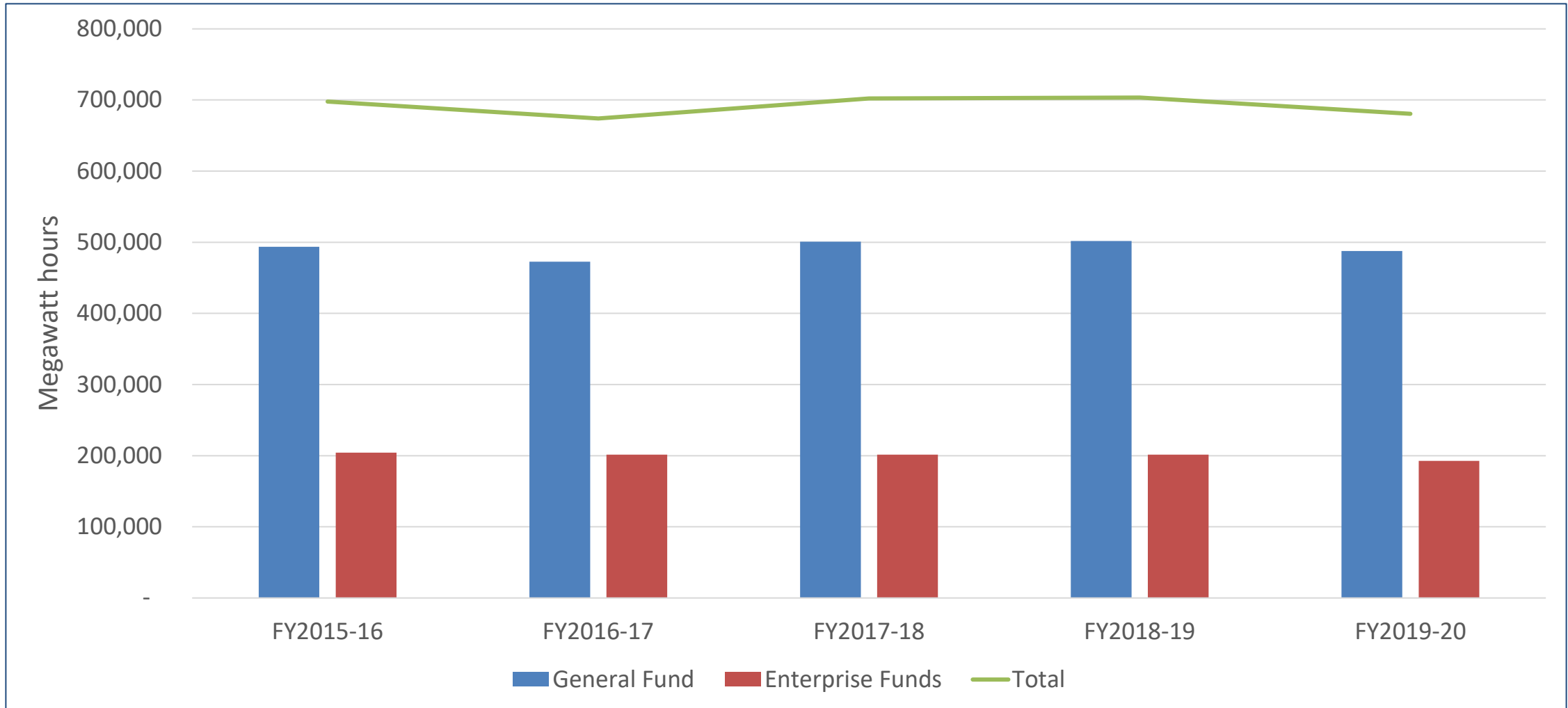
# Background



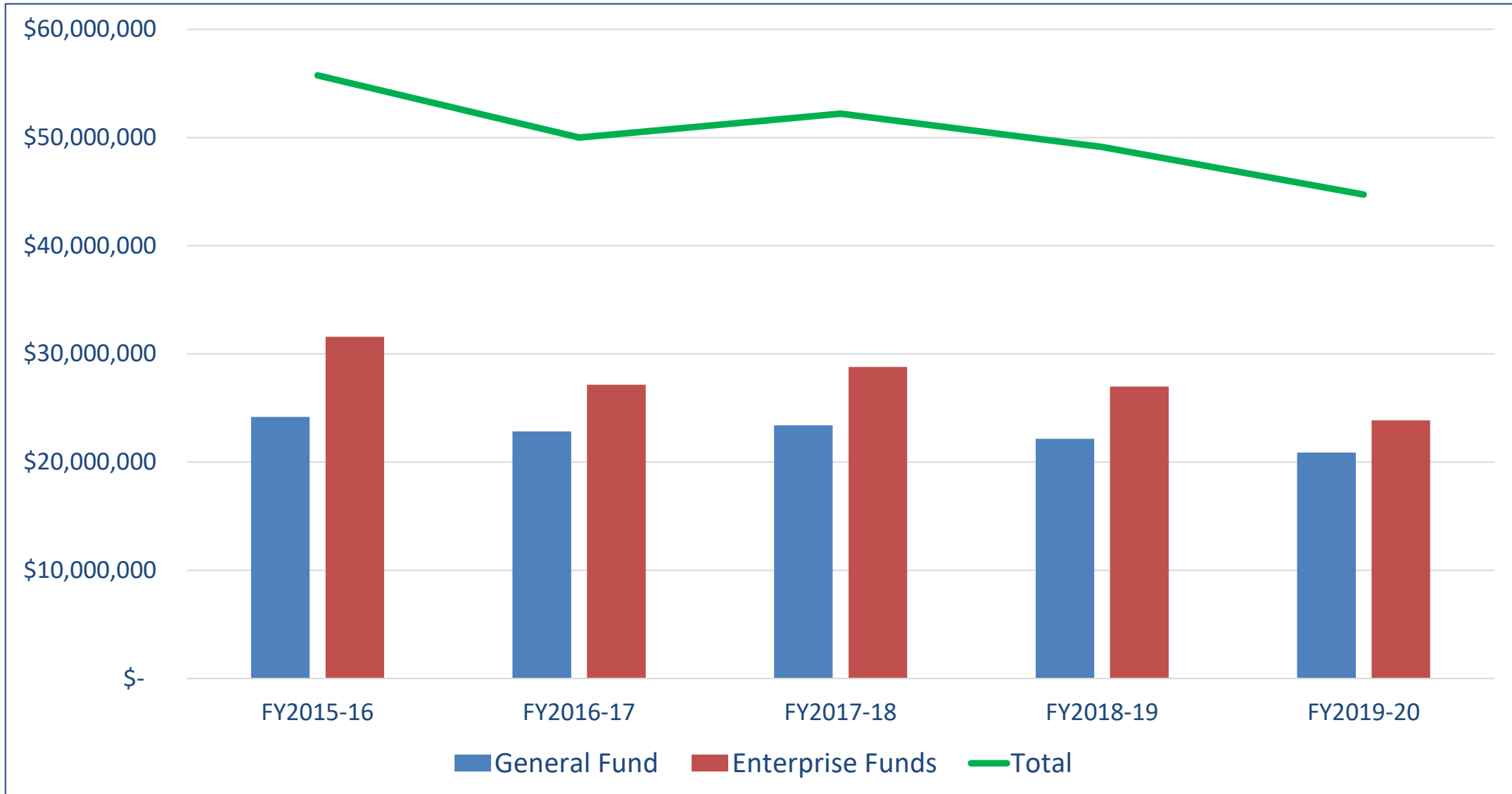
- 387 of the City's 2,893 electricity accounts are for buildings
  - 307 for general fund buildings
  - 80 for enterprise buildings
- FY2019-20 total City electricity consumption was 680,497 MWh at a cost of \$44.7m



# Background: 5 Year Electricity Consumption

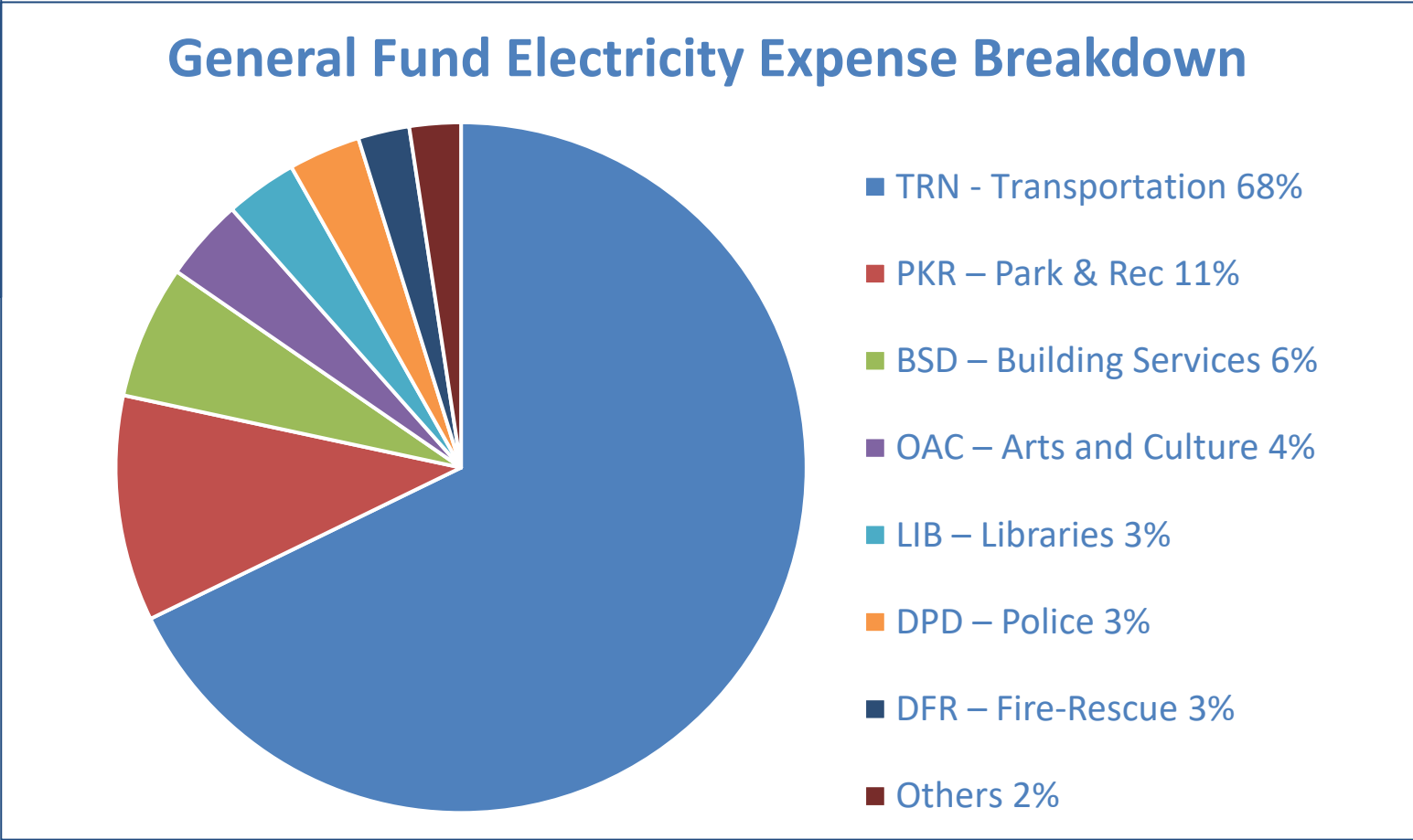
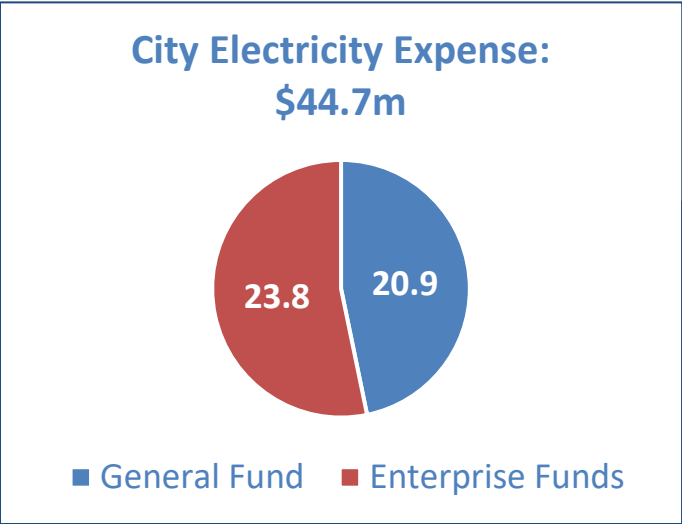


# Background: 5 Year Electricity Expense





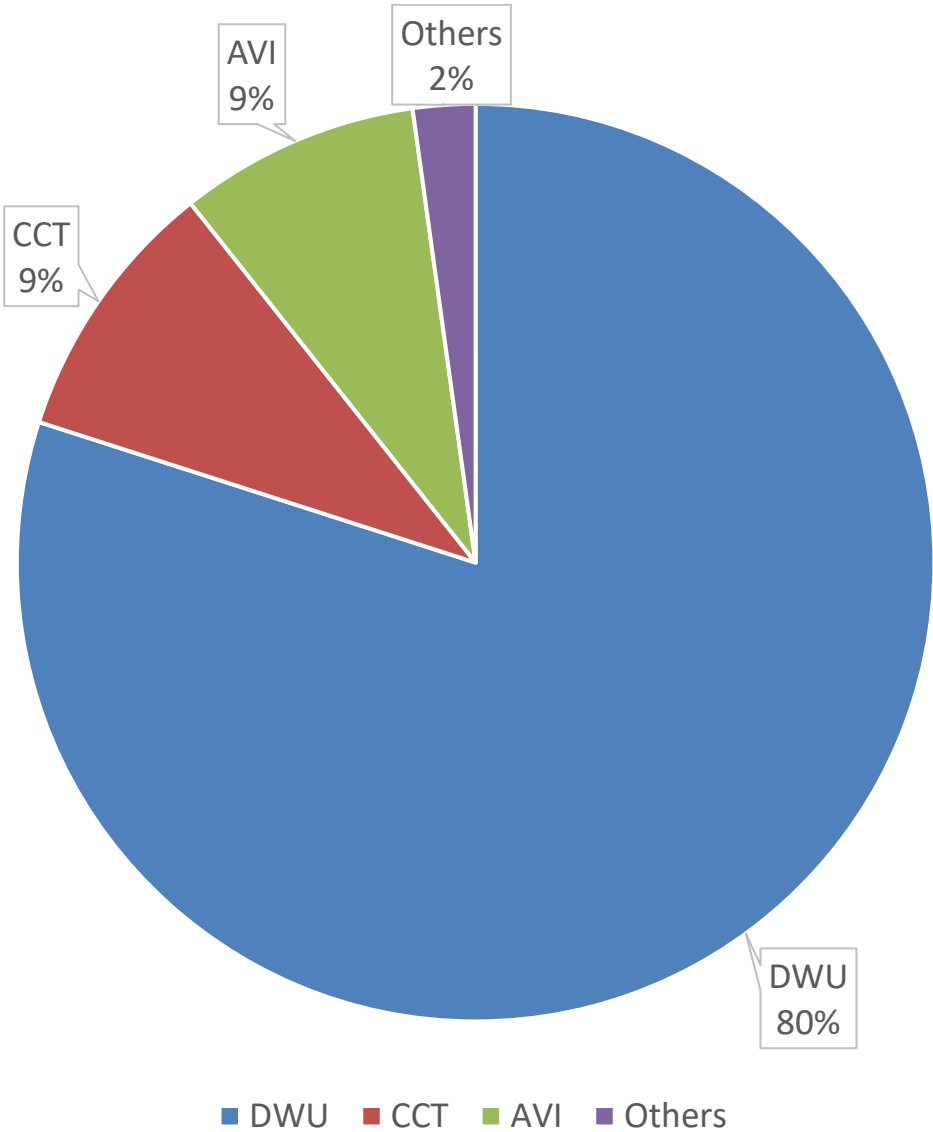
# Background: FY2019-20 Electricity Expense



# Background: FY2019-20 Enterprise Electricity Expense



Department	Electricity Expense
DWU – Dallas Water Utilities	\$19,073,300
CCT – Convention Center	\$2,234,690
AVI - Aviation	\$2,021,794
Others	\$524,248



# Background



- Building Services Department (BSD) leads implementation of the energy management program with support from several stakeholder departments
- Early focus has been on understanding current status and then developing strategies and activities to reduce energy consumption and associated greenhouse gas emissions
- This briefing focuses on the 307 building energy accounts funded in the general fund
  - FY2019-20 electricity consumed: 100,435 MWh (14% of total City consumption)
  - \$5.7m



# CECAP Implementation



CECAP is arranged in eight sectors:



Buildings



Energy



Transportation



Solid Waste



Water  
Resources



Ecosystems /  
Greenspace



Food / Urban  
Agriculture



Air  
Quality

Energy Management primarily supports the Buildings and Energy Sectors, but also Transportation and Air Quality to a lesser degree



# CECAP Implementation



Multiple Buildings Sector action items in the FY2020–21 CECAP Plan for City facilities were initiated including:

- Energy benchmarking for City facilities
- Citywide energy management system implementation
- Energy audits to identify retrofit opportunities
- No cost to low-cost retrofits and efficiency improvements identified in energy audits
- Renewable energy feasibility studies to identify appropriate locations for installing solar photovoltaic panels on City facilities





# CECAP Implementation



## Major Buildings Sector actions items for FY2021– 22:

- Add 50 more City facilities to energy benchmarking initiative (for a total of 175) using Energy Star® Portfolio Manager®
- Prioritize at least 10 additional City facilities for energy assessments and 10 for solar feasibility studies based on benchmarking data
- Evaluate funding opportunities and partnerships for energy conservation
- Develop annual energy report for benchmarked City facilities
- Evaluate at least 5 City facilities for resilience/renewable energy hubs (rubric prepared by North Texas Renewable Energy Group, Office of Equity and Inclusion, and Office of Environmental Quality and Sustainability)
- Develop and distribute additional energy awareness messaging



# CECAP Implementation: Energy Benchmarking



- Energy benchmarking of City facilities helps identify high- and under-performers and prioritize candidates for energy conservation measures
- 125 City facilities benchmarked for energy usage in FY2021
- FY2022 target adds another 50 and FY2023 an additional 25 for total of 200



# CECAP Implementation: Energy Benchmarking



- Portfolio Manager®:
  - requires annual facility energy usage (electricity, gas), facility area, facility type, operating hours, number of employees & computers to generate a facility site energy use intensity (EUI)
  - compares a facility's EUI performance to the median EUI performance of similar facilities from a national database
- Results:
  - 12 of 27 libraries and 11 of 43 recreation centers perform well (use less energy than their benchmarks)
  - 15 of 27 libraries and 32 of 43 recreation centers present opportunities (use more energy than their benchmarks)

See Appendix (slides 45 – 52) for additional details



# CECAP Implementation: Energy Management Software



Our utility partner, TXU, has developed an energy management software “Load Analyzer Tool” with data for City accounts including the following features:

- Web-based platform that providing centralized energy & utility data reporting solutions
- Simple comparisons of facilities or groups of facilities by usage, cost, usage per square foot, etc.
- Quick comparisons of current vs. previous year / other time periods to see impacts of projects or initiatives
- 15-minute interval meter data for all TXU electricity accounts

Additional expanded services pending include Energy Star Portfolio Manager® integration to automate annual benchmarking and a Measurement & Verification feature to track performance of energy projects in terms of energy use and cost savings (anticipated March 2022)





# Brief

# Load Analyzer Tool

# Demonstration





***So now we have some data,  
what do we do with it?***

# CECAP Implementation: Energy Auditing



Recently completed preliminary energy assessments (ASHRAE Level 1) onsite energy audits for 14 City facilities in partnership with the State Energy Conservation Office (SECO) and Jacobs Engineering

MLK Complex A - Administration	Dallas West Branch Library
MLK Complex B - Health Center	Hampton-Illinois Branch Library
MLK Complex C - Branch Library	Lakewood Branch Library
MLK Complex D - Child Care	Mountain Creek Branch Library
MLK Complex E - Recreation Center	Park Forest Branch Library
Oak Cliff Municipal Center	Paul Laurence Dunbar Lancaster-Kiest Branch Library
Arcadia Park Branch Library	Skyline Branch Library

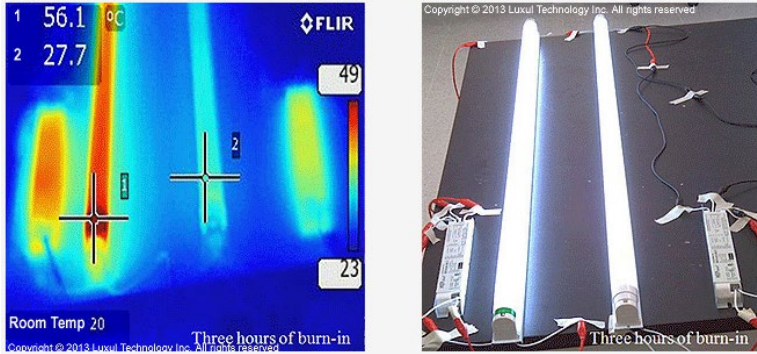
**14 facilities prioritized based on preliminary energy benchmarking results, total energy usage, and equity considerations**



# CECAP Implementation: Energy Auditing



Draft energy audit report received in September identifying and recommending various energy conservation measures such as:



<http://www.luxultek.com/>

Interior lighting upgrades from fluorescent to LED. LED lamps operate much cooler compared to fluorescent and have longer life



<https://www.energyhouseusa.com/>

Exterior lighting upgrades from HID to LED



<https://wisilica.com/>

Interior lighting controls



<https://www.solarquotes.com.au/>

Solar Photovoltaics



# CECAP Implementation: Energy Auditing



- More feasible project using SECO criteria, treats (as report recommends) the 14 facilities as a single project with a 19-year payback period
- Total annual energy savings is projected to be 3,036 MWh or approximately 3% of total general fund buildings' energy usage in FY2019-20

Energy Conservation Measure	Implementation Cost	Electricity Savings (MWh)	Natural Gas Savings* (Mcf)	Energy Cost Savings	Simple Payback** (years)
Lighting Retrofits	\$676,725	1,283	-162	\$84,634	8.00
Solar PV systems	\$2,196,563	1,753	0	\$70,340	31.23
<b>Total</b>	<b>\$2,873,288</b>	<b>3,036</b>	<b>-162</b>	<b>\$154,975</b>	<b>18.54</b>

\*Compared to fluorescent lamps, LED lamps generate less heat resulting in a modest increase in winter natural gas consumption

\*\*Shorter, more attractive payback periods are more challenging to attain with our favorable electricity contract rates as compared to average Texas commercial energy rates





# CECAP Implementation: Energy Auditing



Additional 12 City facilities selected for energy assessments through SECO partnership bringing the total to 26 facilities - site surveys complete, draft audit reports anticipated in December

Tommie M. Allen Recreation Center	Reverchon Recreation Center
Beckley-Saner Recreation Center	Samuell Grand Recreation Center
Martin Weiss Recreation Center	Juanita Craft Recreation Center
Marcus Recreation Center	Pleasant Oaks Recreation Center
Fretz Park Recreation Center	Harry Stone Recreation Center
K.B. Polk Recreation Center	Park in the Woods Recreation Center

BSD anticipates applying for SECO preliminary energy assessments program for 10 to 12 City facilities annually





# CECAP Implementation: Solar Feasibility Assessments



Recently completed assessments of eight (8) City facilities in partnership with SECO and Jacobs Engineering

Fretz Recreation Center	Dallas Animal Services
West Dallas Multipurpose Center	Bachman Recreation Center
MLK Complex	ECO Park
Oak Cliff Municipal Center	Fire Training Administration

**Eight (8) facilities prioritized based on preliminary energy benchmarking results, total energy usage, and equity considerations**



# CECAP Implementation: Solar Feasibility Assessments



Total annual energy savings from implementing the solar projects identified in the report projected to be 5,422 MWh or approximately 5% of total general fund buildings' electricity use in FY2019-20

Energy Conservation Measure	Implementation Cost	Electricity Savings (MWh)	Energy Cost Savings	Simple Payback (years)
Solar PV systems	\$8,075,938	5,422	\$217,434	37.14

Shorter, more attractive payback periods are more challenging to attain with our favorable electricity contract rates - in addition, the City is not eligible for popular federal tax incentives



# CECAP Implementation: Solar Feasibility Assessments



From a purely financial or accounting standpoint, the identified solar projects and their payback periods might not be considered viable – other important considerations are warranted



# CECAP Implementation: Funding



Multiple options for consideration to fund energy projects:

- Annual operating budget (examples: \$1.5m included in the adopted FY2021-22 budget, routine lighting, HVAC, and roofing upgrades, etc.)
- City-issued debt (equipment notes, certificates of obligation, master lease, general obligation bonds, etc.)
- Revolving fund (City dedicates funding to implement seed projects, annual energy savings achieved by seed projects are used to “pay back” initial seed project costs and those funds are then available to implement additional energy projects)



# CECAP Implementation: Funding



- SECO Loan STAR program (City takes loan from SECO for implementing energy projects and pays back the loan from savings generated by the project - limited to projects with payback periods **less than 15 years**)
- Energy Savings Performance Contracts (City takes loan from private financial entity for implementing energy projects and pays back the loan from savings generated by the project - no limitation on payback period but higher cost of capital)
- Power Purchasing Agreement (City agrees to buy, from solar developer, power generated from a renewable energy project at an agreed upon rate for a fixed duration)
- Grants, rebates, and other incentives (example: potential federal infrastructure funding, Oncor efficiency incentive program, SECO Technical Assistance Programs, etc.)



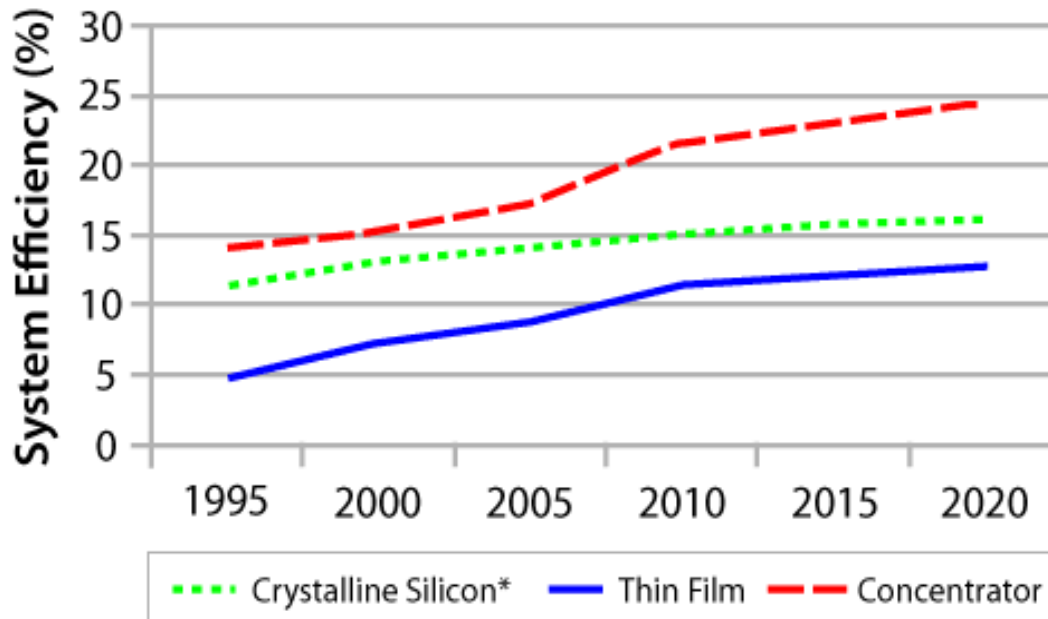


# Solar Photovoltaics Over Time

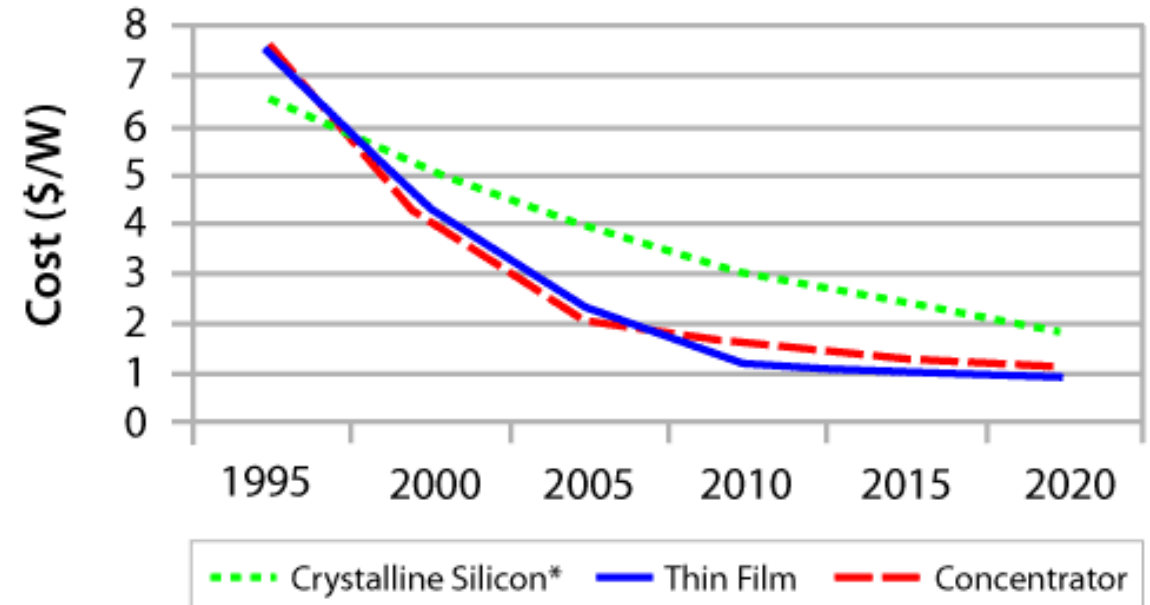


Increasing efficiency . . .

PV System Efficiency



PV System Capital Cost



<https://sites.lafayette.edu/egrs352-sp14-pv/technology/history-of-pv-technology/>

. . . decreasing costs



# Battery Storage Example



Battery storage costs and output/capacity vary:

Example Facility Solar PV installation: 100 kW

- Tesla 13.5 kWh Powerwall\*  
Approx. cost: \$13.4k (\$992/kWh)  
Provides enough storage to power for 8 minutes
- Tesla 232 kWh Powerpack\*  
Approx. cost: \$160k (\$690/kWh)  
Provides enough storage to power for 2 hours, 20 minutes
- Tesla 3000 kWh Megapack\*  
Approx. cost \$1.3m (\$412/kWh)  
Provides enough storage to power for 30 hours



Tesla Powerpacks  
Source: Businessinsider.com

\* **Lithium-Ion battery technology**



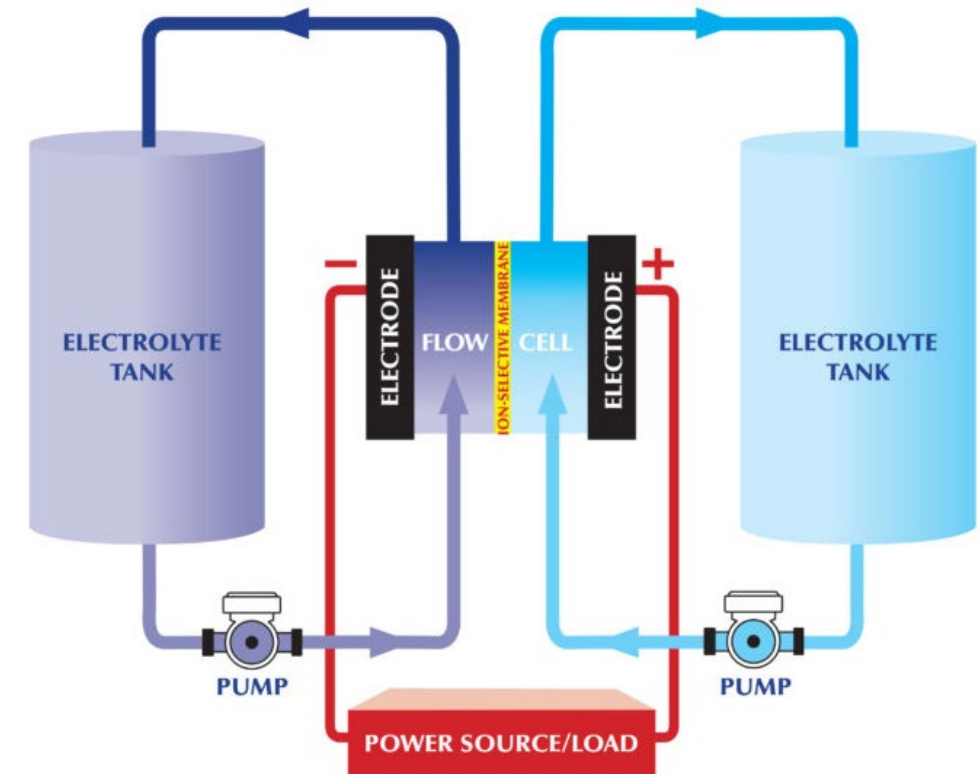
# Battery Storage



## Flow Batteries

Built with three primary (and readily available) components: iron, salt, and water system (electrolyte, electrode, membrane, and pumps) and compared to lithium-ion:

- Provides longer storage
- Have fewer safety concerns (potentially resulting in easier permitting)
- Offer longer operating life (up to 25 years)
- Have lower energy density and as a result require larger footprint



<https://flowbatteryforum.com/what-is-a-flow-battery/>





True resilience will generally consist of multiple energy sources (grid, solar, storage, fuel-fired generator, etc.) working in concert.



# Recommended Project Selection Criteria



Criteria needed to select projects that support CECAP goals and are also efficient and cost-effective – Committee endorsement is sought today on the following recommended criteria:

1. Building roof condition, orientation, and available unobstructed area
2. Foliage / neighboring structure shading
3. Building energy offset of **30% or more\***
4. Payback period of **25 years or less\***
5. Available space for battery storage (for solar + storage projects)

**\* Where feasible, expand project scope to include energy efficiency improvements to increase energy offset and/or shorten corresponding payback period**





# Example Potential Project One



For illustrative purposes, consider the **Lakewood Branch Library**:

Baseline annual energy consumption  
212,800 kWh (\$14,244)

Retrofit with an 80kW rooftop solar array (\$165,000)

- **61%** of baseline energy consumption offset by solar: 129,564 kWh (\$5,104)
- Simple Pay Back Period: **32.3 years**

- Lighting upgrades (26,901 kWh, \$1,592) + solar (above) = **74%** of baseline energy consumption offset
- Simple Pay Back Period: **26.3 years**

*After expanding scope to include lighting upgrades, this project **does not meet** the recommended FY2021-22 project selection criterion of 25 year or less payback period*



# Example Potential Project Two



For illustrative purposes, consider the **Mountain Creek Branch Library**:

Baseline annual energy consumption  
247,240 kWh (\$13,251)

Retrofit with a 55kW rooftop solar array (\$113,500)

- **38%** of baseline energy consumption offset by solar: 93,286 kWh (\$3,635)
- Simple Pay Back Period: **31.2 years**

- Lighting upgrades (65,492 kWh, \$4,086) + solar (above) = **64%** of baseline energy consumption offset
- Simple Pay Back Period: **18.6 years**

*After expanding scope to include lighting upgrades, this project **would meet** the recommended FY2021-22 project selection criteria*



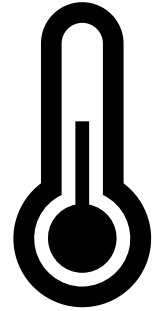
# Potential Policy Considerations



## 1. Consider adopting temperature setpoint standards

Adjusting space temperature setpoints and HVAC equipment schedules at City facilities can produce up to 15% energy savings from baseline conditions

- Adjust cooling and heating setpoints (**consistent with energy code**) to:
  - Occupied / Unoccupied Cooling Setpoint: 75°F / 85°F
  - Occupied / Unoccupied Heating Setpoint: 70°F / 55°F
- Align equipment and building operating schedules where applicable (turn the HVAC equipment on & off closer to normal building operating hours)
- Make and document exceptions (such as 3-degree reduction from standard cooling setpoint in fire stations and large assembly areas)



# Potential Policy Considerations



2. Consider requiring that appliances procured be Energy Star® rated (in development as part of the City's Sustainable Procurement program)
3. Consider requiring minimum Seasonal Energy Efficiency Ratio (SEER) of 16 for applicable replacement HVAC equipment at City facilities

Current National SEER Minimums



# Potential Policy Considerations



4. Consider adopting the 2018 (or 2021) International Energy Conservation Code
5. Consider requiring low-pitch roof replacements for City facilities over conditioned space be Energy Star® rated
6. Consider an energy proposition in the City's next capital bond program
7. Consider requiring U.S.-manufactured solar panels





# In Conclusion



*Energy Management System continues to evolve with progress underway in each of the six major system components in support of multiple CECAP Sectors*



# Next Steps



- Continue work on FY2021-22 CECAP Action Items
- Publish inaugural Annual Energy Report – December 2021
- Prepare and submit projects for potential 2022 Oncor incentives (application window anticipated to open mid-December)
- Implement energy projects beginning 1st quarter of 2022
- Launch energy management software integration with Energy Star® Portfolio Manager® – March 2022





# Questions / Discussion





**City of Dallas**

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# Appendix





# Messaging Example




**NATIONAL ENERGY EFFICIENCY DAY**  
OCTOBER 6, 2021


**SIMPLE TIPS FOR HOME AND OFFICE**



When possible, turn off lights when you leave a room/office for more than a few minutes

Adjust thermostat to save up to 3% on annual energy for each degree raised/lowered in cooling/heating seasons

**CONSERVE TO PRESERVE - WE CAN ALL PLAY A PART**

 **Building Services Department**  
City of Dallas

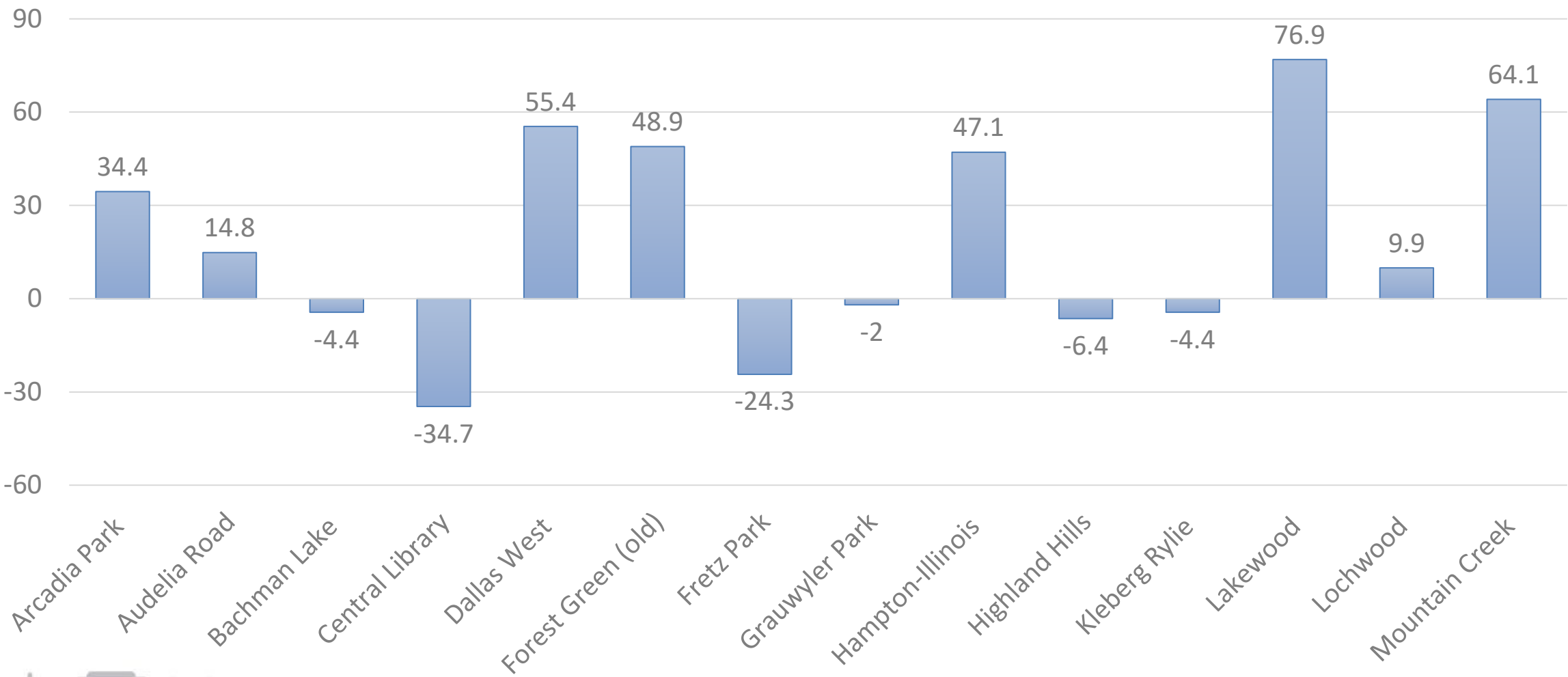


# Energy Benchmarking: Libraries



Forest Green (old) is no longer a City facility as of October 7, 2021

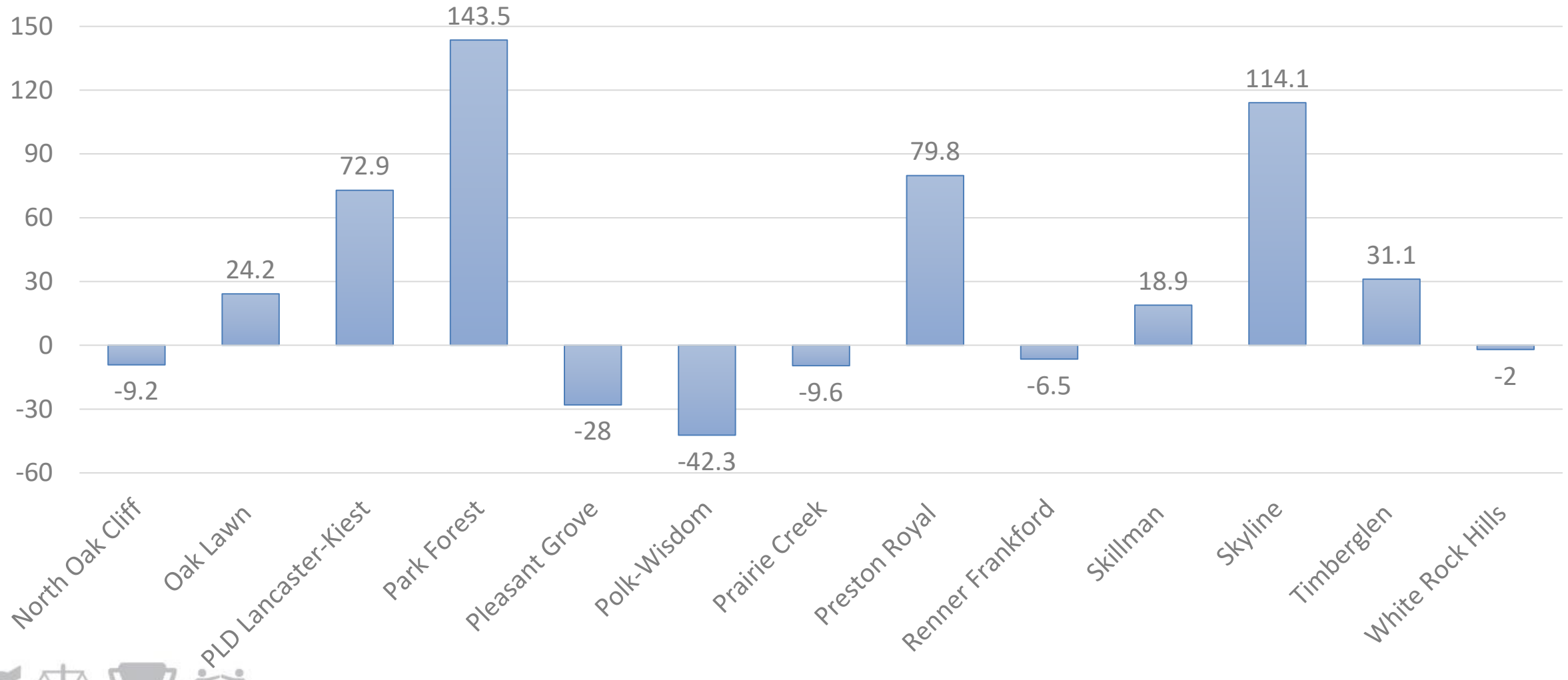
% Deviation from National Median Site EUI



# Energy Benchmarking: Libraries



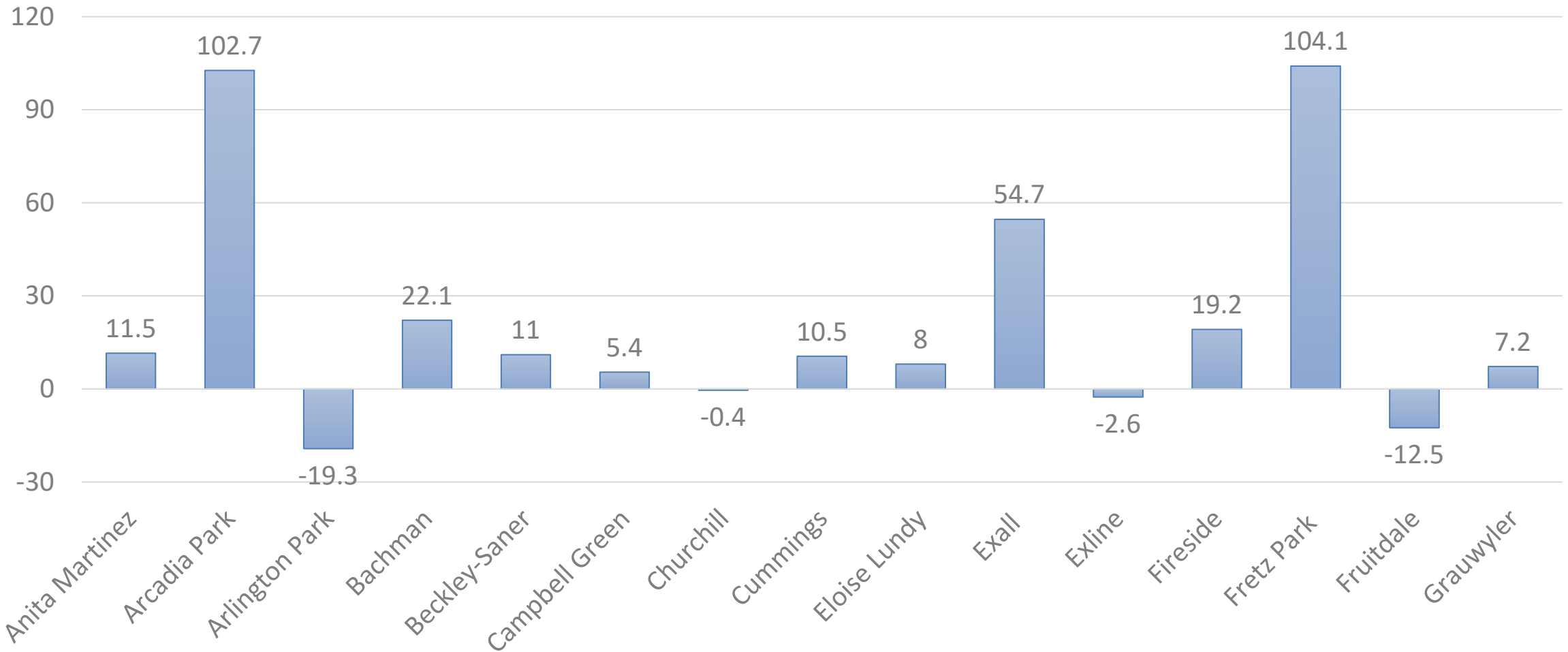
% Deviation from National Median Site EUI



# Energy Benchmarking: Recreation Centers



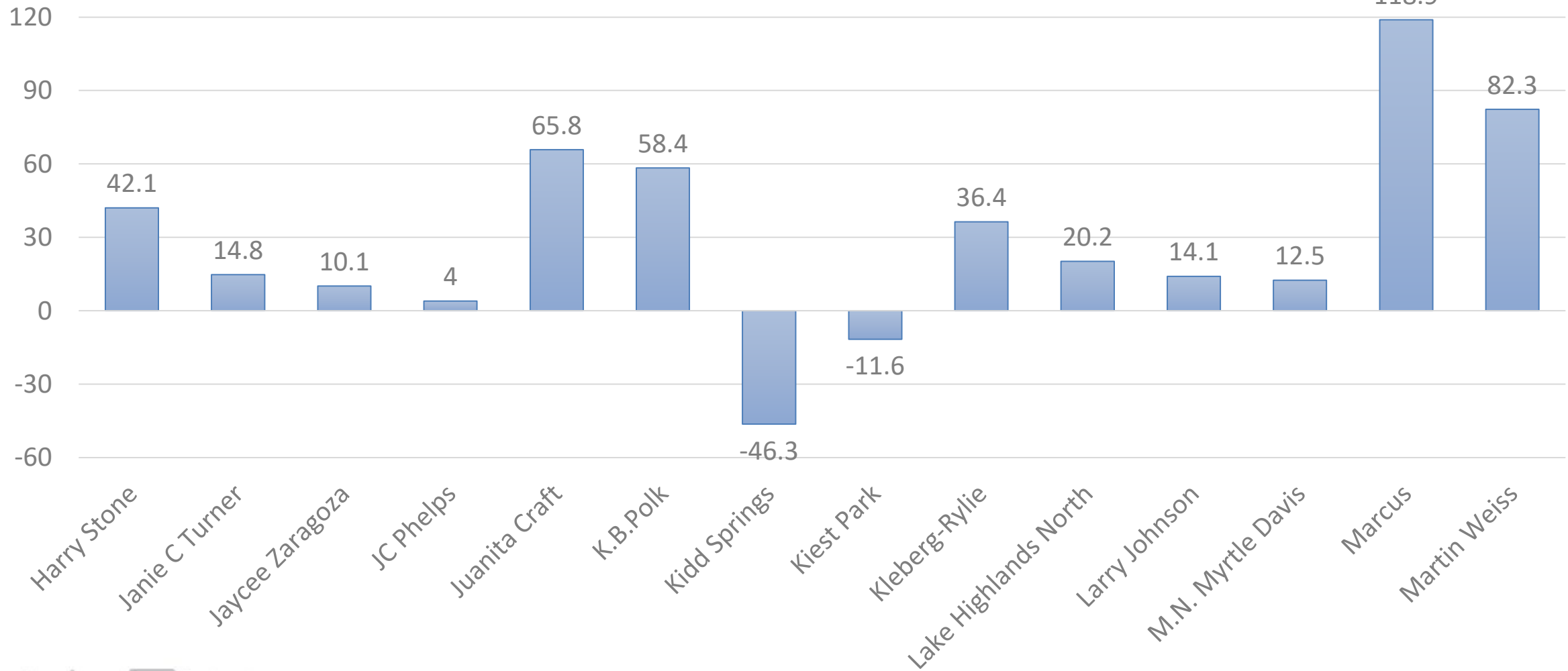
% Deviation from National Median Site EUI



# Energy Benchmarking: Recreation Centers



% Deviation from National Median Site EUI

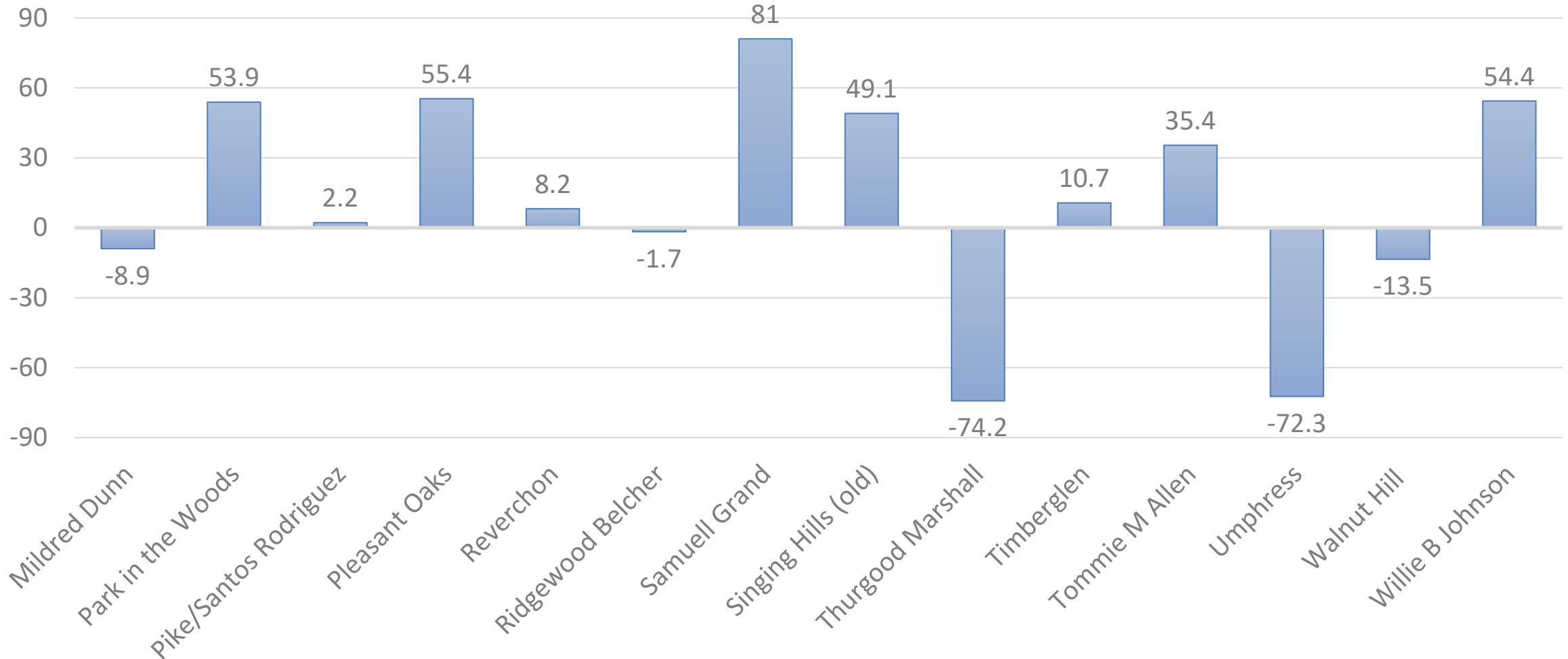




# Energy Benchmarking: Recreation Centers



% Deviation from National Median Site EUI



# Energy Benchmarking: Libraries



Forest Green (old) is no longer a City facility as of October 7, 2021

Site	Site EUI (kBtu/ft <sup>2</sup> )	National Median Site EUI (kBtu/ft <sup>2</sup> )	% Deviation from National Median Site EUI
Park Forest	159.8	65.6	143.5
Skyline	109.8	51.3	114.1
Preston Royal	105.1	58.5	79.8
Lakewood	129.5	73.2	76.9
PLD Lancaster-Kiest	97.7	56.5	72.9
Mountain Creek	113.8	69.3	64.1
Dallas West	112.9	72.7	55.4
Forest Green (old)	76.4	51.3	48.9
Hampton-Illinois	90.9	61.8	47.1
Arcadia Park	68.9	51.3	34.4
Timberglen	80.5	61.4	31.1
Oak Lawn	78.9	63.6	24.2
Skillman Southwestern	61	51.3	18.9
Audelia Road	64.2	55.9	14.8

Site	Site EUI (kBtu/ft <sup>2</sup> )	National Median Site EUI (kBtu/ft <sup>2</sup> )	% Deviation from National Median Site EUI
Lochwood	56.4	51.3	9.9
Grauwyler Park	53.7	54.8	-2
White Rock Hills	50.3	51.3	-2
Bachman Lake	49	51.3	-4.4
Kleberg Rylie	61.8	64.6	-4.4
Highland Hills	51.3	54.8	-6.4
Renner Frankford	64.7	69.2	-6.5
North Oak Cliff	54.7	60.3	-9.2
Prairie Creek	46.4	51.3	-9.6
Fretz Park	40.7	53.7	-24.3
Pleasant Grove	37	51.3	-28
J. Erik Jonsson Central Library	37.1	56.9	-34.7
Polk-Wisdom	29.6	51.3	-42.3



# Energy Benchmarking: Recreation Centers



Site	Site EUI (kBtu/ft²)	National Median Site EUI (kBtu/ft²)	% Deviation from National Median Site EUI
Marcus	102.1	46.6	118.9
Fretz Park	94.9	46.5	104.1
Arcadia Park	81.1	40	102.7
Martin Weiss	83.9	46	82.3
Samuell Grand	102.1	56.4	81
Juanita Craft	66.3	40	65.8
K.B.Polk	74.6	47.1	58.4
Pleasant Oaks	78	50.2	55.4
Exall	87.3	56.5	54.7
Willie B Johnson	87.5	56.7	54.4
Park in the Woods	61.6	40	53.9
Singing Hills (old)	59.6	40	49.1
Harry Stone	73.4	51.7	42.1
Kleberg-Rylie	73.6	54	36.4
Tommie M Allen	68.5	50.6	35.4

Site	Site EUI (kBtu/ft²)	National Median Site EUI (kBtu/ft²)	% Deviation from National Median Site EUI
Bachman	65.3	53.5	22.1
Lake Highlands North	62.8	52.2	20.2
Fireside	67.5	56.6	19.2
Janie C Turner	56.7	49.4	14.8
Larry Johnson	69	60.5	14.1
M.N. Myrtle Davis	53.1	47.2	12.5
Anita Martinez	52.4	47	11.5
Beckley-Saner	64.5	58.1	11
Timberglen	62.7	56.7	10.7
Cummings	58.6	53	10.5
Jaycee Zaragoza	47.5	43.1	10.1
Reverchon	49	45.3	8.2
Eloise Lundy	43.2	40	8
Grauwyler	54.3	50.6	7.2



# Energy Benchmarking: Recreation Centers



Site	Site EUI (kBtu/ft²)	National Median Site EUI (kBtu/ft²)	% Deviation from National Median Site EUI
Campbell Green	42.5	40.3	5.4
JC Phelps	51.2	49.2	4
Pike / Santos Rodriguez	43	42.1	2.2
Churchill	54.3	54.5	-0.4
Ridgewood Belcher	39.3	40	-1.7
Exline	58.2	59.7	-2.6
Mildred Dunn	51.8	56.9	-8.9
Kiest Park	35.4	40	-11.6
Fruitdale	62.7	71.6	-12.5
Walnut Hill	47.9	55.3	-13.5
Arlington Park	48.1	59.6	-19.3
Kidd Springs	26.9	50.1	-46.3
Umphress	11.1	40	-72.3
Thurgood Marshall	13.2	51.2	-74.2

Note: Umphress and Thurgood Marshall were closed for significant portions of the year for renovations

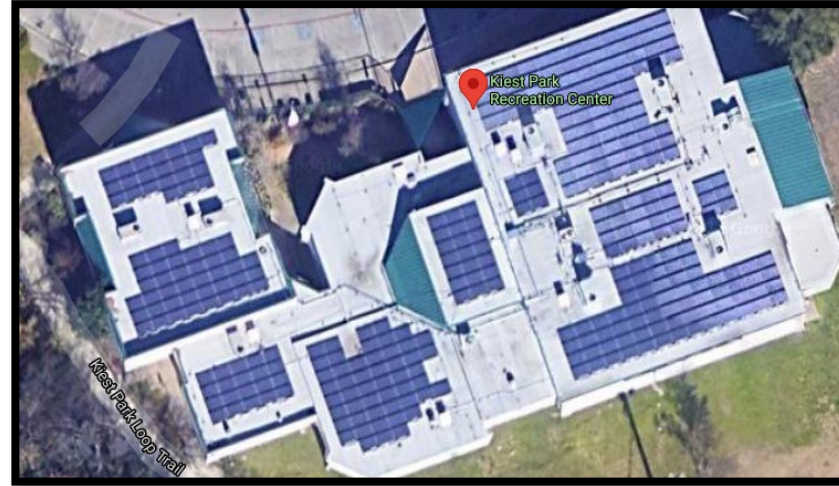




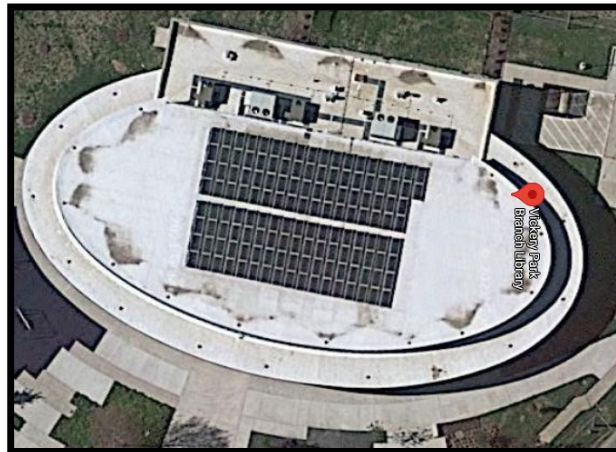
# Current Solar Installations



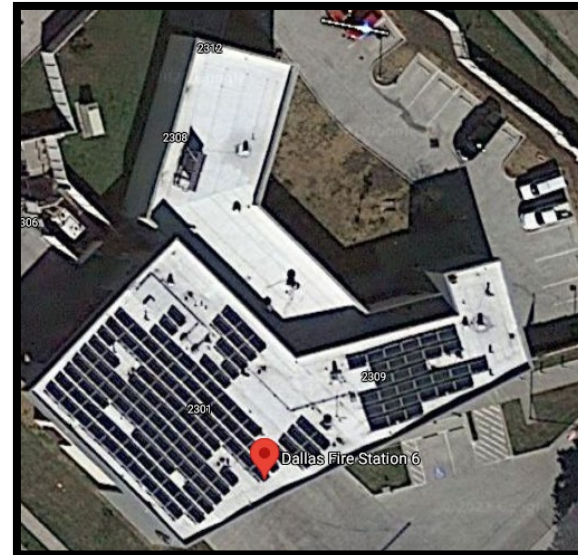
- Vickery Park Library
- Fire Station No. 6
- Fire Station No. 27
- Kiest Park Recreation Center
- Northcentral Police Station
- Northeast Police Station
- Southeast Police Station



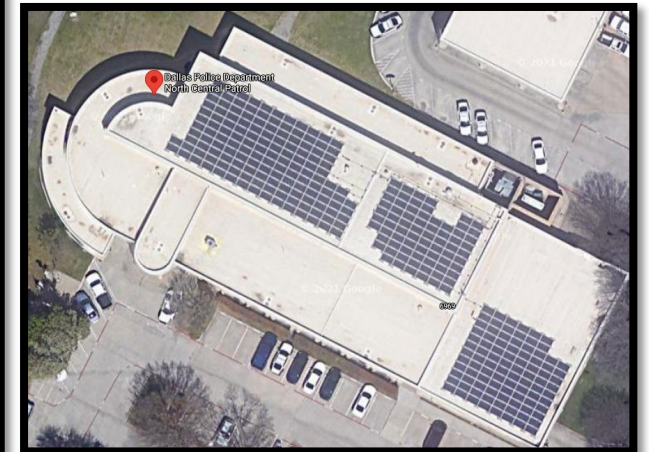
Kiest Park  
Recreation  
Center  
(90kW)



Vickery Park Library (51 kW)



Fire Station No. 6 (26 kW)



Northcentral Police (100 kW)

