Verification and Continuous Commissioning (V & CC)

A Model for Ensuring Long Term Building Performance

FANNING HOWEY

Find. Track. Prove. ENERGYPRINT®

October 3, 2019

Meet Your Presenters

FANNING HOWEY

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Chief Engineering Officer

Fanning Howey

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Energy Service Manager

Fanning Howey

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Business Development

EnergyPrint

Verification and Continuous Commissioning

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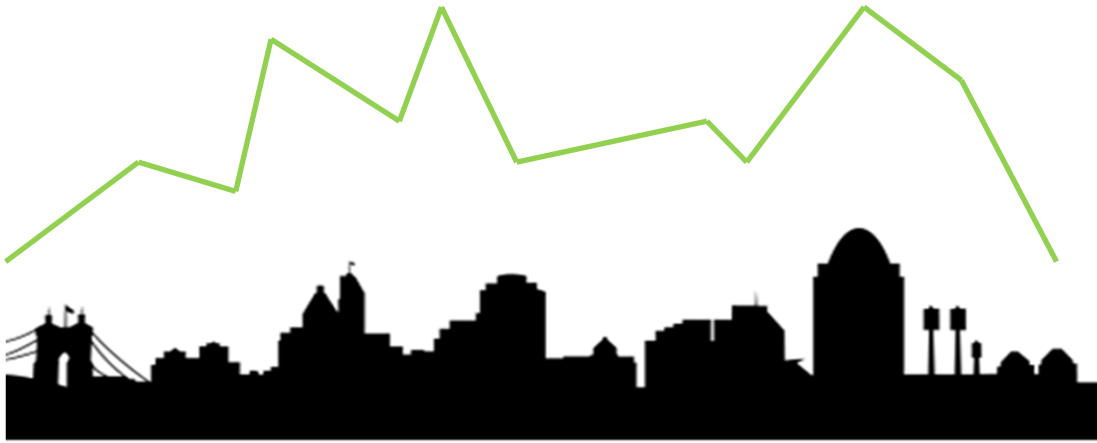
The U.S. Energy Information Administration reported that there were 5.6 million commercial buildings in the U.S. in 2012, totaling 87 billion square feet of floor space.

We don’t have accurate tallies on state owned and city owned properties.



Keeping the Momentum

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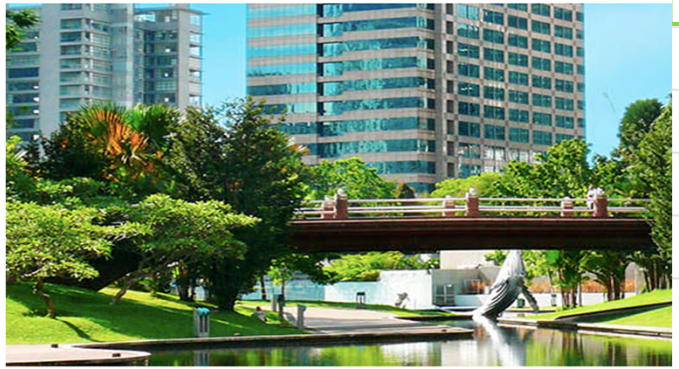
Greenest Cities in America

Oct 10, 2018 | Adam McCann, Financial Writer



28	Orlando, FL	54.65	39	5	77
29	Cincinnati, OH	54.20	8	13	92
30	Stockton, CA	54.04	82	65	1
31	Fresno, CA	53.75	88	40	1
32	Reno, NV	53.37	55	38	26
33	Tucson, AZ	53.22	33	23	56
34	Las Vegas, NV	52.84	96	15	32
35	Anchorage, AK	52.34	23	66	34

Keeping the Momentum

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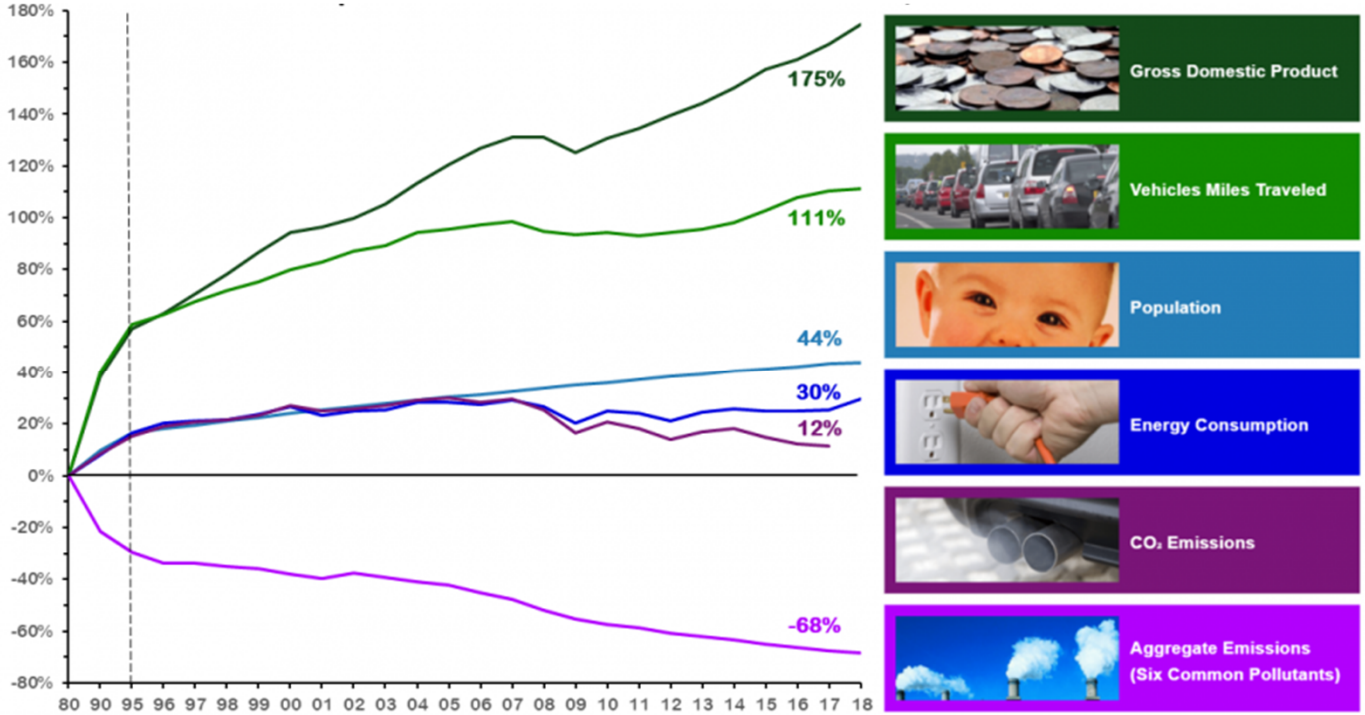
Comparison of Growth Areas and Emissions, 1980-2018



The C02 Challenge for indoor Environments

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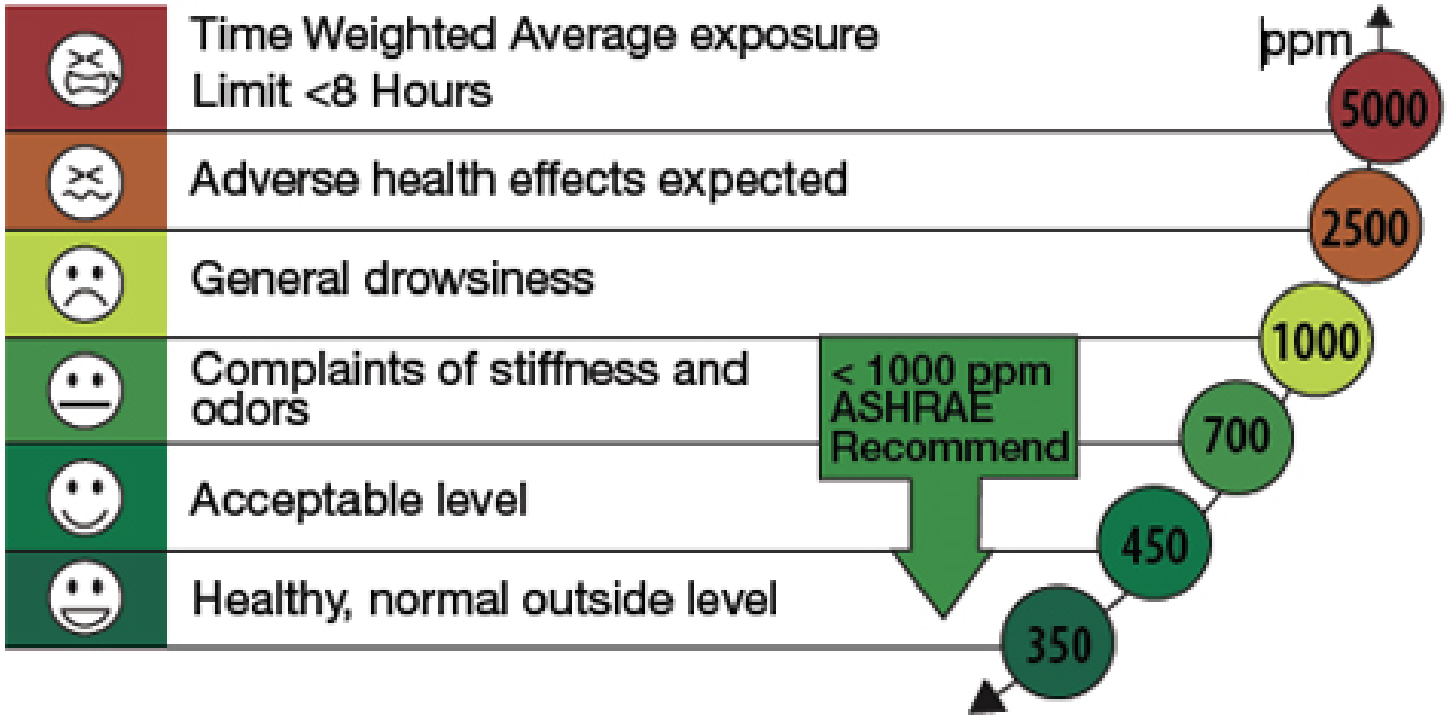
Continuous monitoring, continuous verification of EUI.



Verification and Continuous Commissioning

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WHO
CDC
USGBC
Net Zero
ASHRAE
GreenPeace
Sierra Club
IPCC

Verification and Continuous Commissioning

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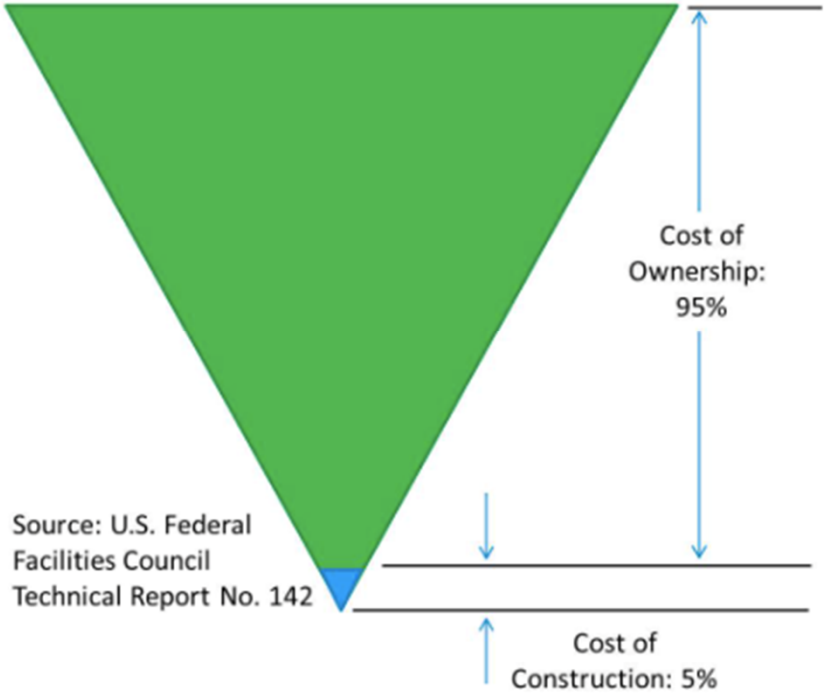
Created to Meet a Great Need



Verification and Continuous Commissioning

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Created to Dissolve the Confusion

Our Global Community Must Evolve

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Critical Thinking

Problem Solving

Communication

Sharing Thoughts, Ideas, and Solutions

Collaboration

Operational Feedback

Creativity

Develop New Ideas

Current Verification Model

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- Extra cost after construction budgets are depleted
- EUI disconnected from systems commissioning
- Short term energy verification – less than 30 days

Current Verification Model

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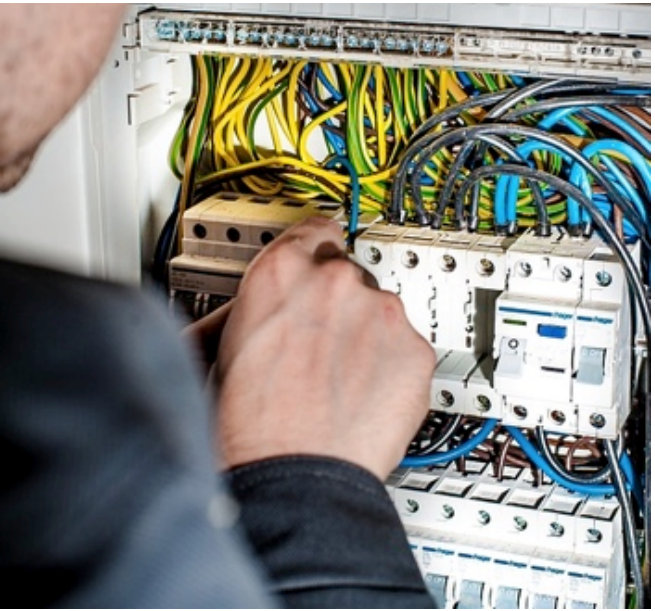
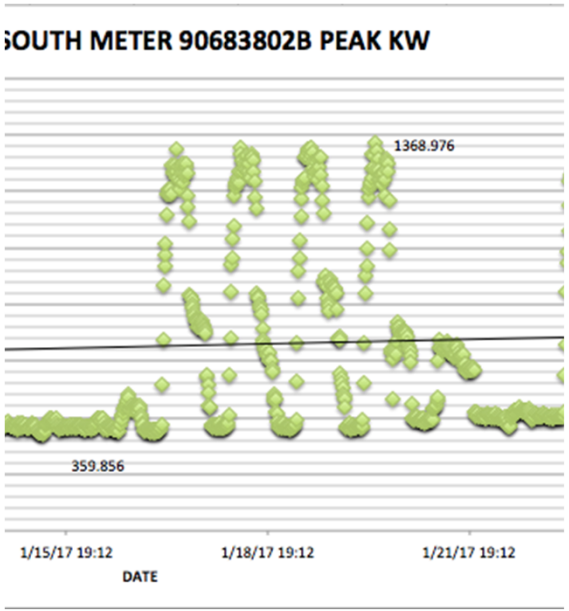
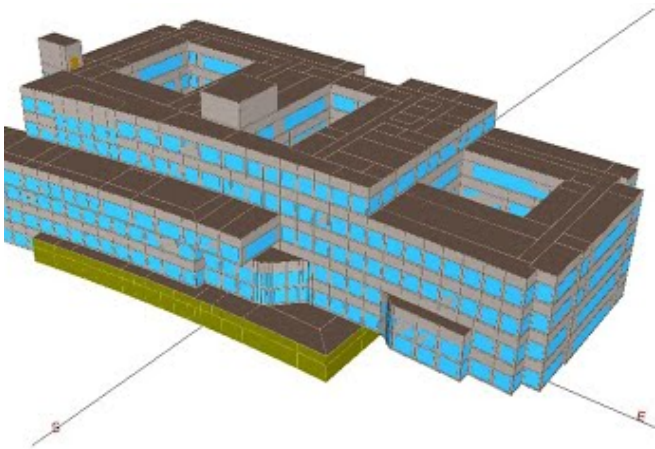
OPTIONS A,B,C,or D







What Is Our Model ,V&CC?

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- Continued commissioning after the occupants have moved in driven by EUI
- Weather normalization of consumption data
- Uploading and maintenance of a dedicated Energy Star Portfolio Manager
- Quarterly coaching and feedback to design engineers for continuous improvement of EUI
- Goal setting for sustainable performance and best EUI
- Comparison of model to actual consumption data
- IPMVP & ASHRAE 14 compliant M&V tacking for ROI projects

Define “Sustainable Performance”

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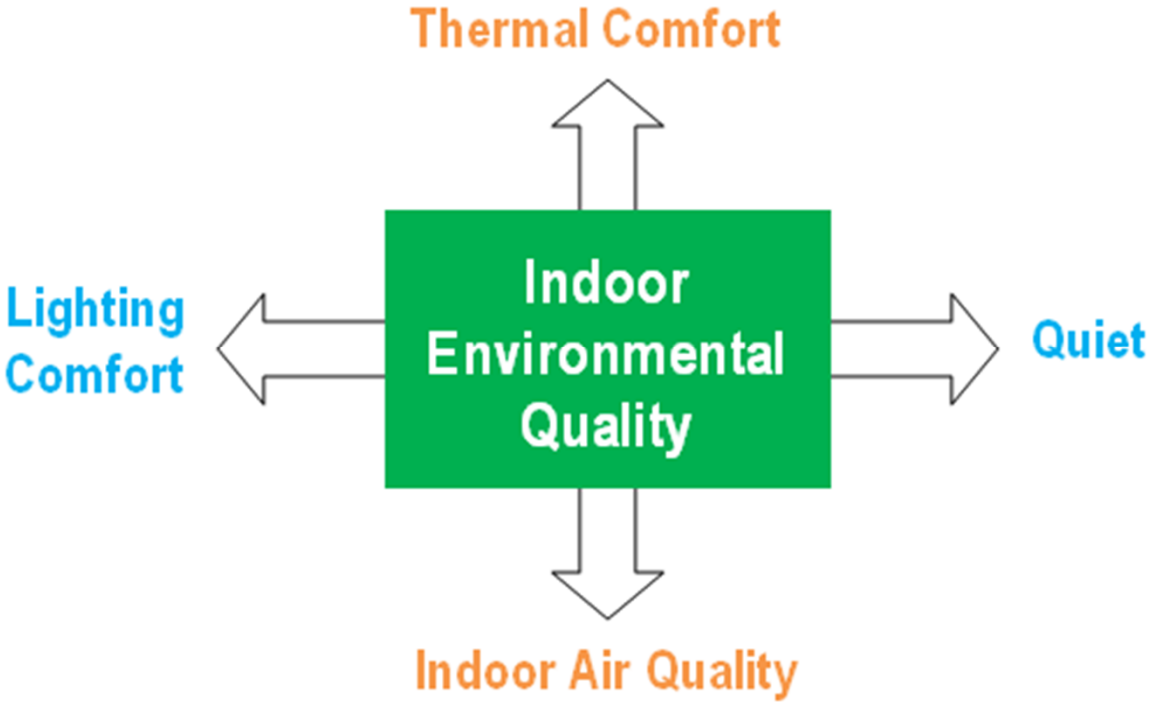
Operating a facility, long term, without compromise to Indoor Environmental Quality at the lowest energy consumption possible.



Verification and Continuous Commissioning

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Provide training and coaching that clients need to operate advanced building technology

Verification and Continuous Commissioning

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- Owners don’t have time to dissect bills and interpret weather data
- Energy modeling has been underutilized
- M&V is underutilized tool that needed automation and simplification
- Most owners without energy coaching do not meet efficient performance standards

Verification and Continuous Commissioning

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Whatever standard you may have designed, there is a suggested return in lower energy.

Verification and Continuous Commissioning

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What is the cost of not operating as designed?

- Compromised IAQ
- Compromised IEQ
- Increased costs of maintenance
- Increased cost of energy
- Management focus on facilities and not on core business

The Data and Its Correlation are Becoming Enormous

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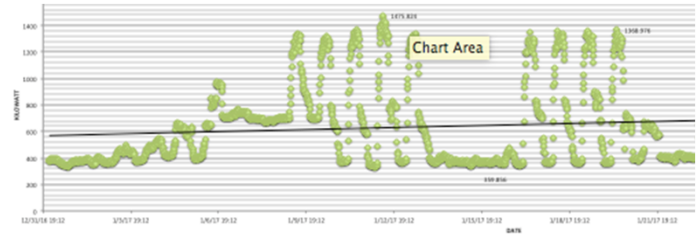
2017	Temp. (F)		
Jun	high	avg	low
6/1/17	79	65	51
6/2/17	84	70	56
6/3/17	86	73	60
6/4/17	87	75	63
6/5/17	88	78	68
6/6/17	78	68	58
6/7/17	72	65	57
6/8/17	77	65	53
6/9/17	84	71	57
6/10/17	84	73	62
6/11/17	88	77	65
6/12/17	90	79	68
6/13/17	87	78	69
6/14/17	90	79	68
6/15/17	81	74	67
6/16/17	86	76	66
6/17/17	86	78	70
6/18/17	81	73	64
6/19/17	81	71	60
6/20/17	84	71	58
6/21/17	89	78	66
6/22/17	84	78	71
6/23/17	77	70	63
6/24/17	77	68	59
6/25/17	76	65	54
6/26/17	74	64	53
6/27/17	74	63	51
6/28/17	80	68	55
6/29/17	87	78	68
6/30/17	85	76	67



Meter ID	Date / Time	KW(ch: 1	KWH(ch: 1	KVARH(ch: 2	KVAH(ch: 2	PF(ch: 3	KVAR(ch: 2	KVA(0(ch: 2
		set	s	set:0)	:	set:0)	set:0)	set:0)
90683802B	1/1/17 0:15	375.984	93.996	0	93.996	1	0	375.984
90683802B	1/1/17 0:30	382.48	95.62	0.056	95.62	1	0.224	382.4801
90683802B	1/1/17 0:45	378.448	94.612	0.028	94.612	1	0.112	378.448
90683802B	1/1/17 1:00	379.456	94.864	0.028	94.864	1	0.112	379.456
90683802B	1/1/17 1:15	382.032	95.508	0.028	95.508	1	0.112	382.032
90683802B	1/1/17 1:30	395.584	98.896	0.084	98.896	1	0.336	395.5841
90683802B	1/1/17 1:45	384.72	96.18	0.028	96.18	1	0.112	384.72
90683802B	1/1/17 2:00	381.36	95.34	0.028	95.34	1	0.112	381.36
90683802B	1/1/17 2:15	385.168	96.292	0.028	96.292	1	0.112	385.168
90683802B	1/1/17 2:30	391.328	97.832	0.028	97.832	1	0.112	391.328
90683802B	1/1/17 2:45	384.496	96.124	0.056	96.124	1	0.224	384.4961
90683802B	1/1/17 3:00	381.584	95.396	0.056	95.396	1	0.224	381.5841
90683802B	1/1/17 3:15	384.72	96.18	0.084	96.18	1	0.336	384.7201
90683802B	1/1/17 3:30	390.208	97.552	0.112	97.5521	1	0.448	390.2083
90683802B	1/1/17 3:45	385.168	96.292	0.056	96.292	1	0.224	385.1681
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90683802B	1/1/17 4:30	393.456	98.364	0.056	98.364	1	0.224	393.4561
90683802B	1/1/17 4:45	384.496	96.124	0.084	96.124	1	0.336	384.4961
90683802B	1/1/17 5:00	382.48	95.62	0.028	95.62	1	0.112	382.48
90683802B	1/1/17 5:15	382.928	95.732	0.028	95.732	1	0.112	382.928
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90683802B	1/1/17 6:30	392.336	98.084	0.056	98.084	1	0.224	392.3361
90683802B	1/1/17 6:45	378.336	94.584	0.028	94.584	1	0.112	378.336
90683802B	1/1/17 7:00	382.928	95.732	0	95.732	1	0	382.928
90683802B	1/1/17 7:15	384.272	96.068	0.028	96.068	1	0.112	384.272
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90683802B	1/1/17 9:30	363.328	90.832	0.028	90.832	1	0.112	363.328
90683802B	1/1/17 9:45	358.064	89.516	0.028	89.516	1	0.112	358.064
90683802B	1/1/17 10:00	356.832	89.208	0.028	89.208	1	0.112	356.832
90683802B	1/1/17 10:15	364.224	91.056	0.112	91.0561	1	0.448	364.2243
90683802B	1/1/17 10:30	363.328	90.832	0.084	90.832	1	0.336	363.3282
90683802B	1/1/17 10:45	359.184	89.796	0.056	89.796	1	0.224	359.1841
90683802B	1/1/17 11:00	354.704	88.676	0.028	88.676	1	0.112	354.704
90683802B	1/1/17 11:15	344.4	86.1	0	86.1	1	0	344.4

READING THE WAVES

Data the Way We Need to See It

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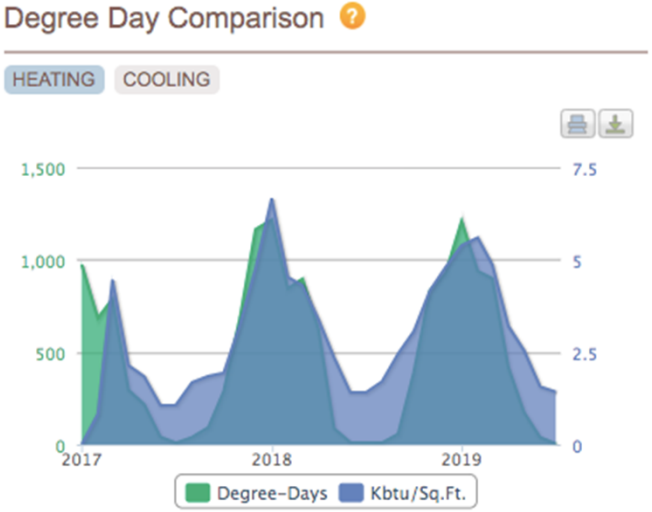

EnergyPrint

Making it simple to Find, Track & Prove savings.

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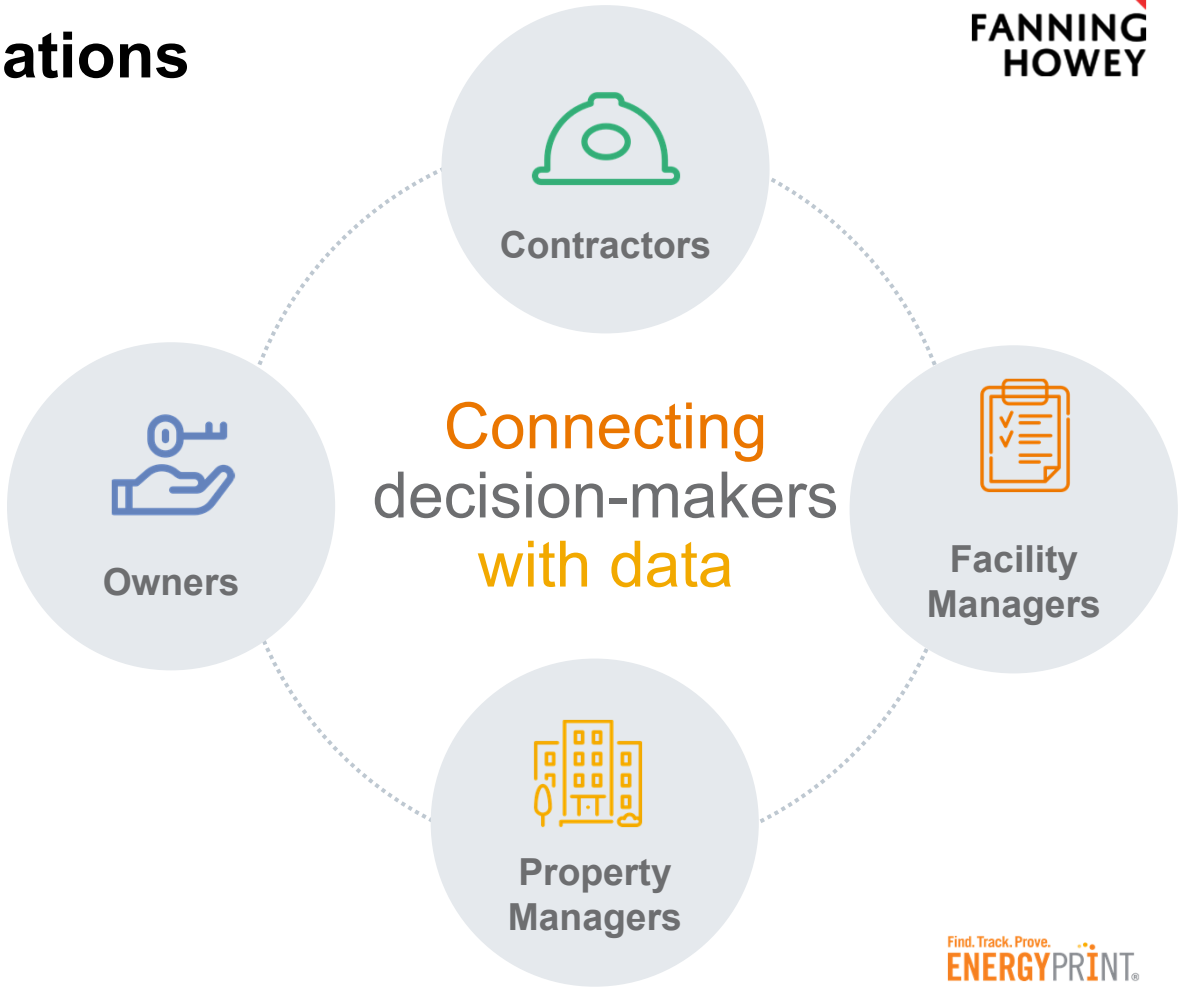
Data-enabled Insights to support ongoing V&CC

Building performance metrics for baseline, benchmarking and ongoing tracking and reporting.

Data-Driven Conversations

- Find opportunities
- Track improvements
- Prove ROI



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Translate complex utility data to identify opportunities for improvement

Utility data is the single common link for all commercial buildings.It is also the most complex.

Benchmarking Utility Data

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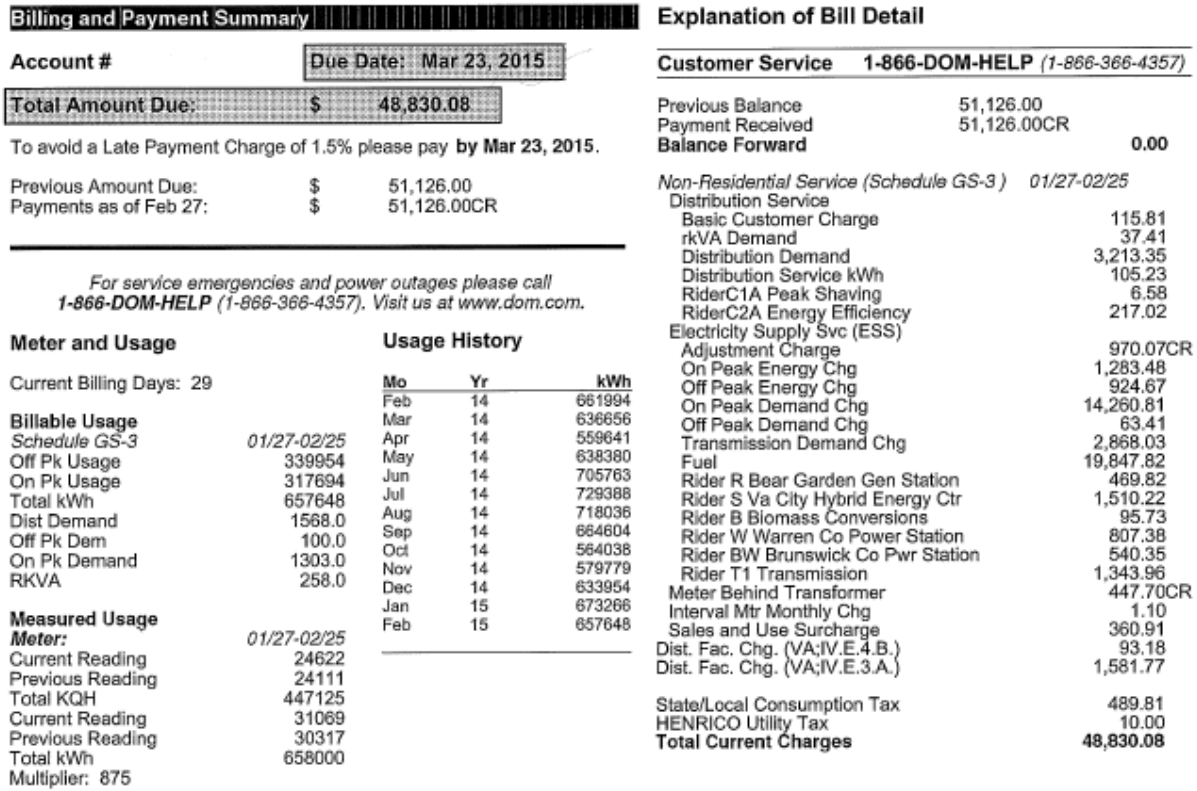
- Gather
- Enter
- Validate
- Visualize



Billing and Payment Summary

Account # **Due Date: Mar 23, 2015**

Total Amount Due: $ 48,830.08

To avoid a Late Payment Charge of 1.5% please pay **by Mar 23, 2015**.

Previous Amount Due:	$	51,126.00
Payments as of Feb 27:	$	51,126.00CR

For service emergencies and power outages please call
***1-866-DOM-HELP** (1-866-366-4357). Visit us at www.dom.com.*

Meter and Usage

Current Billing Days: 29

Billable Usage	
Schedule GS-3	*01/27-02/25*
Off Pk Usage	339954
On Pk Usage	317694
Total kWh	657648
Dist Demand	1568.0
Off Pk Dem	100.0
On Pk Demand	1303.0
RKVA	258.0

Measured Usage	
Meter:	*01/27-02/25*
Current Reading	24622
Previous Reading	24111
Total KQH	447125
Current Reading	31069
Previous Reading	30317
Total kWh	658000
Multiplier: 875	

Usage History

Mo	Yr	kWh
Feb	14	661994
Mar	14	636656
Apr	14	559641
May	14	638380
Jun	14	705763
Jul	14	729388
Aug	14	718036
Sep	14	664604
Oct	14	564038
Nov	14	579779
Dec	14	633954
Jan	15	673266
Feb	15	657648

Explanation of Bill Detail

Customer Service 1-866-DOM-HELP *(1-866-366-4357)*

Previous Balance	51,126.00	
Payment Received	51,126.00CR	
Balance Forward		**0.00**
Non-Residential Service (Schedule GS-3)	*01/27-02/25*	
Distribution Service		
Basic Customer Charge		115.81
rkVA Demand		37.41
Distribution Demand		3,213.35
Distribution Service kWh		105.23
RiderC1A Peak Shaving		6.58
RiderC2A Energy Efficiency		217.02
Electricity Supply Svc (ESS)		
Adjustment Charge		970.07CR
On Peak Energy Chg		1,283.48
Off Peak Energy Chg		924.67
On Peak Demand Chg		14,260.81
Off Peak Demand Chg		63.41
Transmission Demand Chg		2,868.03
Fuel		19,847.82
Rider R Bear Garden Gen Station		469.82
Rider S Va City Hybrid Energy Ctr		1,510.22
Rider B Biomass Conversions		95.73
Rider W Warren Co Power Station		807.38
Rider BW Brunswick Co Pwr Station		540.35
Rider T1 Transmission		1,343.96
Meter Behind Transformer		447.70CR
Interval Mtr Monthly Chg		1.10
Sales and Use Surcharge		360.91
Dist. Fac. Chg. (VA;IV.E.4.B.)		93.18
Dist. Fac. Chg. (VA;IV.E.3.A.)		1,581.77
State/Local Consumption Tax		489.81
HENRICO Utility Tax		10.00
Total Current Charges		**48,830.08**

4 key business questions:

How are my buildings doing?

Are they getting better or worse?

Where are the best opportunities for savings?

Have past improvements paid off?

HOM

- A case study demonstrating the benefits of benchmarking and taking action to improve buildings

How are my buildings doing?

Your Rank

7.4	1.1
CURRENT 12 MO	IMPROVEMENT RANK

Your Usage

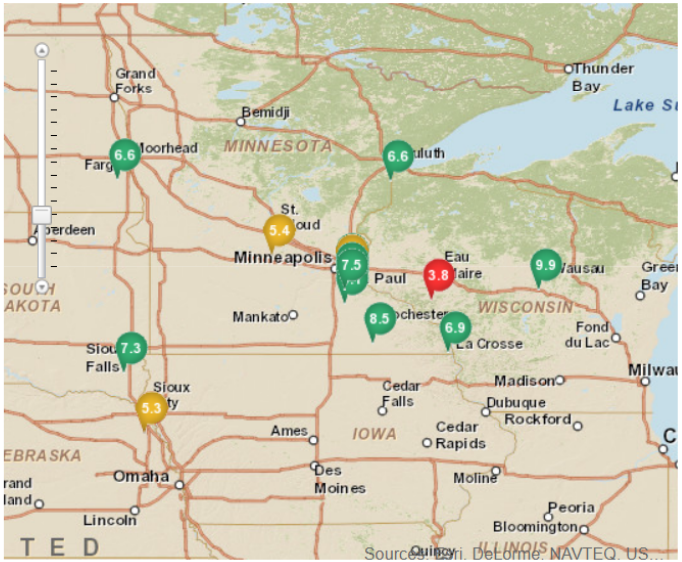
18 of 20 Properties Current Through 01/2019

Cost	Consumption	Carbon
$0.93	46.72 kBtu	15.18 lbs.
PREVIOUS 12 MO. $0.90	PREVIOUS 12 MO. 42.81 kBtu	PREVIOUS 12 MO. 14.51 lbs.

Property Map

View by: Property Name ▾ Descending ▾

8.0	HOM Furniture-Plymouth	4150 Berkshire Lane N Minneapolis, MN 55446
6.9	HOM Furniture-Onalaska	9519 State Road 16 Onalaska, WI 54650
8.1	HOM Furniture-Lakeville	17055 Kenyon Ave. Lakeville, MN 55044
6.6	HOM Furniture-Hermantown	4726 Mall Drive Duluth, MN 55811
6.6	HOM Furniture-Fargo	4601 23rd Ave. SW. Fargo, ND 58104
3.8	HOM Furniture-Eau Claire	2921 Mall Drive



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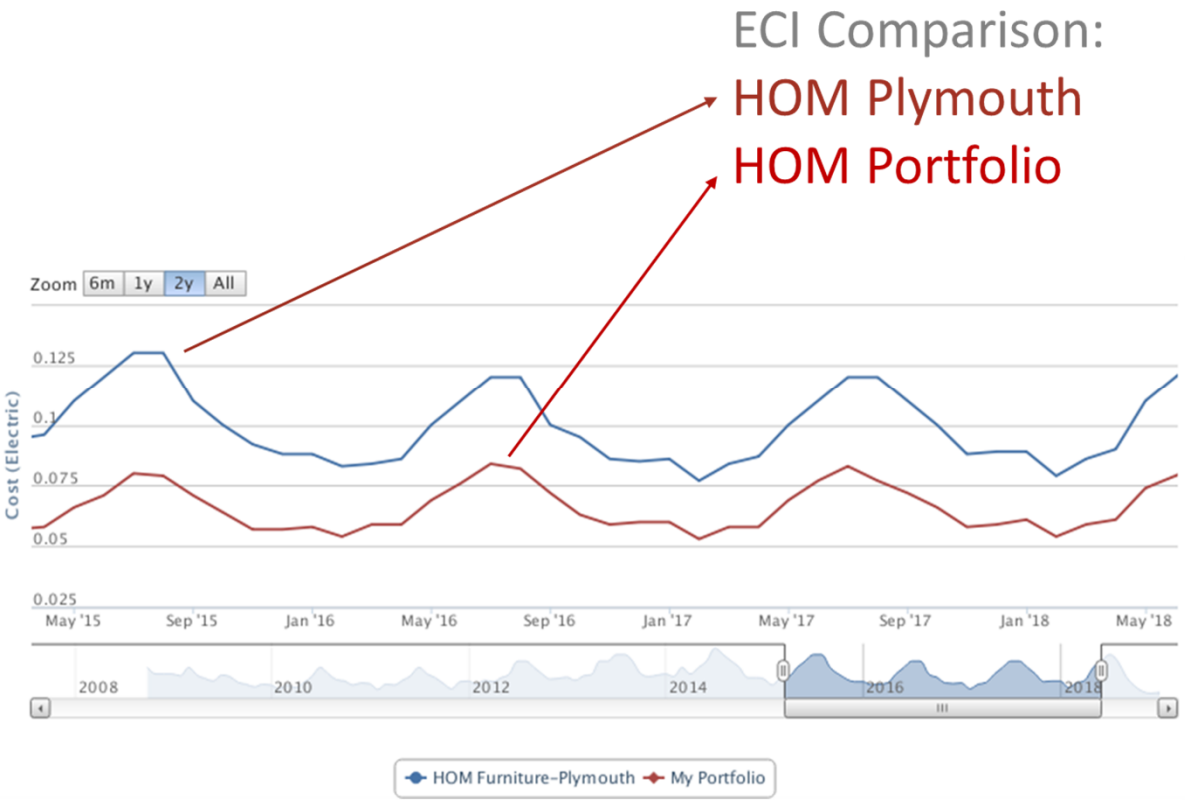
Are buildings getting better or worse?

My Portfolio ▾ | PROPERTY SNAPSHOT | WEATHER SNAPSHOT | PROPERTY INFO

Name	Current Through	Cost /SF	Cost % Change	Consumption /SF	Consumption % Change	Carbon /SF	Carbon % Change
Gabberts-Edina	01/2019	$0.99	-9.8% ↓	40.92	-2.0% ↓	13.12	-12.3% ↓
HOM Furniture-Fargo	01/2019	$1.23	1.3% ↑	52.41	2.6% ↑	24.72	1.7% ↑
HOM Furniture-Lakeville	01/2019	$0.74	-3.5% ↓	40.93	2.2% ↑	15.30	1.9% ↑
HOM Furniture-Plymouth	01/2019	$1.19	-6.2% ↓	42.04	-17.4% ↓	16.49	-10.3% ↓
HOM Furniture-Rochester	01/2019	$1.08	0.2% ↑	36.48	3.4% ↑	12.22	-2.3% ↓
HOM Furniture-St. Cloud	01/2019	$1.33	13.1% ↑	61.62	18.2% ↑	17.05	13.4% ↑
HOM Furniture-Anoka Distribution Center	01/2019	$0.47	9.4% ↑	35.95	12.7% ↑	7.21	4.1% ↑
HOM Furniture-Sioux City Warehouse	01/2019	$1.07	17.1% ↑	101.41	23.7% ↑	19.19	16.9% ↑
HOM Furniture-Rodgers	01/2019	$1.16	0.3% ↑	61.07	5.3% ↑	17.18	-2.4% ↓
HOM Furniture-Onalaska	01/2019	$1.07	-2.8% ↓	50.26	2.9% ↑	17.48	2.0% ↑
HOM Furniture-Woodbury	02/2019	$1.19	10.3% ↑	44.59	-2.1% ↓	15.85	-1.9% ↓
HOM Furniture-Coon Rapids	02/2019	$0.59	-4.1% ↓	41.44	3.5% ↑	12.11	-0.7% ↓
HOM Furniture-Eau Claire	02/2019	$1.50	11.4% ↑	76.18	27.1% ↑	28.47	33.1% ↑
HOM Furniture-Hermantown	02/2019	$1.19	2.7% ↑	51.21	4.8% ↑	16.55	1.3% ↑
Dock 86-Little Canada	02/2019	$1.15	-0.8% ↓	51.15	2.3% ↑	16.71	-3.3% ↓

Where are the best opportunities for savings?



Property Profile | ENERGY STAR | Weather Profile | Cost Avoidance

Property current through 01/2019

Property Rank

	PREVIOUS 12 MO	CURRENT 12 MO	IMPROVEMENT RANK
EnergyPrint Rank	6.8	8.0	9.6

Property Info

Address	4150 Berkshire Lane N Minneapolis, MN View Map
Annual Energy Cost	$213,973.96
Square Footage	179,837
Year Built	1984
Primary Use	Retail - Retail Store
Primary Construction Type	Steel

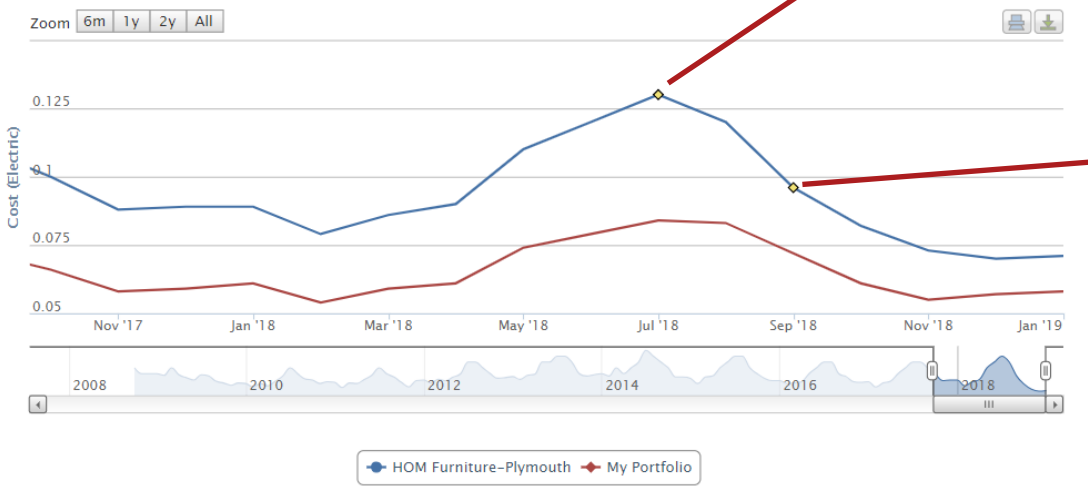
Property Snapshot

Energy Type: Electric

UNITS	PREVIOUS 12 MO	CURRENT 12 MO	% CHANGE
Cost/SF	$1.18	$1.14	-3.5%
Consumption/SF	38	35	-6.9%
Carbon/SF	16.86	15.69	-6.9%

Property Energy Trends

Metric: Cost Energy Type: Electric



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Opportunities

-5 RTU's not operating properly
-ECI significantly higher than peers
-Need advanced scheduling

75F Installation

-RTU Optimization
-Outside Air Economizer Controls
-Smart Thermostat Upgrades

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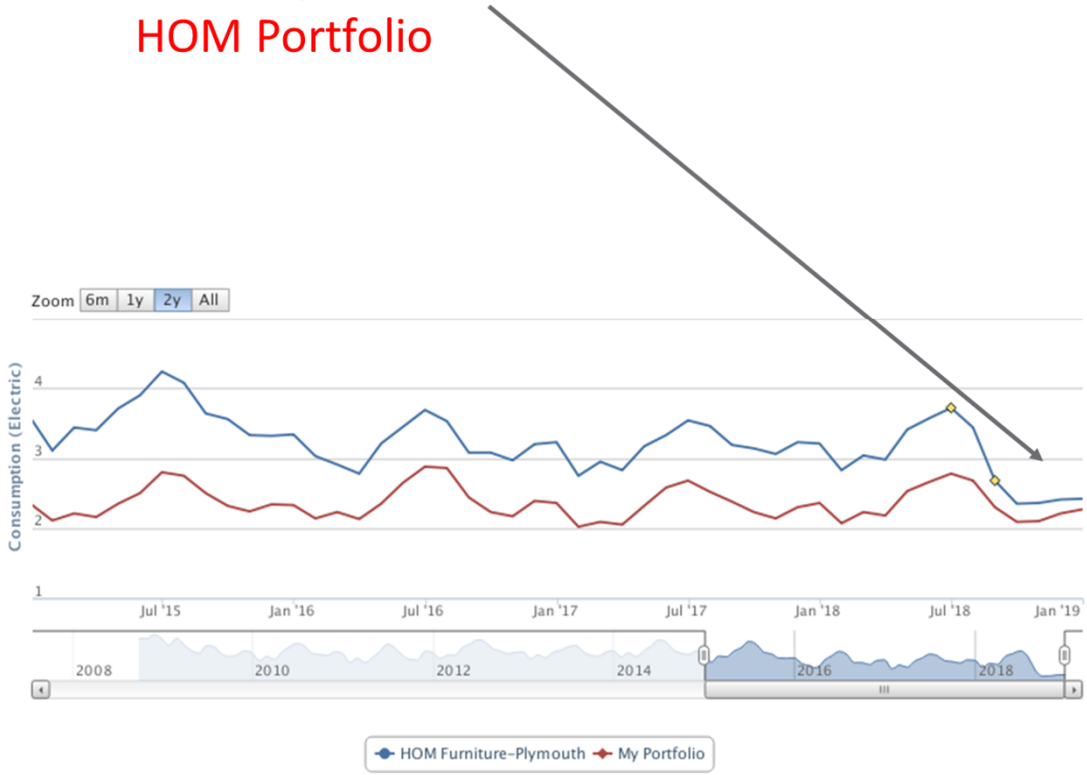
Have past improvements paid off?

EUI Post 75F:
HOM Plymouth
HOM Portfolio

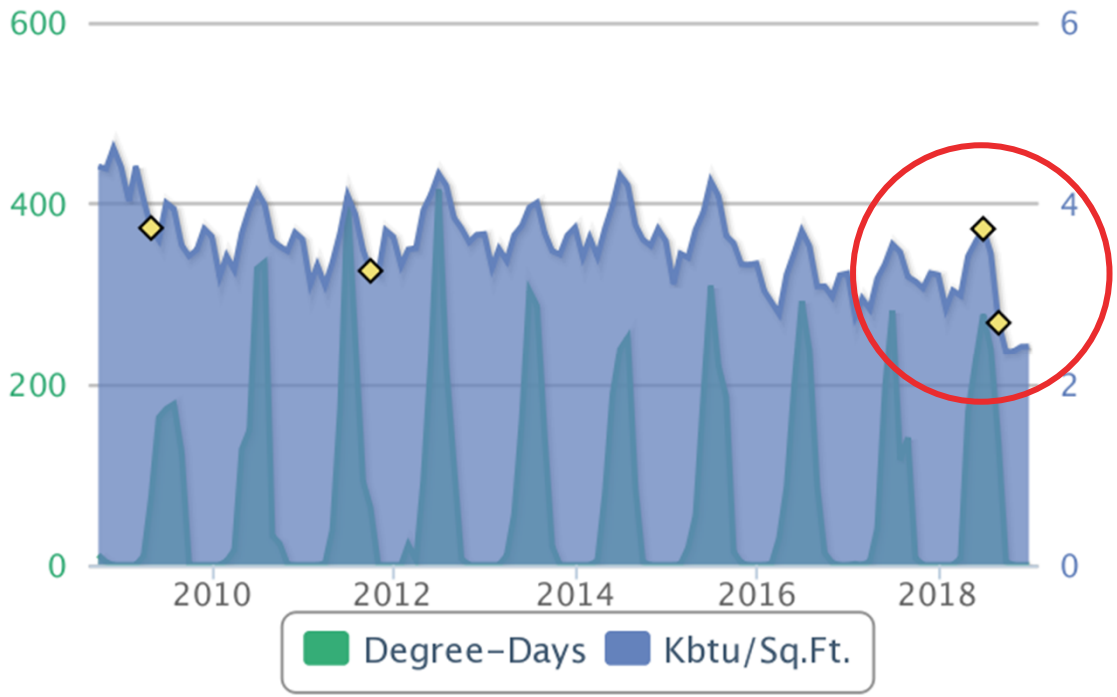


FANNING HOWEY

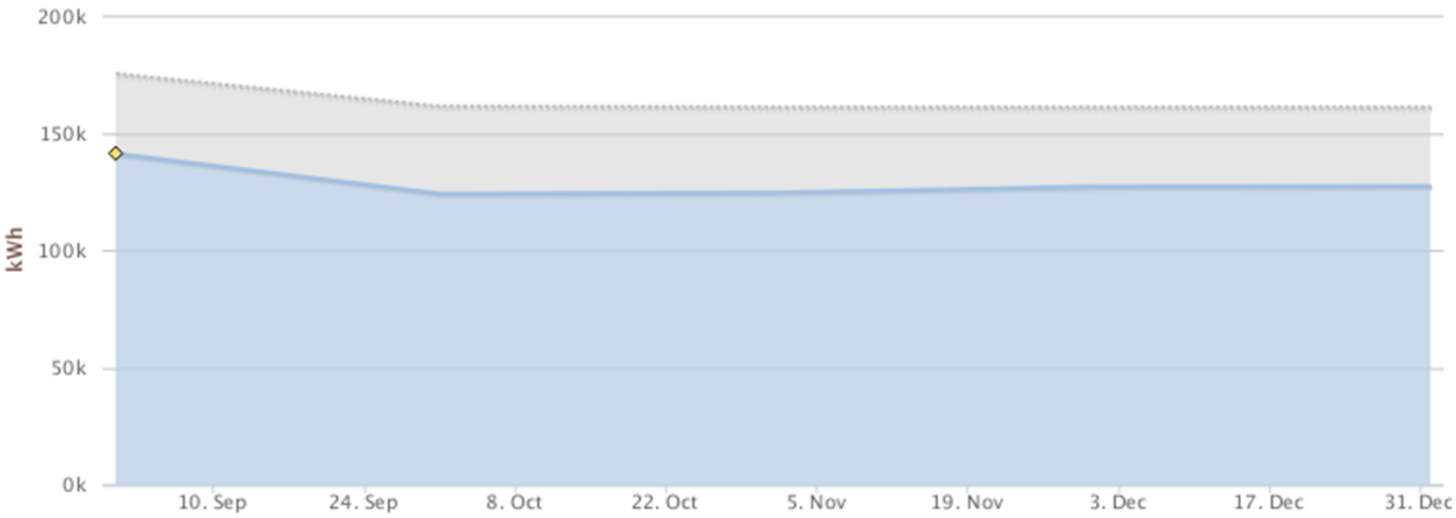
Weather Normalized Data

Electric

UNITS	PREVIOUS 12 MO	CURRENT 12 MO	% CHANGE
Billed Electric - kBtu/SF	37.84	35.22	-6.9% ↓
Cooling Degree Days (CDD)	785.4	1052.6	34.0% ↑



Month	Actual kWh	Baseyear Month	Baseyear Adjustments kWh	Baseline kWh	Cons. Avoidance kWh	Cost Avoidance
09/2018	141,196.77	09/2017	0.00	175,197.03	34,000.26	$4,180.46
10/2018	124,079.31	10/2017	0.00	161,315.58	37,236.27	$4,159.23
11/2018	124,545.69	11/2017	0.00	160,972.83	36,427.14	$3,464.75
12/2018	127,155.00	12/2017	0.00	160,972.83	33,817.83	$3,407.39
01/2019	127,405.71	01/2018	0.00	160,972.83	33,567.12	$3,219.00



Nearly $20k in 5 months…

<12 month investment ROI

HOM

- ENERGY SAVINGS
- 30% overall

Harvard Property Management Inc.

FANNING HOWEY

"Before the Utility Dashboard, no one would've challenged our energy consumption or costs because we didn't have the historic data so easily accessible. Now, we can benchmark against similar buildings and challenge our teams to run buildings better and more efficiently."

-Chris Burrell, Technical Services Director

HARVARD
Property Management Inc.
— A HILL COMPANY —

Simplify Energy Analysis

FANNING HOWEY

- Validated utility data
- Replace spreadsheets
- Simplify reporting process

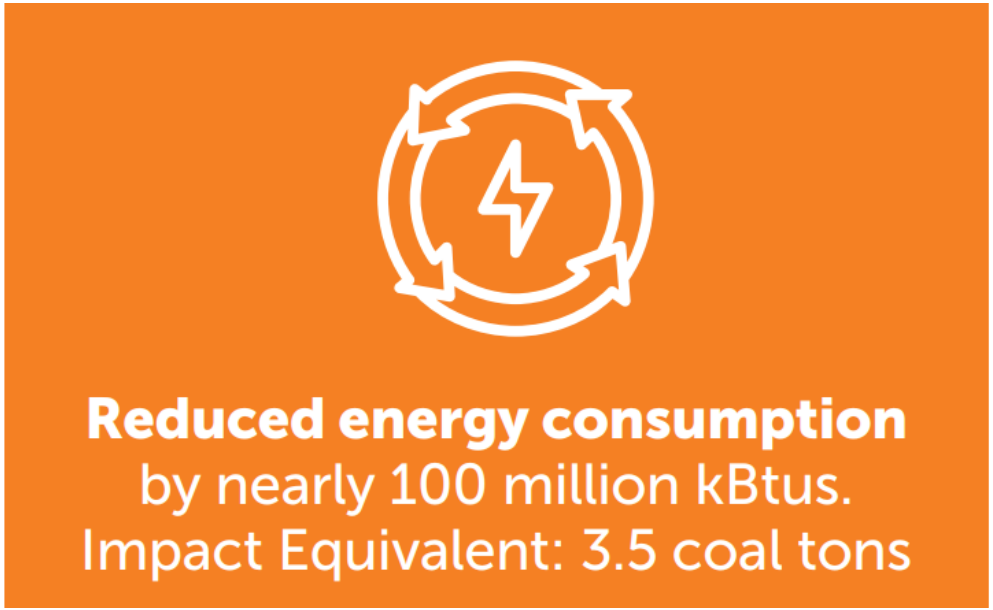
Name	Current Through	Cost /SF	Cost % Change	Consumption /SF	Consumption % Change	Carbon /SF	Carbon % Change
Normanview Shopping Centre	05/2019	$0.35	-0.7% ↓	10.51	-3.7% ↓	1.69	-3.5% ↓
Conexus Plaza	04/2019	$2.35	-2.3% ↓	99.22	-4.7% ↓	12.56	-4.6% ↓
Hill Centre Tower 1	04/2019	$1.89	-3.2% ↓	97.83	1.7% ↑	10.56	-1.8% ↓
Century Plaza	04/2019	$1.51	-5.3% ↓	54.65	-14.0% ↓	7.55	-11.9% ↓
Park Centre	04/2019	$2.61	13.5% ↑	128.39	18.7% ↑	13.42	16.5% ↑
Hill Centre Tower 2	04/2019	$2.30	-6.3% ↓	87.12	-8.4% ↓	12.22	-9.0% ↓
Bank of Montreal	04/2019	$1.97	2.7% ↑	84.21	-0.4% ↓	11.00	-0.7% ↓
Hill Centre Tower 3	04/2019	$2.17	-1.0% ↓	92.68	-2.4% ↓	11.90	-1.8% ↓
FCC Tower	04/2019	$0.29	1.2% ↑	49.43	13.2% ↑	2.48	13.2% ↑
201 Portage	04/2019	$1.72	0.8% ↑	88.48	-3.7% ↓	0.65	-0.5% ↓

Reduce Energy Use

FANNING HOWEY

"We can't control the cost of energy, but we can control consumption. Benchmarking makes it easy for us to find simple and less costly solutions to reducing consumption —including prioritizing investments across our portfolio. Partnering with EnergyPrint has helped us make better strategic financial decisions."

-Richard de la Hey, Operations Support Specialist



Cost Avoidance Snapshot

Hide / Show

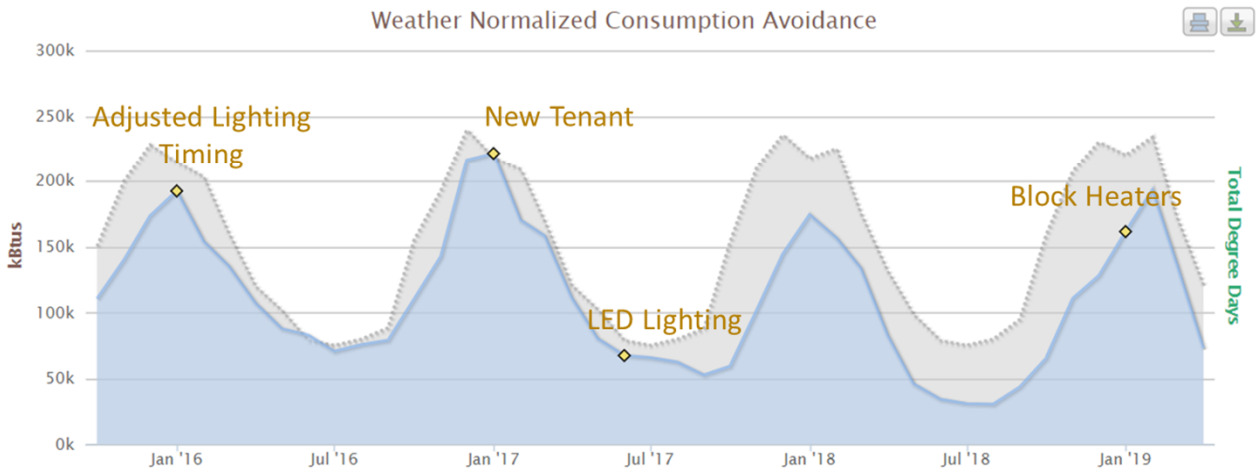
	COST AVOIDANCE	COST % CHANGE	CONSUMPTION % CHANGE	HEATING	COOLING
Weather-Normalized	$74,164.34	-35.6% ↓	-27.2% ↓	✓	✗
Billed	$73,892.52	-35.6% ↓	-26.7% ↓	-	-

Monthly Detail

Hide / Show

Export: CSV

Select detail view: WEATHER NORMALIZED | BILLED



Strengthen Client Relations

FANNING HOWEY

- EnergyPrint provides insights
- Harvard advises clients
- Credible budgeting process
- Prove ROI of reduction initiatives
- Track progress in ENERGY STAR

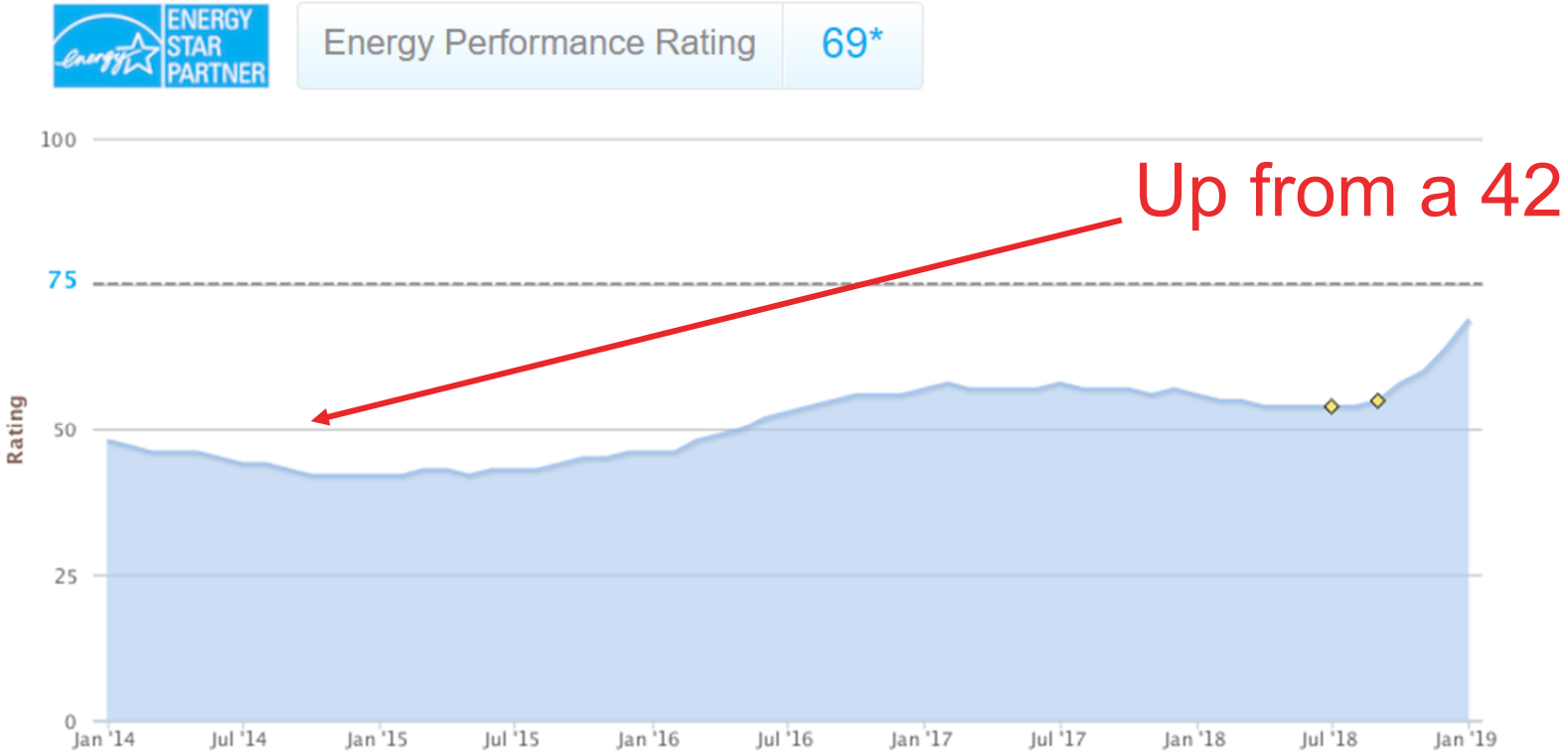
HARVARD
Property Management Inc.
— A HILL COMPANY —

ENERGY STAR PARTNER

Energy Performance Rating 94*

ENERGY STAR ratings and certification

FANNING HOWEY



Ongoing data delivery for your program

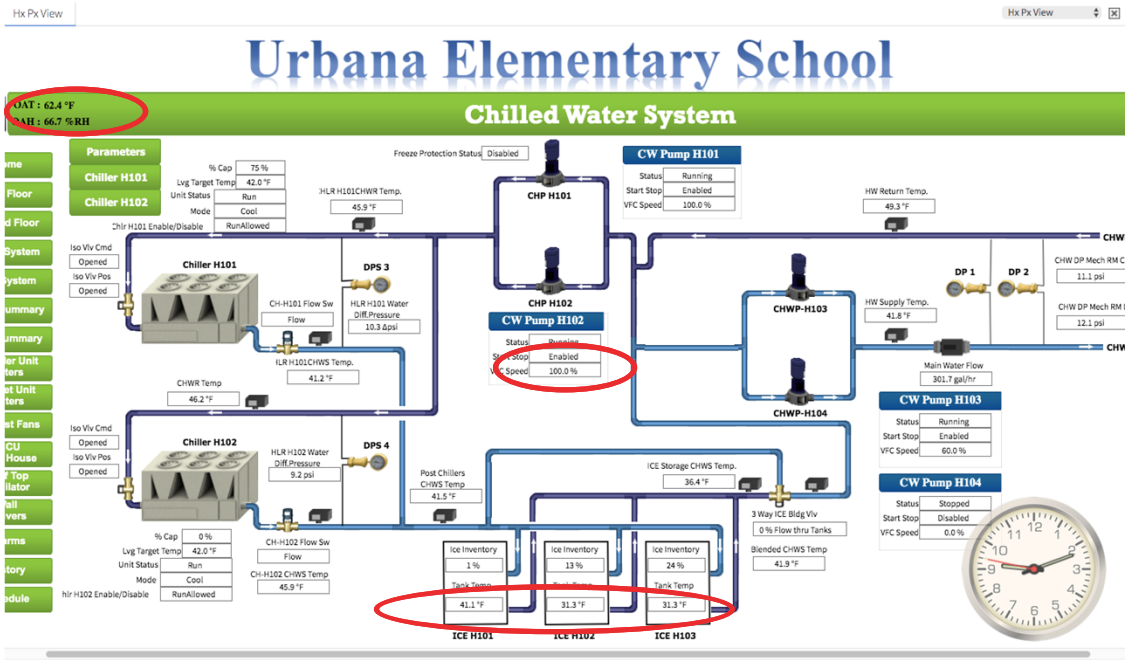
FANNING HOWEY

Ongoing data feed into design standards, certification and benchmarking tools.

Take aways

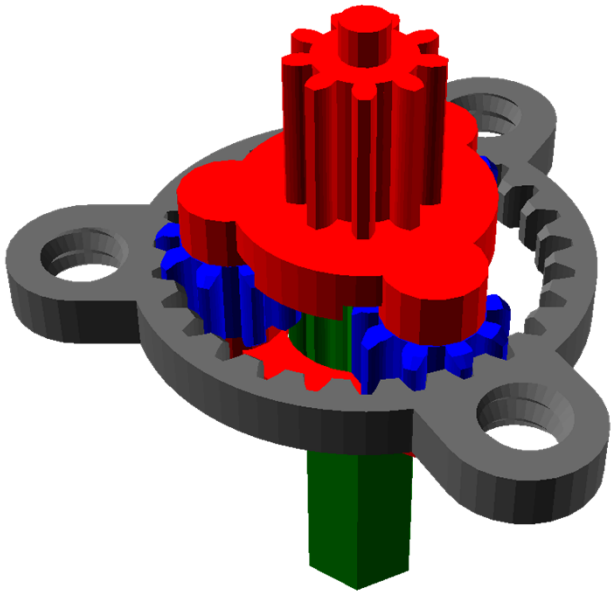
Impact

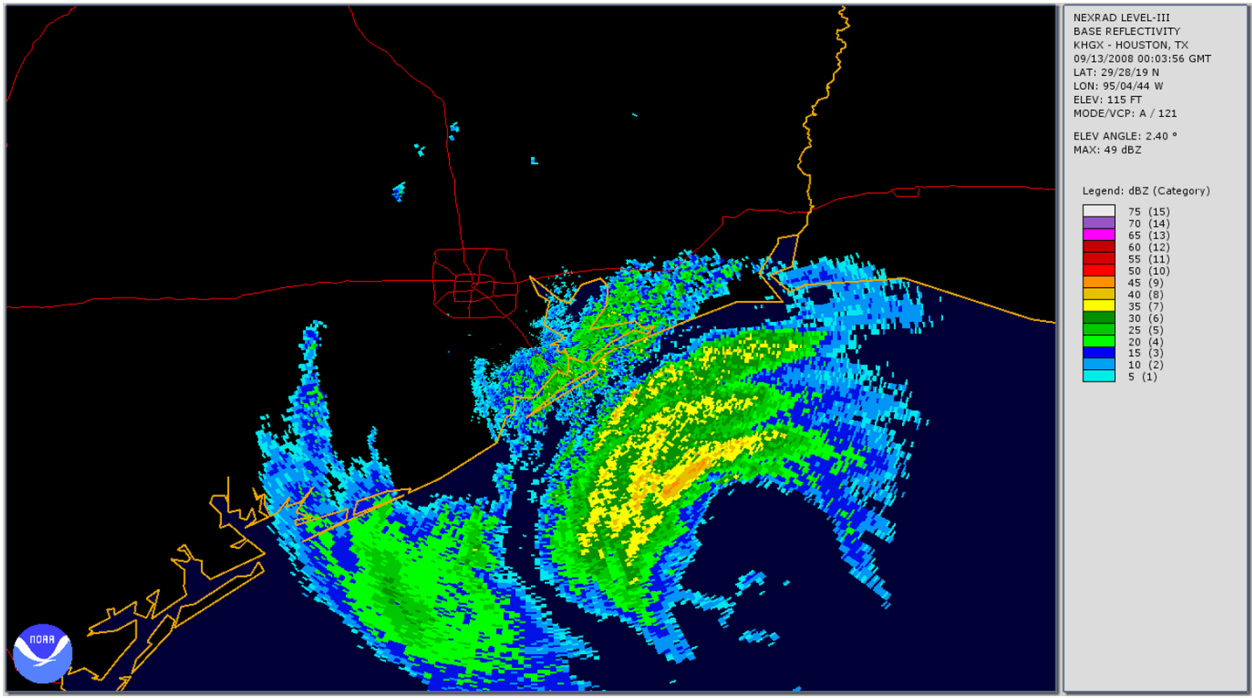
FANNING HOWEY



Impact

FANNING HOWEY





Impact

FANNING HOWEY

Visual

Auditory

(Aural) Learn best by Hearing

Reading/Writing

Learn best by Reading and Writing

Kinesthetic

(Physical) Learn best by Moving and Doing

Wrap up

FANNING HOWEY

- Why consider Verification & Continuous Commissioning?
- Why is it important to understand how your build operates?
- Data-driven decisions result in a better building environment
- Start collecting data today!

Q & A

FANNING HOWEY

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Chief Engineering Officer

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Energy Service Manager

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