




RETROCOMMISSIONING: IT'S WHAT ALL THE COOL HEALTHCARE FACILITIES ARE DOING THESE DAYS






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Your Presenters



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Agenda

- Retrocommissioning Defined
- Process
- Funding
- Outputs
- Healthcare Specifics
- Retrocommissioning in Action





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Learning Objectives

- ▶ Understand what retrocommissioning is and how it can be implemented in a healthcare facility
- ▶ Align retrocommissioning with available capital budget
- ▶ Obtain tools to assist in applying retrocommissioning efforts for a particular type of facility
- ▶ Prioritize implementation of retrocommissioning recommendations to give you the most bang for your buck

RETROCOMMISSIONING



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Retrocommissioning | Defined

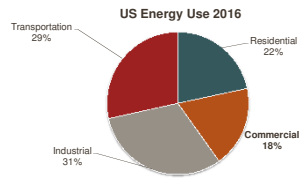
- ▶ A systematic investigation process to improve an existing building's performance
 - ▶ Identify operational and maintenance improvements
 - ▶ Optimize system performance and functionality
 - ▶ Save energy
 - ▶ Increase occupant comfort
- ▶ Not "Commissioning"





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Retrocommissioning | Energy Use





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Retrocommissioning | Defined

	RCx	Energy Audit
Energy Use Breakdown	✓	✓
Identify Low/No Cost Measures	✓	✓
Identify Capital Improvements	✓	✓*
Site Assessment	✓	✓*
Design, System, and O&M Review	✓	✓*
System Sequence of Operation Testing	✓	
System Functional Testing	✓	
Data and Trend Logging	✓	



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Retrocommissioning | Triggers

- ▶ Major changes in energy use
- ▶ Occupancy and/or Space Use Change
- ▶ Recent Renovation
- ▶ Changes to Controls
- ▶ Temporary Fixes
- ▶ Building Ownership Changes
- ▶ Comfort Complaints
- ▶ Maintenance Staff Concerns
- ▶ Benchmarking
- ▶ Green Building Certification




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Retrocommissioning | Who Does It



RETROCOMMISSIONING PROCESS

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Retrocommissioning | Process



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graph TD
    A[Scoping and Planning] --> B[Investigation and Assessment]
    B --> C[Implementation]
    C --> D[Measurement and Verification]
    D --> A
    
```



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Retrocommissioning | Scoping & Planning

- Setting Priorities
 - Facility Requirements
 - Operating Costs
 - Facility Knowledge
 - Capital Funding
 - Staff/ Patient safety





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Retrocommissioning | Investigation & Assessment

- | | |
|--|--|
| <ul style="list-style-type: none"> ▸ Investigation <ul style="list-style-type: none"> ▸ Review plan to coordinate with priorities ▸ Document controls ▸ Monitoring and trending ▸ Code compliance ▸ Assemble existing documentation ▸ Document Current Facility Requirements (CFR) | <ul style="list-style-type: none"> ▸ Output <ul style="list-style-type: none"> ▸ Energy Use Breakdown ▸ CFR ▸ Financial assessment for system optimization recommendations ▸ Optimization Report |
|--|--|





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Retrocommissioning | Investigation & Assessment

- | | |
|---|---|
| <ul style="list-style-type: none"> ▸ Assessment <ul style="list-style-type: none"> ▸ Site assessment, Diagnostic Monitoring ▸ Functional Performance Testing ▸ Interview facilities personnel ▸ Develop List of Findings/Recommendations ▸ Select Operational Improvements | <ul style="list-style-type: none"> ▸ Output <ul style="list-style-type: none"> ▸ Equipment Condition Assessment ▸ Prioritized List of Recommendations |
|---|---|





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Retrocommissioning | Implementation

- Implementation
 - Generate Scope of work
 - Implement selected operational improvements
 - Verify Results
 - Provide technical support
- Output
 - Balancing reports
 - Collect performance data
 - Confirm implementation of scope
 - Systems Manuals
 - Training



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Retrocommissioning | Measurement & Verification

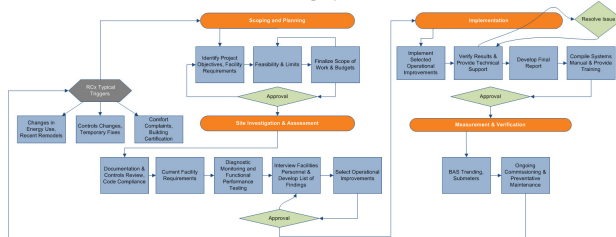
- O&M best practices:
 - Staff training
 - Preventive & Predictive maintenance programs
 - Computerized Maintenance Management Systems
 - Building Information Models (BIM)
 - Energy Management Program
- Output
 - Ongoing process to proactively identify issues





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Retrocommissioning | Process Overview



FUNDING



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Funding | Cost

- ▶ Average study costs of about \$0.30/SqFt*
- ▶ Whole-building energy savings of 10% - 20%*
- ▶ Average payback times about 1 year*
- ▶ Utility Rebate Opportunities



*Lawrence Berkeley Labs (2009)



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Funding | Resiliency







- ▶ Resiliency
 - Climate Risks
 - Community Vulnerability
 - Land Use and Building Design
 - Essential Care Service Planning
 - Environmental Protection
 - Ecosystem Adaptations





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Funding | Resiliency

RESILIENCE ASSESSMENT TOOL								
SEVERITY = DANGER ZONE - MITIGATION								
RISK	LIKELIHOOD <i>Probability per unit time</i>	HUMAN IMPACT	PROPERTY IMPACT	FINANCIAL IMPACT	INTERNAL RESOURCES	EXTERNAL RESOURCES	RISK	
		<i>Physical and Psychological Impacts</i>	<i>Physical and Psychological Impacts</i>	<i>Physical and Psychological Impacts</i>	<i>Physical and Psychological Impacts</i>	<i>Physical and Psychological Impacts</i>	<i>Physical and Psychological Impacts</i>	<i>Relative threat*</i>
		1-5 Low	1-5 Low	1-5 Low	1-5 Low	1-5 Low	1-5 Low	0 - MODIC
	System Unavailability Emergency Through Multiple Locations	1-5 Low	1-5 Low	1-5 High	1-5 Moderate	1-5 High	1-5 Moderate	MODIC
	System Unavailability Emergency Through Multiple Locations	1-5 Low	1-5 Low	1-5 High	1-5 Moderate	1-5 High	1-5 Moderate	MODIC
	Power Failure Emergency Through Multiple Locations	1-5 Low	1-5 Low	1-5 High	1-5 Moderate	1-5 High	1-5 Moderate	MODIC
	Fire Emergency Through Multiple Locations	1-5 Low	1-5 Low	1-5 High	1-5 Moderate	1-5 High	1-5 Moderate	MODIC
	Flood Emergency Through Multiple Locations	1-5 Low	1-5 Low	1-5 High	1-5 Moderate	1-5 High	1-5 Moderate	MODIC
	Bomb Threat Emergency Through Multiple Locations	1-5 Low	1-5 Low	1-5 High	1-5 Moderate	1-5 High	1-5 Moderate	MODIC
AVERAGE SCORE		2.00	1.00	1.00	3.00	2.00	1.00	37%
*Relative threat = average percentage								
RISK = PROBABILITY x SEVERITY		RISK		RISK		RISK		

*RISK = PROBABILITY x SEVERITY
 0.37 0.67 0.06



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Funding | Reliability



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Funding | Equipment

► Lifespan of equipment

Equipment	Life Expectancy (Years)
HVAC Fans	20
Chiller	25
Cooling Tower	20
Boiler	25
Pumps	10-20
Medical Gas System	20
Generator	
Switchgear	



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Funding | Reappropriated

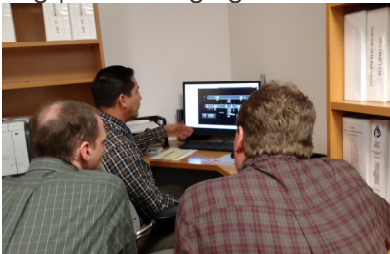
- Repurpose funding
 - PM to RCx
 - Capital Investments





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Funding | Low Hanging Fruit





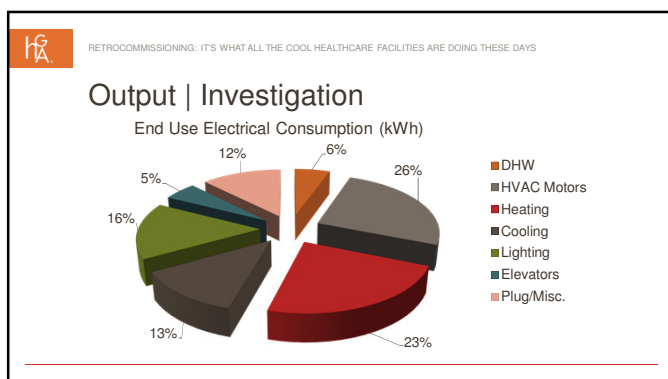
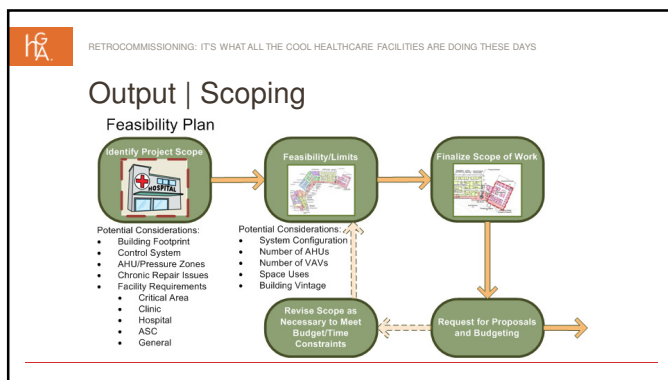
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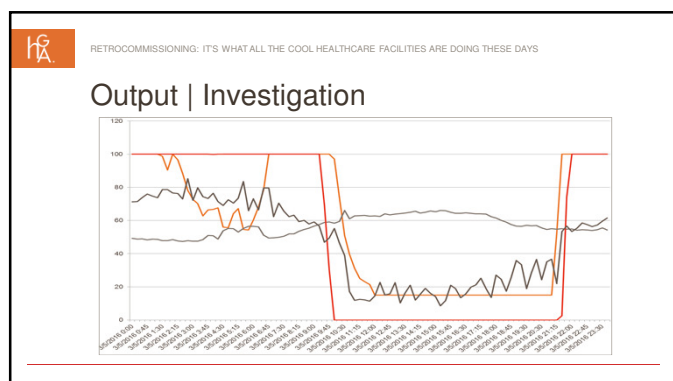
Funding | Typical Low-Cost Findings


- Clogged Air Filters
- Stuck Dampers
- Fan Belts
- Air Leakage
- Over-ridden VFDs
- Pump Run Times
- Temperature Hunting
- Simultaneous Heating and Cooling
- Frozen Valves



RETROCOMMISSIONING OUTPUTS








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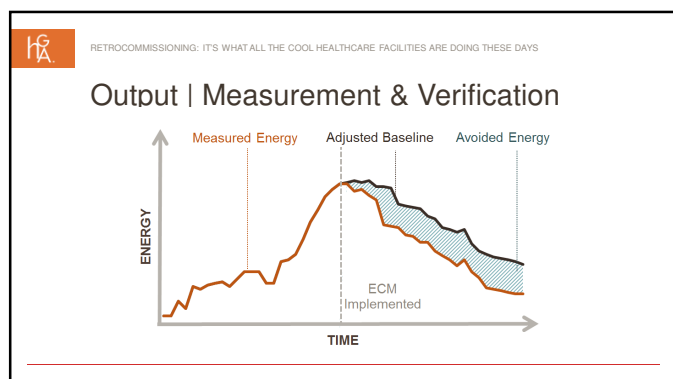
Facility Optimization

Master List of Recommendations



Weighting	Initial Cost	Potential Cost Savings	Estimated Payback	Feasibility
5	High cost	Major savings	Long	Highly visible
4	Medium cost	Significant savings	Medium	Visible
3	Low cost	Some savings	Short	Visible to staff
2	Minimal cost	Minimal savings	Very short	Less visible
1	No cost	No savings	Very short	Not visible

Source	Reference	Category	Goal	Measure/Objective	Recommendation	Implementation Cost	Potential Cost Savings	Estimated Payback	Feasibility
Yes	SAGA	23	Water Use	Reduce Water Use	Provide training for employees and signage for facility users regarding their role in reducing water use.	Immediate	5	4	5
Yes	SAGA	23	Operations	Reduce Costs	Develop and implement a recycling program for day to day operations (cardboard, newspapers, concessions).	Medium	4	4	5
Yes	SAGA	465	M&V	Improve Operation	Require building staff participation during commissioning and testing and balancing activities.	Immediate	5	4	5
Yes	SAGA	378	Energy Performance	Reduce Energy Use	Use a maintenance log to track energy use processes, problems, and fixes.	Immediate	5	3	5
Yes	SAGA	370	Energy Performance	Reduce Energy Use	Develop baseline energy consumption (e.g., perform an energy audit of buildings and facilities).	Medium	3	5	4
Yes	SAGA	376	Energy Performance	Reduce Energy Use	Conduct and implement recommendations from an energy audit periodically (e.g., every 5 years).	Longterm	3	5	2
Yes	ENERG	86-10	IT	Reduce Energy Use	Use network power policy for PC power management.	Medium	4	3	4
No	ENERG	66-7	Energy Performance	Reduce Energy Use	Paint exterior walls with a cool paint color.	Medium	4	2	5
Yes	SAGA	453	Renewable Energy	Reduce Energy Use	Utilize wind power (wind turbines) where appropriate.	Longterm	2	4	3
Yes	SAGA	465	Renewable Energy	Reduce Energy Use	Install solar thermal powered water heaters.	Longterm	2	4	2
Yes	SAGA	466	Renewable Energy	Reduce Energy Use	Install solar thermal walls for passive solar heating.	Longterm	2	4	2
CCC	74.6	USGBC	LEED	Building Commissioning	Building Commissioning Manual	Longterm	1	4	3

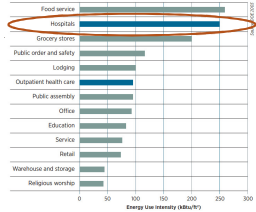


RETROCOMMISSIONING IN HEALTHCARE

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Retrocommissioning | Healthcare

- ▶ **Healthcare Energy Use Statistics**
 - ▶ Hospital construction and operation uses about 5% of all energy in US*
 - ▶ Average Hospital Energy Use Intensity is about 250 KBTu/sf/yr*
 - ▶ 3x that of an average office building
 - ▶ Average energy costs are about \$8.8 billion/yr**




Building Type	Energy Use Intensity (kBtu/sf/yr)
Food service	~280
Hospital	~250
Grocery stores	~180
Public order and safety	~120
Lodging	~100
Outpatient health care	~100
Public assembly	~80
Office	~80
Education	~70
Service	~60
Retail	~50
Warehouse and storage	~40
Religious worship	~30

*University of Washington (2012)
**DOE

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Retrocommissioning | Healthcare

- ▶ Hospital
- ▶ ASC
- ▶ Clinic
- ▶ Accessibility to Systems
 - ▶ 24/7 Occupancy
 - ▶ 23 ½ hour occupancy
 - ▶ Outpatient





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Retrocommissioning | Healthcare

- Challenges for healthcare
 - Operating budget cuts
 - Deferred maintenance
 - Energy costs
 - Facility reliability
 - Patient Care
 - Patient experience
 - Accessibility to Systems





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Retrocommissioning | Healthcare

- Healthcare Systems with unique requirements
 - Med Gas
 - HVAC
 - Oxygen
 - Essential Systems





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Retrocommissioning | Healthcare

- Indoor air quality
- Occupant Comfort



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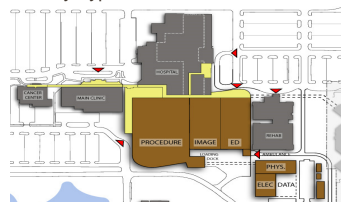


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Process | Full Building

► Scope appropriate to facility Type

- Hospital
- ASC
- Clinic





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Process | Targeted systems

► Separate Systems

- HVAC
- Med Gas
- Building Controls
- Lighting





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Process | Case Study

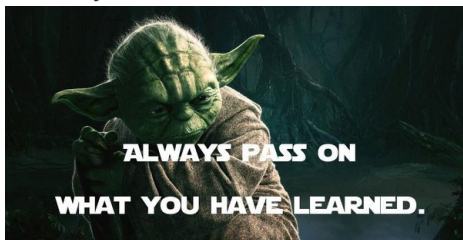
- Get the right people at the table
- Engage a third party
- Commit to implementation



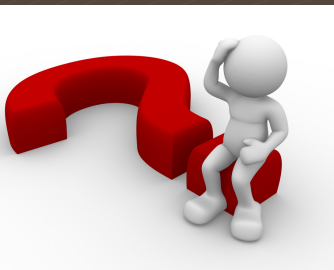


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Summary



Questions?



"Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow."
- William Pollard



THANK YOU!



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