Nothing Compares
NORTH CAROLINA

Utility Savings Initiative

Existing Building Commissioning

New Hanover County Area
December 7, 2015

Definitions

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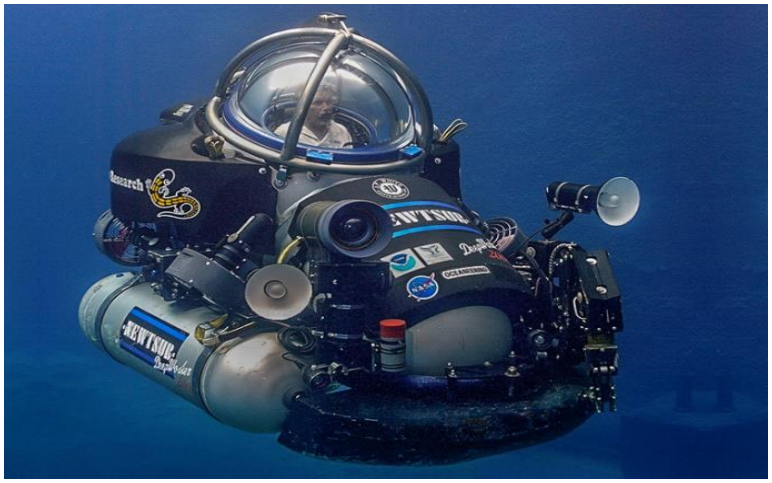
- **Commissioning (Cx)** – Systematic process of ensuring that new building systems perform interactively according to documented design intent and owner's operational needs.

- **Existing Building Commissioning (EBCx)** – Application of the Cx process to existing buildings to improve building performance. Successful implementation can often resolve problems that occurred during design or construction, or address problems that have developed throughout the building's life.

Varieties of Existing Building Commissioning



The Deep Dive

Rapid Implementation and Payback

Building Controls Tune-Up

Third Party Commissioning

Department of Environmental Quality

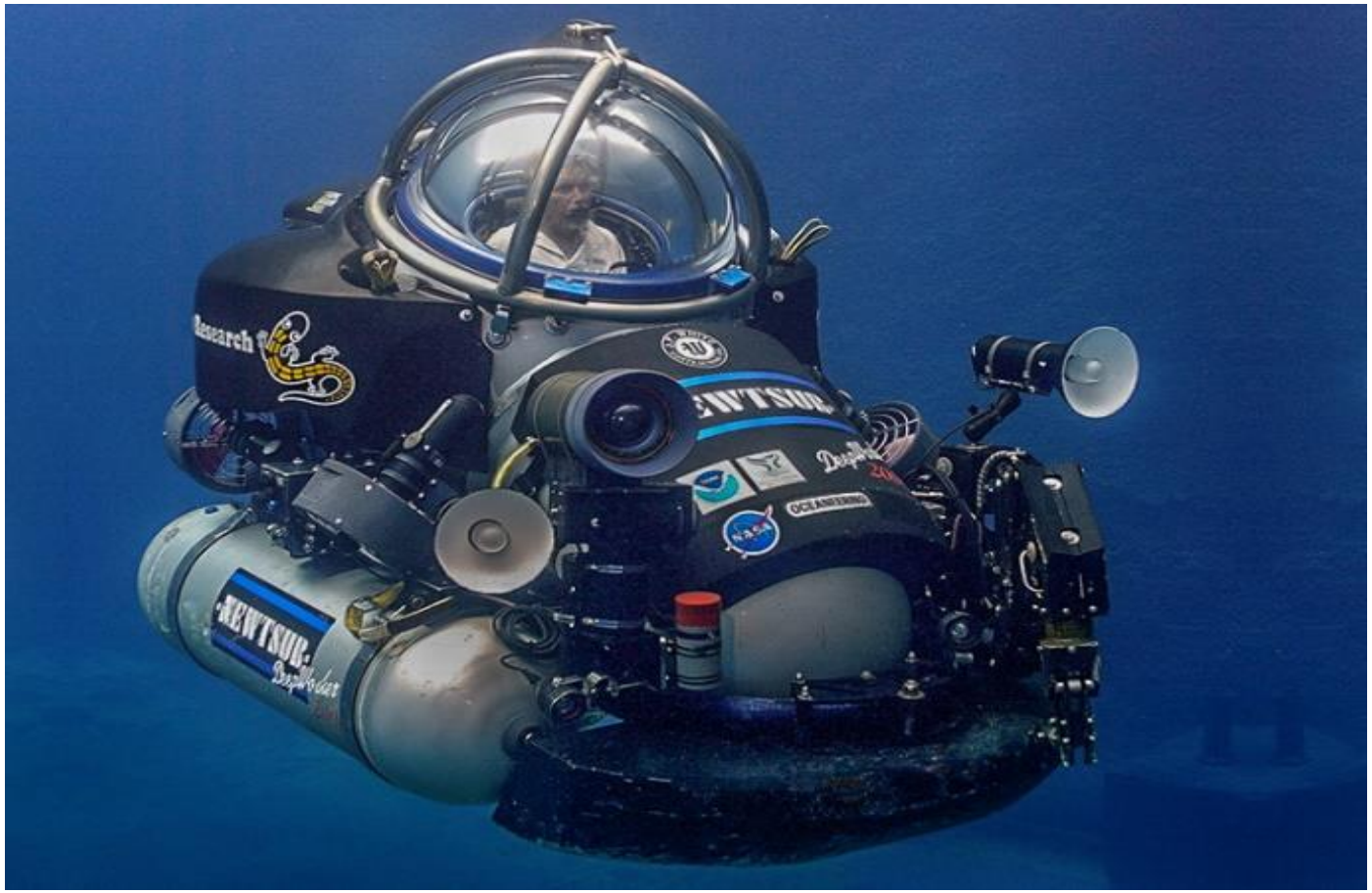
General Benefits:

- Improved occupant safety
- Improved occupant comfort
- Reduced energy / water costs
- Reduced maintenance costs
- Reduced repair / replacement costs
- Increased building value
- Advanced staff skills

Generally Accepted Industry Numbers

Cost:	• $ 0.05 to $ 0.40 per sq. ft.
Energy Savings:	• 15% - 30% commonly realized (up to 40% possible)
Cost Savings:	• 0.7 year payback

Deep Dive



- HVAC optimized to current use of the building
- Defective or improperly installed equipment is repaired or replaced
- Replace aged or malfunctioning equipment with more efficient equipment

- Results in optimally performing building
- May be performed in-house or combination of in-house and outside consultants
- Requires the most resources

Cost:

- $ 1.00 to $2.00 per sq. ft.
  (includes ~25% labor, ~75% equipment)

Energy Savings:

- 10% - 40% commonly realized
  (dependent on condition of building)

Cost Savings:

- Less than 2 year payback

- In-house staff possess high level expertise
- Project has institutional commitment
- Staff has passion and time available
- Building contains digital controls
- Funding is available for commissioning and equipment upgrades

- Results in comprehensive whole building improvement
- Increases capability for continued optimal performance
- Extends life of the equipment
- In-house staff brings institutional knowledge

Individual Project Costs: Fox Labs

➢ Example 1: Mary Anne Fox Labs (70,700 SF)

- Commissioning performed by outside contractor and NCSU Staff
- Building consists of teaching labs and professor offices

EXPENSE (BY PROVIDER)	COST ($)
Commissioning (Consultant)	48,500
Facilitate Contractors (NCSU)	14,052
Repair Work (Zone 7)	2,696
Parts & Components	1,300
Lab Airflow Contractor	12,000
Major Projects (NCSU/Contractor)	24,500
TOTAL COST	**103,048**

COST PER SQUARE FOOT: $1.46

Individual Project Costs: Fox Labs

➢ Example 1: Mary Anne Fox Labs (70,700 SF)

- Energy savings for Fiscal Year 2014 (as compared to FY 2013).

ENERGY CATEGORY	SAVINGS ($)
Electricity	17,854
Steam	23,548
Chilled Water	41,455
Domestic Water	1,230
TOTAL SAVINGS	**84,087**

EUI dropped from 528 to 468

Individual Project Costs: Leazar Hall

➢ Example 2: Leazar Hall (57,027 SF)

- Commissioning performed by outside contractor & NCSU staff
- Building consists of teaching labs, classrooms and professor offices

EXPENSE (BY PROVIDER)	COST ($)
Commissioning (Consultant)	34,900
Facilitate Contractors (NCSU)	14,652
Repair Work (Zone 1)	4,900
Parts & Components	483
Major Projects (NCSU/Contractor)	0
TOTAL COST	**54,935**

COST PER SQUARE FOOT: $0.96

Individual Project Costs: Leazar Hall

➢ Example 2: Leazar Hall (57,027 SF)

- Energy savings for Fiscal Year 2014 (as compared to FY 2013).

ENERGY CATEGORY	SAVINGS ($)
Electricity	7,308
Steam	19,255
Chilled Water	19,045
Domestic Water	333
TOTAL SAVINGS	**45,941**

EUI dropped from 157 to 103

Individual Project Costs: Withers Hall

➢ Example 3: Withers Hall (71,144 SF)

- Commissioning performed by NCSU Commissioning Team
- Building consists of classrooms and professor offices

EXPENSE (BY PROVIDER)	COST ($)
Commissioning (NCSU)	29,630
Repair Work (NCSU Cx Team)	16,387
Repair Work (Zone 1)	6,207
Parts & Components	3,956
Major Projects (NCSU/Contractor)	19,008
TOTAL COST	**$75,188**

COST PER SQUARE FOOT: $1.06

Individual Project Costs: Withers Hall

➢ Example 3: Withers Hall (71,144 SF)

- Energy savings for Fiscal Year 2014 (as compared to FY 2013).

ENERGY CATEGORY	SAVINGS ($)
Electricity	15,193
Steam	6,262
Chilled Water	20,195
Domestic Water	356
TOTAL SAVINGS	**42,006**

EUI dropped from 110 to 77

NCSU First Four Projects

Project	Size (SF)	Project Cost	Cost / SF	Annual Savings	ROI (Years)	Decrease in EUI
Mary Anne Fox Labs	70,700	$ 103,048*	$ 1.46	$ 84,087	1.2	528 to 468
Leazar Hall	57,027	$ 54,935*	$ 0.96	$ 45,941	1.2	157 to 103
David Clark Labs	93,181	$ 148,830*	$ 1.59	$ 334,131	0.5	594 to 371
Withers Hall	71,144	$ 75,188	$ 1.06	$ 42,006	1.8	110 to 77
Totals	292,052	$ 382,001		$ 506,165		

** Includes cost for consultant*

Rapid Implementation and Payback

Department of Environmental Quality

Rapid Implementation and Payback

What Is It?

- Focus primarily on HVAC controls, maintenance and operations
- Target measures with one year payback or less
- Low cost, low risk, high reward alternative
- Requires minimal capital, but high level of in-house expertise

Rapid Implementation and Payback

Cost:

- $ 0.10 to $ 0.25 per sq. ft.
  (includes ~90% labor, ~10% equipment)

Energy Savings:

- 10% - 30% commonly realized
  (dependent on condition of building)

Cost Savings:

- Less than 1 year payback

- In-house staff possess high level expertise
- Project has institutional commitment
- Staff has passion and time available
- Building contains digital controls
- Major building systems are functional

- Primarily labor costs
- Less effort in building & faster payback
- Significant deficiencies are resolved later
- In-house staff brings institutional knowledge

Program Savings for 10 million Sq. Ft.

Fiscal Year	Savings	Cost
2010	$ 4.3 m	$822,000
2011	$ 5.3 m	< $75,000
2012	$ 5.9 m	< $75,000
2013	$ 6.0 m	< $75,000
2014	$ 6.6 m	< $75,000
	$28.1 m	~ $1.1 million

- Link to UNC Chapel Hill's Retro-commissioning white paper

http://save-energy.unc.edu/Projects/EnergyConservationMeasuresProgram

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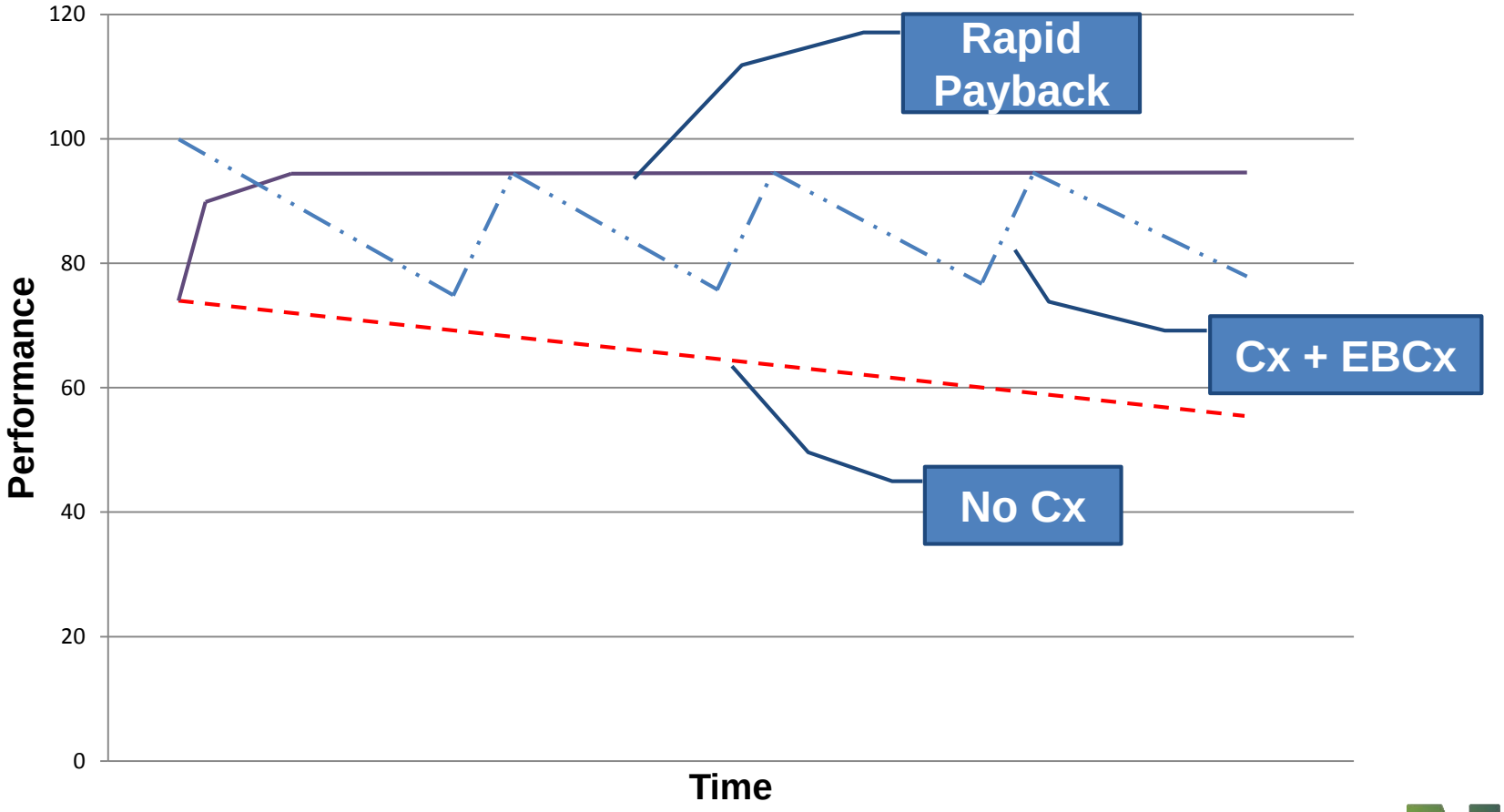

120
100
80
60
40
20
0
Performance
Time
Rapid Payback
Cx + EBCx
No Cx

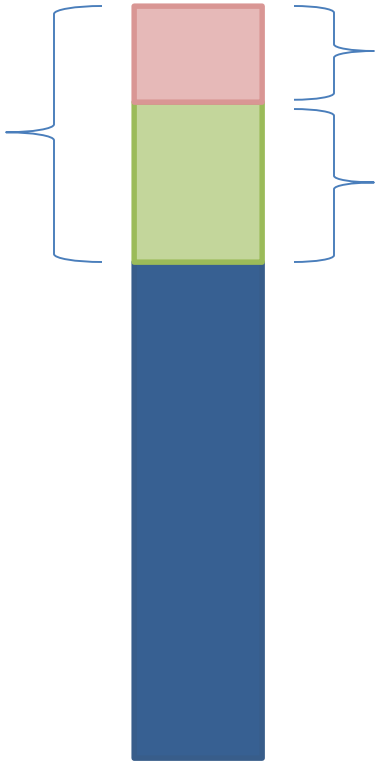
NC State Approach

~ $2.00 / sq. ft.
2.5 year payback

UNC Chapel Hill Approach

~ $2.00 / sq. ft. |3 – 10 year payback

~ $ .25 / sq. ft. |6 month payback



Current condition

UNC Chapel Hill

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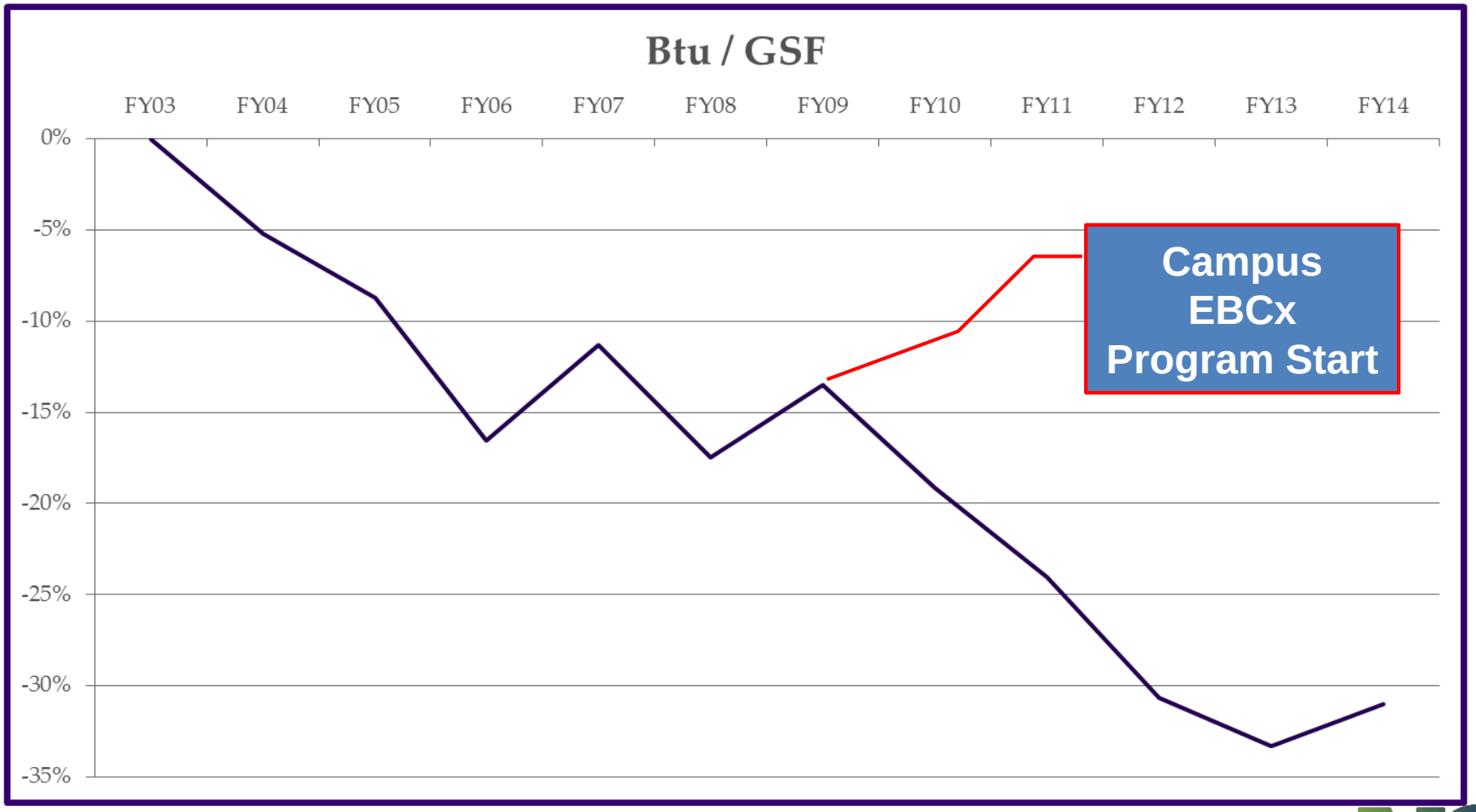

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Program Savings for 10 million Sq. Ft.

Program Year	GSF	Cost (Thousands)	Cost / GSF	Energy Savings (MBtus)	Water Savings (MGals)	MTCO2E Reduction	Energy Savings (Millions)	ROI (Months)
2010	10M	$822	$0.08	439,600	27.2	41,419	$4.3	2.3
2011		<$75	<$0.01	532,500	30.5	43,865	$5.3	<1
2012		<$75	<$0.01	558,500	36.0	41,313	$5.9	<1
2013		<$75	<$0.01	611,500	31.9	52,407	$6.0	<1
2014		<$75	<$0.01	618,000	33.9	51,196	$6.6	<1
5 year Total:	**10M**	**$1,122**	**$0.12**	**2,760,100**	**160**	**230,200**	**$28.1**	**<1**

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Building Controls Tune-Up

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Building Controls Tune-Up

What Is It?

- Vendor analyzes HVAC controls system and proposes changes for improvements based on current building and space use
- Vendor performs agreed upon improvements to reduce energy use as budget allows
- Minor repairs performed by either vendor or in-house staff
- Staff is trained by vendor as part of service

- In-house staff lacks expertise / resources
- To provide training to in-house staff
- Project has institutional commitment
- Building contains digital controls
- Building is metered

- Can have major impact on cost savings by controlling demand charges
- Can easily lose the gains if staff do not provide ongoing monitoring of the system
- Deficiencies found during system analysis are put on list to be resolved later

NCCU Pilot Project

Pearson Dining Hall
Year Built: 2008
Floor Area (GSF): 58,000
No. of Floors: 3
Hrs. Occupied per Week: 84

Miller-Morgan Health Sciences
Year Built: 1982
Floor Area (GSF): 47,000
No. of Floors: 2
Hrs. Occupied per Week: 46 (approx.)

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Building Controls Tune-Up

Cost:

- ~$ 0.25 per sq. ft.

Energy Savings:

- 6% - 10% in electrical consumption
- 22% – 30% reduction in electrical demand
- Heating from steam not yet available

Cost Savings:

- $11,300 in electrical consumption alone

Miller Morgan: **58** measures identified. **50** being implemented.
Pearson Cafeteria: **43** measures identified. **40** being implemented.

Third Party Commissioning

What Is It?

- Consultant assists the owner in developing the EBCx scope of work.
- Consultant manages the EBCx process on behalf of the owner.
- Consultant investigates, analyzes, and provides recommendations for optimizing the performance of existing building systems, which will include payback analysis.

Third Party Commissioning

Cost:

- $ 0.25 to $ 0.75 per sq. ft.

  (does not include implementation costs)

Energy Savings:

- 10% - 35% commonly realized

  (dependent on condition of building and measures from report selected for implementation)

Cost Savings:

- Payback typically 2 years or less

Third Party Commissioning

When to Use It

- In-house staff lacks the expertise or time
- To provide training to in-house staff
- Project has institutional commitment
- Building contains some digital controls
- Knowledge of the building systems is limited

Third Party Commissioning

When to Use It

- To develop comprehensive list of building needs
- Assist in capital planning needs
- To gain expertise of independent consultant
- Implementation by contractor, in-house staff or combination (additional $ 0.50 - $1.25 per sq. ft.)

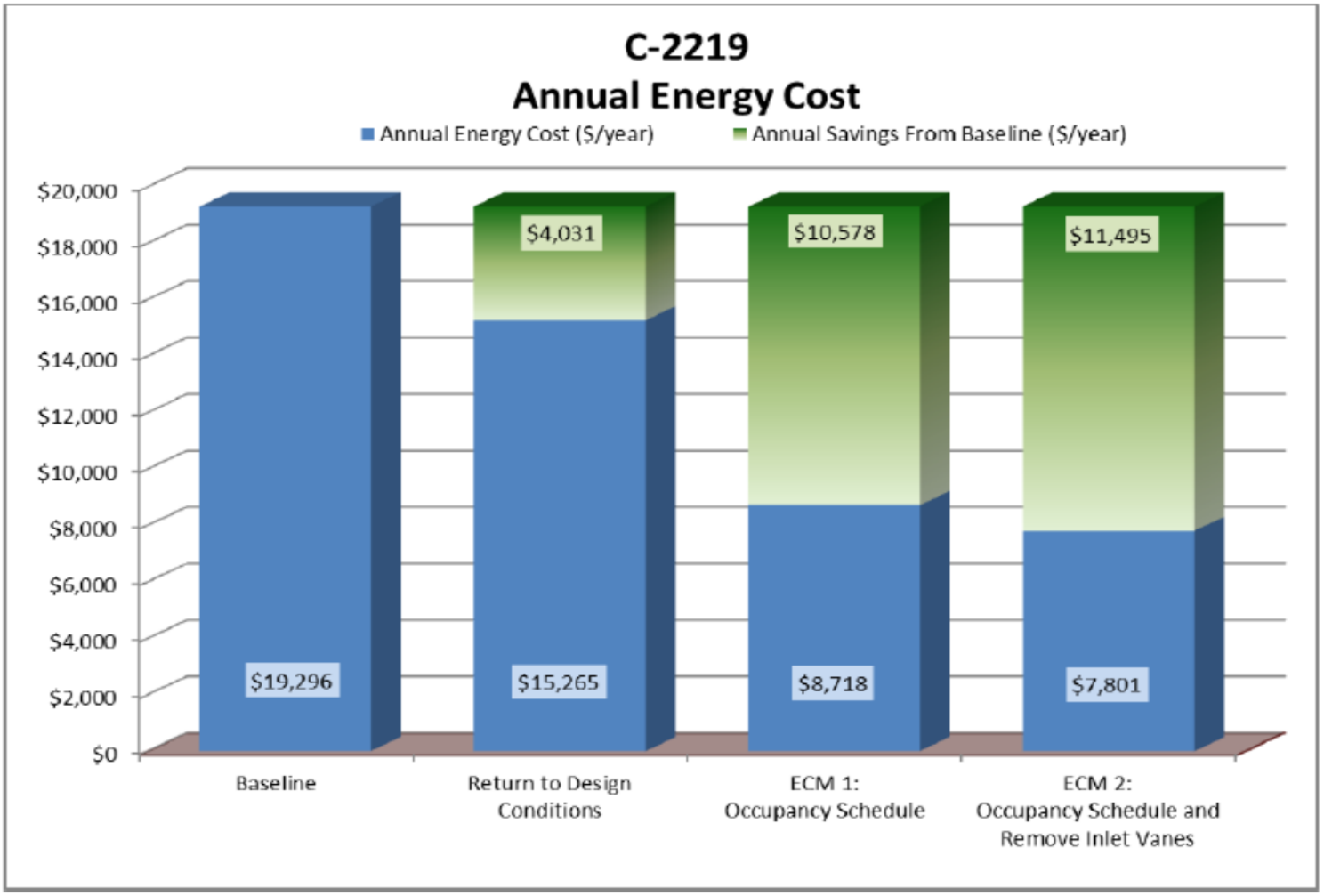
Third Party Commissioning

Other Factors and Benefits

- Analytics phase provides a report only, but no implementation
- Can provide implementation project management
- Wider range of services are available (such as energy modeling)
- Access to wide range of testing equipment

Third Party Commissioning

Results: Avoided Utility Cost



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Comparing Retro-Commissioning Options

	Potential Amount of Energy Savings Realized	Cost to Implement	Skill Level of Owner Staff Required	Time Commitment of Owner Staff Required
Deep Dive (Submersible)	$$$	$$$	High	Very High
Rapid Implementation / Payback (Snorkel)	$$	$	High	High
Controls Tune-Up (Swimming)	$ to $$	$	Medium	Medium
Third Party (Scuba Dive)	$ to $$$	$ to $$$	Low	Low

Potential Funding Sources

- House Bill 1292 Carry Forward (like)
- Maintenance and Operations Budget
- Repair and Renovation Funds
- Existing Utility Budget
- Grants
- Student Sustainability Funds
- Receipts Generated Funds
- Lapsed Salary
- Part of a Performance Contract

JUST SO YOU KNOW

Though in most cases, the building owner will see improvements in energy performance by retro-commissioning, in few cases, where buildings are not providing proper space conditioning, an increase in energy consumption may be seen. However, the building will provide an improved indoor environment and occupant comfort.

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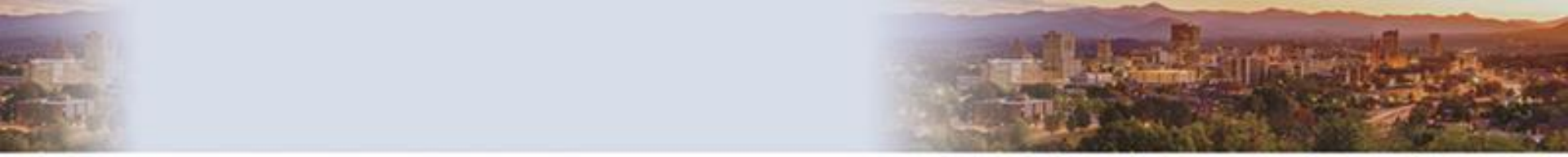
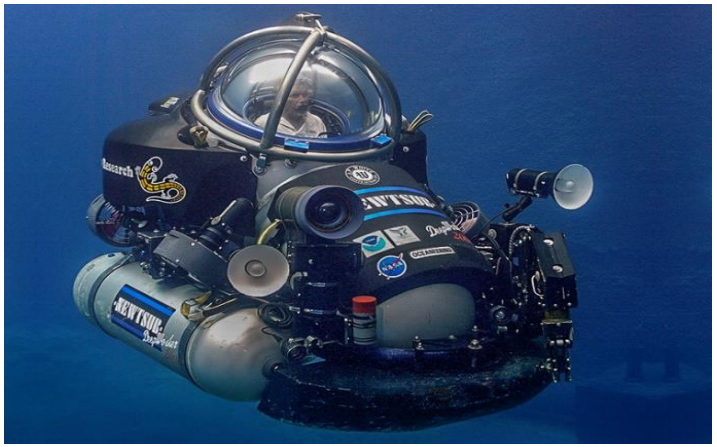


We can't solve problems by using the same kind of thinking we used when we created them.

Albert Einstein

Any Questions?



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