Virtual Energy Assessments

A4LE ASSOCIATION DAYS

Today’s Presenter

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Agenda

- Introduction
- Process
- Measures
- Traditional Energy Audit Pros and Cons
- Virtual Energy Assessment Pros and Cons
- Case Study 1
- Case Study 2
- Summary

What Are Virtual Energy Assessments?

- In-depth analysis of existing buildings
- Energy modeling
- Lower energy costs
- Evaluate facility improvements
- Duke Energy incentive offering

What is Offered with a Virtual Assessment?

- Energy consulting services and whole-building energy analysis
- Implementation costs estimates
- Custom savings and incentive calculations
- Professional, unbiased analysts
- Assistance with the Smart $aver Incentive Application

Benefit 1
Free preliminary benchmark analysis to verify savings opportunities

Benefit 2
Streamlined audit process; building data collected remotely

Benefit 3
Quick turnaround time

Benefit 4
Real-time measure selections during results meeting

Benefit 5
Evaluate implementation costs, savings and incentives

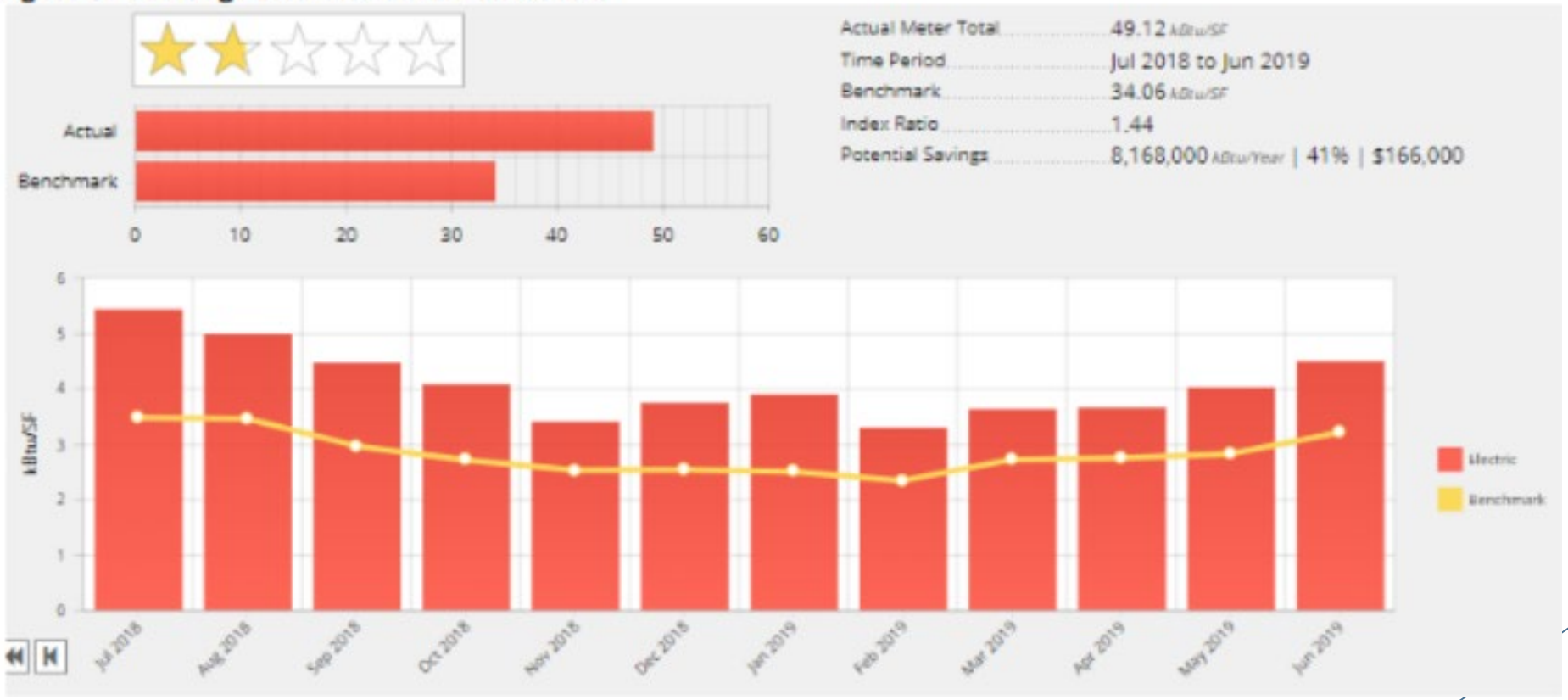
Benefit 6
Understand the measures that most impact your bottom line

Benefit 7
Assistance with all Duke Energy incentive paperwork

Benchmark Analysis

Actual usage higher than benchmark: Good opportunity for energy savings

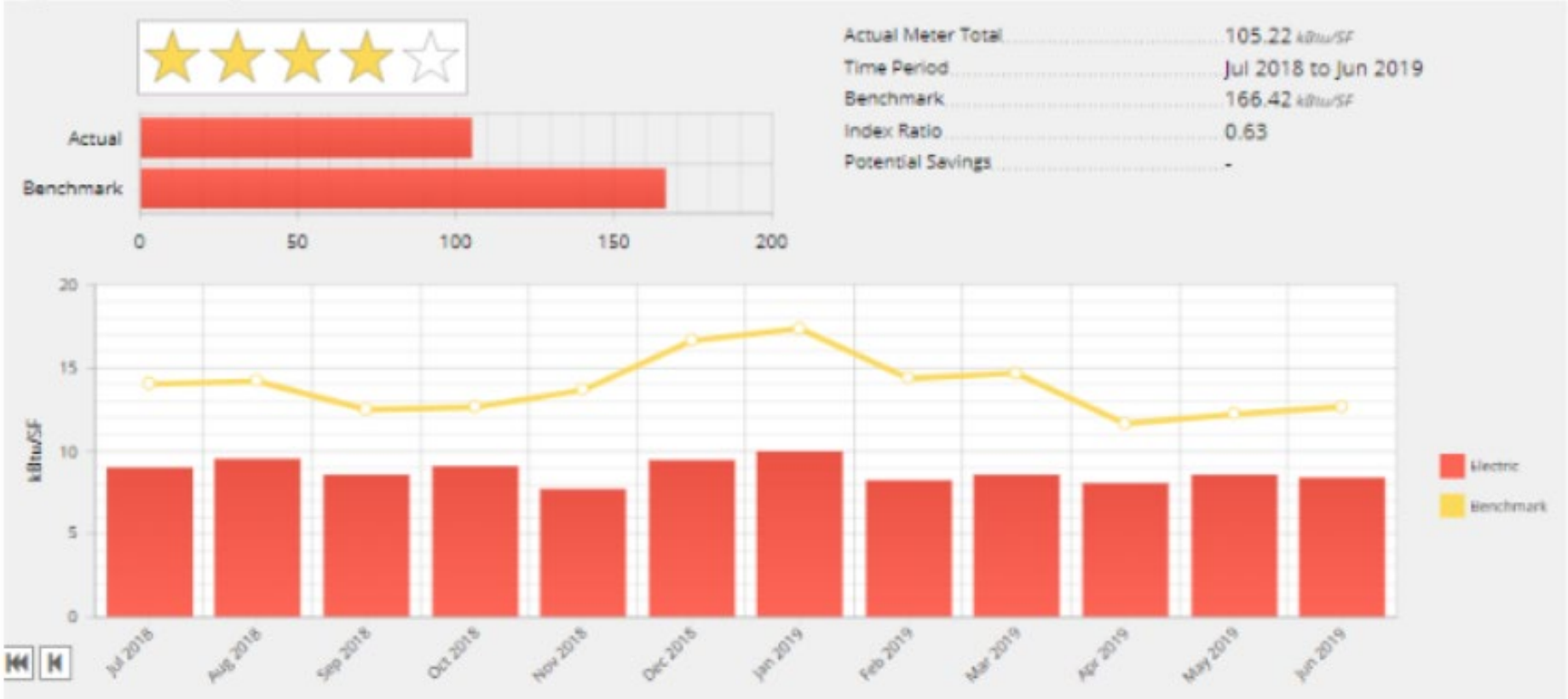
Figure 1 - Building Performance vs. Benchmark



Benchmark Analysis

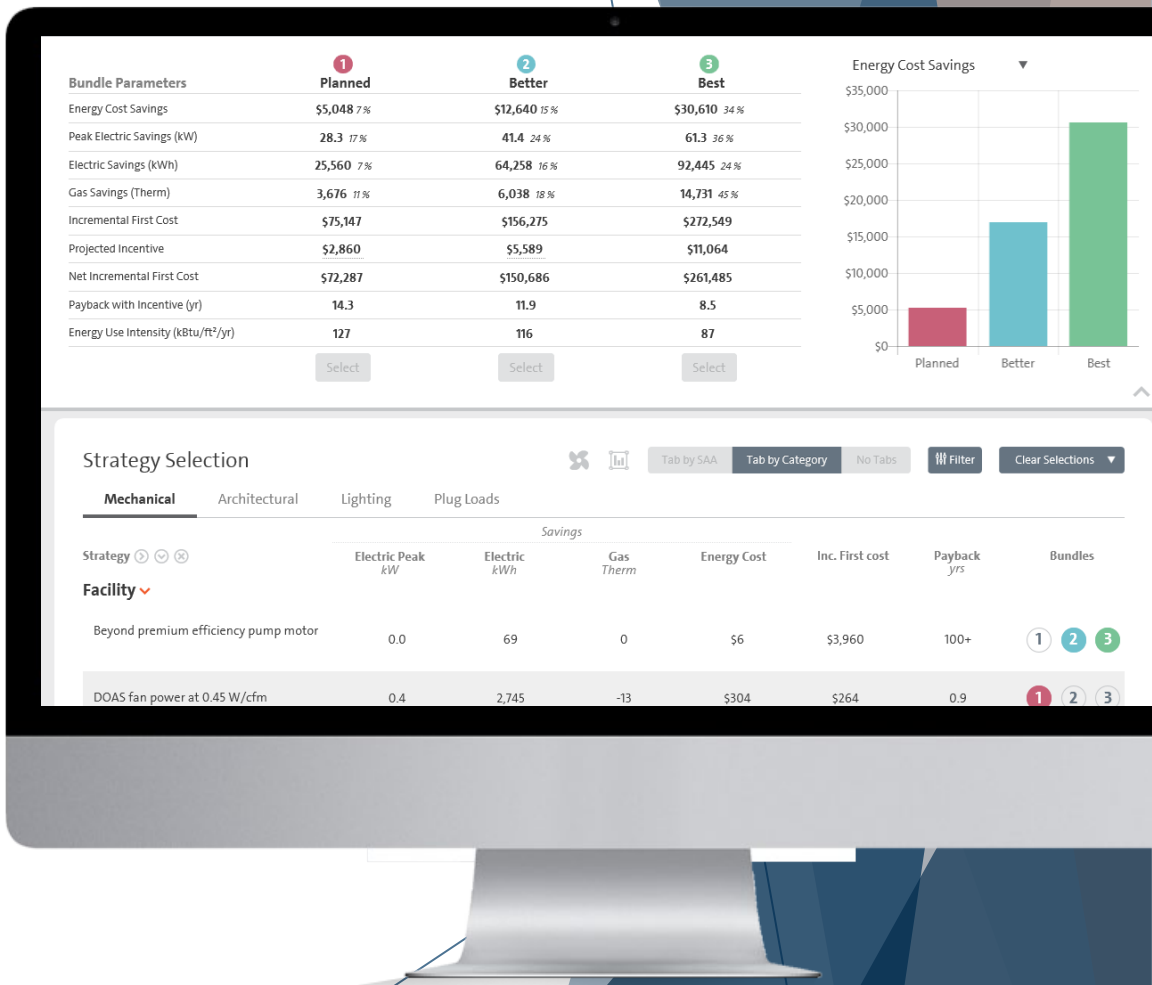
Actual usage lower than benchmark: Minimal opportunity for energy savings

Figure 1 - Building Performance vs. Benchmark



Measures That Can Be Assessed

- Lighting upgrades
- Lighting controls
- HVAC efficiency improvements
- HVAC replacements
- Building controls
  - DDC system upgrades
  - Fan, pump, supply air, chilled water and hot water resets
  - Night temperature setbacks
  - Increased thermostat control
  - Outside air reductions
- Building envelope improvements
- And more!



1	2	3	4	5
Enrollment	Analysis	Results	Validation	Incentives
Online application	▪ Gather information ▪ Model building strategy savings	Collaborative meeting with real-time model adjustments	Confirmation of installed measures	Issued for strategies implemented

Traditional Energy Audit

Pros

- In person interaction with facility engineers and staff. Find out the “real” issues of the building and the systems
- Ability to have eyes on the equipment
- Ability to take photos/videos, deploy data loggers, or take measurements for later use

Drawbacks

- Coordination of key facility team members takes time away from core job responsibilities
- Often requires an escort to provide access to secured areas
- Travel time for auditor to/from facility; could require air travel
- Safety concerns including working on or around ladders, loud noises, hazardous materials, unfavorable weather, COVID-19

Case Study #1 - Overview

Community College in Raleigh, North Carolina

- Planned renovation of mechanical and lighting systems
- 2 buildings; 118,000 total square feet; climate zone 4A
- Offices, library, and classrooms
- Typical operating schedule
- Existing building systems
  - HVAC: 4-pipe fan coil units served by gas-fired boiler and air-cooled chiller
  - Lighting: Fluorescent tubes, CFLs and incandescent canister lights

Case Study #1 - Overview

Community College in Raleigh, North Carolina

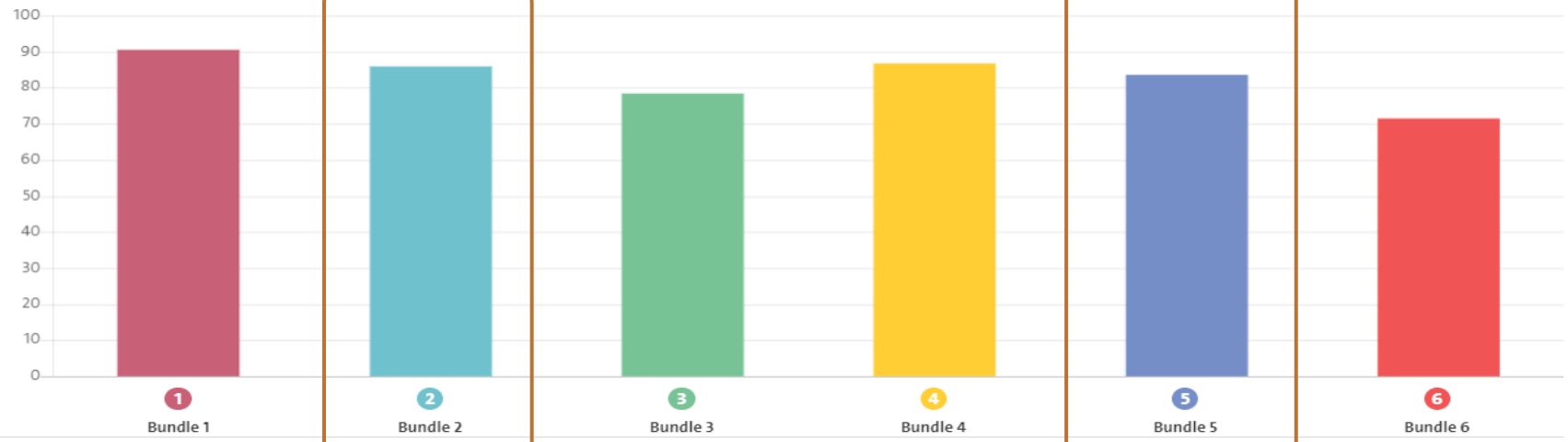
- Ongoing maintenance issues with the air-cooled chillers
- Fan coil units improperly sized or zoned causing comfort complaints
- Multiple fluorescent tube light fixtures to maintain

Case Study #1 – Design Options

- Initially planned on replacing chillers in kind
- Customer wanted to explore decentralizing the cooling system and simplifying HVAC maintenance
- Design team wanted a quick way to explore HVAC alternates

- 6 energy saving strategy bundles were developed
  - 3 scenarios replacing the air-cooled chiller in kind
  - 3 scenarios replacing the air-cooled chiller with a DX VAV system

Case Study #1 – Design Options

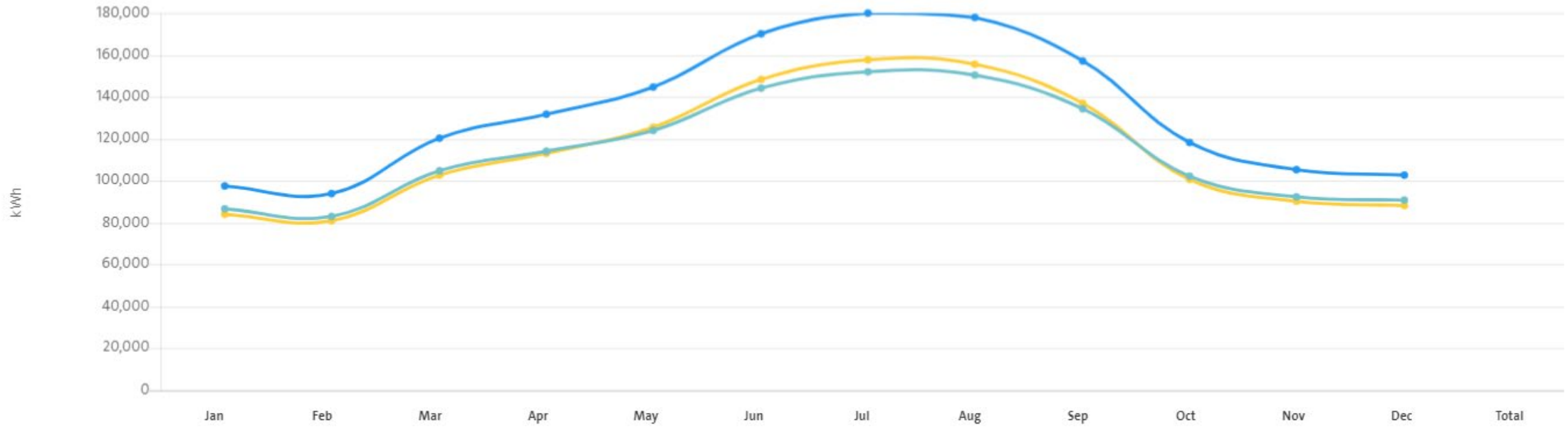


	Bundle 1	Bundle 2	Bundle 3	Bundle 4	Bundle 5	Bundle 6
Energy Use Intensity (kBtu/ft²/yrs)	90.4	85.9	78.4	86.7	83.5	71.5
Energy Cost Savings	$11,912 *20 %*	$14,267 *23 %*	$17,948 *30 %*	$15,065 *25 %*	$17,044 *28 %*	$22,319 *37 %*
Peak Electric Savings (kW)	60.9 *25 %*	75.1 *30 %*	94.6 *38 %*	70.1 *28 %*	81.9 *33 %*	121.9 *49 %*
Electric Savings (kWh)	141,019 *21 %*	166,757 *24 %*	205,262 *30 %*	183,191 *27 %*	206,784 *30 %*	258,060 *38 %*
Gas Savings (Therm)	-224 *-9 %*	-48 *-2 %*	411 *17 %*	-789 *-32 %*	-848 *-35 %*	219 *9 %*
Incremental First Cost	$126,447	$112,614	$278,944	$137,321	$232,799	$303,836
Simple Payback (yr)	10.6	7.9	15.5	9.1	13.7	13.6
Projected Incentive	$23,000	$27,000	$34,000	$28,000	$32,000	$43,000

Air-cooled Chiller Options

DX VAV Options

Case Study #1 – Design Options



E Existing, Total (kWh)	97,598	94,002	120,099	131,829	144,753	169,962	179,878	177,792	157,020	118,285	105,560	102,617	1,599,395
2 Bundle 2, Total (kWh)	86,424	82,970	104,774	113,886	124,036	144,055	152,192	150,608	134,305	102,370	92,271	90,599	1,378,490
4 Bundle 4, Total (kWh)	83,783	80,815	102,607	113,123	125,530	148,557	157,648	155,446	136,734	100,557	90,181	88,140	1,383,121

Case Study #1 – Program Impact

Benefits of Virtual Energy Analysis to Planned Renovation

- Free service utilizing experienced energy modelers
- Design team had less time commitment analyzing alternate systems
- Helped identify best energy efficiency options for HVAC system scenarios
- Predicted energy savings results are based on real historical utility consumption and actual building operation
- Higher utility incentives available for whole-building model

Case Study #2 - Overview

Junior High School in Indiana

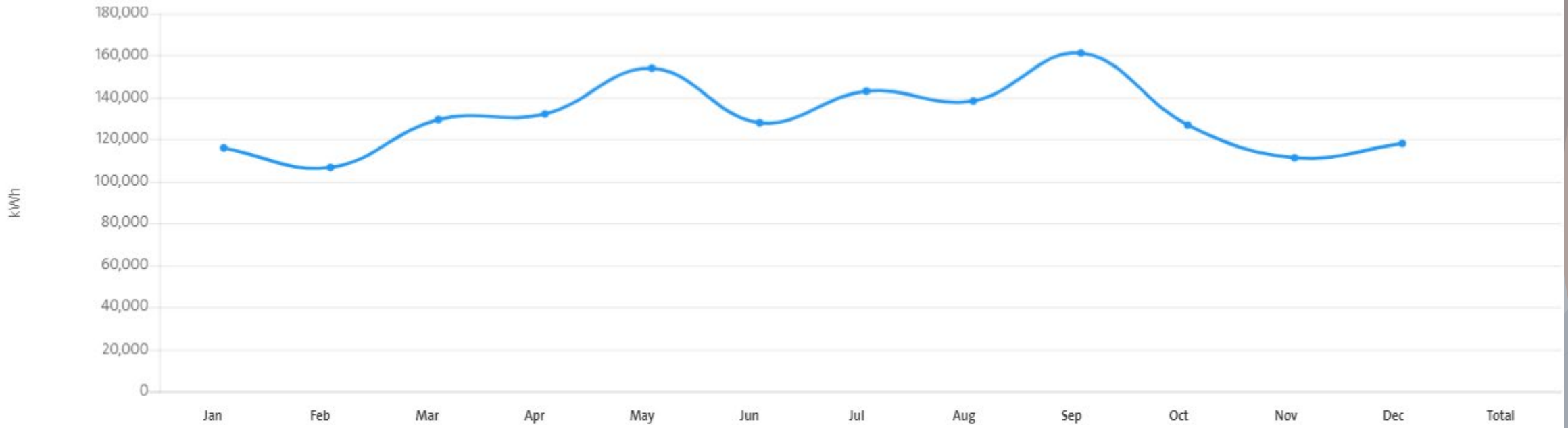
- 1 building, ~183,000 ft^2; Climate zone 5A
- Typical school usage with partial summer occupancy
- Annual energy cost: $180,000-190,000
- Existing system type – VAV with water cooled chiller and gas boilers, hot water reheat

Case Study #2 - Overview

Junior High School in Indiana

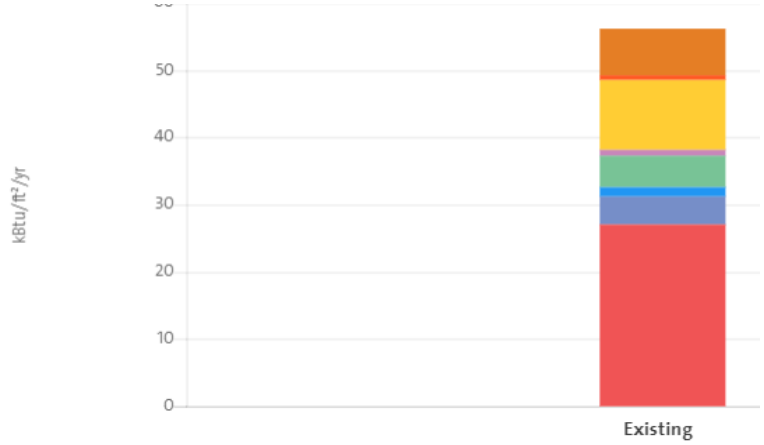
- School has a facility manager and an energy manager
- They wanted to become energy-efficient but did not have a plan
- School district budget cycles are long and larger projects need budget preapproval from the school board
- HVAC controls were maintained by the contractor and set points weren't monitored
- Larger projects can be completed only during summer so as to cause minimum disruption to school activities

Case Study #2 – Monthly Consumption



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Existing, Total (kWh)	116,046	106,767	129,537	132,307	153,740	128,142	142,936	138,419	161,025	126,906	111,364	117,908	1,565,097

Case Study #2 – EUI by End Use



Total (kBtu/ft²/yr)	56.1
Interior Equipment (kBtu/ft²/yr)	6.9
Exterior Lighting (kBtu/ft²/yr)	0.7
Interior Lighting (kBtu/ft²/yr)	10.4
Pumps (kBtu/ft²/yr)	0.8
Fans (kBtu/ft²/yr)	4.7
Heat Rejection (kBtu/ft²/yr)	1.5
Cooling (kBtu/ft²/yr)	4.0
Heating (kBtu/ft²/yr)	27.1

Case Study #2 – Design Options

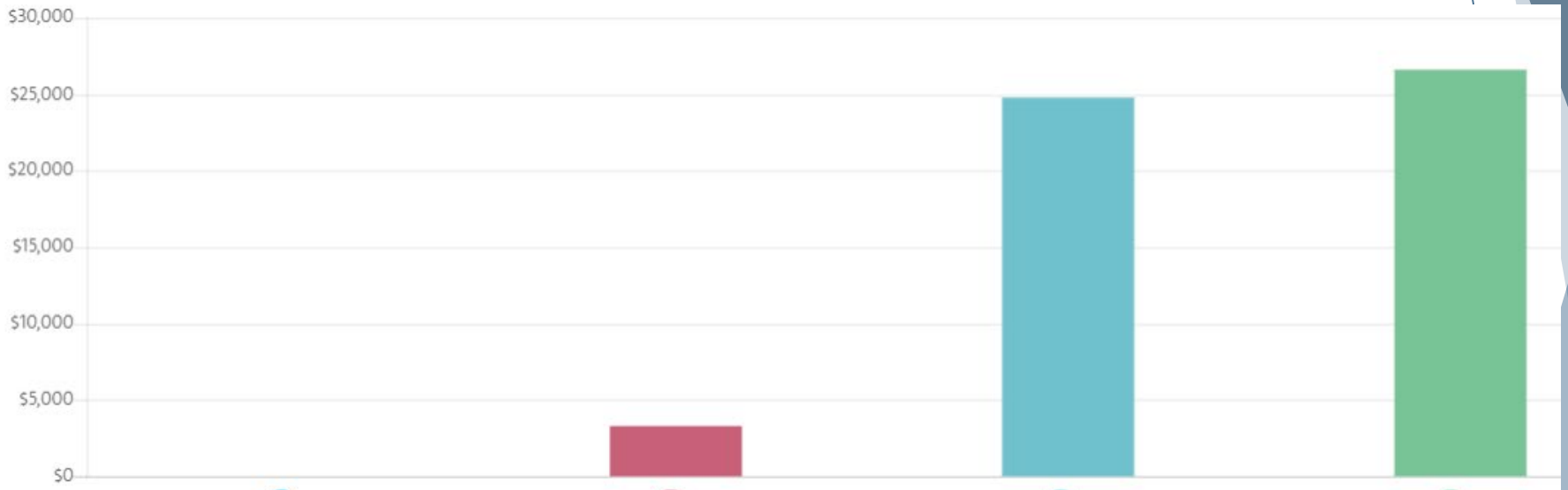
- 3 bundles with over 20 different strategies were customized to the school district's needs

Savings vs Existing	1 Summer '21	2 Summer '22	3 Summer '23
Energy Cost Savings	$3,328 2 %	$24,779 13 %	$26,629 14 %
Peak Electric Savings (kW)	4.1 1 %	71.2 17 %	72.3 17 %
Electric Savings (kWh)	34,565 2 %	286,475 18 %	305,734 20 %
Gas Savings (Therm)	-119 0 %	-5,195 -11 %	-5,268 -11 %
Incremental Cost	$177,251	$78,883	$82,910
Projected Incentive	$3,000	$29,000	$31,000
Energy Use Intensity (kBtu/ft²/yr)	55.6	53.6	53.3

Case Study #2 – Design Option

VFD on building heating water pump	•••	0.0	6,600	-69	$604	0.1	$2,014	30.0 %	3.3	1 2 3
VFD on building chilled water pump	•••	0.5	12,462	0	$1,227	0.2	$2,014	60.9 %	1.6	1 2 3
10% improved chiller efficiency	•••	15.7	18,643	0	$1,836	0.3	$397,951	0.5 %	100+	1 2 3
20% improved chiller efficiency	•••	27.2	32,367	0	$3,187	0.6	$460,746	0.7 %	100+	1 2 3
30% improved chiller efficiency	•••	38.8	46,095	0	$4,540	0.9	$522,512	0.9 %	100+	1 2 3
VFD on chiller compressor	•••	16.4	70,742	0	$6,967	1.3	$27,353	25.5 %	3.9	1 2 3
Frictionless chiller	•••	12.6	73,881	0	$7,276	1.4	$73,501	9.9 %	10.1	1 2 3
VFD on cooling tower fan	•••	1.0	5,768	0	$566	0.1	$2,014	28.1 %	3.6	1 2 3

Case Study #2 – Energy Savings Over the Years

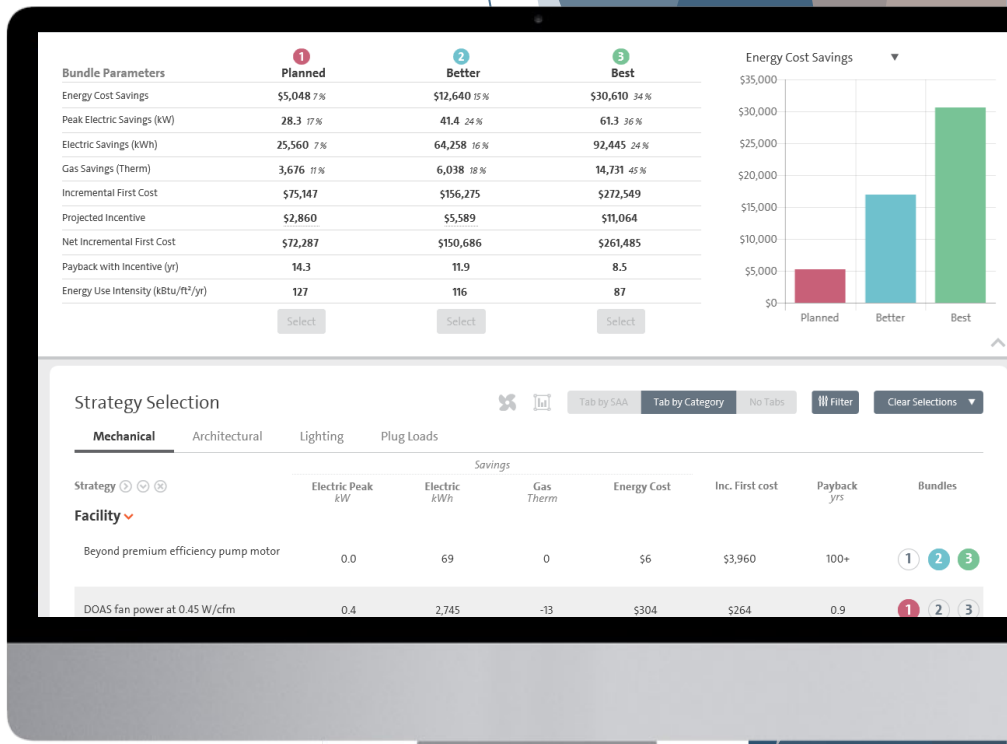


	Existing	Summer '21	Summer '22	Summer '23
Energy Cost Savings	$0 0 %	$3,328 2 %	$24,779 13 %	$26,629 14 %

Case Study #2 – Program Impact

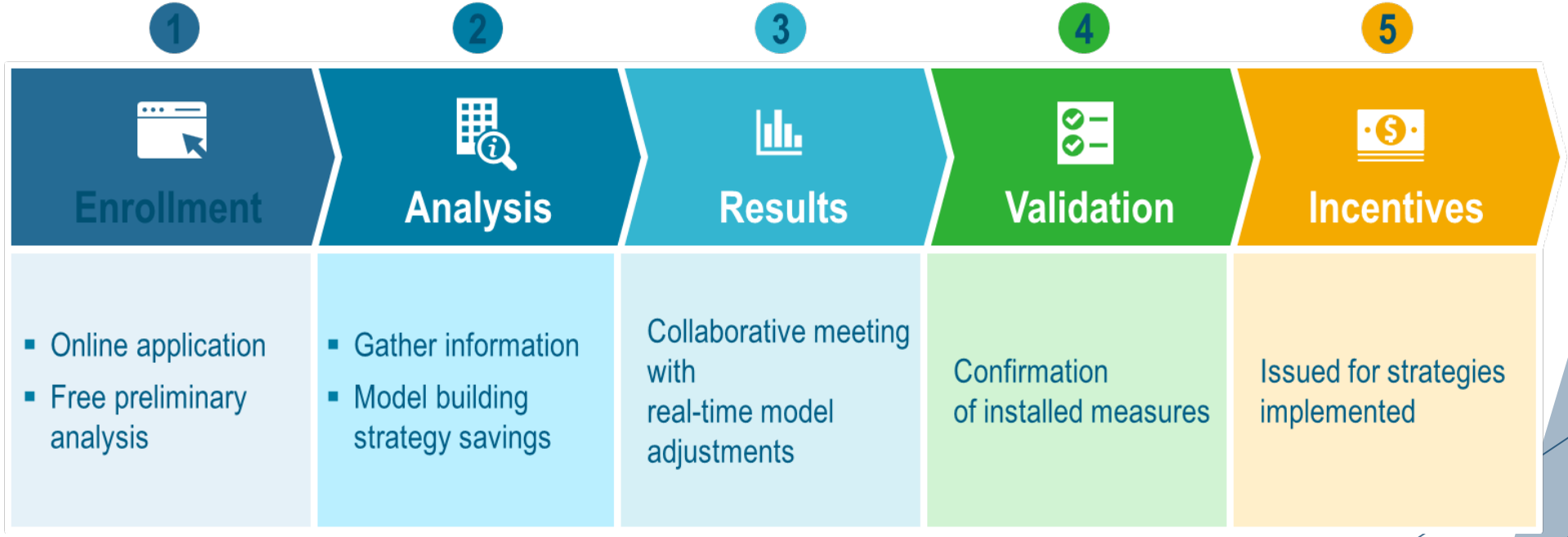
Benefits of Virtual Energy Analysis to community schools

- Helped schools create an energy efficiency plan
- Helped create a phased approach to handle energy efficiency projects



Summary

- Virtual Assessments have their place, though they do not completely replace the traditional onsite energy audit
- There is a learning curve for building owners and facility managers
- With advances in technology, including VR, analytics, and AI, virtual assessments have the potential to become the primary form of energy audits in the future



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