

The Efficient Building

(and the real truth about demand)



The Utilities Group Inc.

- Independent & Unbiased Energy Advisory Firm
- Founded in 1999
- Procurement, Risk Management, Benchmarking, Forecasting, Tariff Analysis, Sustainability & Energy efficiency consulting
- Executive team members have 35+ yrs of experience each
- Local clients include:
 - Cincinnati Public Schools, Cincinnati Reds, Cincinnati Zoo & Botanical Gardens, Frisch's, JTM Foods, LaRosa's, The Health Collaborative

Popcorn Anyone?

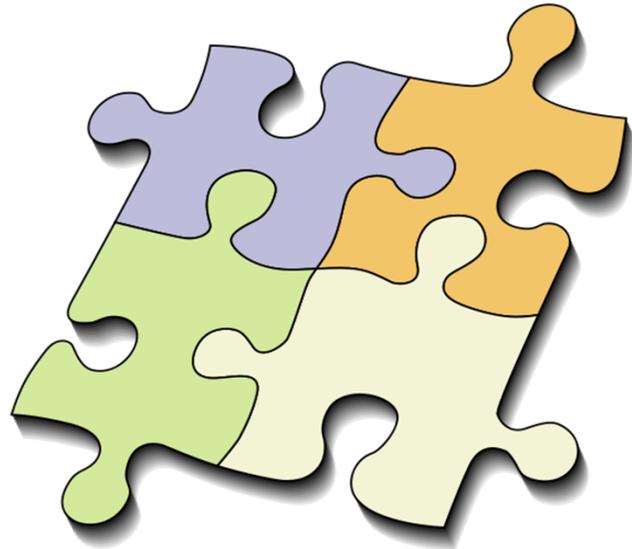
How do you define *Energy Efficiency*?

The Truth about Energy Efficiency!

- The average commercial building wastes 30% of the energy it consumes (EnergyStar)
- No **BLACK BOX MAGIC** or **SILVER BULLET** exists
- Not all projects pay off as advertised

The Truth about Energy Efficiency!

- There is plenty of room for improvement
- Multiple coordinated projects can be very effective

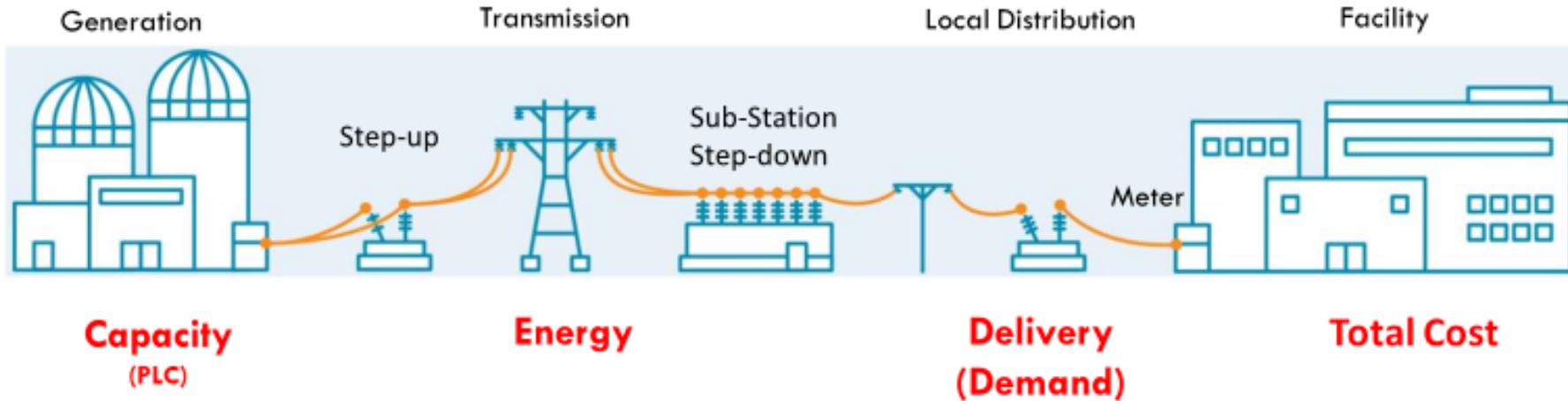


- Operations and maintenance
- Lighting
- Office equipment
- Commissioning (re)
- Heating and cooling

- Due diligence to confirm accuracy of projected savings

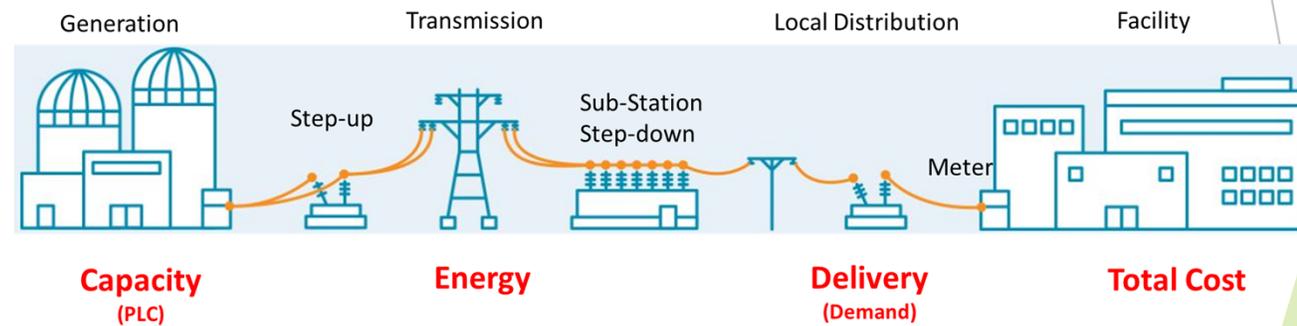
But First - A little background...

Energy Flow



Terms to Know

- Capacity – Electricity available for the Max amount demanded in 1 hour
- Energy – Electricity consumed per Hour (kwh)
- Delivery – Utility Costs to Deliver Energy
- Demand – Max amount of Electricity consumed in 15 minutes (kw)
- Peak Demand – Max during a year (summer)
- Total Cost = Supply + Delivery (including demand)



Typical Cost of Electricity

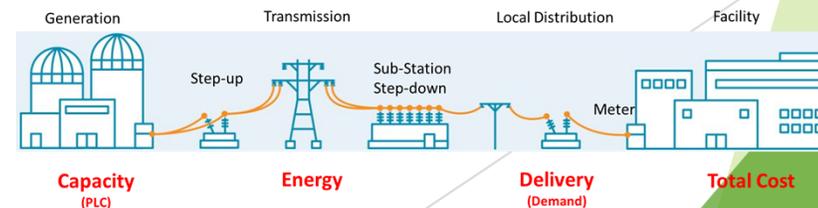
Energy = 3 to 5 cents

- Commodity - ~60%
- Capacity - 25% or more
- Other components - 10% +/-

Delivery = 3 to 10 cents

- Demand - 50% or more (depending on load factor)
- Other components

Total Unit Cost - \$0.06 to \$0.15 /kwh



Typical Duke Bill (pg 2)

Explanation of Current Charges			
Gas			
Meter -	000681467	Duke Energy	
CCF Usage -	362	Rate FTLS - Firm Transportation-Large	
Pressure Factor -	1.3170	Fixed Delivery Service Charge	\$ 226.64
Aug 26 - Sep 25		Usage-Based Charge	
30 Days		362 CCF @ \$ 0.10483000	37.95
		Gas Delivery Riders	55.31
		Applicable Surcharge	
		362 CCF @ \$ 0.00571430cr	2.07cr
			\$ 317.83
		Santanna Energy Services	
		Rate SG08 - Santanna Energy Services	
		Gas Supplier Energy Chg	
		362 CCF @ \$ 0.39900000	\$ 144.44
			144.44
		Total Current Gas Charges	\$ 462.27
Electric			
Meter -	108027171	Duke Energy	
kWh Usage -	26,933	Rate DS01 - Distribution Service	
On Peak		Distribution-Customer Chg	\$ 45.95
Actual kW -	119.70	Delivery Charges	
Actual kVa -	130.20	Distribution-Demand Chg	
Power Factor -	91.9%	120.19 kW @ \$ 5.67180000	681.69
		Delivery Riders	588.41
Billed kW -	120.19	Total Delivery Charges	\$ 1,270.10
Aug 26 - Sep 25		Generation Riders	0.41
30 Days			1,316.46
		Generation Charge	
		Dynegy Energy Services	
		Rate DE68 - Dynegy Energy Services	
		Supplier Energy Charge	
		26,933 kWh @ \$ 0.04590000	\$ 1,236.22
			1,236.22
		Total Current Electric Charges	\$ 2,552.68

* Based on 85% of Previous Maximum Actual Demand of 141.40 kW Billed in Jun 19

Typical Duke Bill (pg 2) - behind the scenes

Explanation of Current Charges	
Gas	
Meter - 000681467	Duke Energy
CCF Usage - 362	Rate FTLS - Firm Transportation-Large
Pressure Factor - 1.3170	Fixed Delivery Service Charge Usage-Based Charge \$ 226
Aug 26 - Sep 25 30 Days	362 CCF @ \$ 0.10483000 37
	Gas Delivery Riders 55
	Applicable Surcharge 2
	362 CCF @ \$ 0.00571430cr
	Santanna Energy Services
	Rate SG08 - Santanna Energy Services
	Gas Supplier Energy Chg 362 CCF @ \$ 0.39900000 \$ 144
	Total Current Gas Charge
Electric	
Meter - 108027171	Duke Energy
kWh Usage - 26,933	Rate DS01 - Distribution Service
On Peak Actual kW - 119.70	Distribution-Customer Chg Delivery Charges \$ 45
Actual kVa - 130.20	Distribution-Demand Chg 120.19 kW @ \$ 5.67180000 681
Power Factor - 91.9%	Delivery Riders 588
Billed kW - 120.19	Total Delivery Charges \$ 1,270
Aug 26 - Sep 25 30 Days	Generation Riders 0
	Generation Charge
	Dynegy Energy Services
	Rate DE68 - Dynegy Energy Services
	Supplier Energy Charge 26,933 kWh @ \$ 0.04590000 \$ 1,236
	Total Current Electric Charge

* Based on 85% of Previous Maximum Actual Demand of 141.40 kW Billed in Jun 19

Tariff	Billing Unit	Billing Quantity	Cost
Dist-Service Charge	Acct	1	\$ 45.95
Primary Voltage Service Charge	Acct	1	\$ -
Demand Charge	kW	120.19	\$ 681.69
Energy Charge 0-2800	kWh		\$ -
Energy Charge 2,801-6,000 kWh	kWh		\$ -
Energy Charge > 6000 kWh	kWh		\$ -
Delivery Sub-Total			\$ 681.69
Load Management Rider Customer Charge	76 Acct		\$ -
Electric Tax Cuts & Job Act Rider	77 % Base Dist		\$ (41.26)
Electric Service Reliability Rider	80 % Base Dist		\$ 32.31
Ohio Excise Tax (OET) Rider 0-2000	kWh		\$ 9.30
OET 2001-15,000	kWh		\$ 54.47
OET >15,000	kWh		\$ 43.32
OET Total	83		\$ 107.09
Universal Svc Fund Rider 1st 833,000	kWh		\$ 18.24
USR> 833,000	kWh		\$ -
USR Total	86		\$ 18.24
Base Transmission Rider (BTR)- Capacity	kw/kVa		\$ 178.30
BTR- Energy	kWh		\$ -
BTR RTEP Credit	kWh		\$ 28.98
BTR Total	89		\$ 207.28
Dist Storm Rider	101 Acct		\$ -
Dist Capital Investment Rider	103 % Base Dist		\$ 77.22
Infrastructure Modernization (DR-IM)	104 Acct		\$ -
Economic Competitive Fund (DR-ECF)	105 kWh		\$ 5.33
Uncollectible Exp-Elec Dist (UE-ED)	108 Acct		\$ 0.03
Energy Eff + Peak Demand Response (EE-PDR)	119 kWh		\$ 139.32
Distribution Decoupling (DDR)	122 kWh		\$ -
Price Stabilization Rider	126 kWh		\$ 42.85
Uncollectible Exp.-Elec Gen (UE-Gen)	88 Acct		\$ 0.41
Load Factor Adjustment (LFA) Demand Charge	kWh/kVa		\$ -
LFA Usage Credit	kWh		\$ -
LFA Total	114		\$ -
Regional Transmission Org. (RTO)	97 kWh		\$ -
Alternative Energy Recovery Rider (AER-R)	110 kWh		\$ -
Retail Capacity (RC) 1st 150 kWh/kW (DS, DP, TS)	kWh/kW		\$ -
Retail Capacity (RC) 2nd 150 kWh/kW (DS, DP, TS)	kWh/kW		\$ -
Retail Capacity (RC) 3rd 150 kWh/kW (DS, DP, TS)	kWh/kW		\$ -
Retail Capacity (RC) >450 kWh/kW (DS, DP, TS)	kWh/kW		\$ -
RC 1st 2800 kWh (DM and EH)	kWh		\$ -
RC Next 3200 kWh (DM and EH)	kWh		\$ -
RC >6000 kWh (DM and EH)	kWh		\$ -
RC Total	111		\$ -
Retail Energy (DS, EH, DP, TS)	kWh		\$ -
RE 1st 2800 kWh (DM)	kWh		\$ -
RE Next 3200 kWh (DM)	kWh		\$ -
RE >6000 kWh (DM)	kWh		\$ -
RE Total	112		\$ -
Supplier Cost Reconciliation (SCR)	122 kWh		\$ -
Summary			
Customer Charge			\$ 45.95
Distribution Charge			\$ 681.69
Delivery Riders			\$ 588.41
Delivery Charges Subtotal			\$ 1,270.10
Generation Riders Paid to Duke			\$ 0.41
Total Delivery Charges to Duke			\$ 1,316.46
Transmission Charge			\$ -
Generation Charge			\$ 1,236.22
Total Supply Cost			\$ 1,236.22
Grand Total Cost			\$ 2,552.69

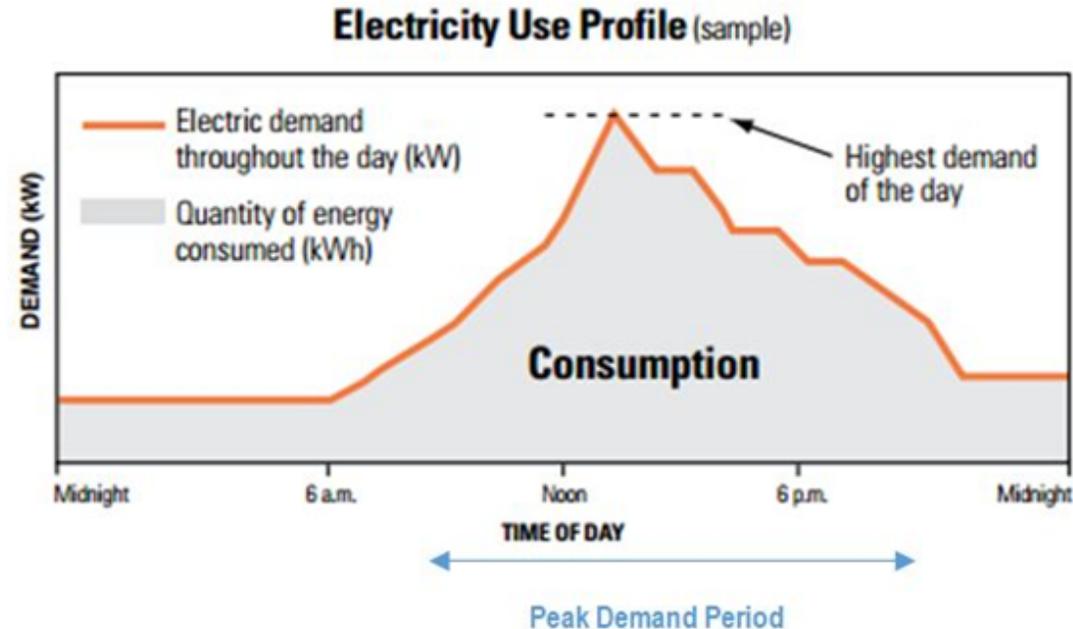
Note:
This analysis assigns rates according to the month in which the meter was read and does not prorate

Legend:

Delivery Charges	Transmission Charge
Generation Riders Paid to Duke	Generation Charge
Supply Charges (Trans and Gen)	



Demand - what is it and why is it important?



Electric Demand is the rate of using electricity. For most commercial buildings, demand is measured in kilowatts (kW). Utilities measure the highest rate of using electricity each billing cycle in order to **adequately size the generation, transmission and distribution capacity** required to provide energy to each customer. The utility then recoups these costs by billing you based on your highest measured demand, and when that demand occurs relative to when the utility experiences peak demand on their system.

Capacity's impact on your Energy cost?

PJM's capacity market, called the Reliability Pricing Model (RPM), ensures long-term grid reliability by securing the appropriate amount of power supply resources needed to meet predicted energy demand three years in the future.

PJM Planning Year	Auction Price
June1, 2019 to May 31 2020	\$ 98
June1, 2020 to May 31 2021	\$ 130
June1, 2021 to May 31 2022	\$ 141

What is your Capacity Contribution?

- Peak Load Contribution (PLC)
- Avg. demand during the 5 highest summer hours
- Determines next year's Capacity tag

2019

Day	Date	Hour
Friday	7/19/2019	18
Wednesday	7/17/2019	17
Monday	8/19/2019	17
Wednesday	7/10/2019	18
Monday	7/29/2019	17

Capacity Cost - Expectation

- Client that uses 4.4 million kwh with a Capacity Tag of 1,700 kW
- Annual energy spend \$225,000
- Capacity is more than 25%

PJM Planning Year	Capacity Tag (PLC)	Auction Price	Daily Cost	Annual Cost	kWh Unit Cost
June1, 2019 to May 31 2020	1,700	\$ 98	\$167	\$60,852	\$0.0138
June1, 2020 to May 31 2021	1,700	\$ 130	\$221	\$80,485	\$0.0183
June1, 2021 to May 31 2022	1,700	\$ 141	\$239	\$87,199	\$0.0198

$1,300 \times \$141 \times 365 = \$66,900$ saves \$21,000

➔ Take away - Reduce future Capacity Tag = potential Savings

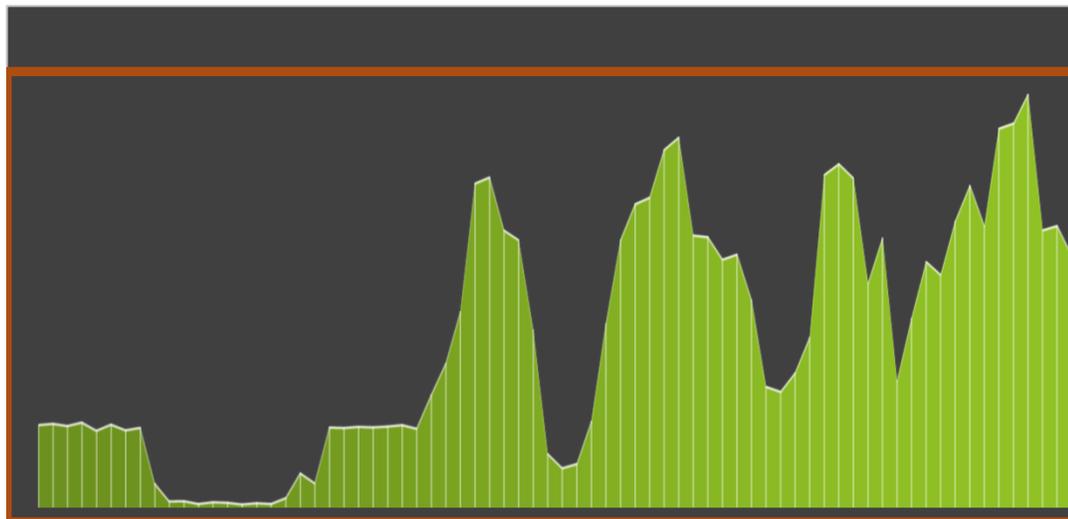
Load Factor



Load Factor - what is it and why is it important?

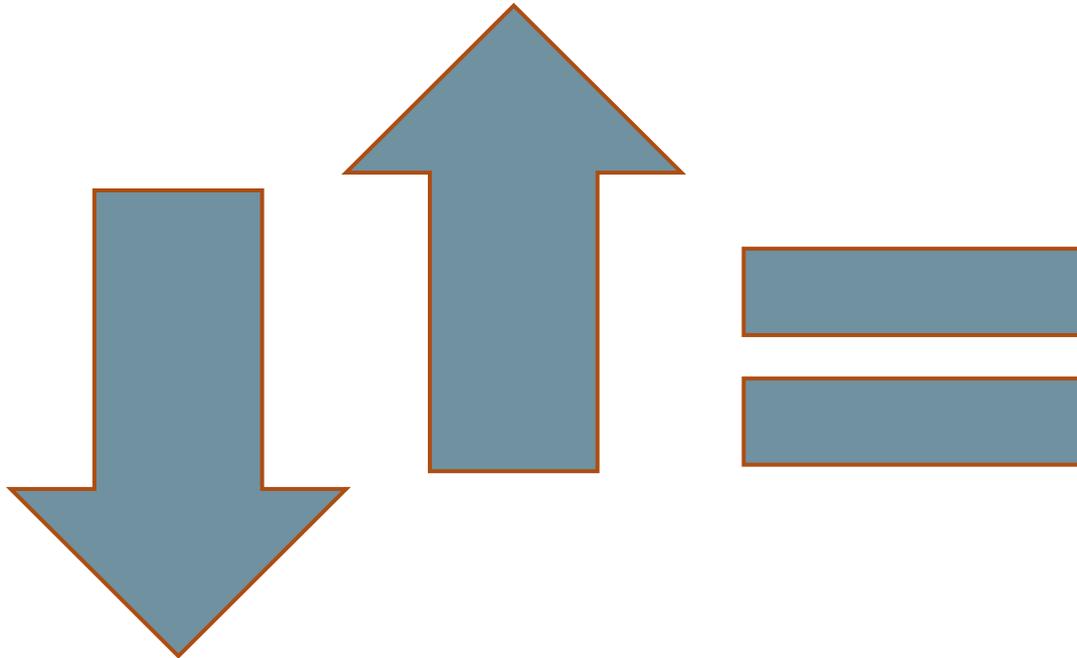
The ratio of actual kilowatt hours used in a given period, divided by the total possible kilowatt hours that could have been used in the same period, at the peak kW level established by a customer during the billing period.

A high load factor is “a good thing,” and a low load factor is a “bad thing”



Ways to Improve your Load Factor

- Reduce kW demand and Maintain kWh Consumption
- Increase kWh consumption and Maintain kW demand



Load Factor Calculation

	Chiller A	Chiller B
KW Demand	500	300
Run Hours	8	16
Kwh Used	4,000	4,800
Hours in a Day	24	24
Kwh Available	12,000	7,200
Load Factor	33%	67%

Load Factor Cost Impact

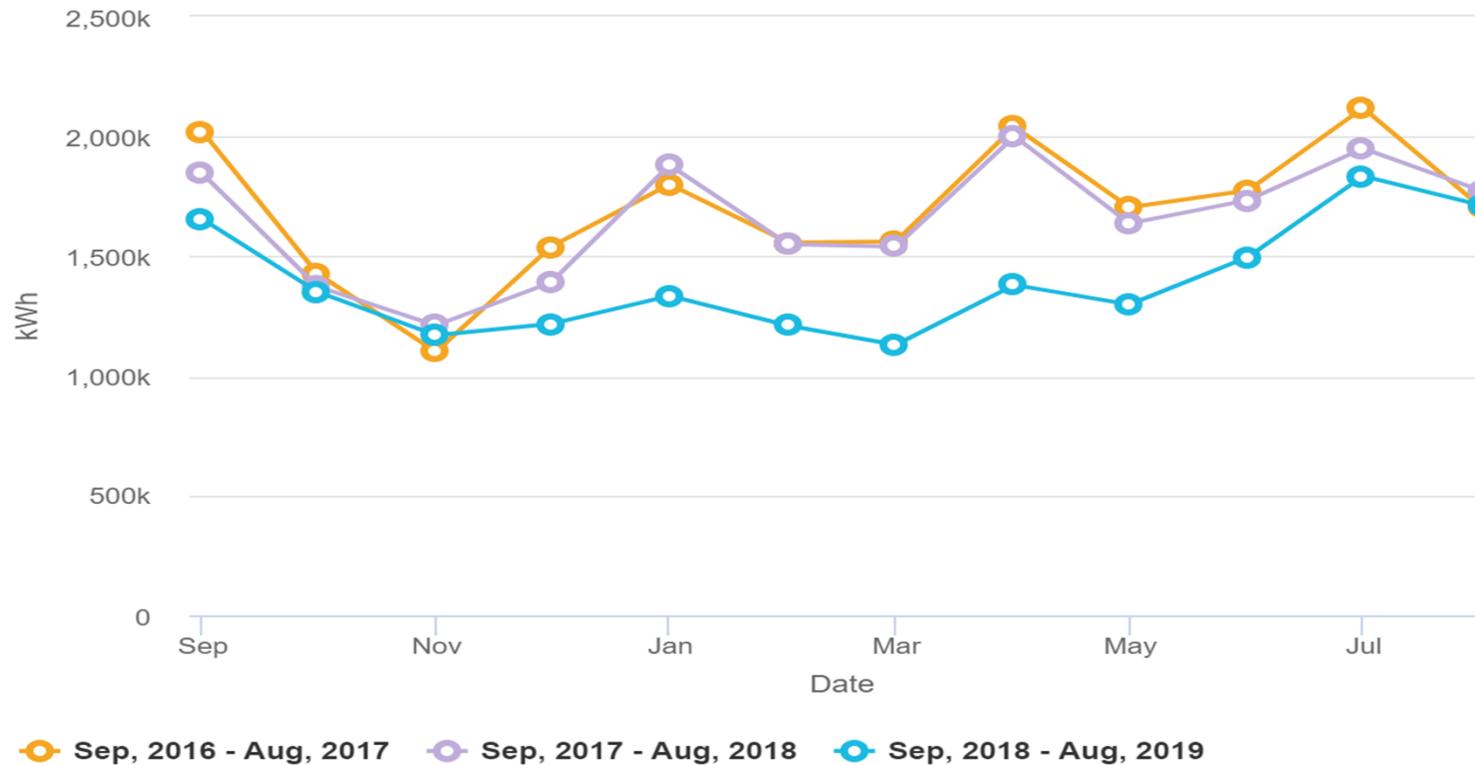
Annual Cost Comparison

	Chiller A		Chiller B		Variance
Load Factor	33%		67%		
KW Demand	500		300		200
Run Hours	8		16		8
Annual Kwh Used	1,460,000		1,752,000		292,000
Annual Kwh Available	4,380,000		2,628,000		1,752,000
Delivery Cost	\$ 57,489	\$ 41,174	\$ 16,315.00		
Delivery Cost per Kwh	\$ 0.0394	\$ 0.0235	\$ 0.0159		
Supply Cost	\$ 81,478	\$ 82,762	\$ 1,284.00		
Unit Cost	\$ 0.056	\$ 0.047	\$ 0.0086		
Total Cost	\$ 138,967	\$ 123,936	\$ 15,031		

Example: MLB Stadium

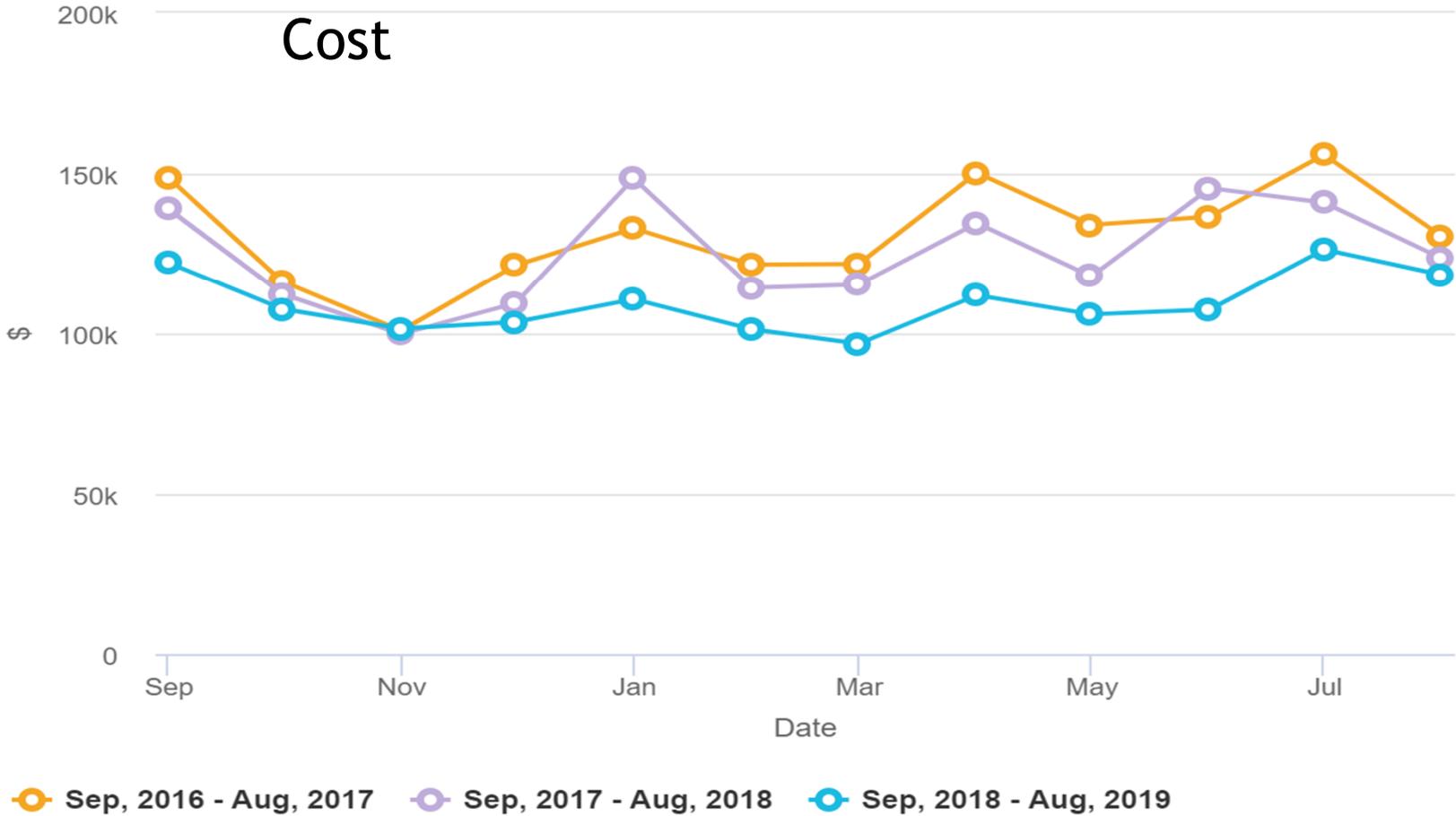
LED lighting retrofit, HVAC and Control upgrade

- 16% reduction in kWh usage
- 1000 kW reduction in demand



○ Sep, 2016 - Aug, 2017 ○ Sep, 2017 - Aug, 2018 ○ Sep, 2018 - Aug, 2019

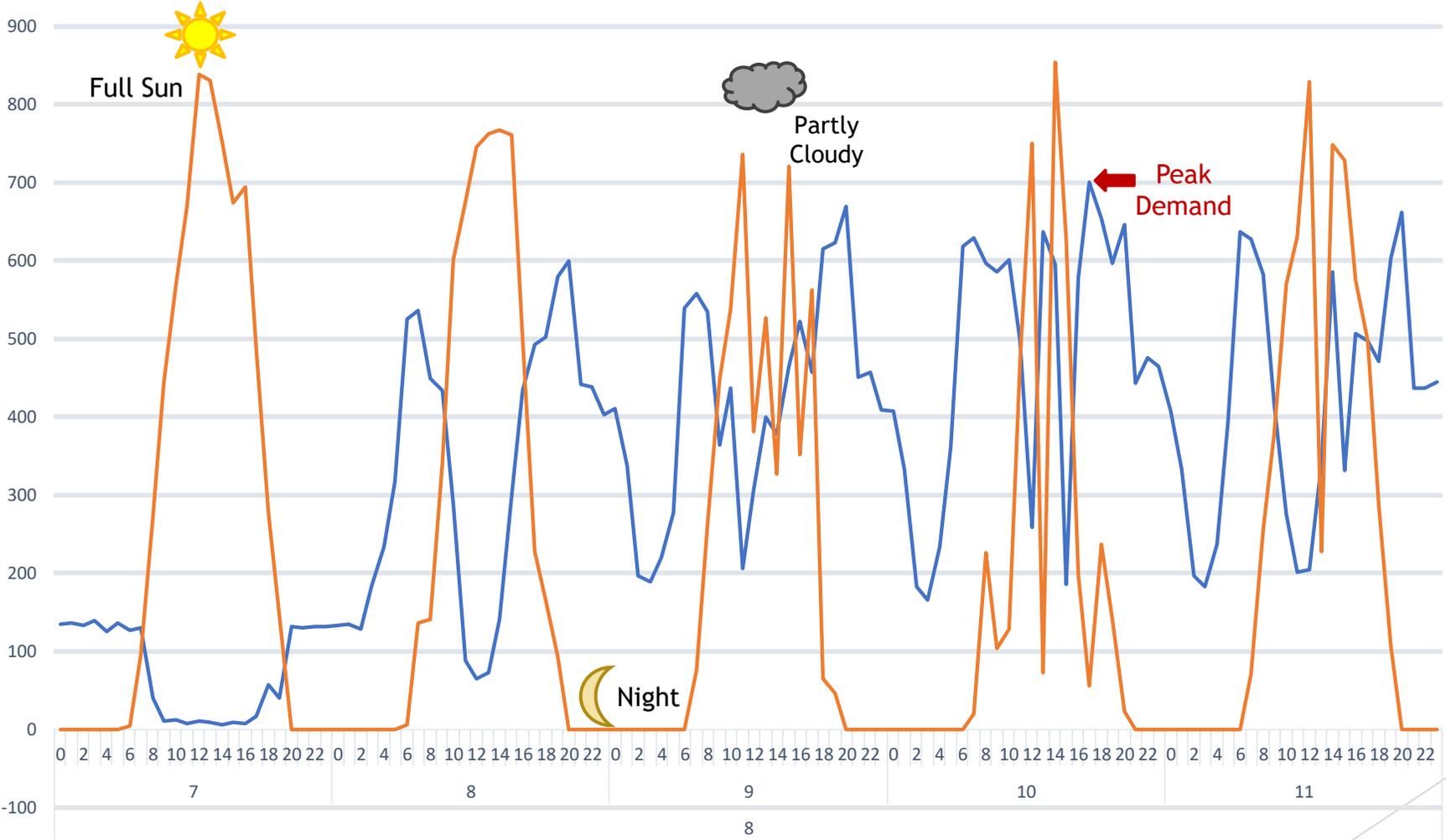
Example: MLB Stadium



JadeTrack.com



Solar does not reduce Billed kW Demand



Solar Metered Electric

Solar - True Impact

“Always inaccurate”

Typical Cost Calculation		0.0758	679,297	\$	51,485
	Baseline	Baseline w/Solar	Variance	% of Variance	
Annual Kwh	6,336,654	5,657,375	679,279		
PK KW	1,517	1,517	-		
Load Factor	54.8%	49.0%	5.8%	10.6%	
PTC (Price to Compare)	\$ 0.04996	\$ 0.05137	(0.00141)	-2.8%	
Duke Delivery Costs	\$ 163,695	\$ 159,162	\$ 4,533	2.8%	
Duke Electric Gen. Costs	\$ 316,579	\$ 290,619	\$ 25,960	8.2%	
Duke Del. & Gen Costs	\$ 480,274	\$ 449,781	\$ 30,493		
Total KWH Cost	\$ 0.0758	\$ 0.0795	\$ 0.045		

➔ Take away: Don't make a 20-year mistake on exaggerated Cost and/or Savings

Questions & Further Discussion

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