ENERGY COMMITTEE BRIEFING

August 22, 2022

Carlton D. Hunt, PhD., Chair

Presentation Outline

- Energy Committee History, Role, and Charge
- Outcomes from Green Community Designation
- Municipal Solar Energy Purchase Outcome
- Future

Energy Committee (EC) History

Created in 2008 by the Board of Selectmen

Appointed under prior Master Plan Implementation Committee (MPIC)

- Small projects were initiated (e.g., Big Belly solar compactor) **Where is it now?**
- Worked with consultants and Board of Selectmen in 2009 -2010 on Green Community Designation
- Town Meeting Adopted Green Community designation in 2011.
- State designation became effective July 1, 2012

Committee continued under MPIC after 2011 Charter adoption

Town officially replaced the MPIC/Energy Committee under the Town's Administrative Code 2016 with a Master Plan Committee and an Energy Committee

Admin Code Section Energy Committee

Parts A&B

A. Term of office. There **shall** be an Energy Committee consisting of three members.

B. Authorities and responsibilities. The Energy Committee is charged with advising town officials on energy conservation efforts throughout the Town's physical plant, including but not limited to all municipal and school buildings, streetlights, vehicles, and equipment. The Committee may recommend methods to monitor and manage energy costs.

The Committee **shall**: (1) Advise concerning applications for grants from federal and state sources, including the Massachusetts Green Communities Program. (2) Recommend changes to Town ordinances to promote energy conservation and renewable energy use.

Admin Code Section Energy Committee

PART C. Interrelationships

C. The Energy Committee works in cooperation with other multiple member appointive bodies to carrying out its mission and responsibilities. The Committee will also seek the cooperation and assistance of relevant governmental agencies, nonprofit organizations, businesses and the general public.

(1) Town Council: The Committee **shall meet at least annually with the Town Council** to apprise the Committee of issues pertaining to energy conservation and renewable energy.

(2) Town Manager: The Committee meets, as necessary, with the Town Manager and all municipal departments and other administrative staff to effectuate accomplishment of its mission.

(3) Other Bodies: The Committee meets as necessary with any multiple member body of the Town, to effectuate accomplishment of its mission.

The EC is a standing committee that is advisory to the Town.

Four Major Foci Since Creation

Green Communities Projects

Alternative Energy

- Sourcing solar derived power for Town's electrical energy supply
- Advised on the Solar Energy Installation Zoning Ordinance
- Wind Energy Zoning Ordinance (draft)

Advocating for Alternative Energy Assessment

- Solar installations on large town owned parcels including the Golf Course parking lot
- Reduction of municipal energy use (e.g., electrical, gasoline, diesel, gasoline, propane etc.)

Advocating Planning for Coming Electric Vehicle (EV) wave

Green Communities Projects

Types:

- Building efficiency upgrades (e.g., insulation, equipment, etc.)
  - Police Station Control unit
  - HVAC installation (e.g., Memorial Building, Library Historic Room)
  - Heating plant upgrades
  - Water pump upgrades
- Streetlight LED conversion
- Purchase of Town EV vehicles and installation of charging stations (2018)

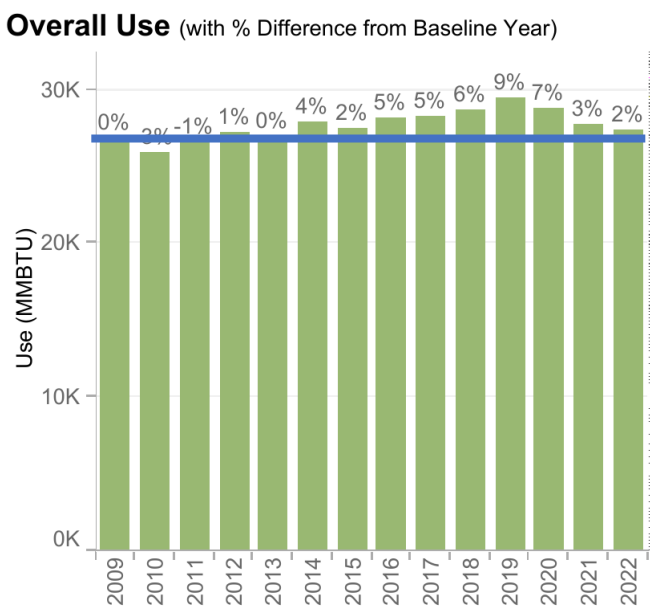
Funding since 2012 inception:

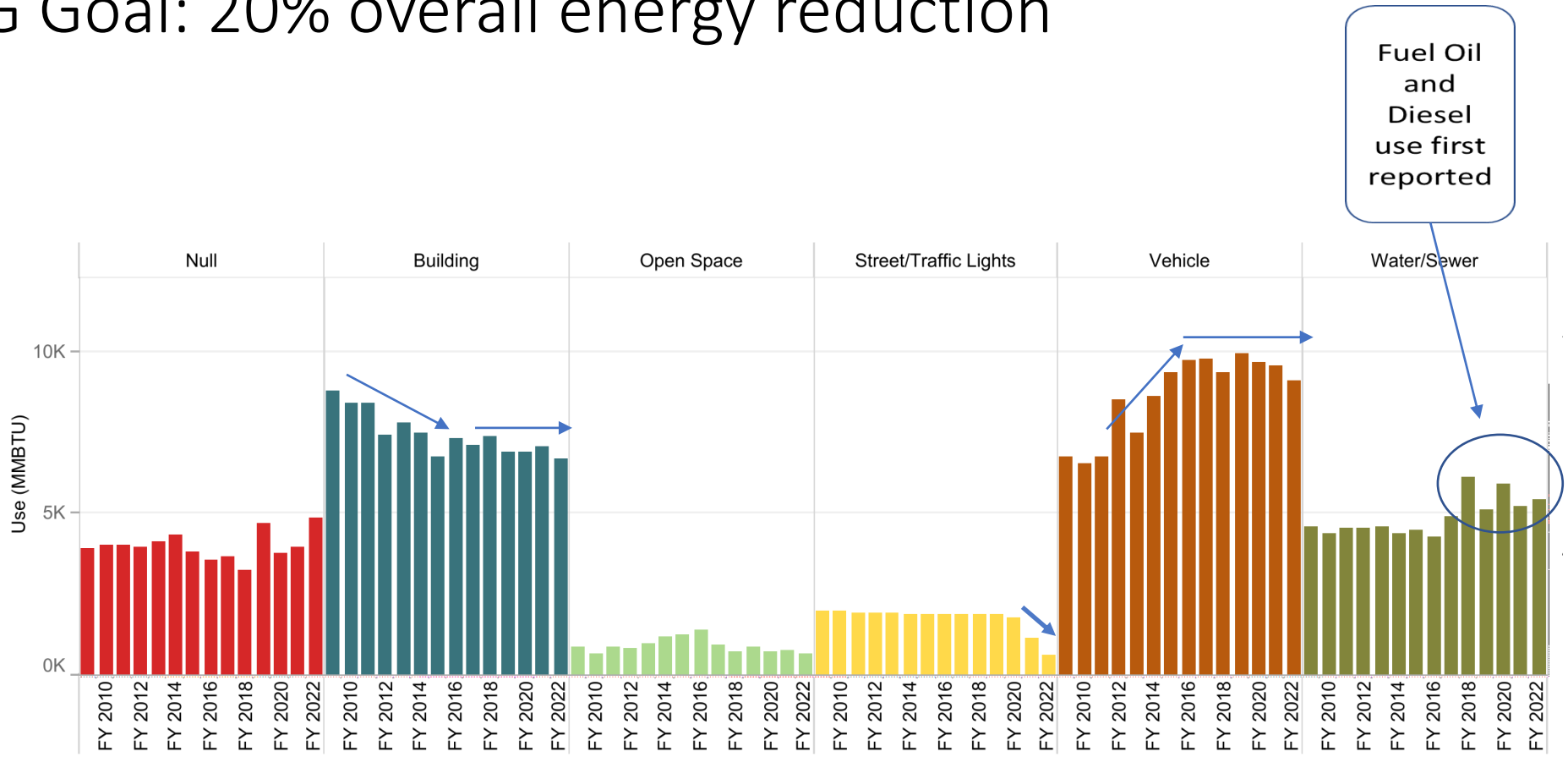
• Total projects cost:	~$ 1,528,731
• Reimbursed Grant funds:	$ 1,008,591
• National Grid Incentives:	~$ 251,711
• DOER Discount	~$ 75,444
• Direct cost to Bridgewater:	~$ 192,985

Bridgewater Energy Consumption Trends 2009-2022

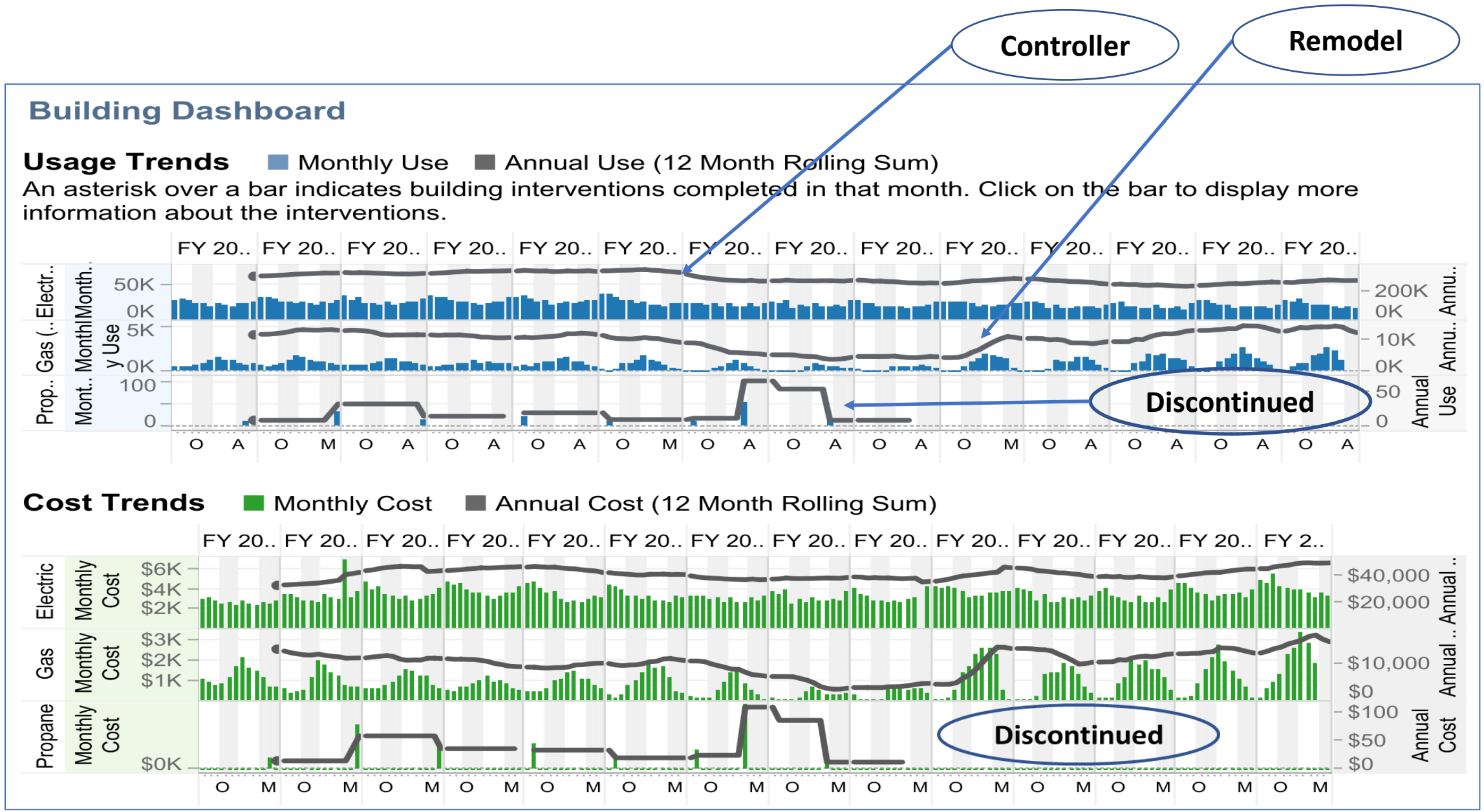
Overall Energy Use By Category FY09 – FY22

CG Goal: 20% overall energy reduction





Police Station Trends



Public Library Trends

Historic Room HVAC Upgrade

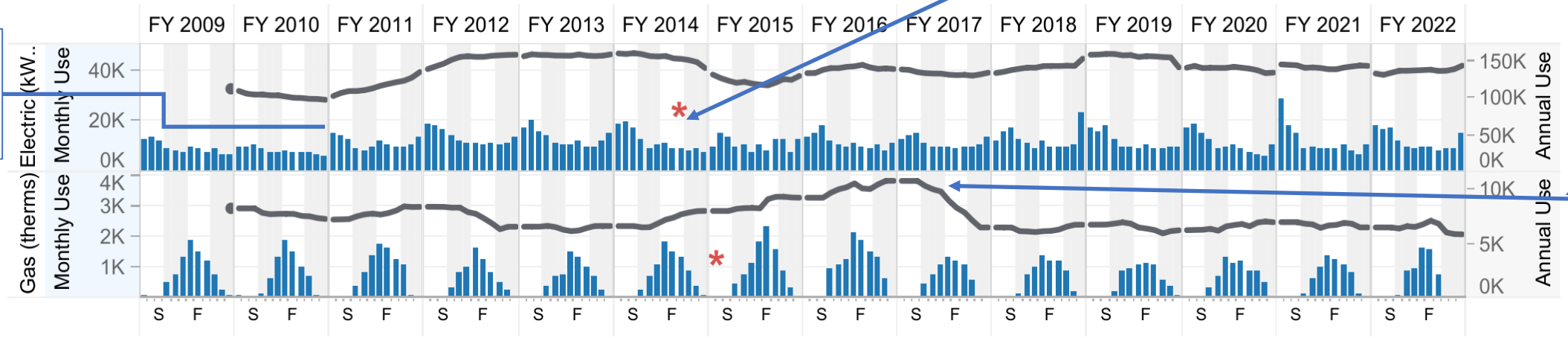
Reduced hours open

Heating system upgrade

Usage Trends

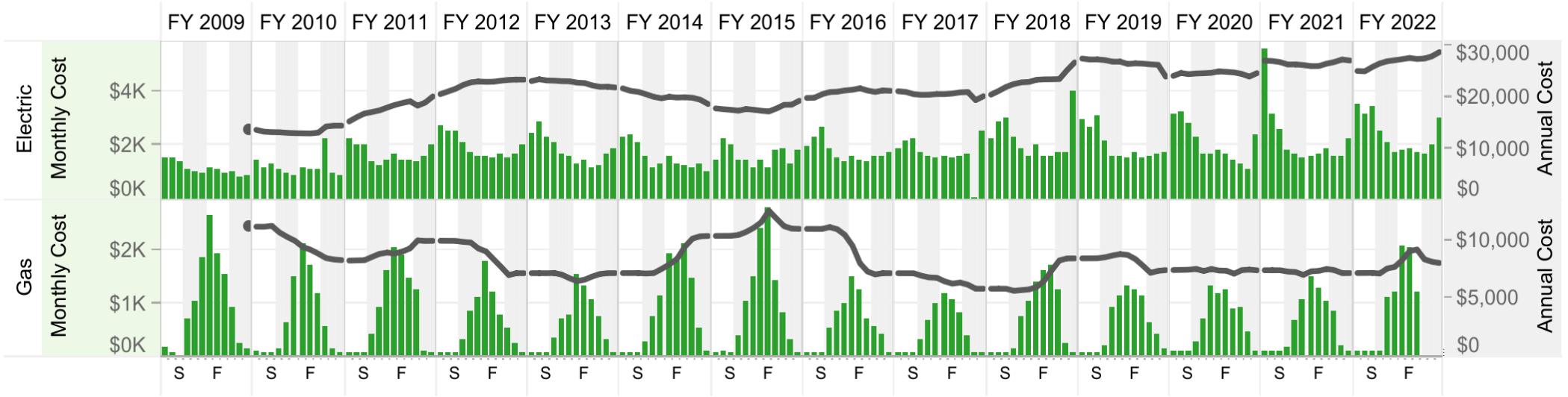
Monthly Use Annual Use (12 Month Rolling Sum)

An asterisk over a bar indicates building interventions completed in that month. Click on the bar to display more information about the interventions.



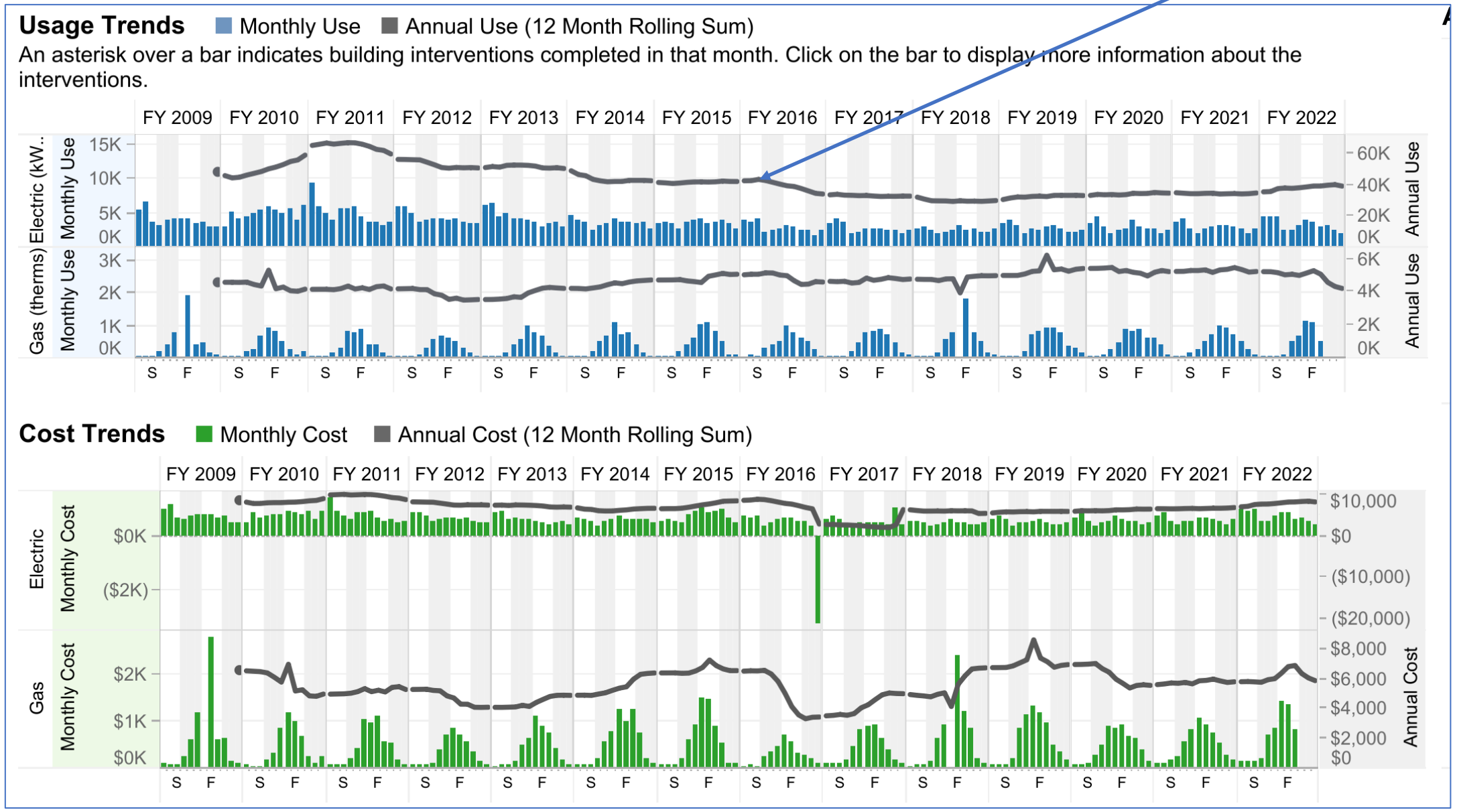
Cost Trends

Monthly Cost Annual Cost (12 Month Rolling Sum)



Senior Center Trends

Various Energy efficiency Interventions

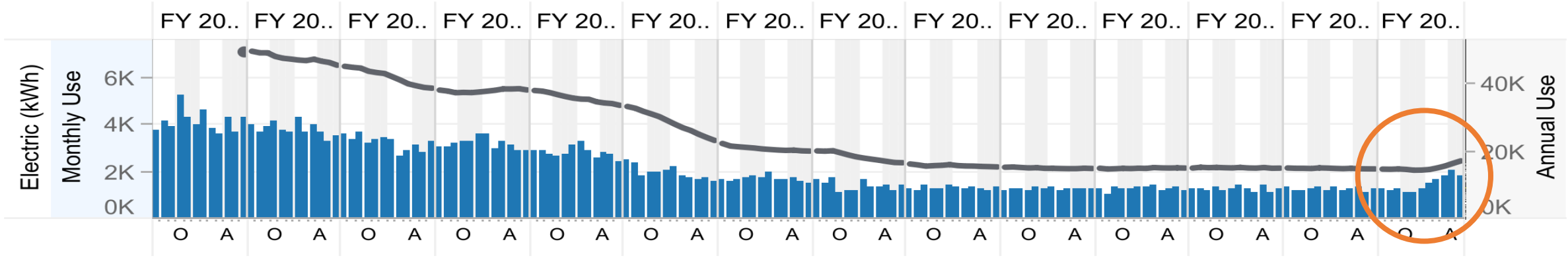


Traffic Light Trends

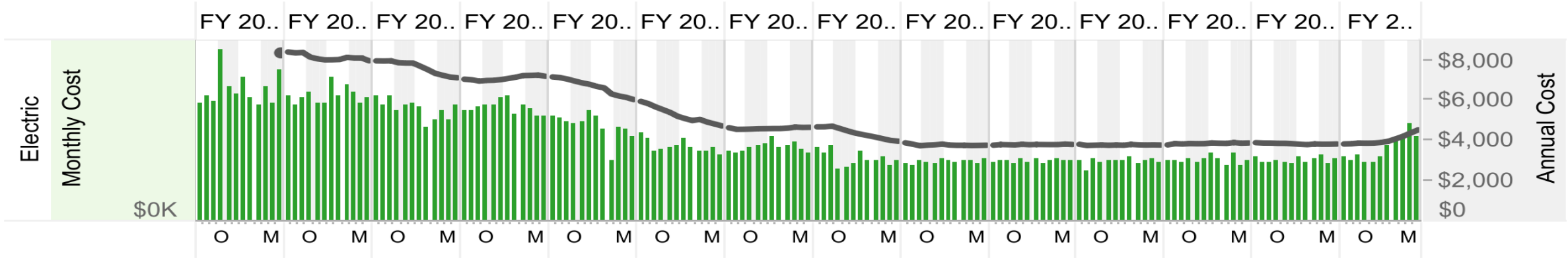
Building Dashboard

Usage Trends Monthly Use Annual Use (12 Month Rolling Sum)

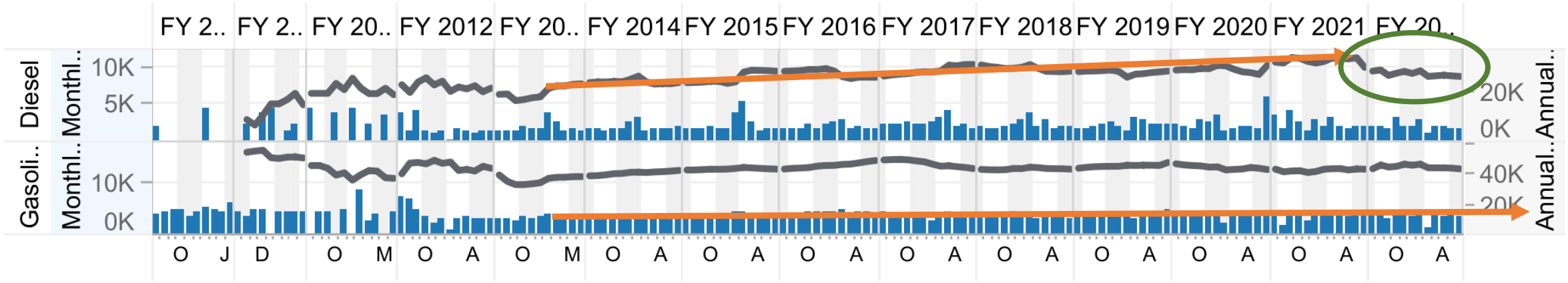
An asterisk over a bar indicates building interventions completed in that month. Click on the bar to display more information about the interventions.



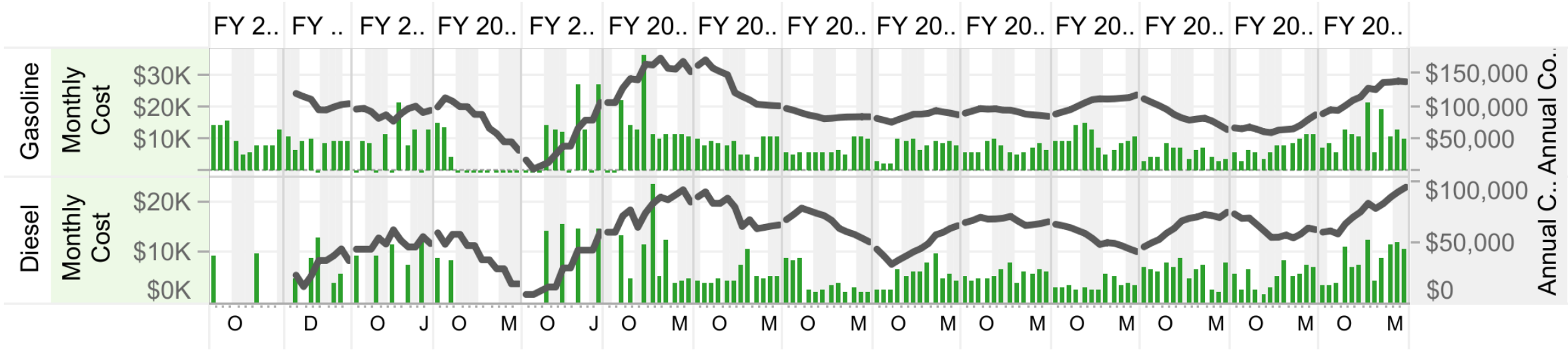
Cost Trends Monthly Cost Annual Cost (12 Month Rolling Sum)



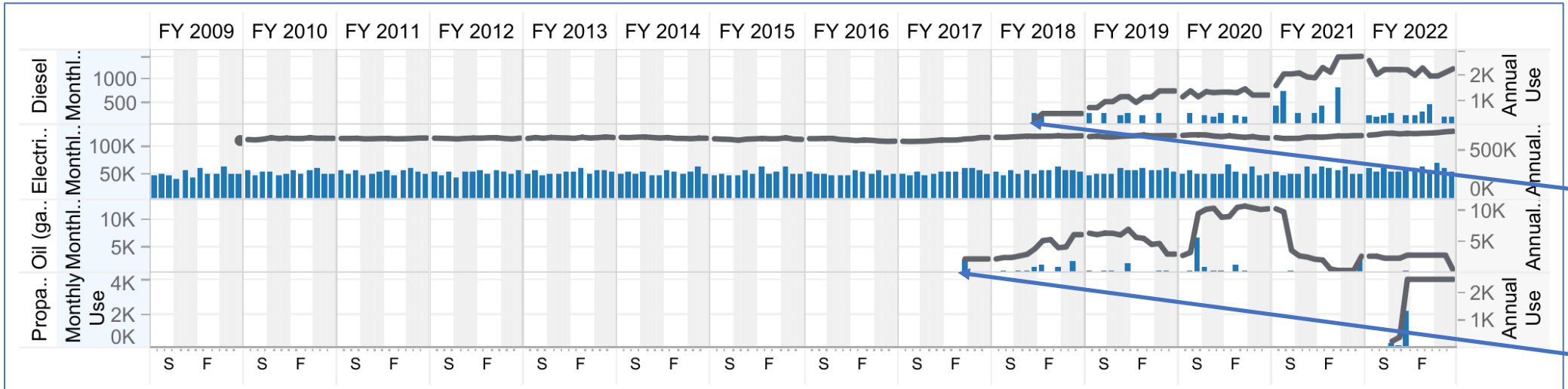
Vehicle Fuel Trends



Cost Trends ■ Monthly Cost ■ Annual Cost (12 Month Rolling Sum)

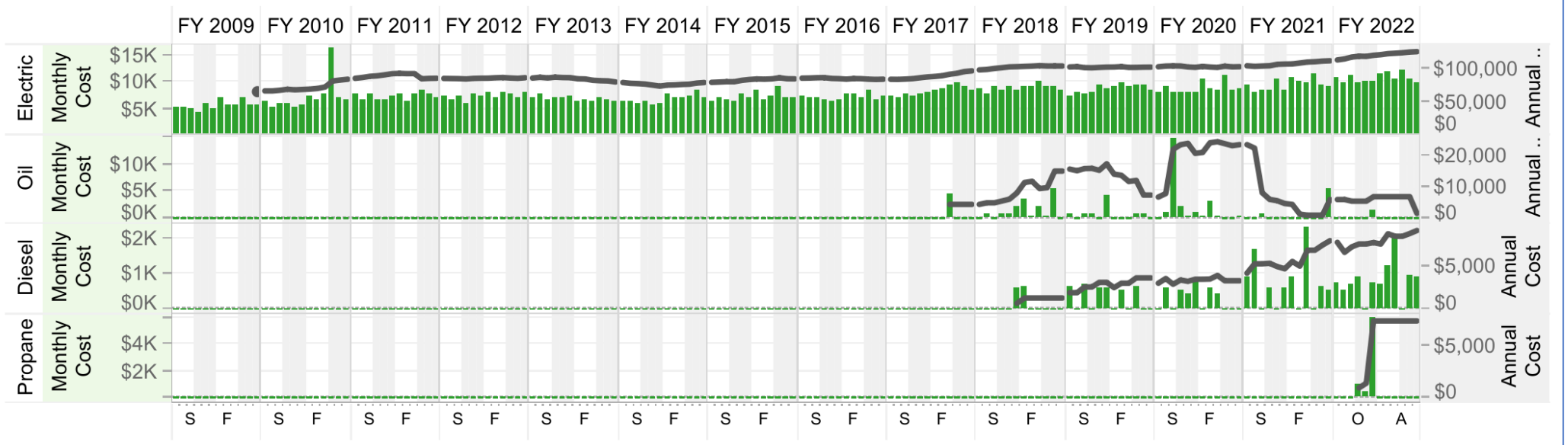


Sewer Treatment Plant Trends

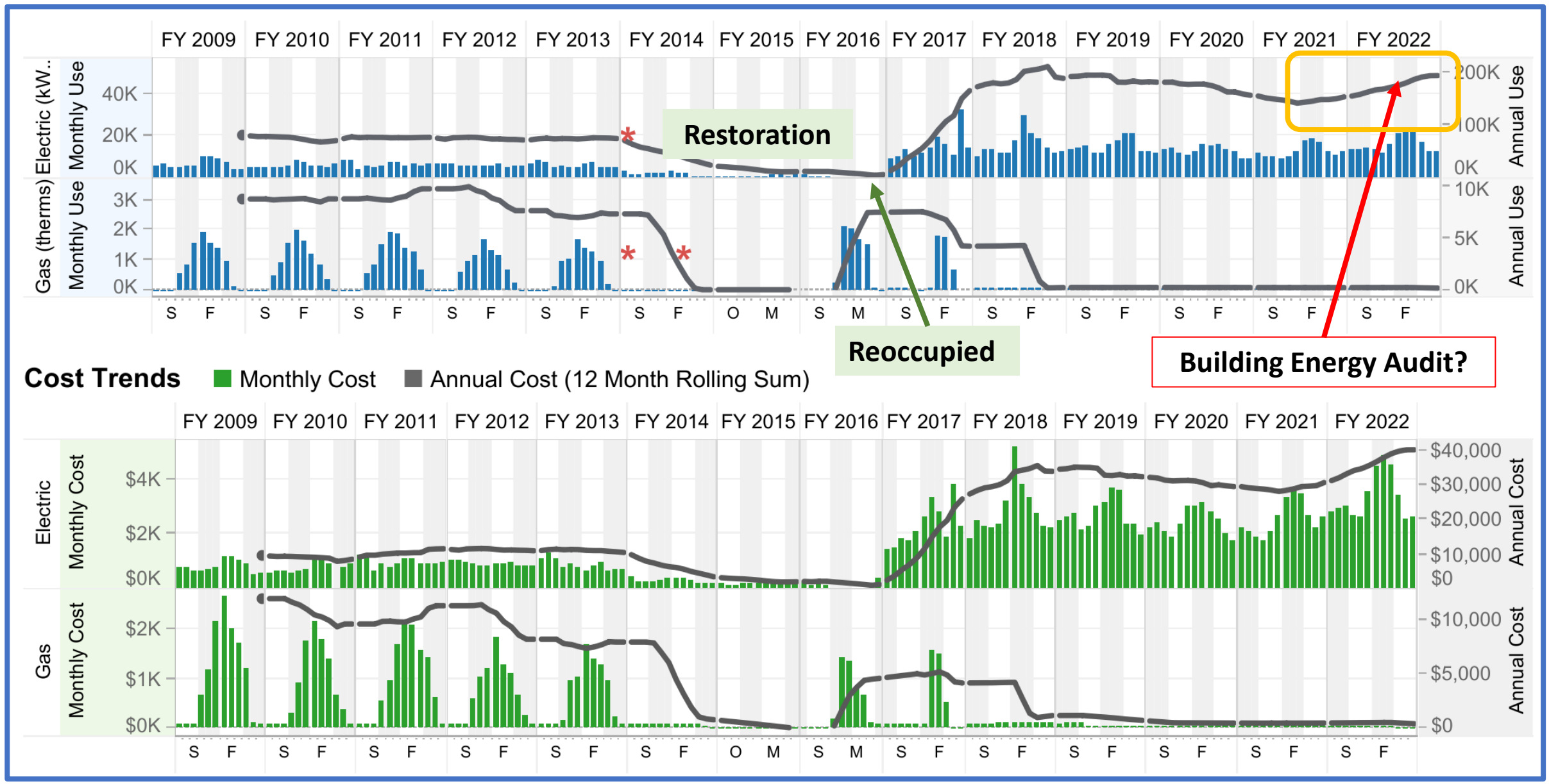


Fuel Oil and Diesel use first reported for W&S accounts

Cost Trends Monthly Cost Annual Cost (12 Month Rolling Sum)



Academy Building



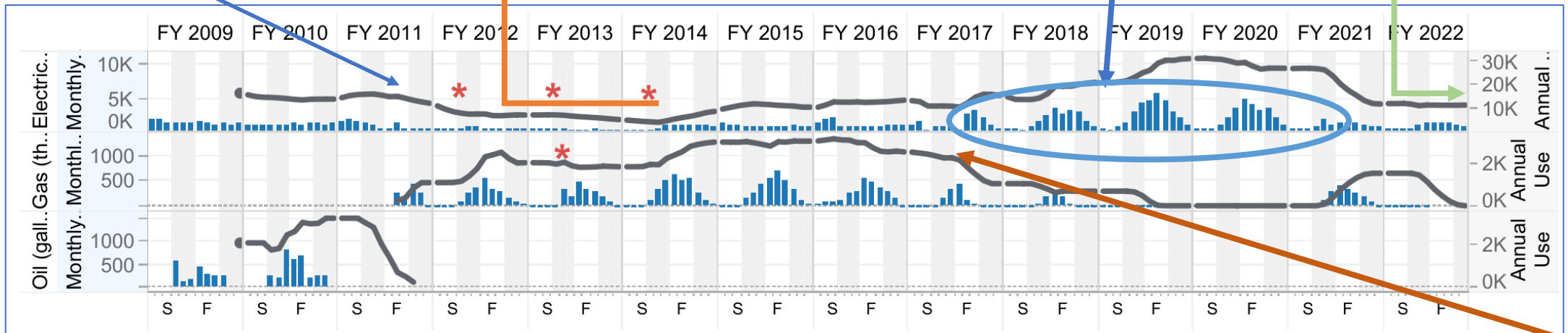
Memorial Library Building

Energy Upgrades

Not occupied

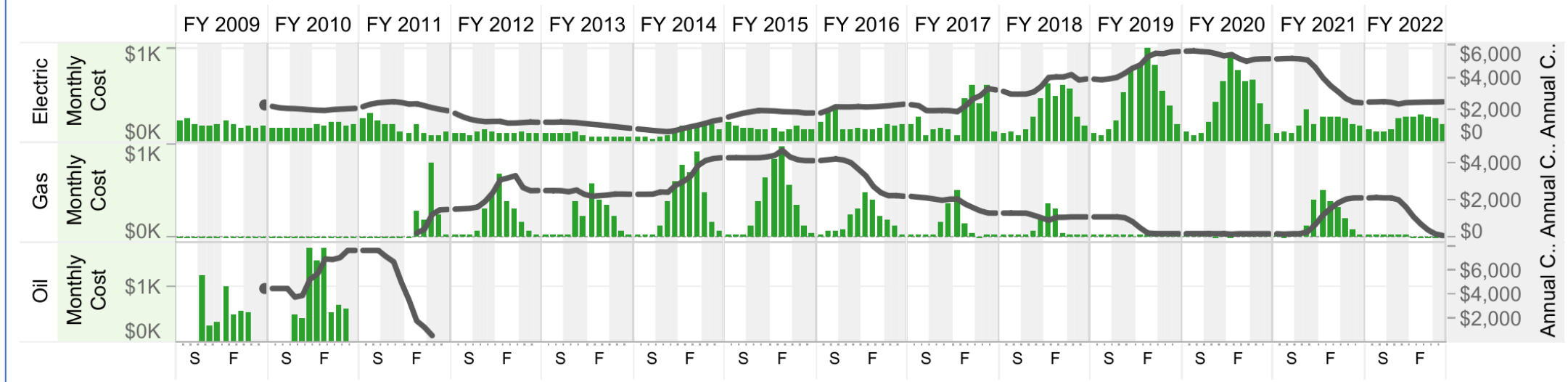
Town Manager and Town Council used building

Building Upgrade

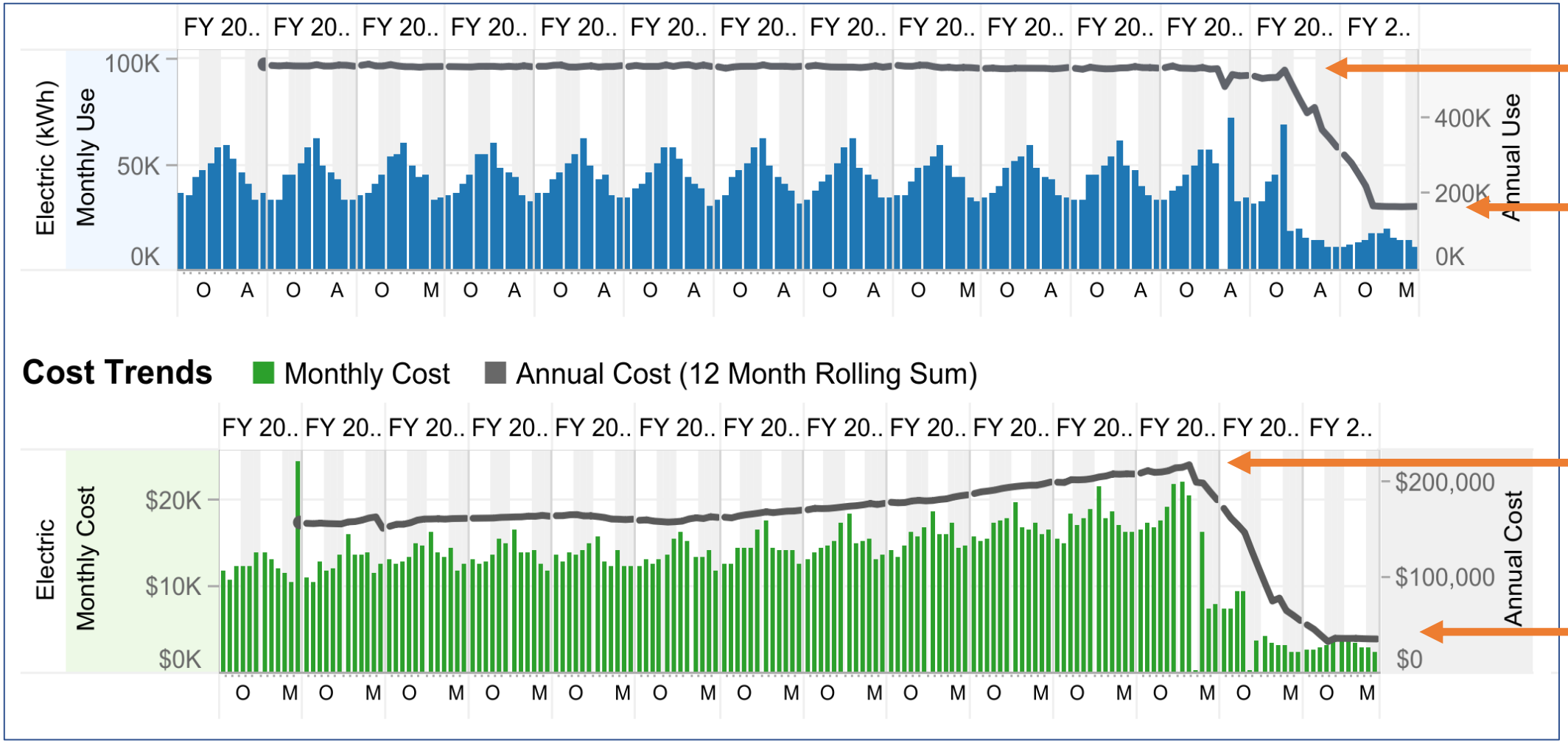


HVAC System Installed

Cost Trends ■ Monthly Cost ■ Annual Cost (12 Month Rolling Sum)



Street Light Trends & LED Upgrade Savings



Annual Use ~527K/yr.

LED Annual Use ~168K/yr.

Cost Trends Monthly Cost Annual Cost (12 Month Rolling Sum)

~Annual cost $217K/yr.

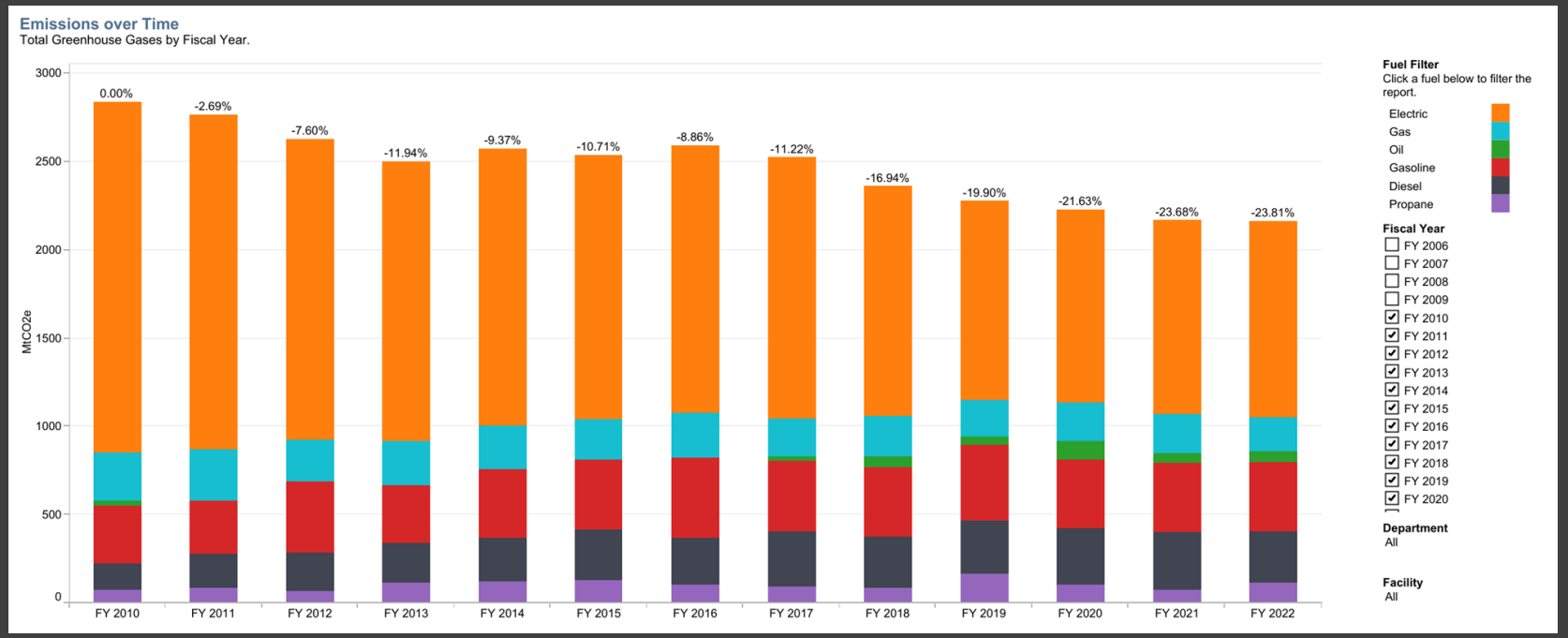
Post LED Upgrade Cost ~$37K/yr.

Annual Cost Avoided ~$180K

Energy Use Change By Category vs. 2009 Baseline

THIRTEEN YEARS OF DATA

		Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date	Year Date
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Null	Use (MMBTU)	3,924	4,002	4,033	3,965	4,106	4,319	3,793	3,573	3,680	3,222	4,709	3,749	3,952	4,884
Null	% Difference from Baseline	0.00%	2.01%	2.79%	1.05%	4.65%	10.07%	-3.34%	-8.93%	-6.22%	-17.88%	20.03%	-4.45%	0.73%	24.47%
Building	Use (MMBTU)	8,399	8,671	8,513	8,292	7,905	6,922	7,111	7,954	7,796	7,288	6,780	7,020	7,351	7,557
Building	% Difference from Baseline	0.00%	3.24%	1.36%	-1.27%	-5.88%	-17.59%	-15.34%	-5.30%	-7.19%	-13.24%	-19.28%	-16.42%	-12.48%	-10.03%
Open Spac	Use (MMBTU)	864	668	875	840	1,009	1,191	1,239	1,399	925	732	910	729	782	661
Open Spac	% Difference from Baseline	0.00%	-22.65%	1.30%	-2.80%	16.80%	37.89%	43.41%	61.97%	7.04%	-15.25%	5.31%	-15.63%	-9.47%	-23.46%
Street/Traf	Use (MMBTU)	2,011	1,981	1,955	1,951	1,944	1,902	1,892	1,881	1,859	1,863	1,859	1,793	1,154	636
Street/Traf	% Difference from Baseline	0.00%	-1.51%	-2.80%	-2.98%	-3.32%	-5.41%	-5.92%	-6.47%	-7.56%	-7.34%	-7.54%	-10.83%	-42.61%	-68.38%
Vehicle	Use (MMBTU)	6,756	6,511	6,759	8,501	7,483	8,633	9,362	9,733	9,777	9,355	9,902	9,643	9,562	9,093
Vehicle	% Difference from Baseline	0.00%	-3.63%	0.04%	25.82%	10.76%	27.77%	38.56%	44.05%	44.71%	38.46%	46.56%	42.72%	41.53%	34.59%
Water/Sew	Use (MMBTU)	4,583	4,415	4,537	4,560	4,596	4,384	4,489	4,259	4,892	6,094	5,117	5,929	5,219	5,419
Water/Sew	% Difference from Baseline	0.00%	-3.67%	-1.01%	-0.50%	0.29%	-4.34%	-2.04%	-7.07%	6.75%	32.98%	11.65%	29.38%	13.88%	18.24%
Grand Tota	Use (MMBTU)	26,537	26,248	26,671	28,108	27,044	27,351	27,885	28,799	28,928	28,554	29,277	28,863	28,021	28,249
Grand Tota	% Difference from Baseline	0.00%	-1.09%	0.51%	5.92%	1.91%	3.07%	5.08%	8.52%	9.01%	7.60%	10.33%	8.77%	5.59%	6.45%



Total Greenhouse Gas Emission Trends FY10-FY22

O2e Emissions (Mt):	**-23.59%**
CO2e Emissions factor:	**0.00362/fuel unit**
Use (MMBTU):	**27,384**
Cost:	**$1,003,645**

Green Communities Project Conclusions

- Green Communities 20% energy reduction goal **not** achieved
- Current overall energy consumption is ~22% higher than goal.
- Recovery from the 2009 economic slowdown and budget woes demonstrated in the vehicle fossil trends (added vehicles) and library (reduced hours open) energy trends.
- Weather normalized **building** energy consumption decreased ~10 % since 2009 **on ~25% of total energy consumption.**
- Reduction in building energy consumption is offset by **fossil fuel** use increase **on ~32% of total energy consumption**.
- Impact of Town electric vehicle use is not clear. *Town employees no longer use personal vehicles!*
- Financial tracking improvements are reflected by consistent fossil fuel data reporting post FY12 and FY18 addition of water and sewer departments' fossil fuel use.
- Conversion to LED streetlights is a major step toward the overall Green Communities energy reduction goal. **~68% reduction on 2% of total energy consumption; avoided cost large.**
- ~24% reduction in greenhouse gas emission

Future Green Community Projects

HVAC system operation training for Academy Building is possible. Requires an energy audit!

Town House reuse and upgrades

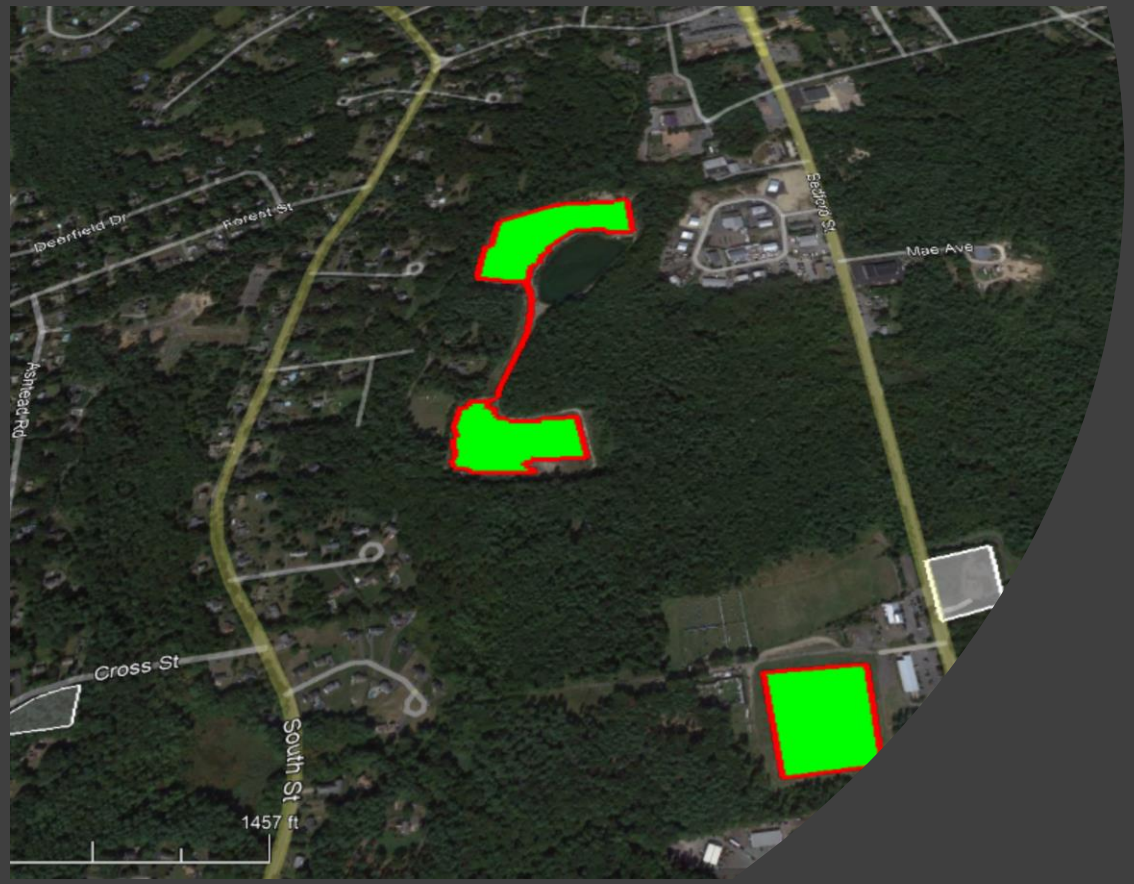
- The Town House Reuse Committee (THRC) has secured a grant for the building's roof repair!
- This project is scheduled for completion in the Fall of 2022.
- The THRC 's next project is to clean the building of mold and organize, clean, and scan Town Department documents stored in the building.
- **Projects after that are TBD but may include energy upgrades in anticipation of recommendations for building reuse.**
- **There are options available for energy source upgrades and energy efficiency projects. REQUIRES AN ENERGY AUDIT.**

Next GC competitive application **due on October 7, 2022**

- Bridgewater is **eligible for up to $100k in grant funding** if all GC projects are complete and the Town is up-to-date with the required Annual Reports. **We are compliant with this requirement!**
- The GC annual report is due November 2022.

Bridgewater Municipal Solar Energy Purchase (Fireworks Circle)

“FIREWORKS CIRCLE” SOLAR FACILITY



In August 2015, Bridgewater began purchasing municipal electrical energy from a private solar installation west of Fireworks Circle.

Fireworks Circle Solar Installation Notes

Contract agreement is to meet 100% of our municipal electricity demand

Initial solar power price was $0.11 per KWH escalating 2% annually through 2035

Current solar energy price is $0.1228/KWH versus NGIRD's ~$0.19/KWH price

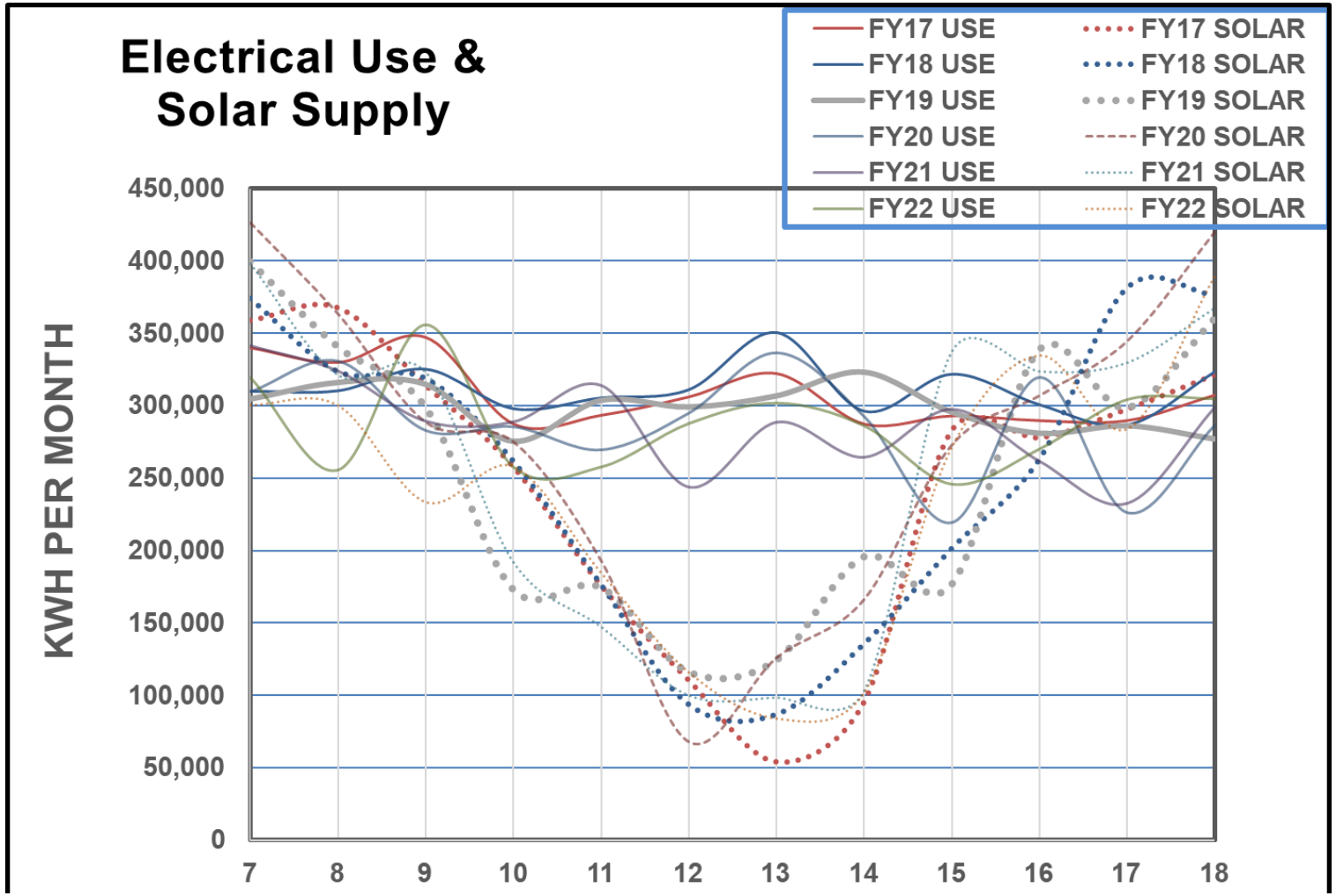
- Annul cost savings is ~16% relative to NGRID supply
- Field provided $45,686 tax revenue in FY22

NGRID issues monthly energy credits to Bridgewater

- FY22 Credit was $311,773
- Excess credits can be sold by the Town or used to offset Town costs in other areas (~100K in FY23 budget)

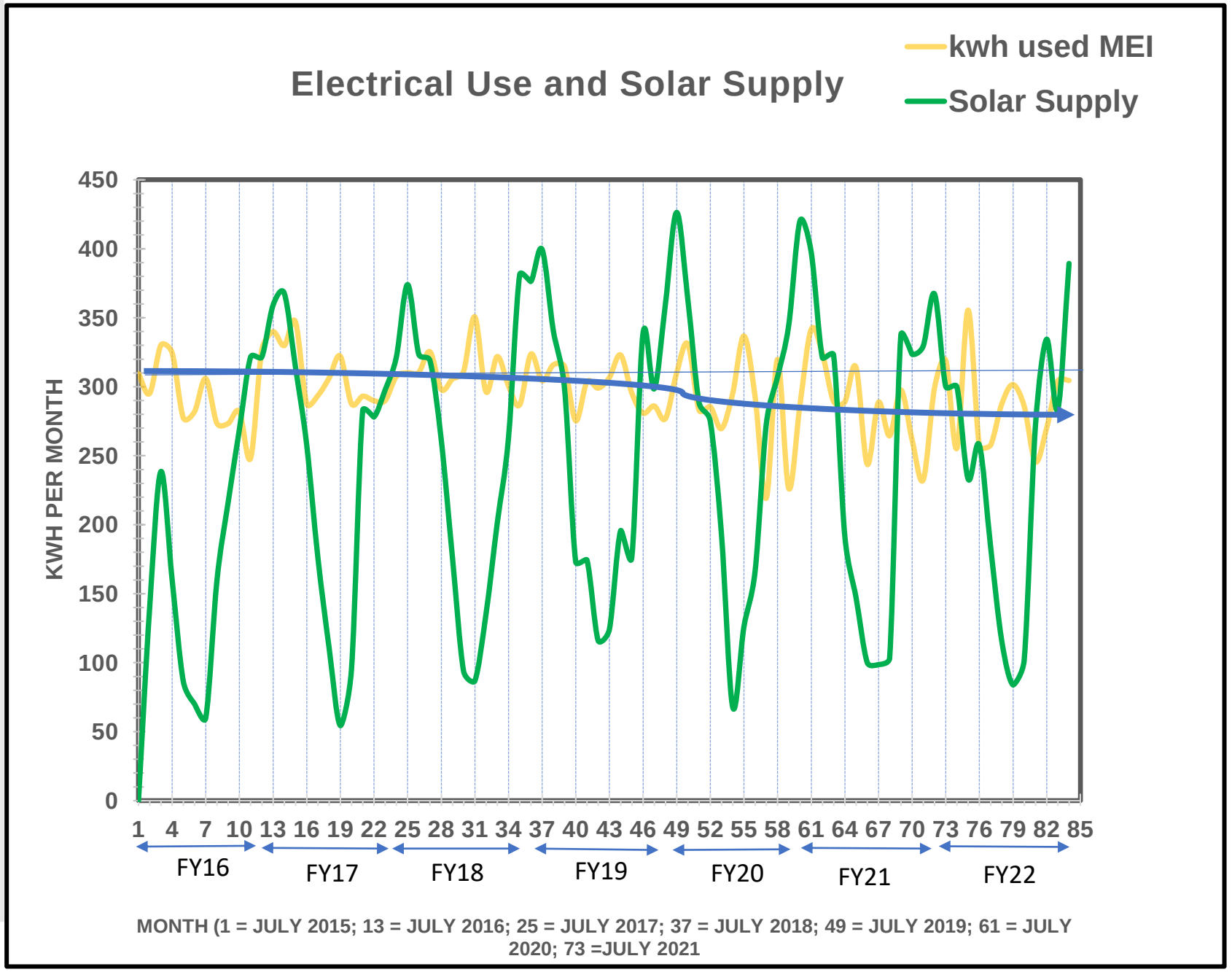
Avoided electrical energy cost was $291,122 in FY22

Energy Committee has not been asked to provide advice on excess credit distribution

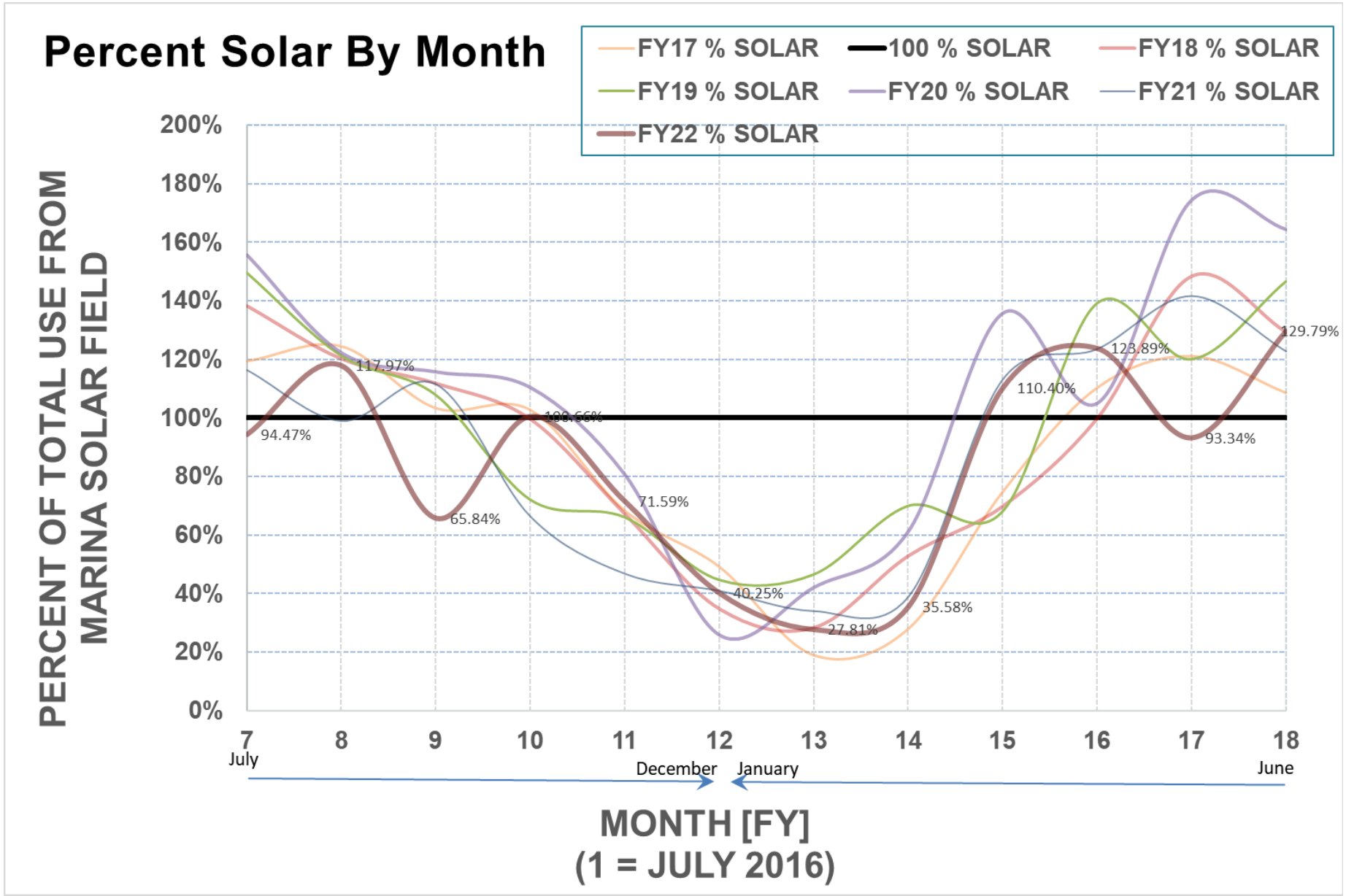


Monthly Electrical Use versus Solar Supply by Year

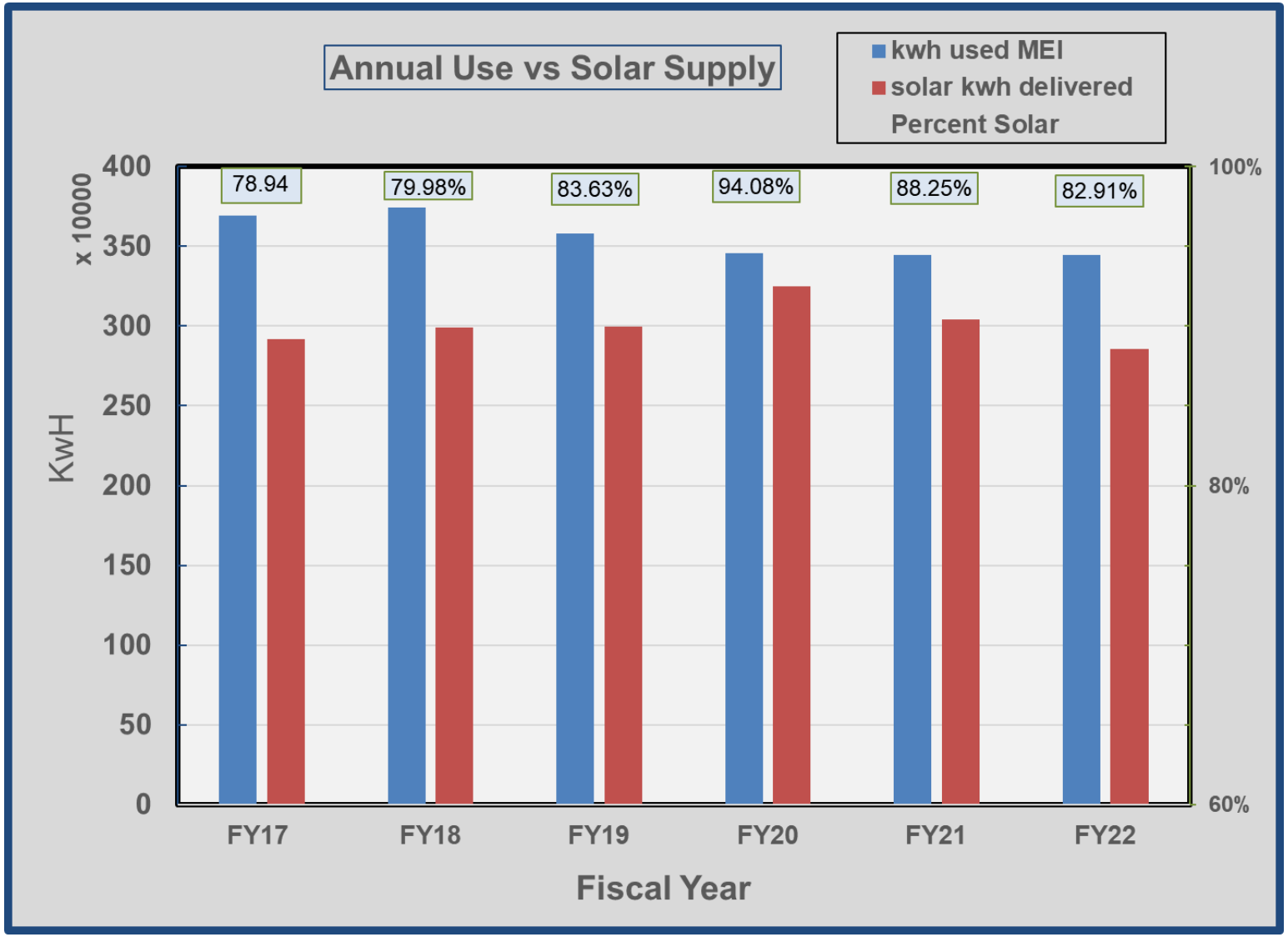
Monthly Solar Production Versus Bridgewater Use



Percent Solar By Month By Fiscal Year



Annual Use Versus Solar Supply



Electrical energy Cost Comparison to Date

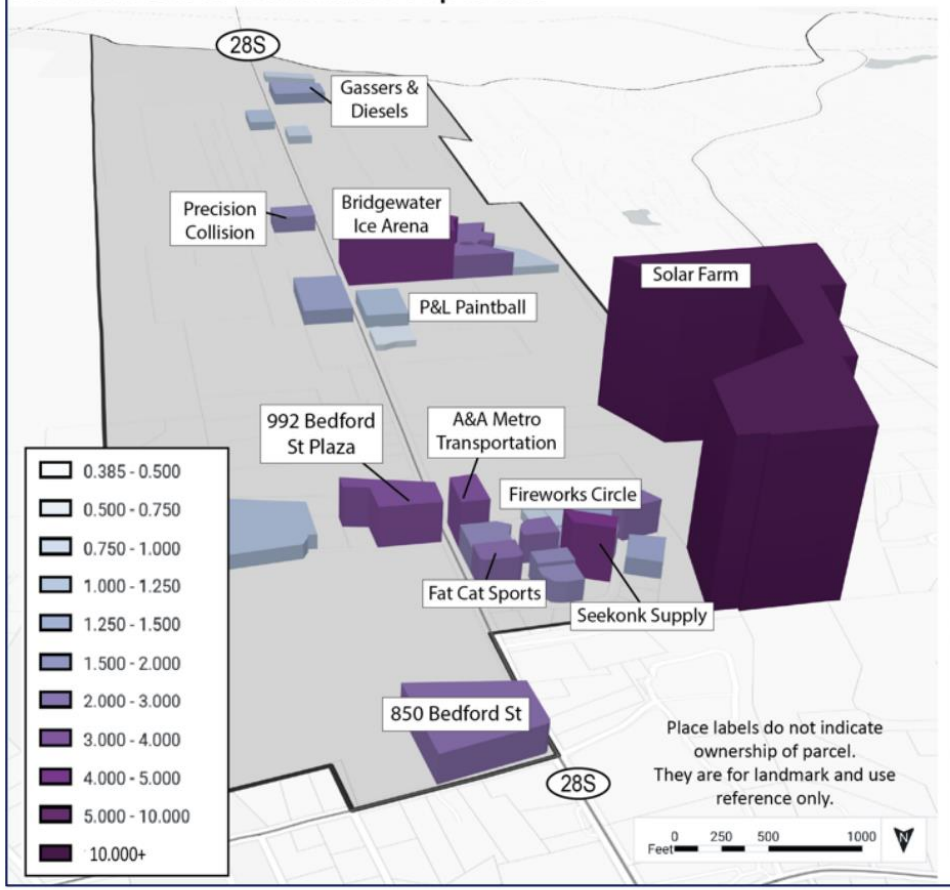
FY	Annual cost	% reduction over NGID cost	Cost avoided
FY16	$672,928	-6.235%	-$39,495
FY17	$684,146	0.000%	$0
FY18	$743,711	0.000%	$0
FY19	$719,159	0.000%	$0
FY20	$751,792	-8.359%	-$57,996
FY21	$364,285	41.146%	$254,683
FY22	$353,014	45.196%	$291,122
FY23 FY24			
Total	**$4,289,035**	**9.463%**	**$448,314**
	Average Annual Data	13.0%	
	Average Total Data	**10.2%**	**$64,045**

Economic Value of Solar Installations (2022 BWTR Master Plan)

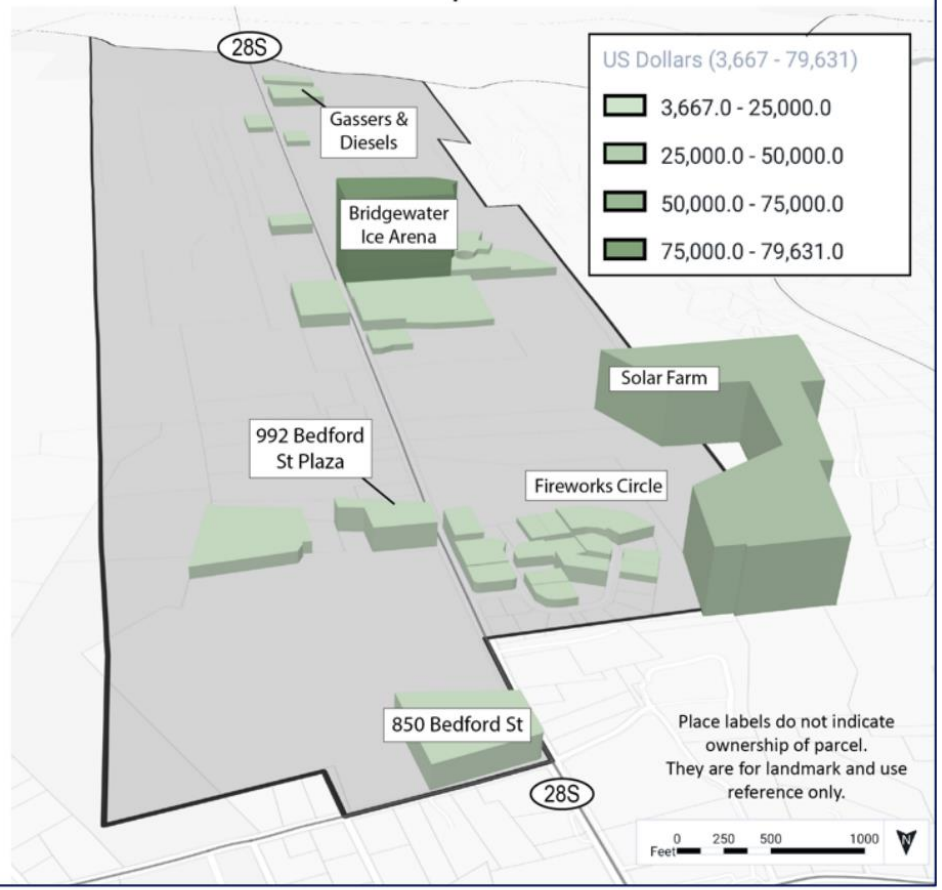
SOUTH BUSINESS DISTRICT LOOKING SOUTH TOWARD MIDDLEBOROUGH

Source: Town of Bridgewater, 2019 Assessor's Data, accessed through Urban Footprint

Building-to-Land Value Ratio of Commercial & Industrial Properties



2019 Property Tax Revenue of Commercial & Industrial Properties



Note that this is based on the 2019 Assessor's database, which is the most current available as of March 2021 and may not reflect all current development.

Energy Summary

BWTR has held steady in its overall energy use for 12 years.

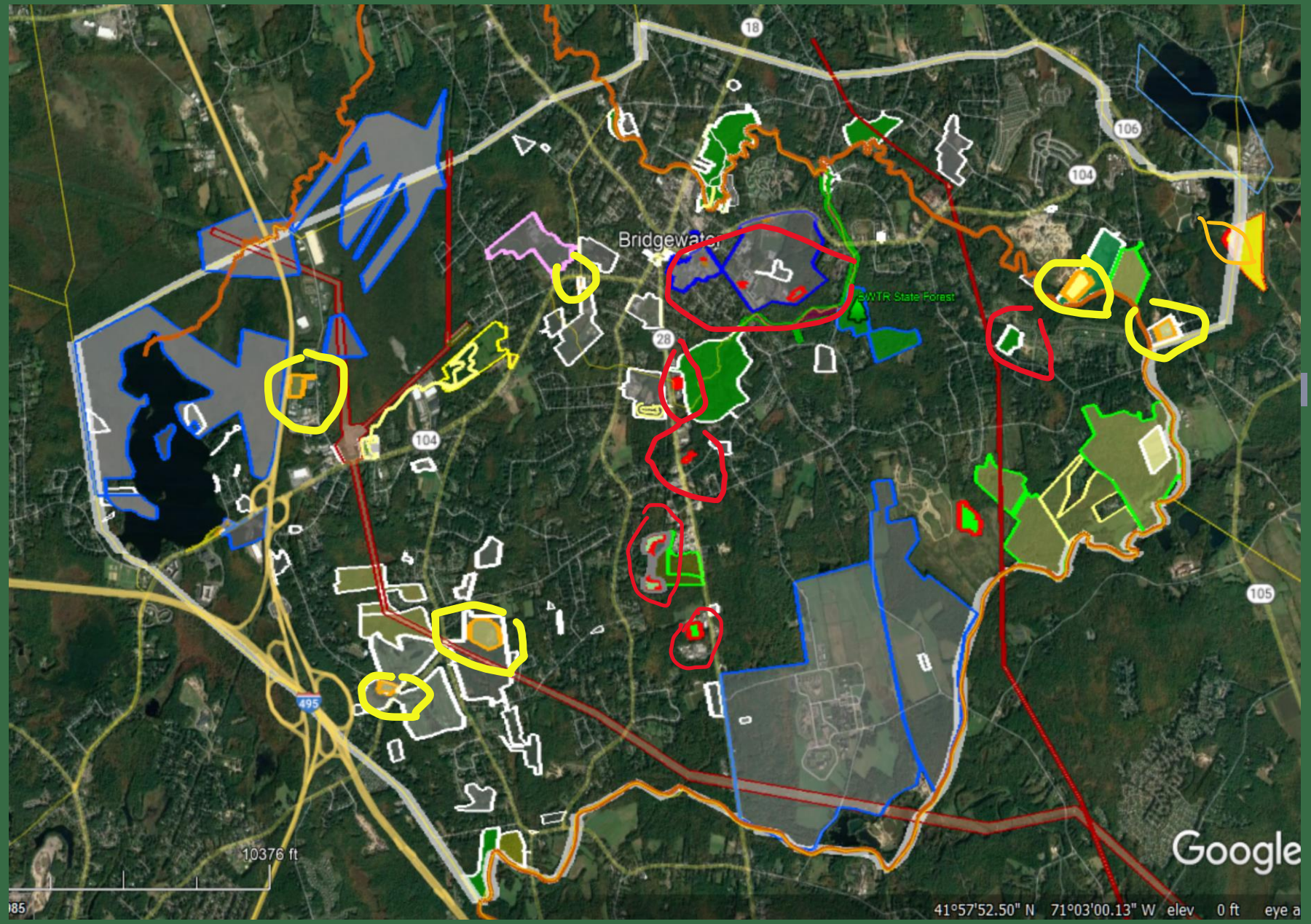
Conversion of streetlights to LEDs put the Town in a more positive position relative to energy use and cost reduction.

Solar energy purchase reduced municipal electricity cost by ~15% .

Solar derived energy purchase is positive from perspectives of energy cost (lower), tax revenue (commercial), and state and national climate change objectives and goals.

Solar installations have the highest ratio of land improvement value vs. land value and property tax revenue in BWTR (BWTR 2022 Master Plan).

Failure to a maintain buildings and equipment will negate positive energy consumption gains over time

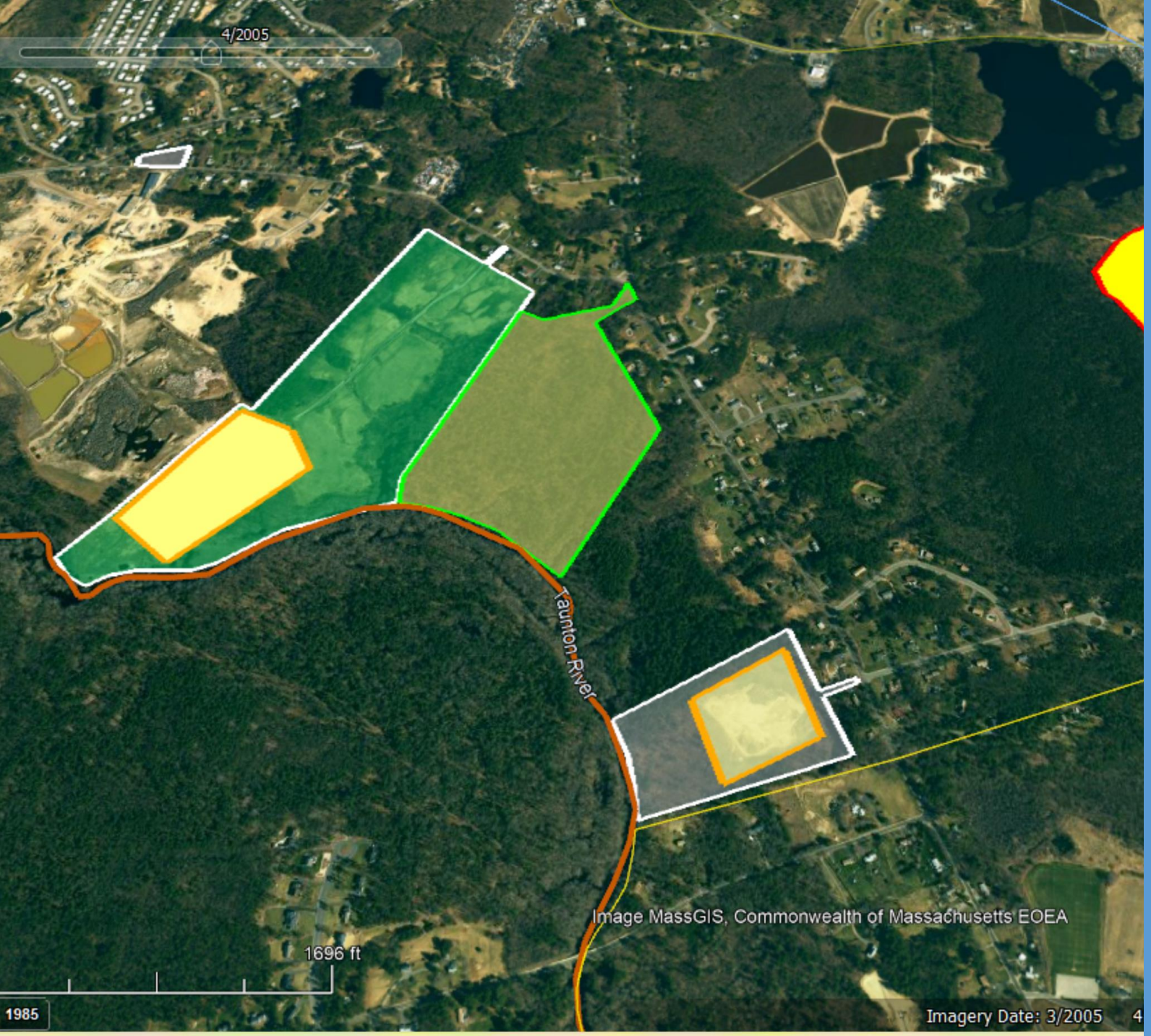


CURRANT & POTENTIAL SOLAR AND WIND ENERGY LOCATIONS IN BRIDGEWATER

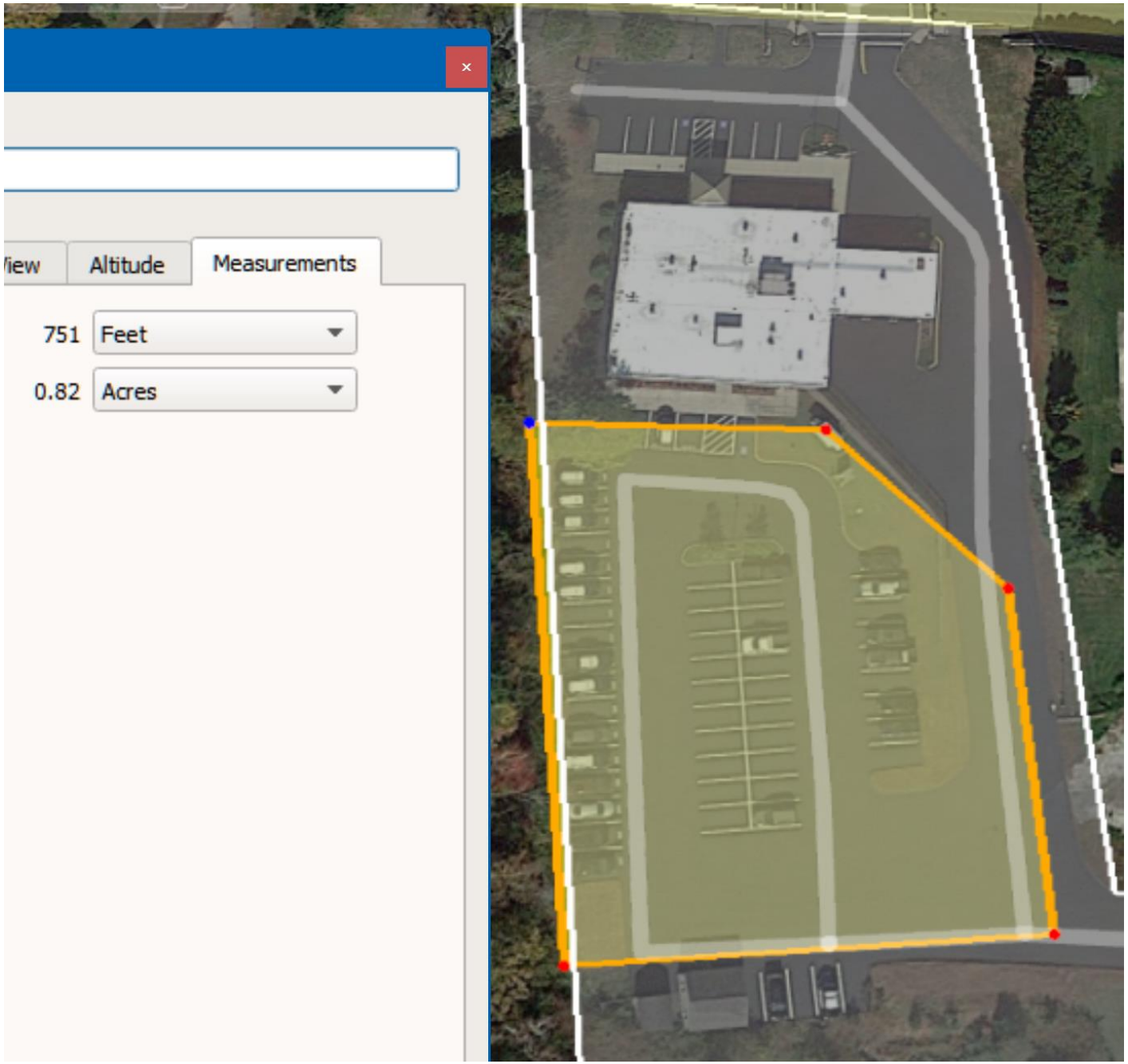
Solar Installations in BWTR

Future Solar Installations in BWTR

Potential Solar Installations on Town Owned Parcels



POTENTIAL SOLAR INSTALLATION LOCATIONS – EAST



POTENTIAL SOLAR INSTALLATION LOCATIONS – CENTRAL

POTENTIAL SOLAR INSTALLATION LOCATIONS – WEST

Potential Solar Facility Revenue for Bridgewater

Cumulative Annual Revenue guesstimate			
		Highest lease + tax	$334,575
		Middle lease + tax	$280,575
		Lowest lease + tax	$246,606

Potential Solar Installations Revenue												Comments
Parcel Name	Map and Parcel	Parcel Acres	Solar Acres Option 1	Solar Acres Option 2	Lease Revenue minimum	Lease Revenue middle	Lease Revenue maximum	solar installation tax revenue	Estimted annual revnue minimum	Estimted annual revnue middle	Estimted annual revnue maximum	
East Street Parcel	54-7	18	8		$1,600	$8,000	$16,000	$33,567	$123,523	$41,567	$49,567	Former sand supply parcel
				14	$2,800	$14,000	$28,000	$58,742	$61,542	$72,742	$86,742	Former sand supply + additonal upland area
Wyman Meadows	33-135	20		14	$2,800	$14,000	$28,000	$58,742	$61,542	$72,742	$86,742	Southern exposure, no trees
			20		$4,000	$20,000	$40,000	$83,917	$87,917	$103,917	$123,917	Large area unforested
Police Station Parking lot	33-135	2	0.8	NA	$160	$800	$1,600	$0	$160	$800	$1,600	Shade for vehicles, storm protection
Golf Course Parking Lot	116-7		2.2	NA	$440	$2,200	$4,400	$0	$440	$2,200	$4,400	Parking lot improvement, golf course power; parking lot improvements required
				5	$1,000	$5,000	$10,000	$0	$1,000	$5,000	$10,000	
Chaffe Farm	109-8	45	20		$4,000	$20,000	$40,000	$83,917	$87,917	$103,917	$123,917	Highway Rubble Disposal
	109-12	5		14	$2,800	$14,000	$28,000	$58,742	$61,542	$72,742	$86,742	Highway Rubble Disposal
	109-13	8										Highway Rubble Disposal
	109-22	4	x	x								drainage
	109-26	0.11	x	x								road
	99-15	4										Highway Rubble Disposal
	117-3	41	?	?								Forested and wetlands
	total	107										
Elm S.t Parcel	58-45	8	7	NA	$1,400	$7,000	$14,000	$29,371	$30,771	$36,371	$43,371	Forest and wetlands
Private Land Opportunities		Parcel Acres	Solar Acres		Tax Revenue			solar installation tax revenue	Total Tax revenue	% Increase		Increase is over current assessed land value
Halifax Land fill	40-9, 10, 16, 17	19	8		$9,544	NA	NA	$33,567	$43,111	**452%**		Owners have permits from State; building elevation; part of large (45 acer) solar facility on former land fill

Wind Generated Electricity Potential

Low Wind Harvesting System

https://arcindustries.co/

The Orb

The next generation wind turbine.

Our patent pending turbine design:

- Deploys in constrained spaces
- Generates power in even the lightest breeze
- Excellent complement to solar technology
- Requires virtually no maintenance
- Offsets 9.3 metric tons of CO_2 per year*
- Pays for itself with electricity savings in 3-5 years

ARC Industries' turbine design addresses critical operational constraints that currently plague the vertical-axis wind-turbine industry including low-power generation performance (most only work in a narrow range of wind speeds), low reliability, high noise levels, and killing flying wildlife.

ARC Industries' low cut-in speed, innovative control system, and 2.8-kilowatt generator is designed to deliver high energy density over a wide range of wind speeds and avoid ecological impacts to local fauna.

Low Wind Harvesting System Municipal Golf Course

	The Orb	Rooftop Solar
Power per Unit Area	83 W/Ft^2	18 W/Ft^2
Output per Unit	3 kW	250 – 400 Watts per panel
Return on Investment	3-5 years	3-5 years
Installed Cost per Watt	$3.33 per Watt	$3-$5 per Watt
Output	120V, 240V – AC or 12V, 24V, 48V – DC	12V, 24V, 48V – DC

The Future Energy Committee Considerations

Needs

- **Comprehensive Town wide energy assessment**
  - Optimal alternative energy production locations (small wind options, solar options, etc.)
  - Explore town owned parcels for potential alternative energy production (commercial tax revenue)
  - Municipal facilities energy audits/assessments/recommendations
  - Transfer Green Communities fuel use tracking to employees (reduce dependence on volunteer)
- **Develop policy for distribution of excess solar energy (important and urgent) revenue?**
  - What should the Town do with this future excess production? Examples:
    - Use credits to reduce school district costs for the Town's municipal school buildings?
    - Sell credits to other entities such as housing authority, BSU, ???
    - Use as revenue source for general fund?
- **Become EV (Electric Vehicle) ready under zoning; policy discussions on how**
- **Explore the safety needs for current and emerging energy storage systems (i.e., lithium battery spontaneous dissolution, fire, etc.)**

Uncertainties

- **Town commitment to energy conservation and production**
- **Role of the committee going forward**