Draft for Review

Facility Asset Management:
Tools to Design, Implement and Monitor Energy Efficiency Measures

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Background on Facility Asset Management

- Based on the fact that you cannot manage what you don't measure.
- Database tool to collect, organize and manage facility data.
- Includes all building systems such as structural, roofing, finishes, mechanical, electrical and plumbing.
- Builds in age, value and replacement cost to create Facility Condition Index (FCI)

Background on Facility Asset Management (cont.)

- Uses RS Means local costs for current value and future renewals.
- Powerful Capital Planning tool for project budgeting and scheduling.
- Includes utility data, both baseline and current, to calculate Energy Use Intensity (EUI) in kBTU/ft2 and to track trends.
- Organizes facility and portfolio data in reportable form for property managers and to present to administrators and grant agencies.

What Do We Do With The Data?

- Set benchmarks for individual buildings to track conditions over time.
- Set energy baselines to watch for change or track improvements.
- Compare buildings against each other to prioritize capital improvements and energy projects.
- Inventory and assess buildings to provide data for re-design or replacement efforts or studies. (Public Library, Zoo)

FCI DEFINITION

Facility Condition Index (FCI)…is used in facilities management to provide a benchmark to compare the relative condition of a group of facilities.

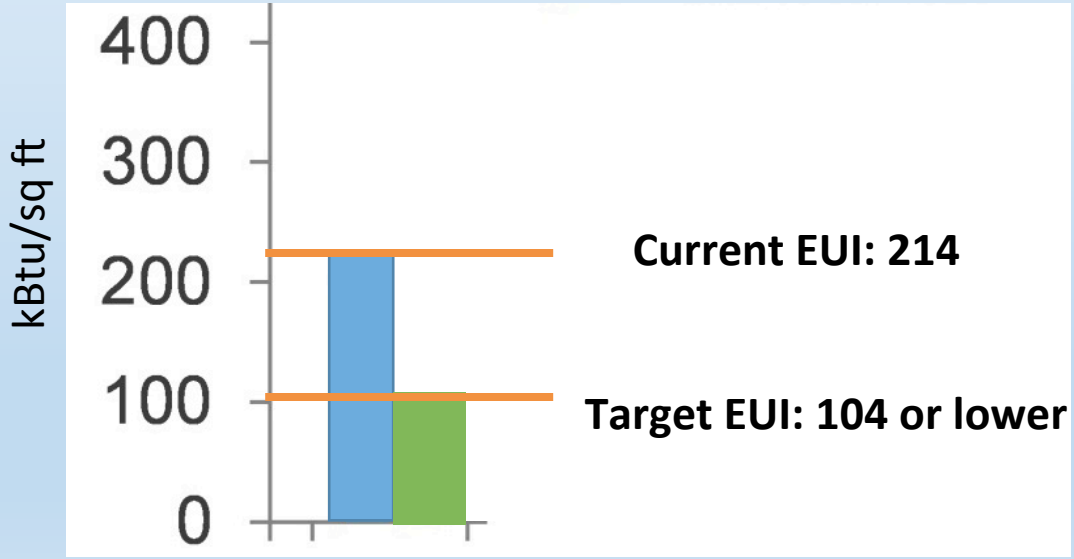
$$FCI = \frac{\$ \text{ to Modernize}}{\$ \text{ to Replace}}$$

.60 Creekside Community Center

EUI DEFINITION

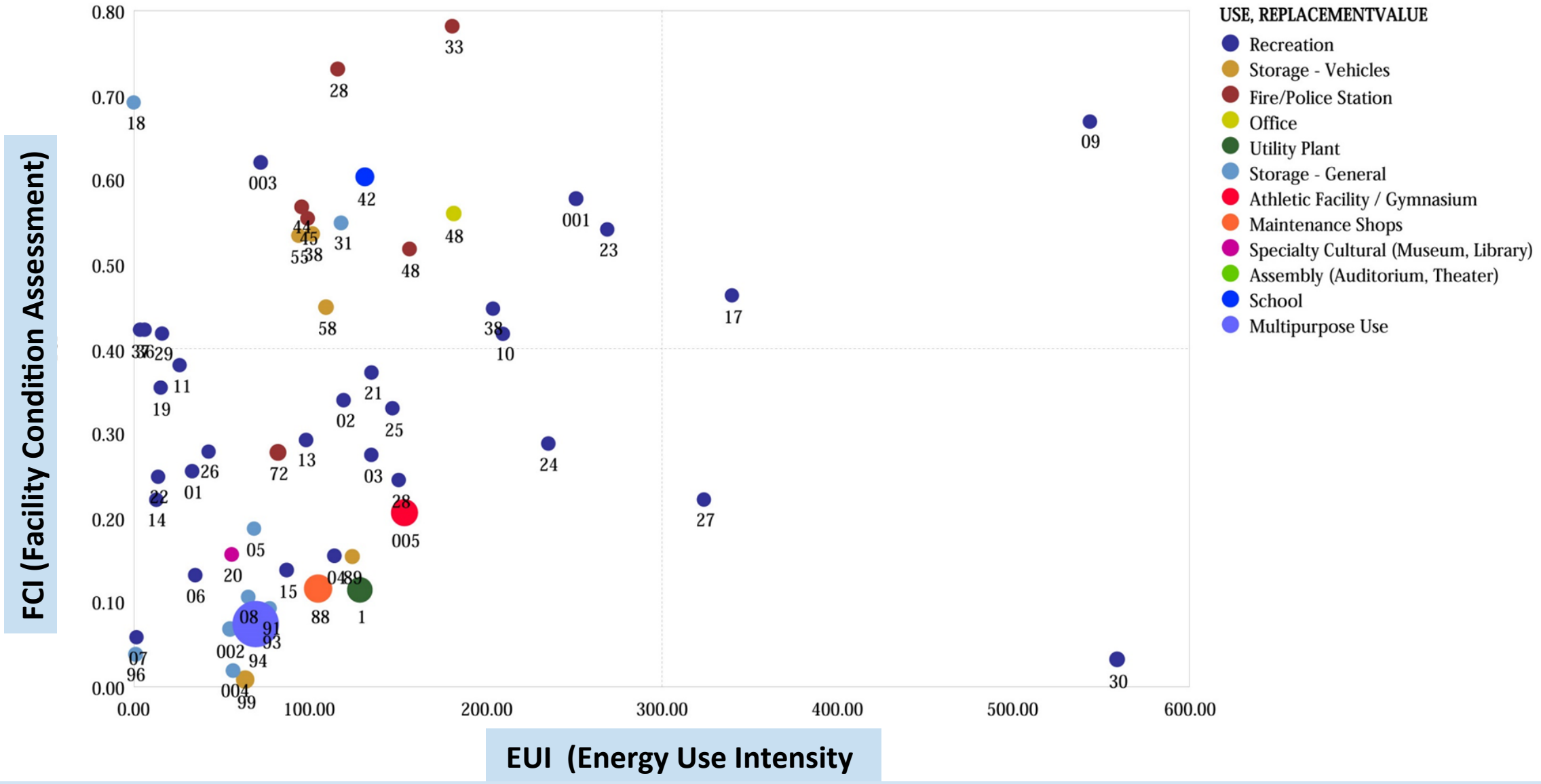
Energy Use Index(EUI)…expresses a building's energy efficiency compared to its size and patterns of operation.

$$EUI = \frac{\text{Energy Use}}{\text{Building Area}}$$



EUI vs. FCI Scatterplot

FCI (Facility Condition Index) 0 = NEW, 1 = NEEDS REPLACEMENT
EUI (Energy Use Intensity) kBTU per square foot

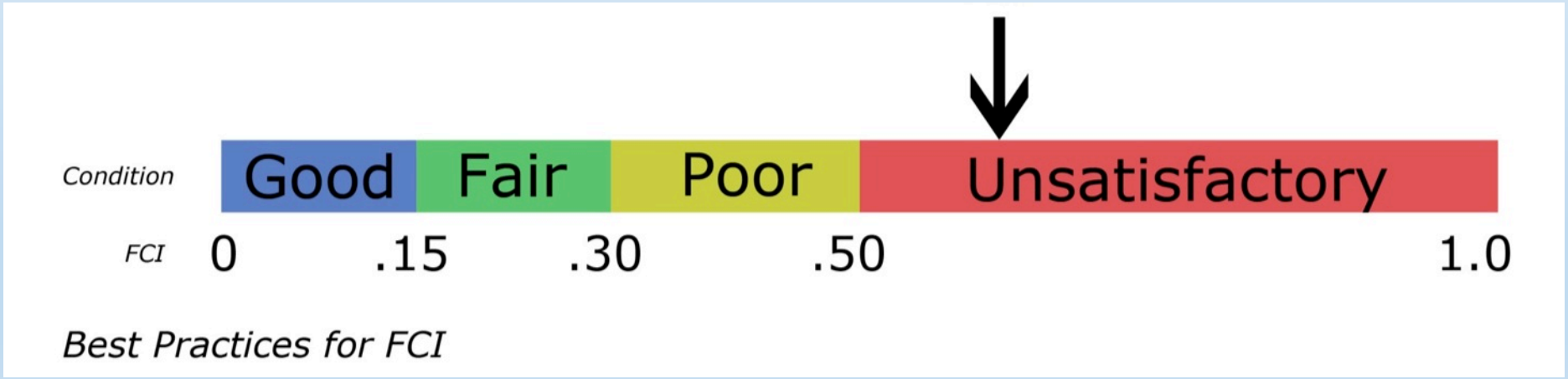


Background Information | Existing Facility Data

Facility Condition Index (FCI)…is used in facilities management to provide a benchmark to compare the relative condition of a group of facilities.

$$FCI = \frac{\$ \text{ to Modernize}}{\$ \text{ to Replace}}$$

.64 *(NOC 2015 Data)*



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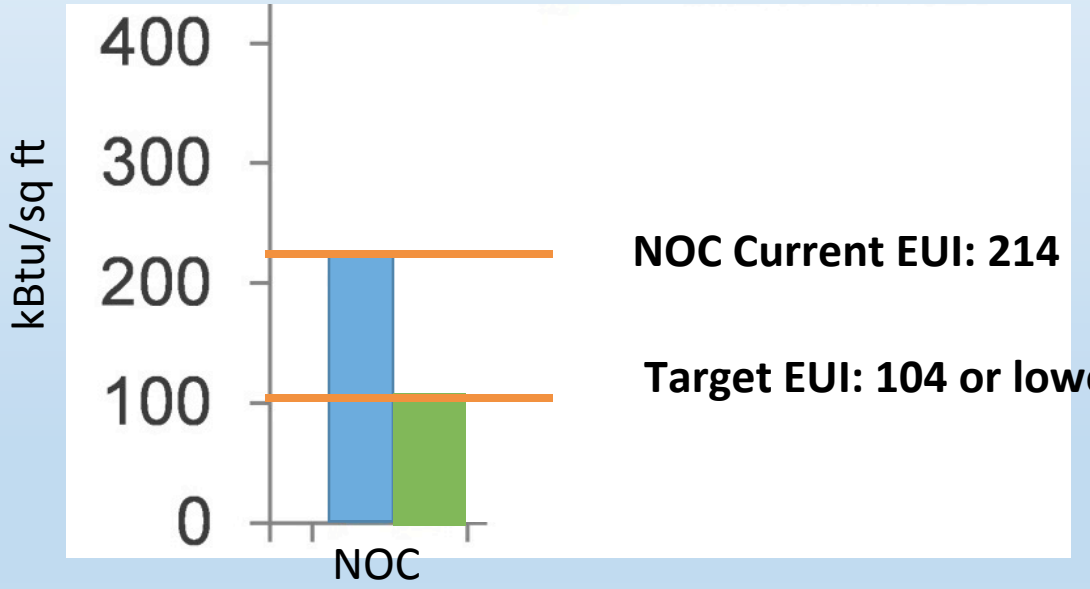
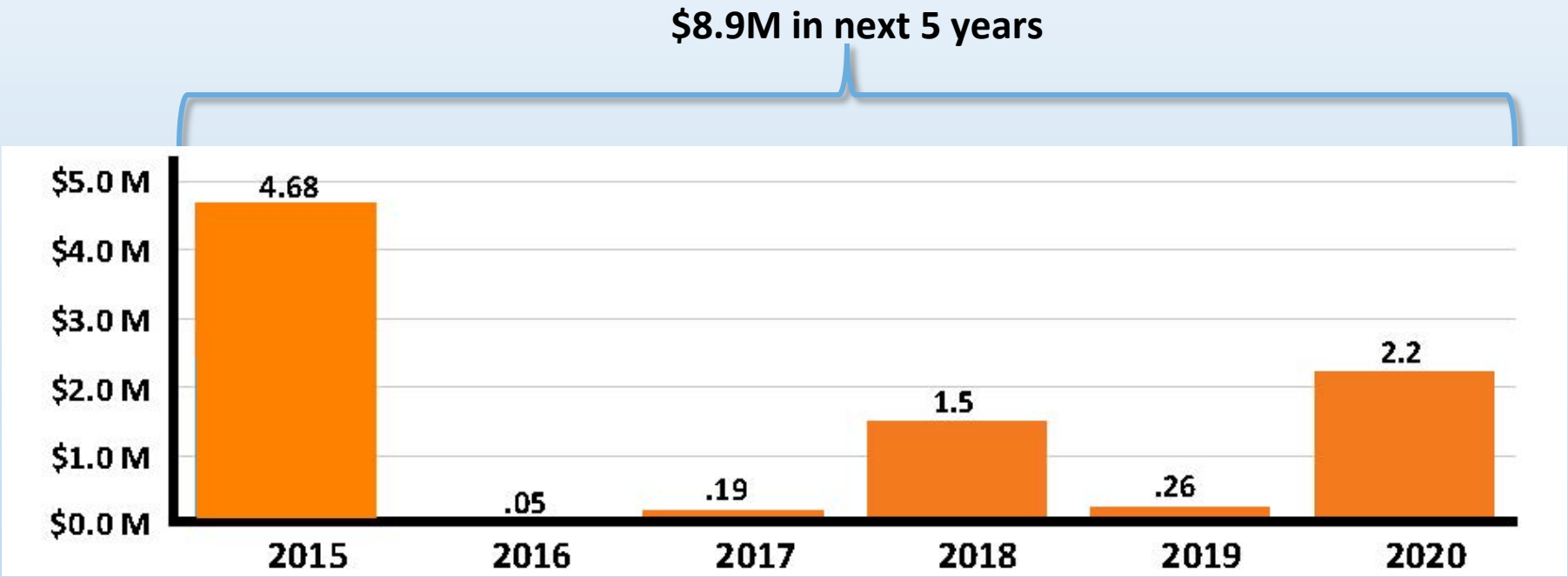


NOC Current EUI: 214 *(NOC 2015 Data)*

Target EUI: 104 or lower

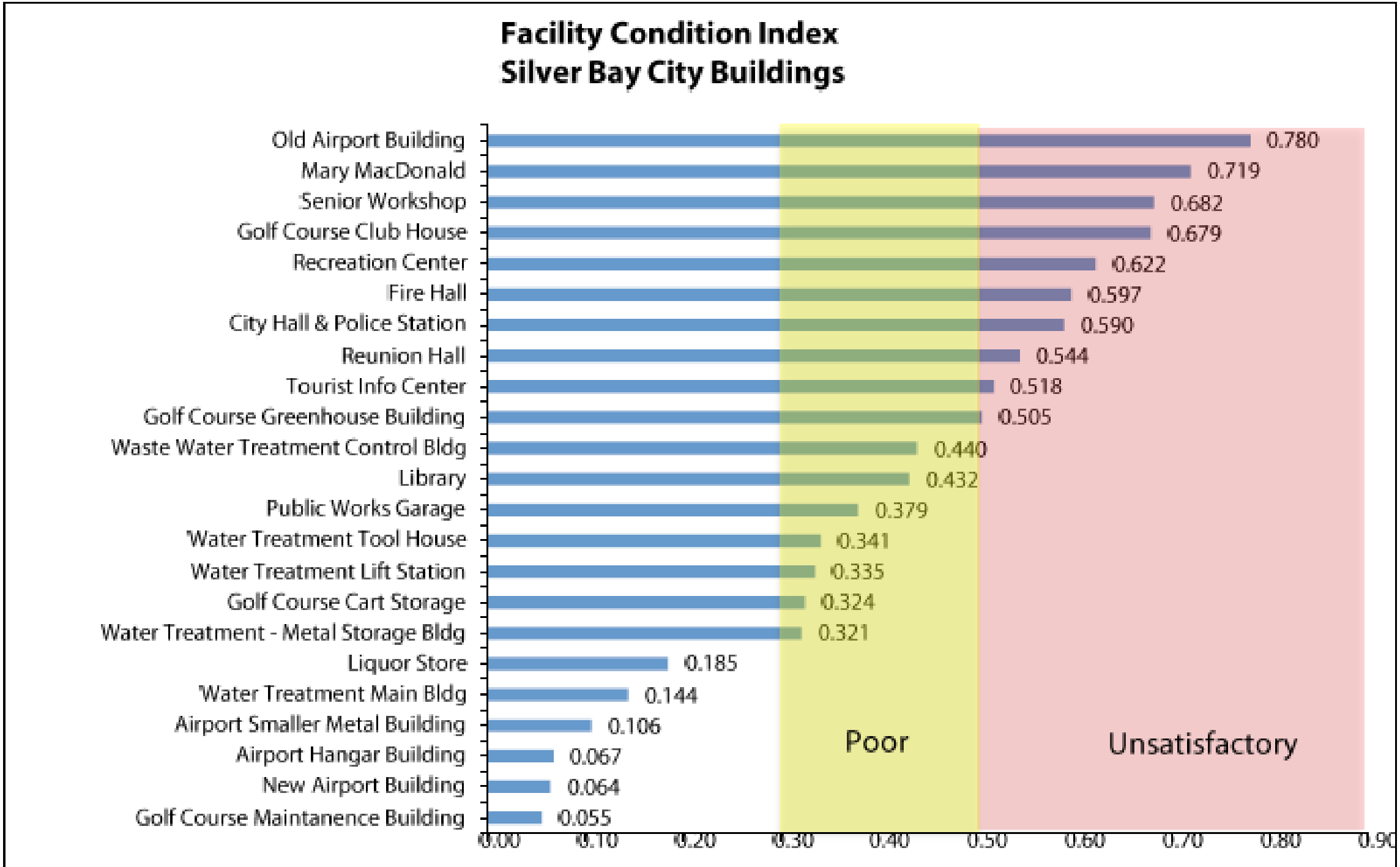
Background Information | Existing Facility Data

Summary of Funding Needed



HIGHEST FCI (WORST CONDITION)

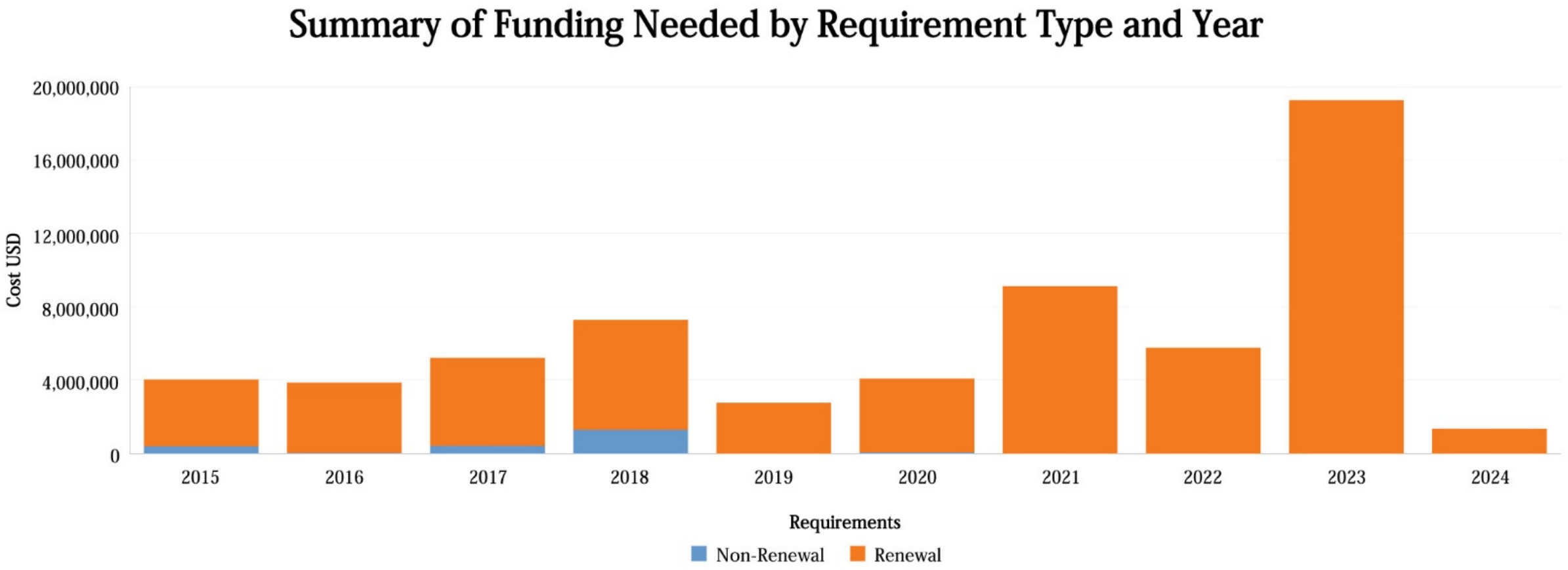
Asset	Number	Year Constructed	Age	Use	Size	Replacement Value	FCI Cost	FCI	RI Cost	RI	EUI
Fire Station #4	33	1970	45	Fire/Police Station	4,429	642,227	501,083	0.78	528,542	0.82	181.55
Fire Station #3	28	1966	49	Fire/Police Station	6,624	933,918	681,362	0.73	837,875	0.90	116.46
Northcrest-Park Structure	18	1960	55	Storage - General	448	55,672	38,414	0.69	38,414	0.69	0.47
Dred-Wheel	09	1975	40	Recreation	1,324	291,855	194,775	0.67	218,795	0.75	544.09
Hyland Golf Course-Club House	003	2001	14	Recreation	2,850	498,443	308,560	0.62	317,470	0.64	72.68
Creekside Community Center	42	1960	55	School	25,137	5,882,792	3,541,522	0.60	3,550,766	0.60	131.89
Dwan Golf Course-Club House	001	1970	45	Recreation	4,434	787,461	453,707	0.58	453,707	0.58	251.96
Fire Station #5	44	1975	40	Fire/Police Station	5,315	736,679	417,290	0.57	444,749	0.60	95.99

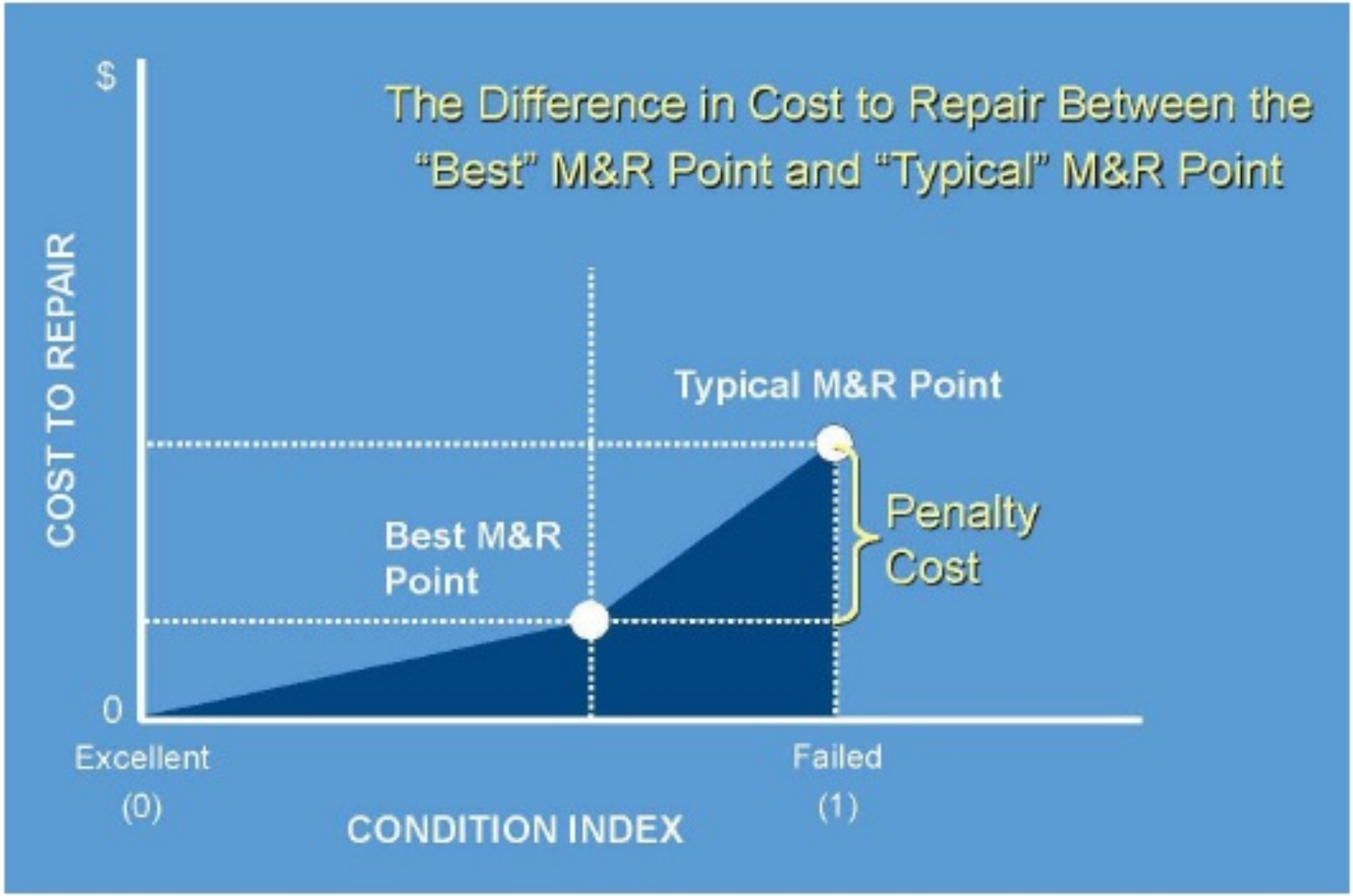

Facility Condition Index
Silver Bay City Buildings
Old Airport Building
Mary MacDonald
Senior Workshop
Golf Course Club House
Recreation Center
Fire Hall
City Hall & Police Station
Reunion Hall
Tourist Info Center
Golf Course Greenhouse Building
Waste Water Treatment Control Bldg
Library
Public Works Garage
Water Treatment Tool House
Water Treatment Lift Station
Golf Course Cart Storage
Water Treatment - Metal Storage Bldg
Liquor Store
Water Treatment Main Bldg
Airport Smaller Metal Building
Airport Hangar Building
New Airport Building
Golf Course Maintanence Building
0.780
0.719
0.682
0.679
0.622
0.597
0.590
0.544
0.518
0.505
0.440
0.432
0.379
0.341
0.335
0.324
0.321
0.185
0.144
0.106
0.067
0.064
0.055
Poor
Unsatisfactory
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90

OVERALL FUNDING NEEDS

Currency: USD Period: 10 years Inflation: 4.70%

The current year is always the Period start date. If "Include past due Action Dates/Renewals" is selected, the cost of those past due Requirements is included in the current year cost.




The Difference in Cost to Repair Between the "Best" M&R Point and "Typical" M&R Point
$
COST TO REPAIR
Typical M&R Point
Penalty Cost
Best M&R Point
0
Excellent
(0)
Failed
(1)
CONDITION INDEX

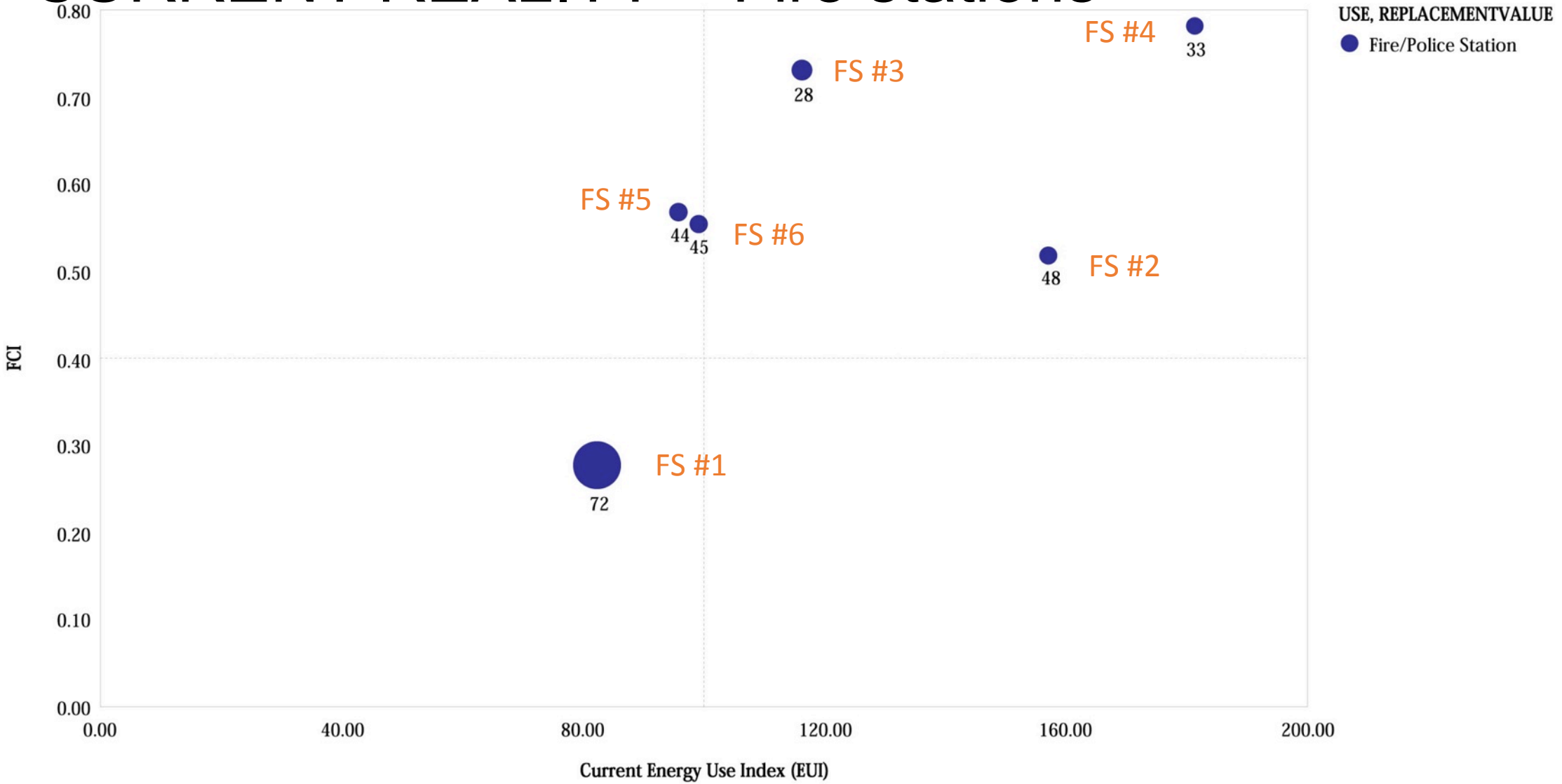
HIGHEST EUI (WORST ENERGY PERFORMANCE)

Asset	Number	Year Constructed	Age	Use	Size	Replacement Value	FCI Cost	FCI	RI Cost	RI	EUI
Family Aquatic Bath House	30	1971	44	Recreation	7,504	1,831,069	56,952	0.03	56,952	0.03	559.54
Dred-Wheel	09	1975	40	Recreation	1,324	291,855	194,775	0.67	218,795	0.75	544.09
Mt Normandale-Restroom	17	1979	36	Recreation	378	119,651	55,249	0.46	79,270	0.66	340.55
Sunrise-Park Structure	27	1991	24	Recreation	1,006	234,338	51,594	0.22	75,615	0.32	324.64
Running-Park Structure	23	1963	52	Recreation	924	224,995	121,445	0.54	145,466	0.65	269.68
Dwan Golf Course-Club House	001	1970	45	Recreation	4,434	787,461	453,707	0.58	453,707	0.58	251.96
Smith-Park Structure	24	1975	40	Recreation	1,134	324,101	92,828	0.29	116,849	0.36	236.21
Gene Kelley-Park Structure	10	1966	49	Recreation	1,196	237,430	98,827	0.42	122,847	0.52	210.36

CURRENT REALITY BY DEPARTMENT

- Fire Stations
- Main Buildings
- Parks
- Recreation Facilities
- Water Treatment

CURRENT REALITY – Fire stations



CURRENT REALITY – Fire stations

Currency: USD Period: 10 years Inflation: 4.70%

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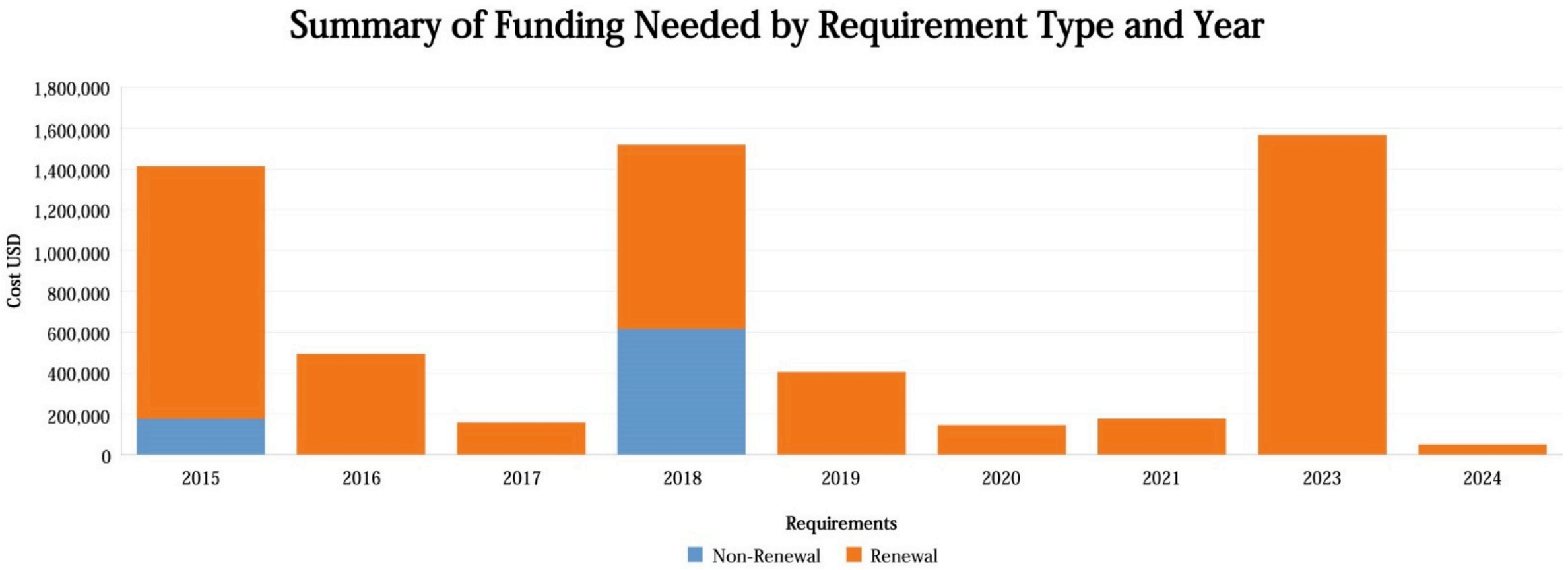
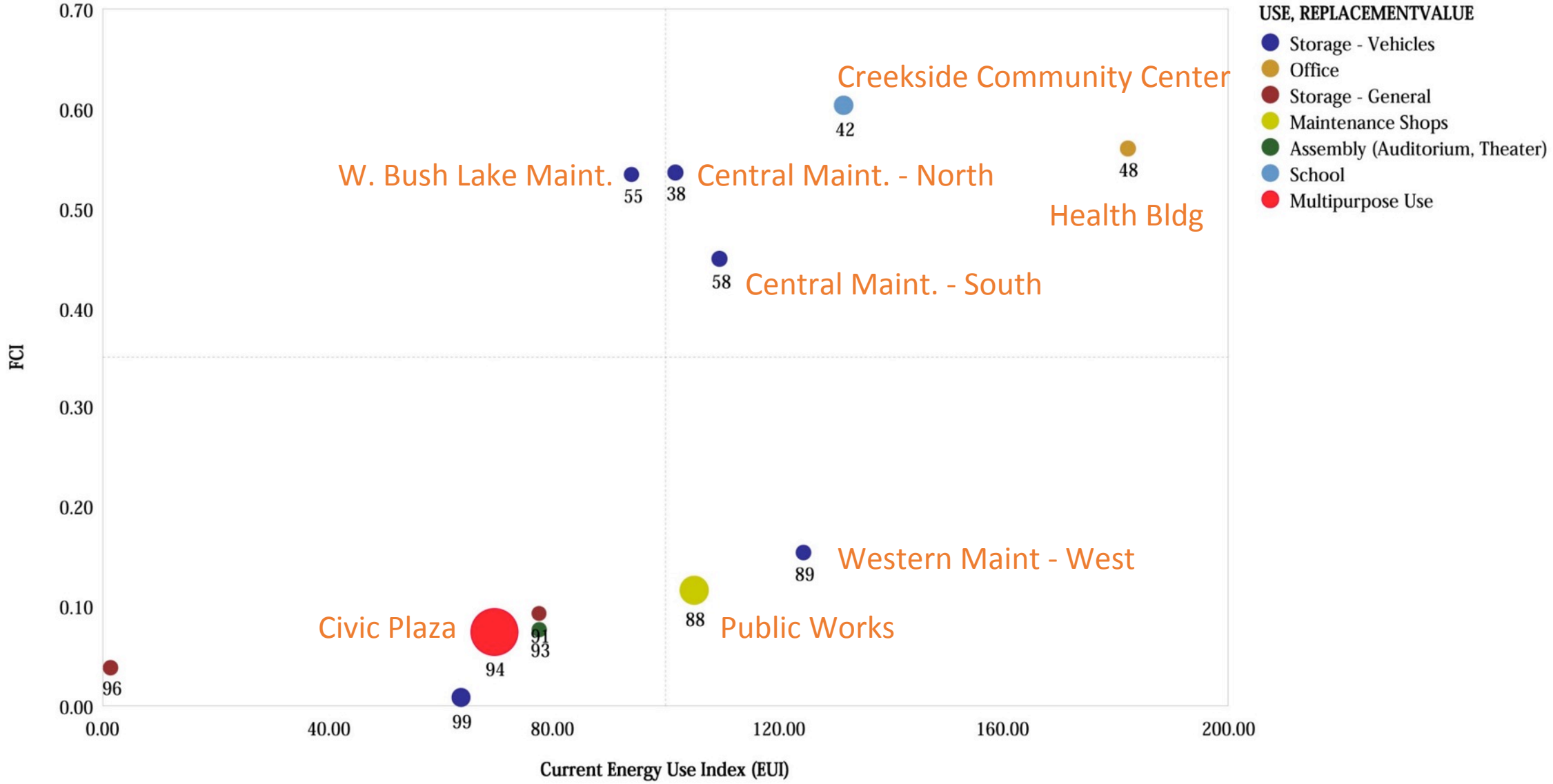


CURRENT REALITY – Main Buildings



CURRENT REALITY – Main Buildings

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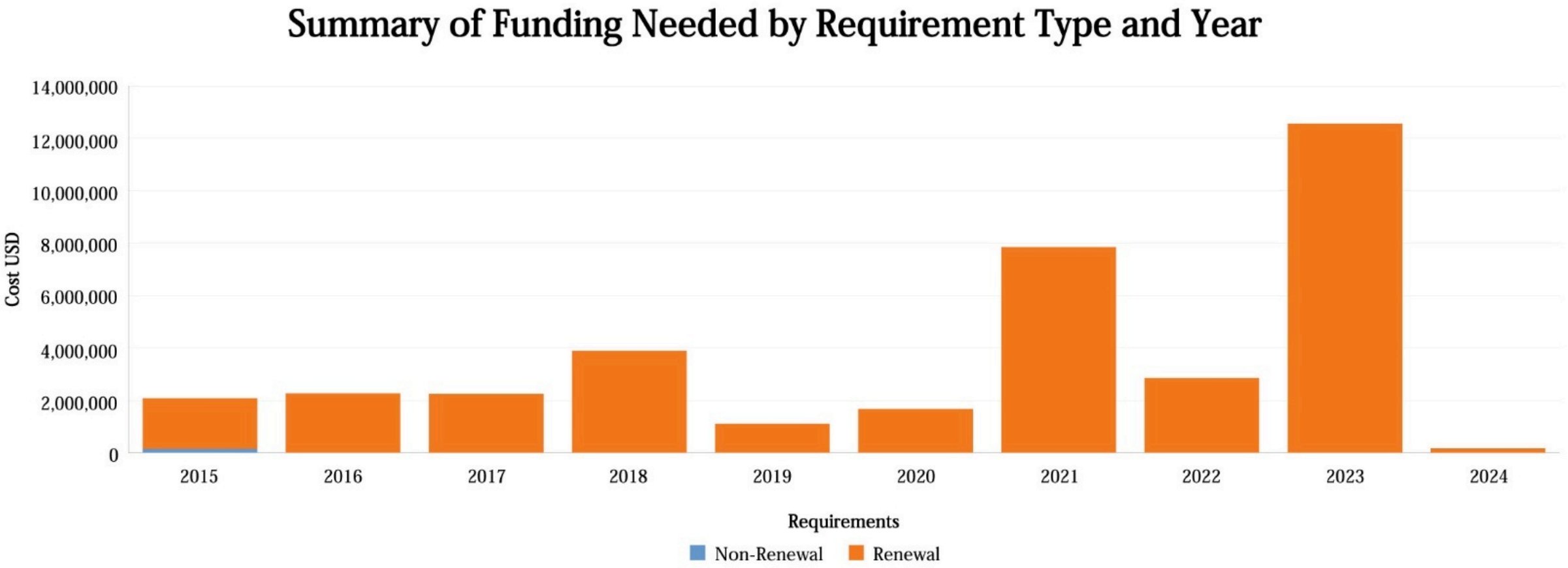


With a Focus on Energy

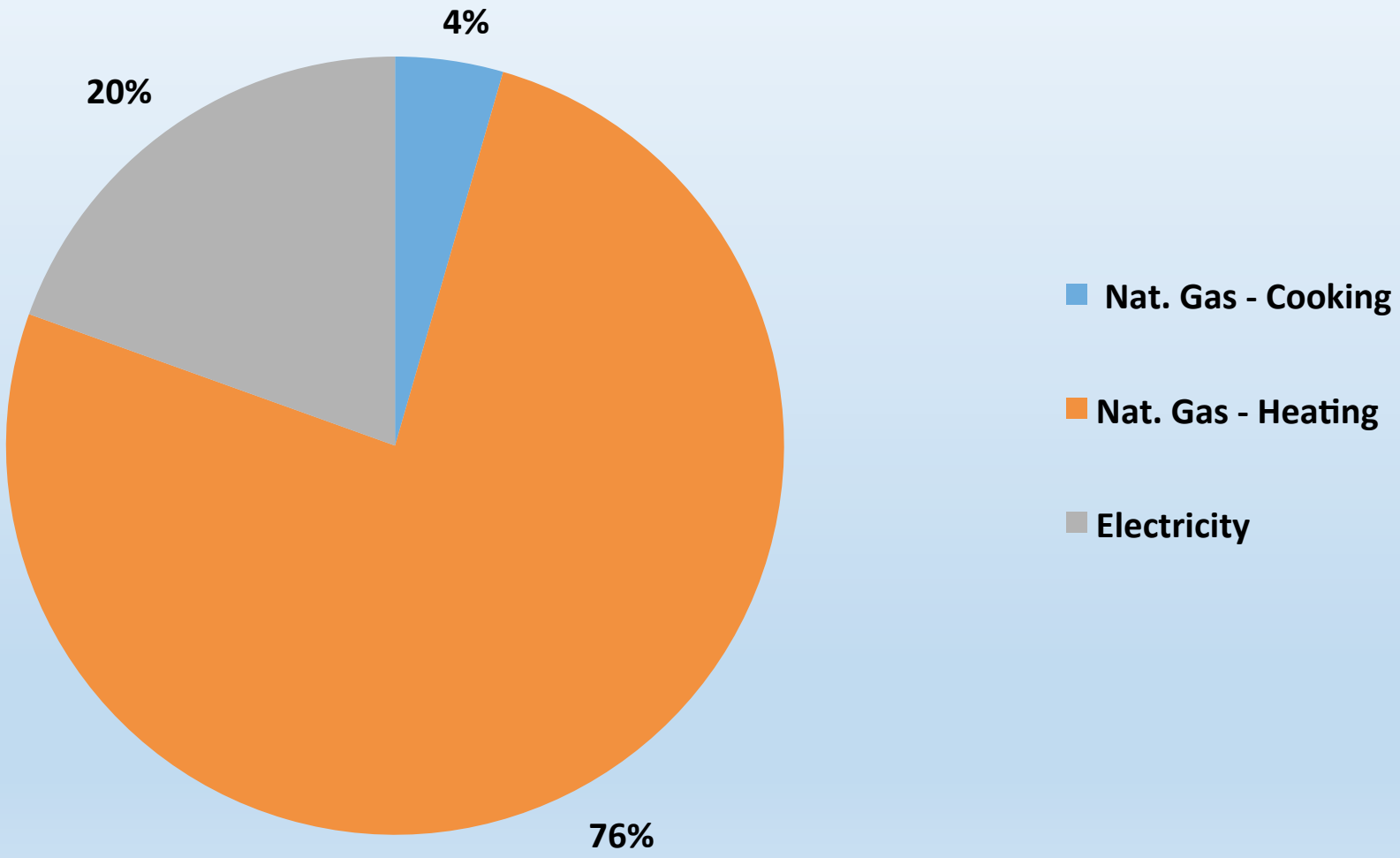
- Utility data is collected for up to 10 years if available.
- Sub-metering is used to learn more about energy load profiles.
- On-site renewable production data is also merged into utility data.
- Long range trends are important to really understand the full story.
- Comparison of buildings across portfolio helps prioritize energy saving efforts.

						UTILITY DATA								
			Therms Cooking	Therms Heating	kWh Electricity		kBTU Nat. Gas - Cooking	kBTU Nat. Gas - Heating	kBTU Electricity		Cost Nat. Gas - Cooking	Cost Nat. Gas - Heating	Cost Electricity	
	2004	Jan-04	100.00	3,194.00	8,960.00		10,000.00	319,400.00	30573		$81.00	$2,095.00	$625.00	
	2004	Feb-04	92.00	3,377.00	11,520.00		9,200.00	337,700.00	39308		$78.00	$2,380.00	$829.00	
	2004	Mar-04	81.00	1,959.00	10,800.00		8,100.00	195,900.00	36851		$73.00	$1,446.00	$784.00	
	2004	Apr-04	87.00	1,388.00	8,960.00		8,700.00	138,800.00	30573		$74.00	$1,015.00	$659.00	
	2004	May-04	76.00	767.00	8,160.00		7,600.00	76,700.00	27843		$64.00	$571.00	$550.00	
	2004	Jun-04	83.00	388.00	8,400.00		8,300.00	38,800.00	28662		$74.00	$350.00	$631.00	
	2004	Jul-04	62.00	97.00	7,600.00		6,200.00	9,700.00	25932		$60.00	$146.00	$524.00	
	2004	Aug-04	62.00	2.00	8,160.00		6,200.00	200.00	27843		$57.00	$76.00	$571.00	
	2004	Sep-04	65.00	17.00	8,400.00		6,500.00	1,700.00	28662		$63.00	$86.00	$609.00	
	2004	Oct-04	67.00	218.00	6,080.00		6,700.00	21,800.00	20746		$53.00	$200.00	$476.00	
	2004	Nov-04	87.00	824.00	7,520.00		8,700.00	82,400.00	25659		$73.00	$625.00	$545.00	
	2004	Dec-04	91.00	1,830.00	8,720.00		9,100.00	183,000.00	29754		$87.00	$1,506.00	$616.00	

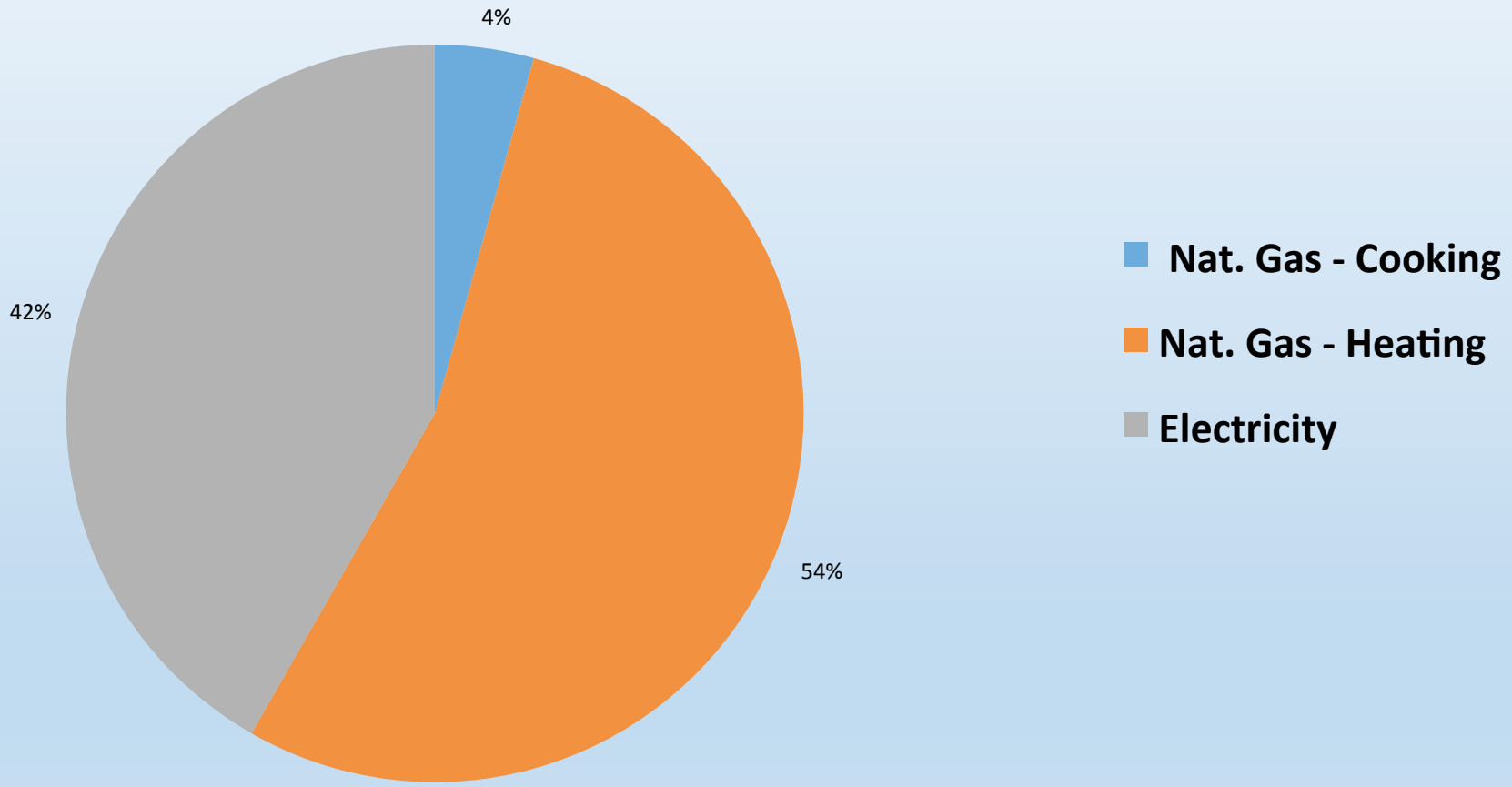
Energy Data Analysis

- Sorting data helps tell the story by various perspectives.
- Sorting by energy unit normalizes against cost fluctuations.
- Sorting by cost helps in efforts to control costs.
- Normalizing against weather patterns helps identify anomalies.
- Mapping out trends can tell a rich story about a facilities energy use.

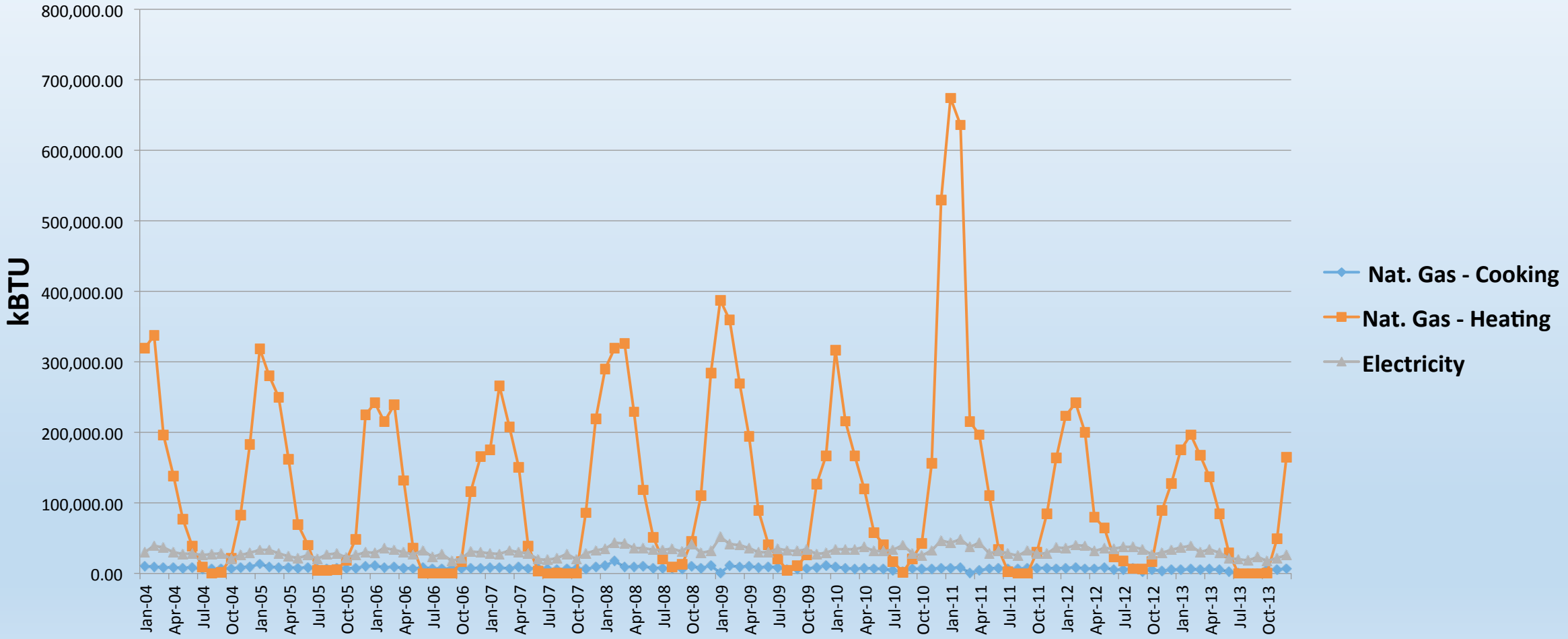
Energy Use Breakdown By kBTU
1/2004 - 12/2013



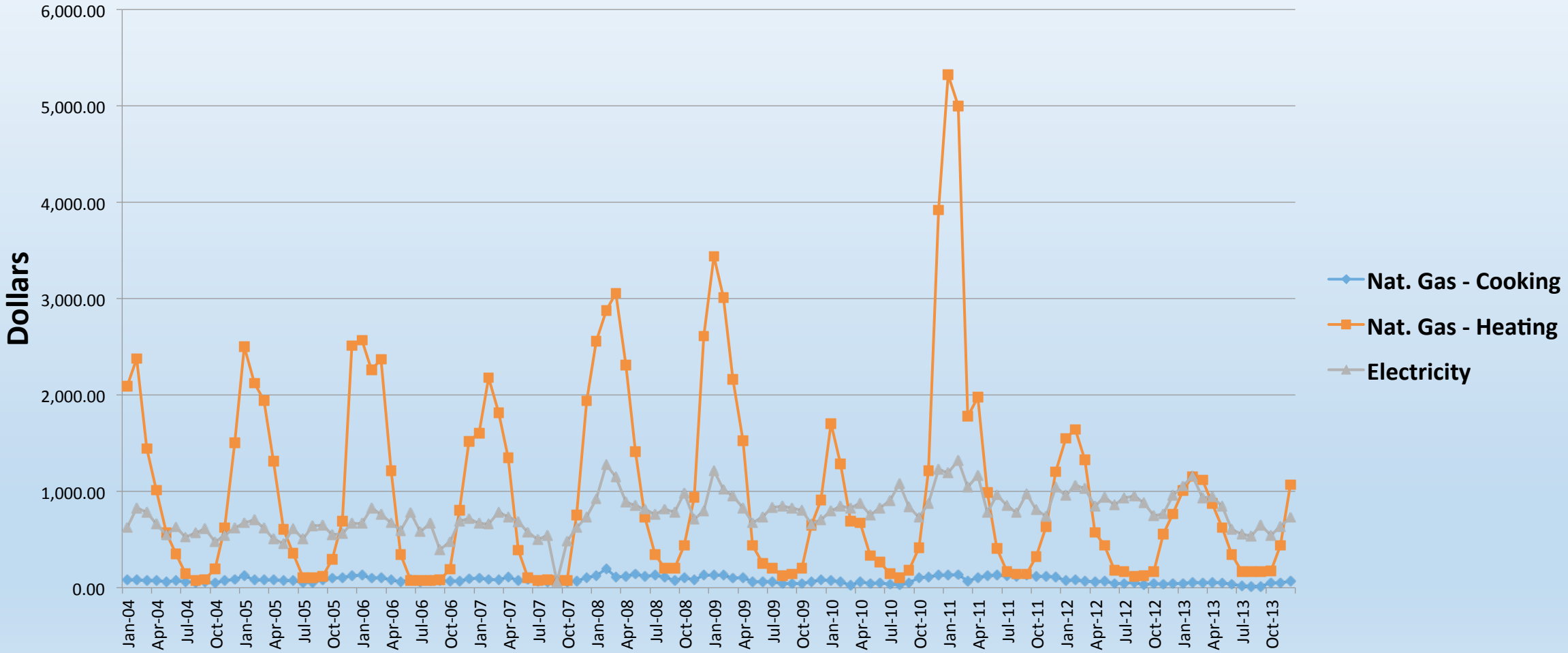
Energy Use Breakdown By Cost
1/2004 - 12/2013



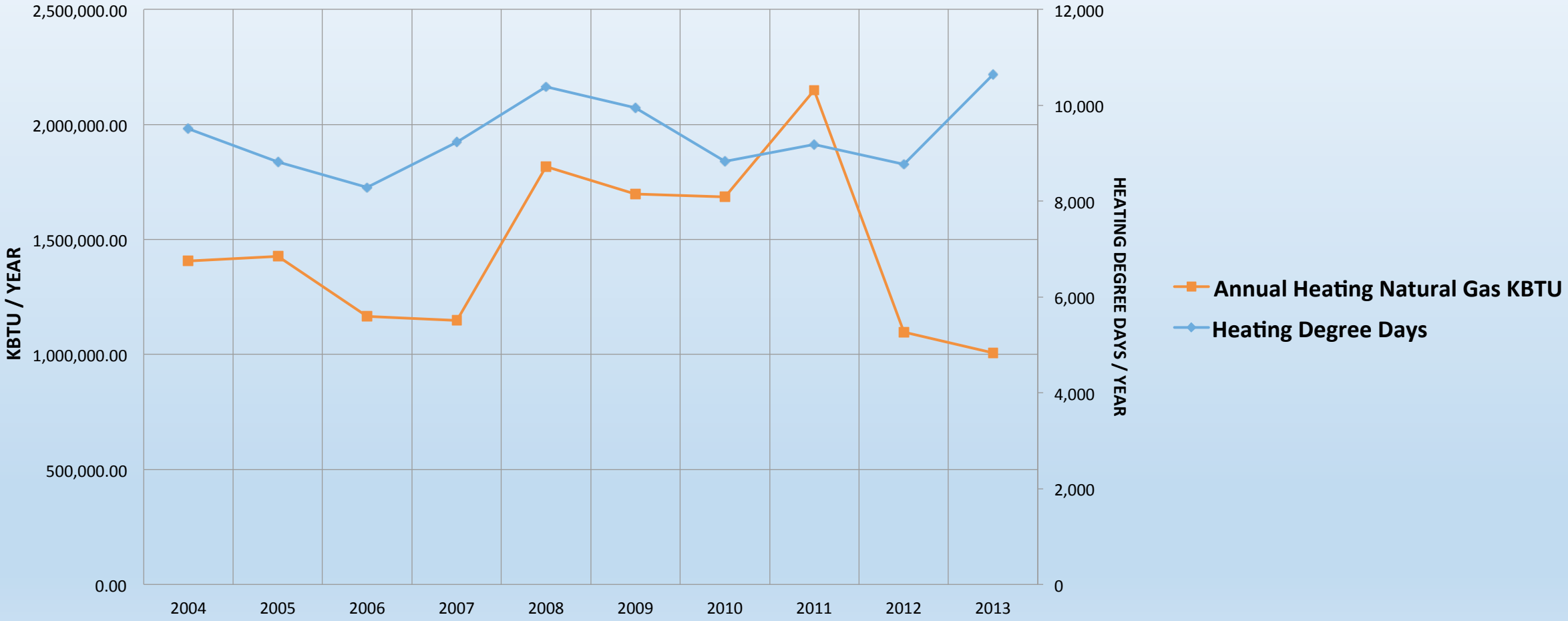
Energy Trends 1/2004 - 12/2013
By kBTU



Energy Trends 1/2004 - 12/2013
By Cost



Heating Energy Trends 2004 - 2013
Annual KBTU VS. Heating Degree Days



Integrated Approach – Pilot Project

- Current project in 26,000 ft2 City of Duluth multiple use facility
- Re-commissioning of HVAC systems
- Air-tightness testing in 4 stages using multiple blower doors
- Electrical and gas sub-metering to narrow focus of efforts
- Enhanced Interactive O&M Manual pilot project


City Center West Campus
Legend
5830 Grand Ave
Community Room
Bldg Area: 25,991 sqft
Estimated Property Area: 73,350 sqft
5830 Grand Ave
Library
Fire Hall
Police
Google earth
©2015 Google
N
200 ft

Example of Electrical Demand Controller for Load Curtailment

Courtesy of Energy Sentry

Site Energy versus Source Energy

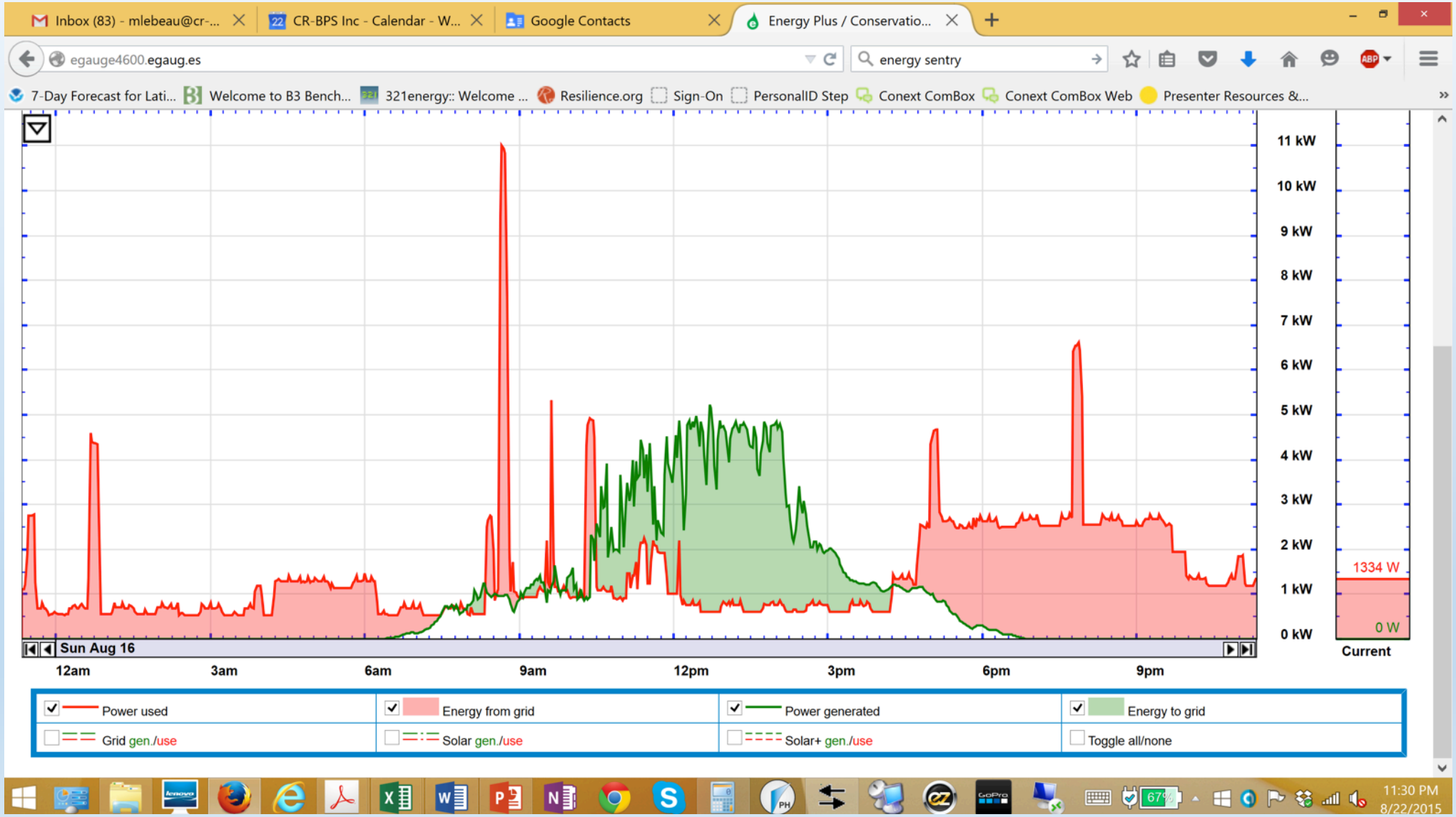
- What we measure at the meter, or sub-meter, is **Site Energy**.
- **Site Energy** represents the performance of the building and loads.
- **Source Energy** is the amount of energy that goes into production, transmission and distribution.
- Many programs, such as PH, requires the calculation of **Source Energy.**

Source-Site Ratios of Various Fuels (EPA 2013)

*(Electrical values vary regionally, and over time, as the generation fuel mix shifts)

Energy Type	U.S. Ratio *	Canadian Ratio
Electricity (Grid Purchase)*	3.16 *	2.05
Electricity (on-Site Solar or Wind Installation)	1	1
Natural Gas	1.05	1.02
Fuel Oil (1,2,4,5,6,Diesel, Kerosene)	1.01	1.01
Propane & Liquid Propane	1.01	1.03
Steam	1.2	1.2
Hot Water	1.2	1.2
Chilled Water	1	0.71
Wood	1	1
Coal/Coke	1	1
Other	1	1

Monitoring demand and production to help users track energy balance and control loads



Thank You!

- Questions?