Leveraging Opportunities: Facilities' Energy Lifecycles

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Today's Learning Objectives

- Introduction
- Existing Buildings
  - Path to Decarbonization
- Case Study:
  - Novant Health
- Case Study:
  - Decarbonization in Mecklenburg County

Energy Saving Projects

Energy Efficiency Projects include audits, implementation, and renewable energy integration.

Why do this as a facility manager? How does this help my facility?

40% of US emissions are attributed to the built environment wherein an estimated 30% of the energy used is wasted

- Design and construction: Improving building design and construction
- Operational efficiency: Improving operational efficiency
- Renewable energy: Generating renewable energy on-site
- Greenhouse gas offsets: Offsetting GHG emissions off-site
- Utility generation planning

Existing Building Commissioning?

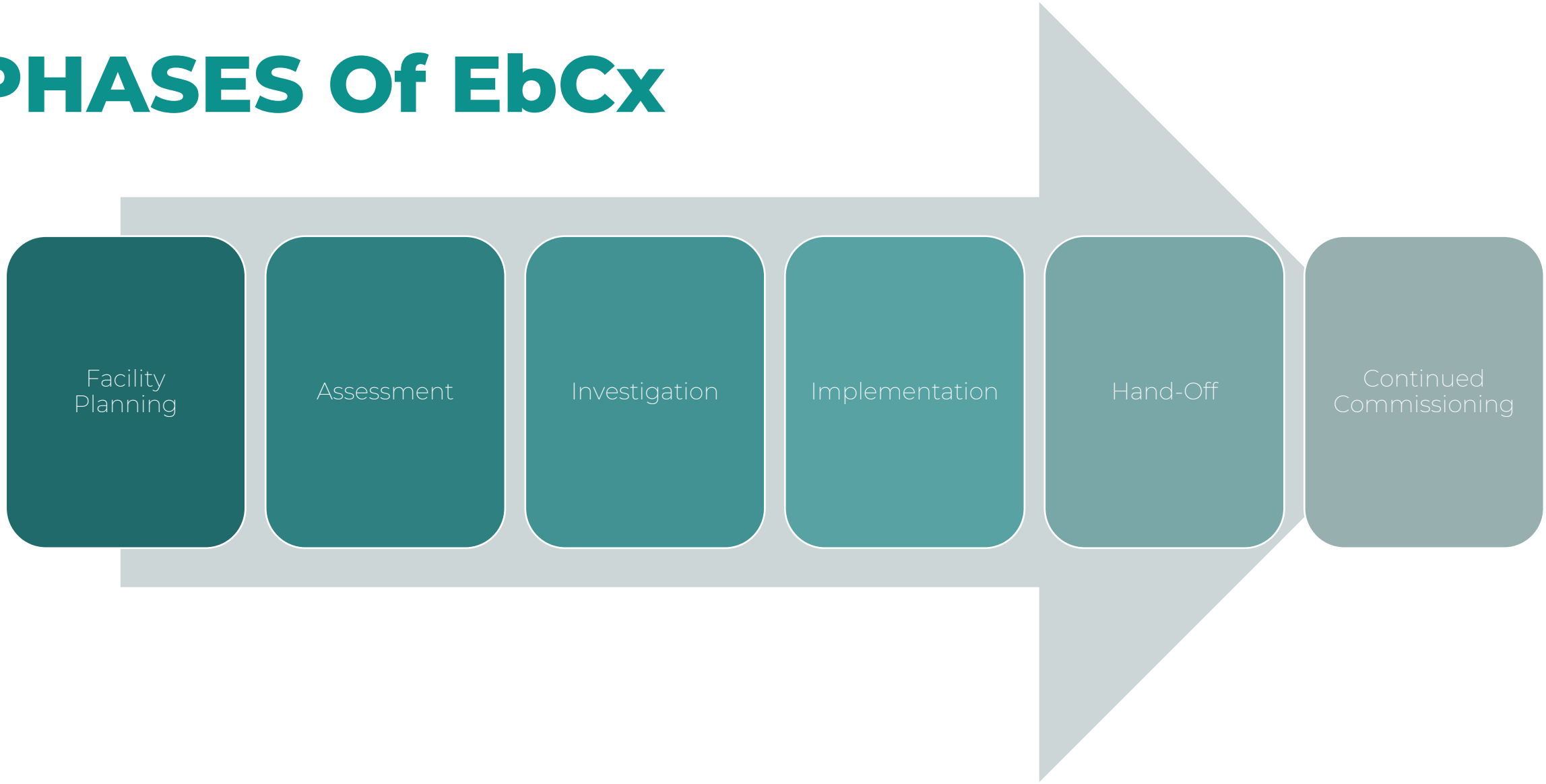
New Building Cx

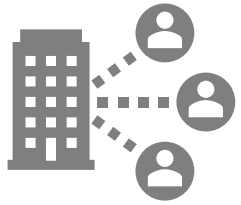
- General awareness and required by code in a lot of cases
- Usually paid for in capital cost dollars.
- Participation by all parties built into cost of project (i.e. design contracts, project specifications, etc.).
- Cost to address issues built-into project.

Existing Building Cx

- Lesser awareness of what it is, costs/benefits.
- Usually must be paid for in operating cost dollars.
- Participation by all parties must be funded.
- Repairs must be funded.

PHASES Of EbCx





Assessment

The initial assessment is vital in developing the goals and understanding the challenges of a facility in its current use.

Actions

- Goals and Cx Plan
- Available Documents:
  Drawings, TAB reports, Maintenance Logs
- Current Facility Requirements
- Interviews with Building Staff
- Walkthrough

Investigation

The investigation phase dives deeper into the energy use, controls, and equipment of the building

Actions

- Document Reviews
- Detailed Walkthrough
- Energy Analysis/Benchmarking
- Evaluation of Building Automation System
- Functional Testing
- Master List of Findings

Typical Findings

Typical Findings

No equipment shutdown/turndown during offhours

Operator Overrides

Simultaneous heating and cooling

Equipment in “HAND”

Sensors out of calibration/not working

Valves/Dampers working backwards

Equipment not running

Over/Under Ventilation

Thermal comfort issues

Why?

NO COMPLAINTS + NO MONITORING = NO ACTION

Facilities Management/Maintenance often not tasked with saving energy

Facilities and Energy often different accounting;

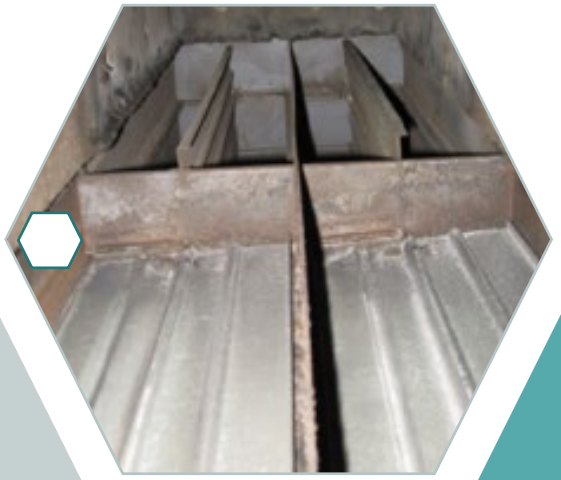
Owners struggle to invest facilities dollars to save energy dollars

Very small percentage of Facility Owners are implementing existing building commissioning

“Easy” Fixes

- Program Schedules
- Release overrides
- Change setpoints
- Reverse valve/damper actuators
- Sensor calibration
- Cleaning equipment/changing filters

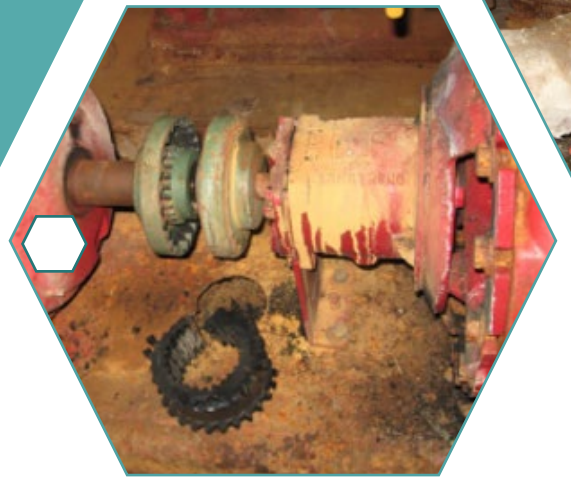
“Harder” Fixes



Resistance from facilities personnel

Old/outdated equipment

Major sequence changes



Broken/faulty components

“Hardest” Fixes

- Envelope problems
- Fatal design flaws
- Major equipment past service life
- Outdated controls systems

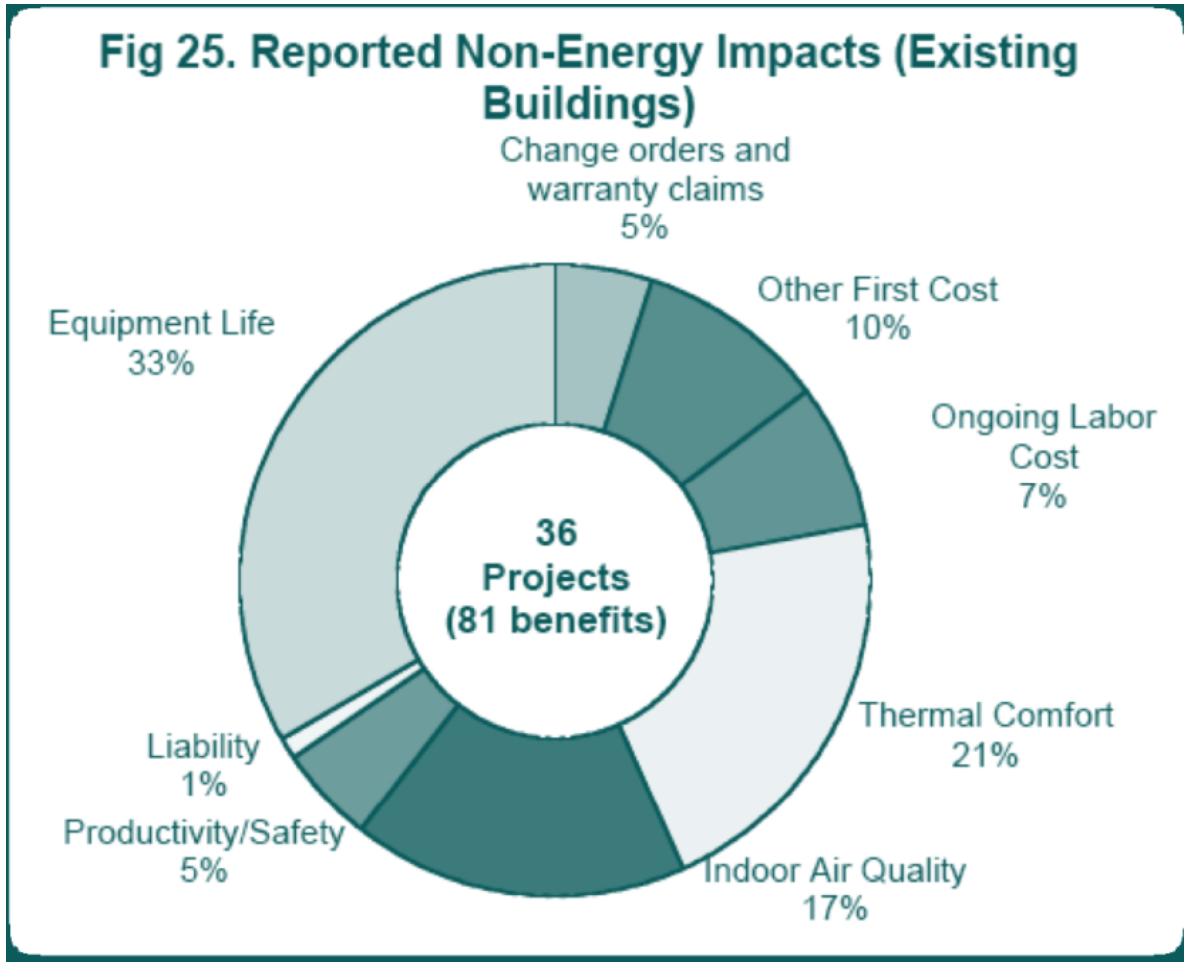
Existing Building Cx

A 2004 commissioning study by LBNL, PECI, Texas A&M Institute studied 224 buildings totaling 30 million SF

•73% were existing buildings in 21 states (included various building types

18% average energy savings

·$.27/SF median energy savings
•0.7 year median payback (.2 to 1.7year range)
·$.18/SF qualitative payback



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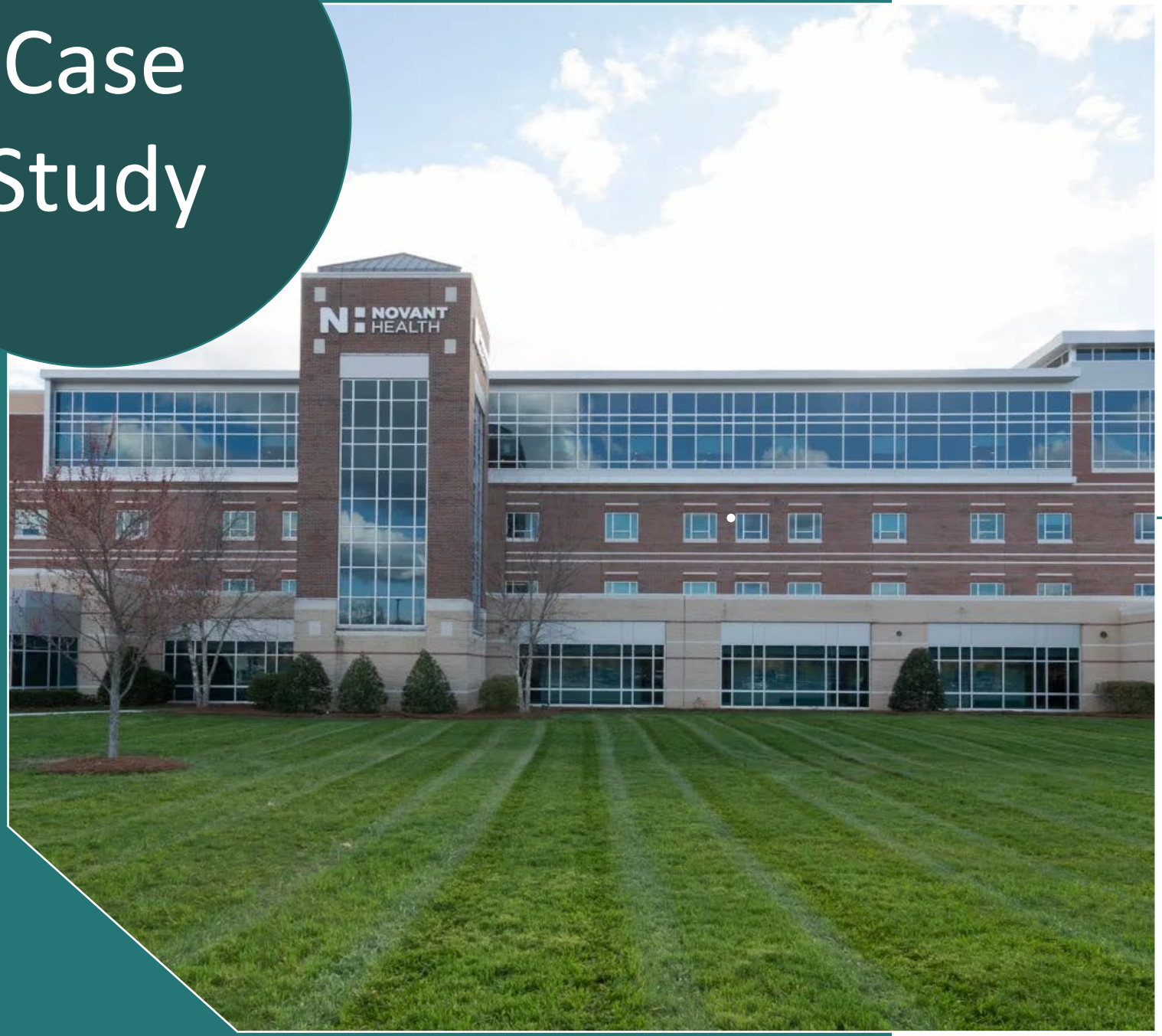
Case Study



- Building is approximately 6 years old
- Building was designed as an out-patient clinic
- No occupancy schedules; runs 24/7
- Commissioning team was Commissioning WorCx, Novant Central Facilities staff and the Novant Energy Manager
- Building started out with a 51 Energy Star rating (actually 35)
- After changes were made the Energy Star rating improved to 65

Our Findings

Easy Fixes

-Added occupancy schedules to office modules, cafeteria, and areas not used 24/7

-Corrected some faulty control sequences

-Corrected VAV box sequence and modified cooling minimums to a more realistic value with third point heating maximum air flow

Harder Fixes

-Modify the dedicated outdoor air unit schedules.

-Analyze OR schedule

-Need more occupant override capability in some areas

The Results

-The building was more comfortable in the wintertime

-Initial Energy Star rating in the low 50's

-Final Energy Star rating 65

-Estimated payback less than 6 months

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Project Background

Net Zero Carbon

County policy requires “result-oriented steps” that drive pollution reduction, resource conservation and climate preparedness initiatives with the goal of transitioning to net-zero carbon energy sources by 2035.

Deep Energy Retrofit

A DER targets the entire building as an integrated system addressing multiple components such as the envelope, HVAC, lighting, and appliances. It aims to optimize the energy performance of the entire building rather than focusing on isolated upgrades.

The Considerations

To analyze the effectiveness of measures included in the DER, the team considered lifecycle costs and benefits, operational savings, maintenance requirements, and the return on investment to inform the implementation schedule.

The Master Plan

The Master Plan serves as a roadmap to implement the DER measures to reduce energy consumption from the County’s facilities, thus reducing carbon emissions from electricity generation and creating ‘net-zero carbon capable’ facilities.

Overview of Proposed Retrofit Measures

56
Measures Identified

$1.3M
Annual Savings

50%
Reduction in Energy Use

$59M
Project Cost

$13M
Incremental Cost

Reduction in Carbon Emissions

Methodology: ECM Overview

HVAC

Airside HVAC

- Roof Top Units (RTU)
- Make-Up Air Unit (MAU)
- Air Handling Unit (AHU)
- Split Systems
- Infrared Heaters (IR)
- Heat Pumps

Waterside HVAC

- Chiller (Air Cooled, Scroll and Screw)
- Heating Hot Water (HHW) System
- Pool Water Heating
- Dehumidification

Building Automation Systems

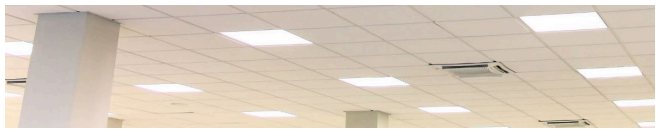
- BAS - Scheduling & Setpoint Adjustments
- Upgrade existing BAS and HVAC Controls
- Retro-Commissioning

Refrigeration

- Install Refrigeration controls and EC Motors
- Install centralized refrigeration and upgrade walk-in spaces

Domestic Water

- Install Laminar Low Flow Regulators on Faucets
- Install Low Flow Showerheads on Locker Room Showers
- Domestic Water Heater (DHW)



Lighting, Transformers, Appliances

- Interior Lighting Upgrades
- Exterior Lighting Upgrades
- Replace Appliances
- Install Vending Machine Controls
- Replace Transformers with High-efficiency Models

Control Strategies

- Modify Occupied Temperature Setpoints
- Modify Unoccupied Setpoints:
- Implement Chilled Water Reset Strategy
- Implement a Heating Hot Water Temperature Reset Strategy
- Implement Duct Pressure Reset Strategy

Renewable Energy Integrations

- Convert Water-Source Heat Pump Loop to Geothermal Loop
- Install Geothermal Well System on RTUs and PTHPs

Project Timeline

2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Judge Clifton		New Courthouse		Spratt A		Spratt B		Southview		Sugaw
-237 Tonnes C02e	CCOB	-2,678 Tonnes C02e		-77 Tonnes C02e		-68 Tonnes C02e		-100 Tonnes C02e		-19 Tonnes C02e
-3,481 MMBtu	-195 Tonnes C02e	-36,548 MMBtu		-1,306 MMBtu		-1,372 MMBtu		-1,782 MMBtu		-265 MMBtu
$62,942	-2,408 MMBtu	$566,357		$28,008		$21,070		$28,611		$4,091
$1,274,112	$63,266	$19,088,270	Aquatic Center	$1,554,239	Hwy-16 P&R AOB	$1,400,472	Elon	$898,796	West Charlotte	$8,299
	$1,365,653		-832 Tonnes C02e		-45 Tonnes C02e		-12 Tonnes C02e		-42 Tonnes C02e	
			-17,426 MMBtu		-873 MMBtu		-153 MMBtu		-769 MMBtu	Marion D
	Valerie Woodard Center		$178,795	LUESA - Suttle Ave.	$26,534	Historic	$5,392	Tyvola Center	$13,378	-182 Tonnes C02e
Bette Rae	-557 Tonnes C02e	Ivory Baker	$13,725,224	-108 Tonnes C02e	$1,482,807	-153 Tonnes C02e	$110,558	-35 Tonnes C02e	$534,996	-3,913 MMBtu
-46 Tonnes C02e	-6,890 MMBtu	-75 Tonnes C02e		-1,332 MMBtu		-2,602 MMBtu		-427 MMBtu		$38,727
-762 MMBtu	$82,746	-1,256 MMBtu		$36,377		$50,201		$7,625		$1,943,899
$17,164	$5,087,235	$27,202		$948,942		$352,744	Arbor Glenn	$6,224	Ray's Splash	
$2,569,881		$1,172,351			MEB		-19 Tonnes C02e		-208 Tonnes C02e	
	Materials Recover Facility				-86 Tonnes C02e		-363 MMBtu		-4,108 MMBtu	
	-94 Tonnes C02e				-1,548 MMBtu		$9,804		$38,641	
	-1,396 MMBtu				$27,896		$744,243		$973,983	
	$38,601				$1,858,381					
	$1,040,778									
CO2e Emissions	-283 Tonnes C02e/yr	-845 Tonnes C02e/yr	-2,752 Tonnes C02e/yr	-832 Tonnes C02e/yr	-185 Tonnes C02e/yr	-131 Tonnes C02e/yr	-221 Tonnes C02e/yr	-31 Tonnes C02e/yr	-135 Tonnes C02e/yr	-250 Tonnes C02e/yr	-201 Tonnes C02e/yr
Energy Saved	-4,244 MMBtu/yr	-10,694 MMBtu/yr	-37,804 MMBtu/yr	-17,426 MMBtu/yr	-2,638 MMBtu/yr	-2,421 MMBtu/yr	-3,974 MMBtu/yr	-516 MMBtu/yr	-2,208 MMBtu/yr	-4,877 MMBtu/yr	-4,178 MMBtu/yr
Energy Cost Savings	$80,107	$184,612	$593,558	$178,795	$64,385	$54,430	$71,271	$15,196	$36,236	$52,019	$42,818
Project Costs	$3,843,994	$7,493,666	$20,260,621	$13,725,224	$2,503,181	$3,341,187	$1,753,216	$854,801	$905,020	$1,508,980	$1,952,198

Next Steps

- Procurement
- Project Implementation
- Commissioning and Acceptance
- Measurement & Verification

Thank you!