

SI-E3 Environmental Management Branch Energy and Water

Jonathan Haling, ASU Civil Engineering Major



Energy Use Index

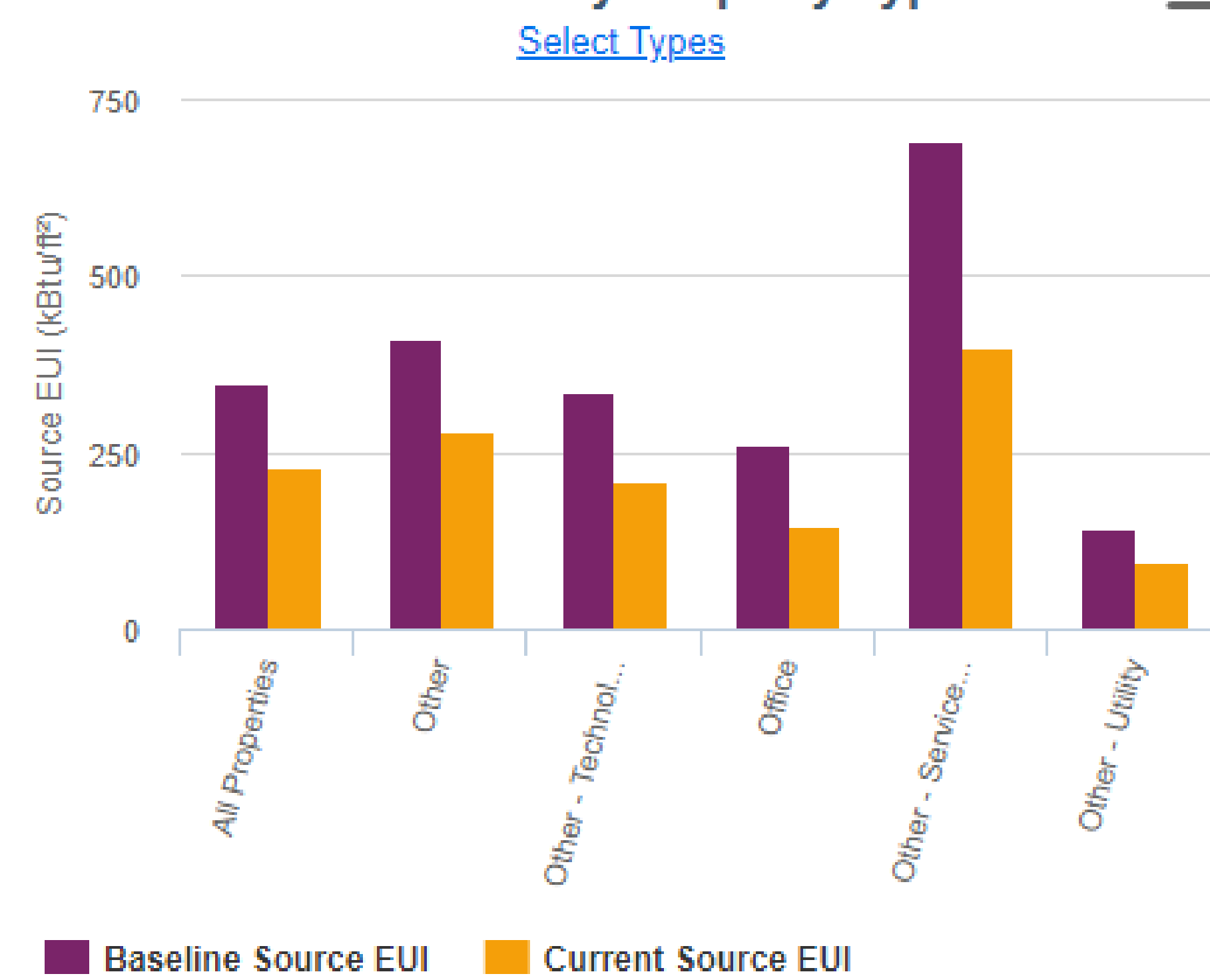
The Energy Use Index (EUI) is used as a metric to track a building's energy performance both in comparison to other buildings of similar type. There are two types of EUI. The basis of EUI is

$$EUI = \frac{kBTU \text{ of energy}}{\text{year}} \div \text{Square footage of the building}$$

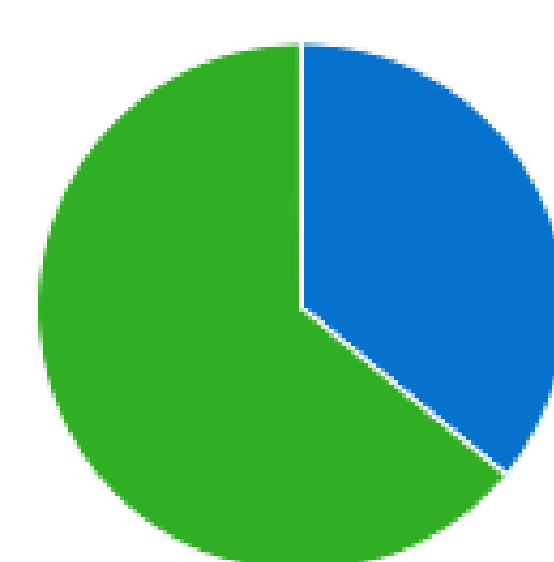
Site EUI- This value is the energy consumed as seen on an electric or natural gas bill
Source EUI- This is the value of energy consumed by all sources. This includes a building's solar power production, chill water, steam, and utility bills.

Site EUI is a good metric to determine the electrical energy use of the building, but source EUI is preferred as it give a better reflection of the energy use of the whole building

Source EUI by Property Type



KSC Properties Compared to the National Median Source EUI



■ Source EUI Equal to or Below the Median
■ Source EUI Above the Median

Propellants North



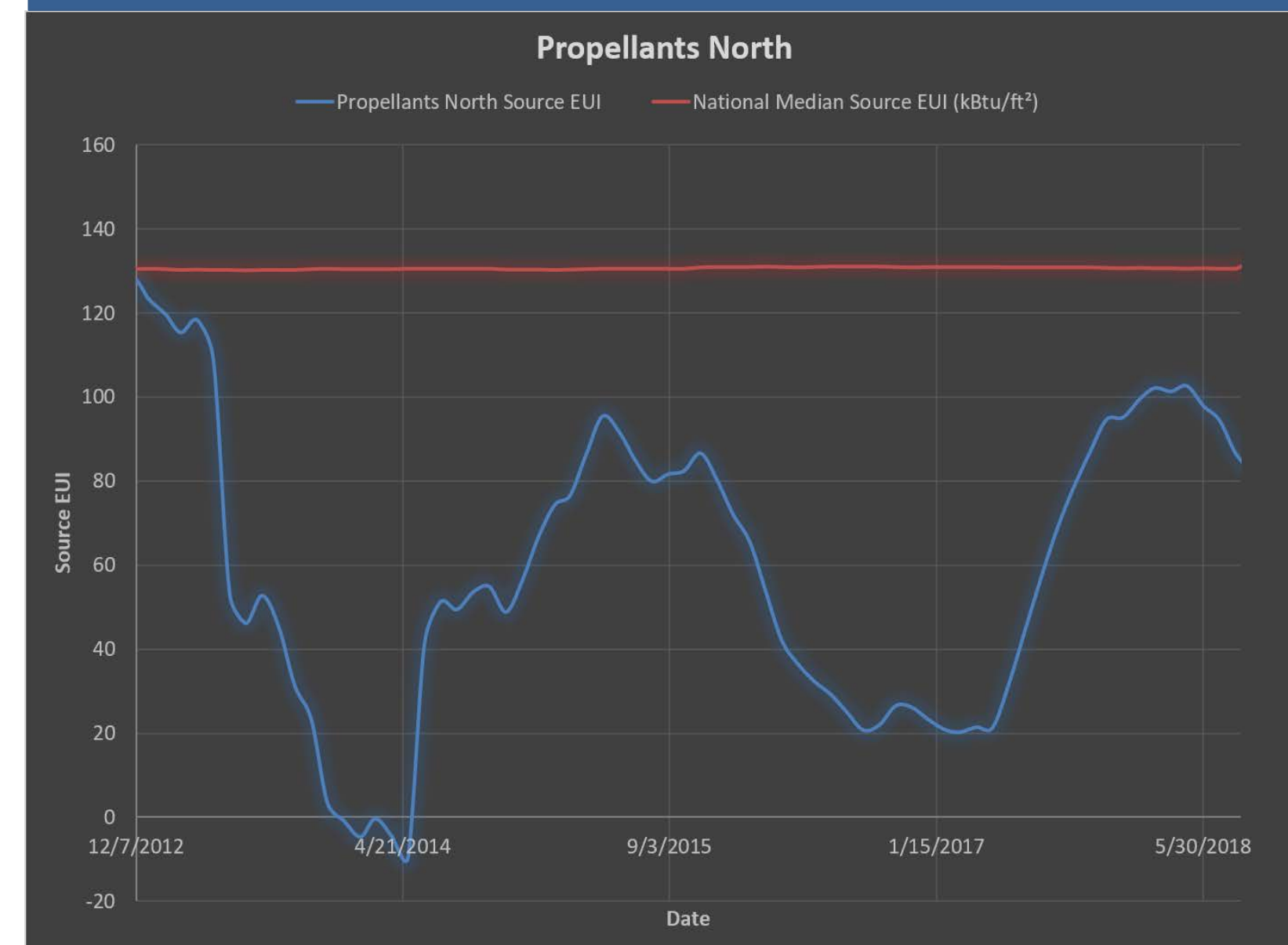
- Propellants north is KSC's only LEED platinum rated building
- The EUI for this building varies greatly but has been below the national average since its initial occupancy.
- The PV installed on the roof has had ongoing problems since its construction, failed inverters, blown fuses, weather damage and power supply failures
- Several systems used to achieve LEED platinum is no longer functioning as designed, for example there is a HVAC control system to adjust power based off of occupancy but has malfunctioned and is now operated in manual
- Propellants North was an excellent test case for building green office space as well as a source of lessons learned for future projects

Fire Station #1



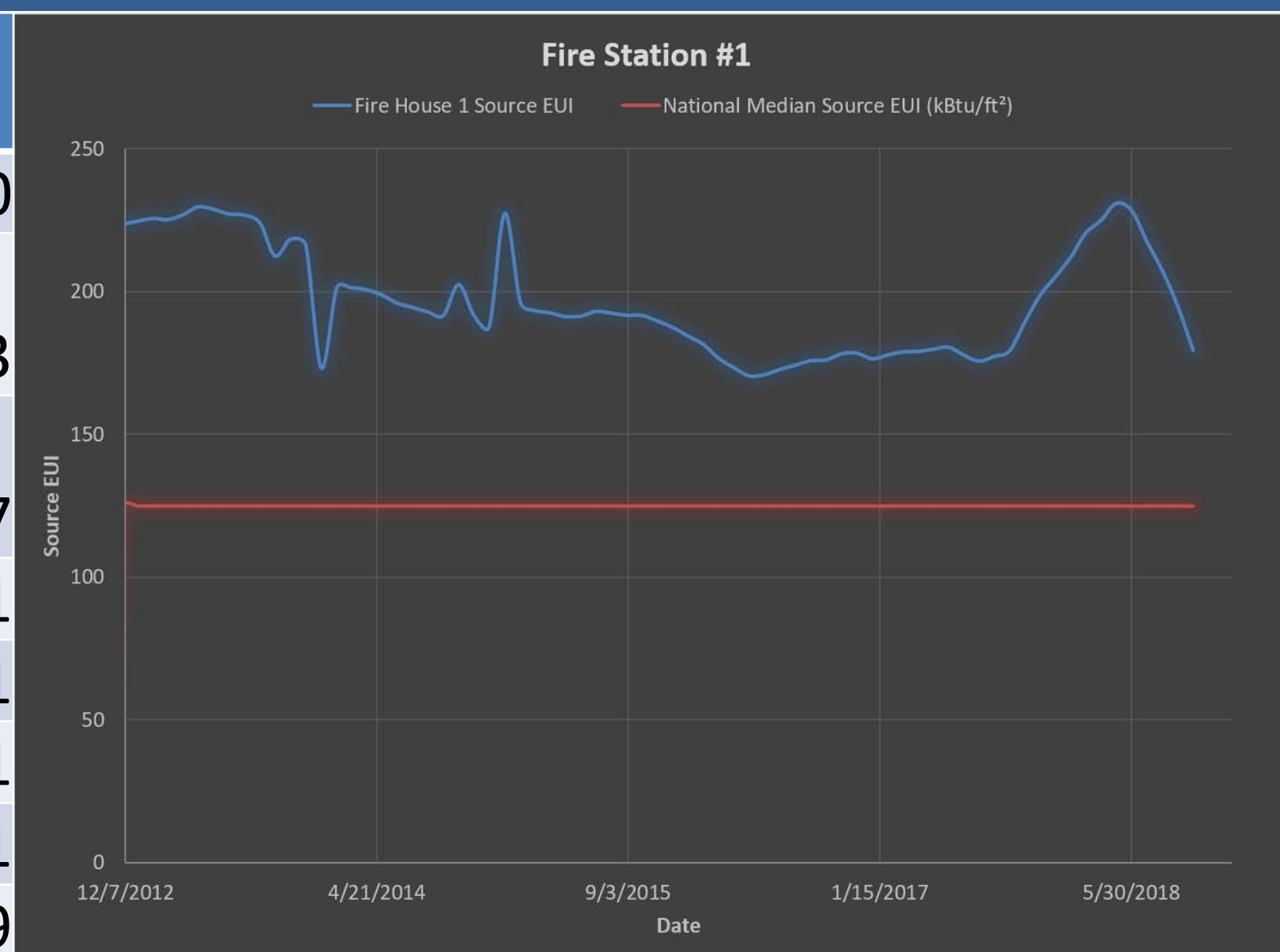
- There are 3 fire stations located at Kennedy Space Center and all three have unusually high EUIs.
- Fire station 1 was built in 1964 and is a concrete block construction
- There are many ECMs associated with Fire Station 1 most associated with HVAC and its associated boiler
- One of the difficulties in this building is the lack of insulations, the building was constructed using hollow concrete blocks with no insulation inside, as well as many sun facing windows.
- Although the HVAC systems were replaced in 2012, they were replaced with old designs without new energy conservation requirements
- This building would be an excellent test case to apply pilot projects such as an open loop geothermal heat pump

EUI Graphs and Comparisons



Propellants North Average Source EUI 60.7

Building	2019 Source EUI
Security Gate 2	1,206.90
Occupational Health	529.3
Security Patrol Headquarters	266.7
Fire Station 2	188.1
OSB 2	136.1
Fire Station 1	121.1
OSB 1	81.1
Hangar N	68.9



Fire Station #1 Average Source EUI 195.4

ENERGY STAR PortfolioManager® Technical Reference

U.S. National Median Reference Values for All Portfolio Manager Property Types

Broad Category	Primary Function	Further Breakdown (where needed)	Source EUI (kBtu/ft²)	Site EUI (kBtu/ft²)	Reference Data Source - Peer Group Comparison	
Banking/Financial Services	Bank Branch*		209.9	88.3	CBECs - Bank/Financial	
	Financial Office*		116.4	52.9	CBECs - Office & Bank/Financial	
	Adult Education		110.4	52.4	CBECs - Education	
	College/University		180.6	84.3	CBECs - College/University	
Education	K-12 School*		104.4	48.5	CBECs - Elementary/Middle & High School	
	Pre-school/Daycare		131.5	64.8	CBECs - Preschool	
	Vocational School		110.4	52.4	CBECs - Education	
	Other - Education					
	Convention Center		109.6	56.1	CBECs - Social/Meeting	
	Movie Theater					
Entertainment/Public Assembly	Museum		112.0	56.2	CBECs - Public Assembly	
	Performing Arts					
	Recreation	Bowling Alley				
		Fitness Center/Health Club/Gym				
		Ice/Curling Rink		112.0	50.8	CBECs - Recreation
		Roller Rink				
Swimming Pool						
Other - Recreation						
Social/Meeting Hall		109.6	56.1	CBECs - Social/Meeting		
Healthcare	Ambulatory Surgical Center		138.3	62.0	CBECs - Outpatient Healthcare	
	Hospital	Hospital (General Medical & Surgical)*	426.9	234.3	Industry Survey	
		Other/Specialty Hospital	433.9	206.7	CBECs - Inpatient Healthcare	
	Medical Office*		121.7	51.2	CBECs - Medical Office	
	Outpatient Rehabilitation/Physical Therapy		138.3	62.0	CBECs - Outpatient Healthcare	
	Residential Care Facility		213.2	99.0	Industry Survey	
	Senior Care Community*		213.2	99.0	Industry Survey	
	Urgent Care/Clinic/Other Outpatient		145.8	64.5	CBECs - Clinic/Outpatient	
	Barracks*		107.5	57.9	CBECs - Dormitory	
	Hotel*		146.7	63.0	CBECs - Hotel & Motel/Inn	
Multifamily Housing*		118.1	59.6	Fannie Mae Industry Survey		
Lodging/Residential	Prison/Incarceration		156.4	69.9	CBECs - Public Order and Safety	
	Residence Hall/Dormitory*		107.5	57.9	CBECs - Dormitory	
	Residential Care Facility		213.2	99.0	Industry Survey	
	Senior Care Community*		213.2	99.0	Industry Survey	
	Single Family Home		N/A	N/A	None Available	
	Other - Lodging/Residential		143.6	63.6	CBECs - Lodging	
Manufacturing/Industrial	Manufacturing/Industrial Plant		N/A	N/A	None Available	
	Mixed Use Property		89.3	40.1	CBECs - Other	
Office	Medical Office*		121.7	51.2	CBECs - Medical Office	
	Office*		116.4	52.9	CBECs - Office & Bank/Financial	
	Veterinary Office		145.8	64.5	CBECs - Clinic/Outpatient	
Parking	Parking		N/A	N/A	None Available	
	Courthouse*		211.4	101.2	CBECs - Courthouse	
Public Services	Drinking Water Treatment & Distribution (Average EUI presented in Energy per Gallon per day)		5.90	2.27	AWWA - Water Treatment Plant	
	Fire Station		124.9	63.5	CBECs - Fire Station/Police Station	
	Library		143.6	71.6	CBECs - Library	
	Mailing Center/Post Office		96.9	47.9	CBECs - Service	
	Police Station		124.9	63.5	CBECs - Fire Station/Police Station	
	Prison/Incarceration		156.4	69.9	CBECs - Public Order and Safety	
	Social/Meeting Hall		109.6	56.1	CBECs - Social/Meeting	
	Transportation Terminal/Station		112.0	56.2	CBECs - Public Assembly	
	Wastewater Treatment Plant* (Average EUI presented in Energy per Gallon per day)		7.51	2.89	AWWA - Wastewater Plant	
	Other - Public Services		89.3	40.1	CBECs - Other	
	Religious Worship	Worship Facility*		58.4	30.5	CBECs - Religious Worship
	Retail	Automobile Dealership		124.1	55.0	CBECs - Retail other than Mall
Convenience Store		Convenience Store with Gas Station	592.6	231.4	CBECs - Food Sales	
		Convenience Store without Gas Station	170.7	65.7	CBECs - Enclosed Mall	
Mall		Enclosed Mall	228.8	103.5	CBECs - Strip Shopping Mall	
		Strip Mall	225.3	101.6	CBECs - Enclosed Mall and Strip Shopping Mall	
		Other - Mall	225.3	101.6	CBECs - Enclosed Mall and Strip Shopping Mall	
Retail Store*		120.0	51.4	CBECs - Retail Store		
Supermarket/Grocery Store*		444.0	196.0	CBECs - Grocery Store/Food Market		
Wholesale Club/Supercenter*		120.0	51.4	CBECs - Retail Store		
Technology/Science	Data Center* (Average PUE presented in place of EUI: PUE = Total Energy / IT Energy)		1.82	1.82	EPA - Data Center	
	Laboratory		318.2	115.3	CBECs - Laboratory	
	Other - Technology/Science		89.3	40.1	CBECs - Other	
Services	Personal Services (Health/Beauty, Dry Cleaning, etc.)					
	Repair Services (Vehicle, Shoe, Locksmith, etc.)		96.9	47.9	CBECs - Service	
Utility	Drinking Water Treatment & Distribution (Average EUI presented in Energy per Gallon per day)		5.90	2.27	AWWA - Water Treatment Plant	
	Energy/Power Station		89.3	40.1	CBECs - Other	
	Wastewater Treatment Plant* (Average EUI presented in Energy per Gallon per day)		7.51	2.89	AWWA - Wastewater Plant	
Warehouse/Storage	Other - Utility		89.3	40.1	CBECs - Other	
	Self-Storage Facility		47.8	20.2	CBECs - Non-refrigerated Warehouse	
Warehouse/Storage	Warehouse/Distribution Center	Distribution Center*	52.9	22.7	CBECs - Non-refrigerated Warehouse & Distribution Center	
		Non-Refrigerated Warehouse*	235.6	84.1	CBECs - Refrigerated Warehouse	
		Refrigerated Warehouse*	89.3	40.1	CBECs - Other	
Other	Other		89.3	40.1	CBECs - Other	

Contact Information

Jonathan Haling
SI-E3
Email: jonathan.l.haling@nasa.gov
Phone: 7158929359

References

1. ENERGYSTAR Portfolio Manager Technical Reference
2. NASA KSC AUDRIS
3. NASA KSC Facility Manager

Acknowledgements

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