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Prioritizing Improvements in Healthcare Facilities

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Agenda

- SHSC Background
- Today's Challenges
- Addressing Change
  - Research
  - Codes and Standards
  - Clinical Observations
- Case Study: Prioritizing Improvements

MYHA2017

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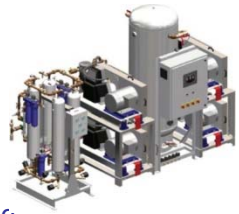
MES Master Plan: Background

- Critical plant system reliability factors - include age, condition, design, quality, redundancy, operations & maintenance.
- Ice Storm 2013 - emergency power and medical air system failures presented significant risk to our patients (NICU & other).
- Process for HIRF/MIRF project selection & prioritization to date was led by Director of POM with input from EVP and some department heads (ie MRI emergency power). VFA assessment priorities also informed process.
- Most of the projects completed between 2012 and 2016 (approx. $50M) have reduced patient risk significantly.
- **The need for a more comprehensive assessment and prioritization process was identified by the Board & SLT. M&E Master Plan process initiated to address this need.**

New Emergency Generators



New Medical Air System

New A/C Chillers

MES Master Plan

- HDR Architects & HH Angus engaged Jan/16 to develop M&E Master Plan for all sites. Sunnybrook participants include CPD, POM & Risk Management.

- Scope of work for consultant team included documentation of systems, development of risk-based prioritization methodology and establishment of M&E system upgrading priorities. VFA and other infrastructure assessments were incorporated as appropriate. Final report has been submitted for review.

- M&E Plan excludes building structure, building envelope, elevators and other non-base building systems such as security & nurse call systems.

- M&E Master Plan also considers future site development and includes infrastructure renewal concepts.

MES Risk Prioritization Methodology

Mechanical & Electrical System Risk Criteria:

- Priority Class - reason upgrade is proposed
- Building Priority - ranking based on building importance to hospital operations and survivability, as well as the acuity of the patients within said building
- Consequence (Impact) of Failure - if the upgrade is not implemented
- Estimates Likelihood of Failure / Urgency to Pursue - based on HHA professional judgement
- Time Past BOMA (Building Owners & Maintenance Association) End of Life - in conjunction with VFA reports. Relates to the useful life of equipment & systems and helps to predict failures.

* Sub-categories included with weighting listed under each criteria heading

Risk Criteria (detail)

Mechanical and Electrical Risk Criteria		
Designation	**Report Definition and Usage**	**Weight**
Priority Class - reason upgrade is proposed		
Regulatory	Mandated by an Authority Having Jurisdiction (AHJ) for the hospital to comply	20
Safety concern - Person	A safety concern to staff or patients (all persons)	20
Code/Standard Compliance	Hospital is non-compliant with the latest code/standard	10
Operational / Functionality	A risk to the operations of the hospital, or beneficial operational efficiency	5
No Upgrade Required	System is up to standards and operating with no known issues	0
Building Priority – ranking based on functional programs within each wing		
Critical Patient & Operations	Wings containing patient care areas where the induction and maintenance of general anaesthesia routinely occurs in connection with the examination or treatment of patients, or where cardiac contact between a patient and medical electrical equipment is frequent or normal.	20
Hospital/In Patient Sectors	Wings containing patients that occupy beds for at least night	15
Clinical & Research	Wings containing mostly research laboratories. The clinical laboratory services (medical lab) provides testing on a variety of specimens to support the diagnosis, treatment, monitoring, and wellness assessment of patients.	10
Administrative	Wings where there are no patients or patient care related facilities	5
External	Wings not connected to the main campus (e.g. Vaughan Estates and McLean House)	5
Consequences of Failure – consequences if the Reason for Upgrade is not be implemented		
Life Safety Risk - multi-building, multi-person	A failure that would result in life safety risks campus wide in multiple buildings	20
Life Safety Risk - multi-person, single building	The risk would be to the health of an entire department or building.	15
Life safety Risk - single-person	Single event impacting the life safety for a single person.	10
Degraded operations – campus wide	Hospital can't respond to patient needs throughout the campus due system failures	10
Degraded operations or relocation of patients	Hospital can't respond to patient needs / Hospital must relocate patients to other areas of the hospital or to other hospitals if failure happens	5
Scheduling cancellations or relocations of staff	Hospital can adapt to failure through scheduling and cancelling appointments or patient visits.	2
Estimated Likelihood of Failure/Urgency to pursue - HHA professional judgment		
Urgent		20
Within 2 years		15
Within 5 years		10
Within 10 years		5
Over 10 years		2
Time Past BOMA End of Life – (in conjunction with VFA reports)		
Does not exist		20
Over 10 years		20
0 to 10 years		10
Under		5

2015/16 VFA Assessment (Bayview)

- Final VFA facility Condition Assessment reports received May/16. Improvements to assessment, as requested by Sunnybrook, include:
  - M Wing split between Original 1997 Building and 2009 Vertical Expansion and separate reports received, to reduce business case requirements.
  - Further breakdown for some areas/systems to allow for more flexibility around HIRF project selection and completion.
  - Additional information provided, such as for roofing, to improve comprehensiveness and accuracy of VFA report.
- C

VFA PRIORITIES	2011 Requirements	2016 Requirements
Priorities 1 – 3: (HIGHEST) Health & Safety, Code Compliance, Asset Integrity: Imminent Breakdown	**$198,126,741**	**$248,066,816**
Priorities 4 - 7: (OTHER) Asset Integrity: Proactive Replacement, Energy & Discretionary	**$98,277,761**	**$80,071,844**
TOTAL	**$296,404,502**	**$328,138,700**
Facility Condition Index (FCI, lower is better)	**0.30**	**0.33**

  - Differences between 2011 and 2016 VFA Requirements values reflect various factors such as 1) construction escalation, 2) variation in data collected by VFA assessment teams, 3) VFA requirements completed and 4) new renewal items added due to equipment and systems reaching the end of their useful life.

TODAY'S CHALLENGES

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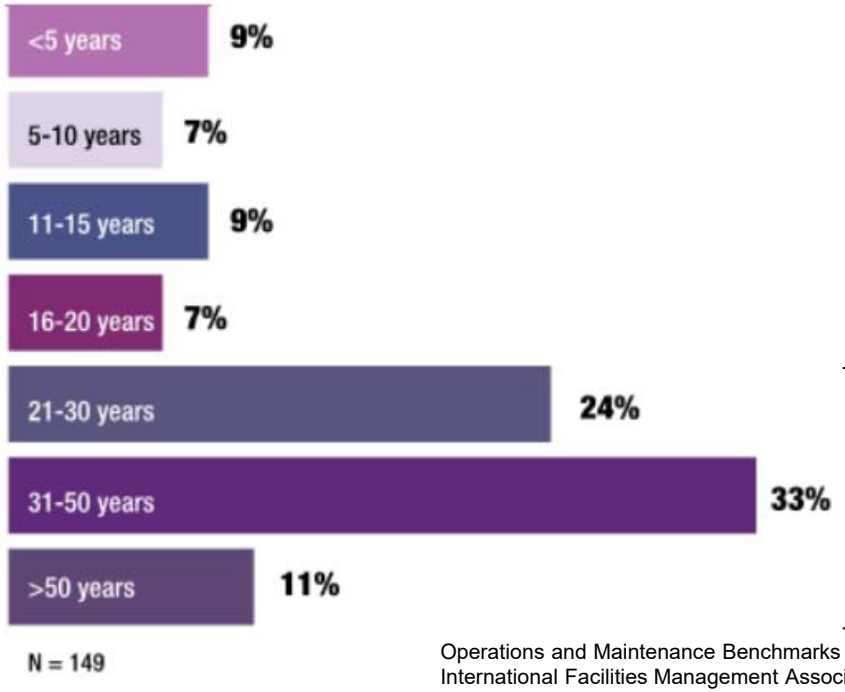
Today's Challenges

- Accommodating Demand
- Stretched Resources
- Medical Advancement: Program Developments
- Aged Facilities:
  - Upgrade Facilities to Accommodate Programs
- Build New Facilities

Age of Health Care Facilities, North America



2/3: 20+ years

Operations and Maintenance Benchmarks for Health Care Facilities Report, 2010, International Facilities Management Association, Adams, Epstein, Gregory, Wilkening

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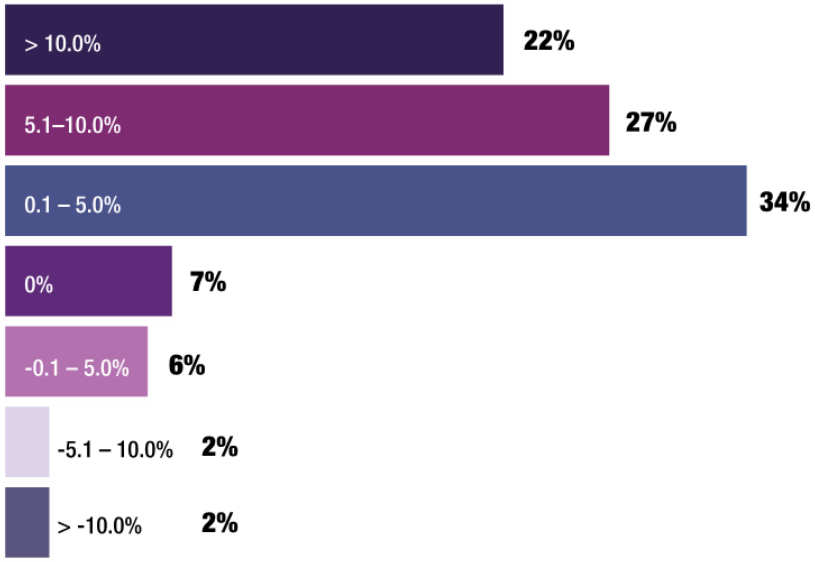
Today's Challenges

- Re-purpose and/or Upgrade Facilities
  - New Program Needs
  - Energy Efficiency Goals
  - Modern Healthcare Standards

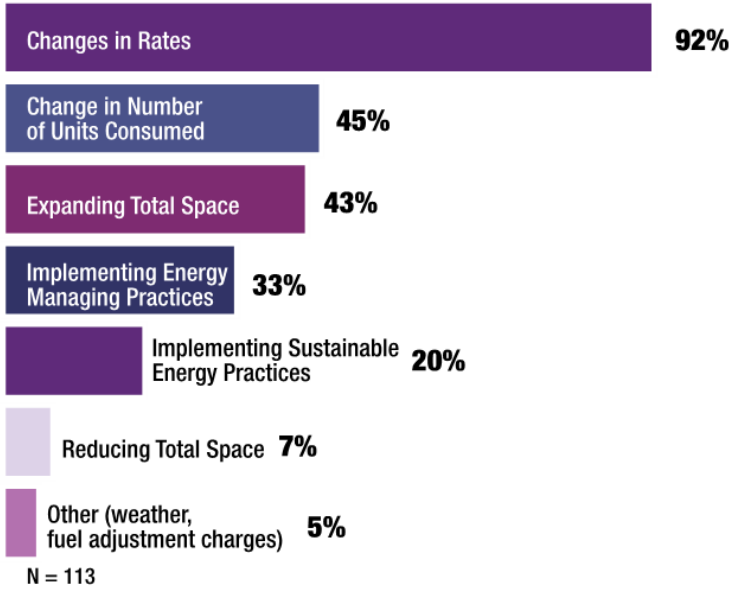
- Conflict between Operating Cost / Capital Budget

Energy Efficiency Goals: Utility Cost

Percentage Change in Utility Cost



Utility Budget Impacted By



Operations and Maintenance Benchmarks for Health Care Facilities Report, 2010, International Facilities Management Association, Adams, Epstein, Gregory, Wilkening

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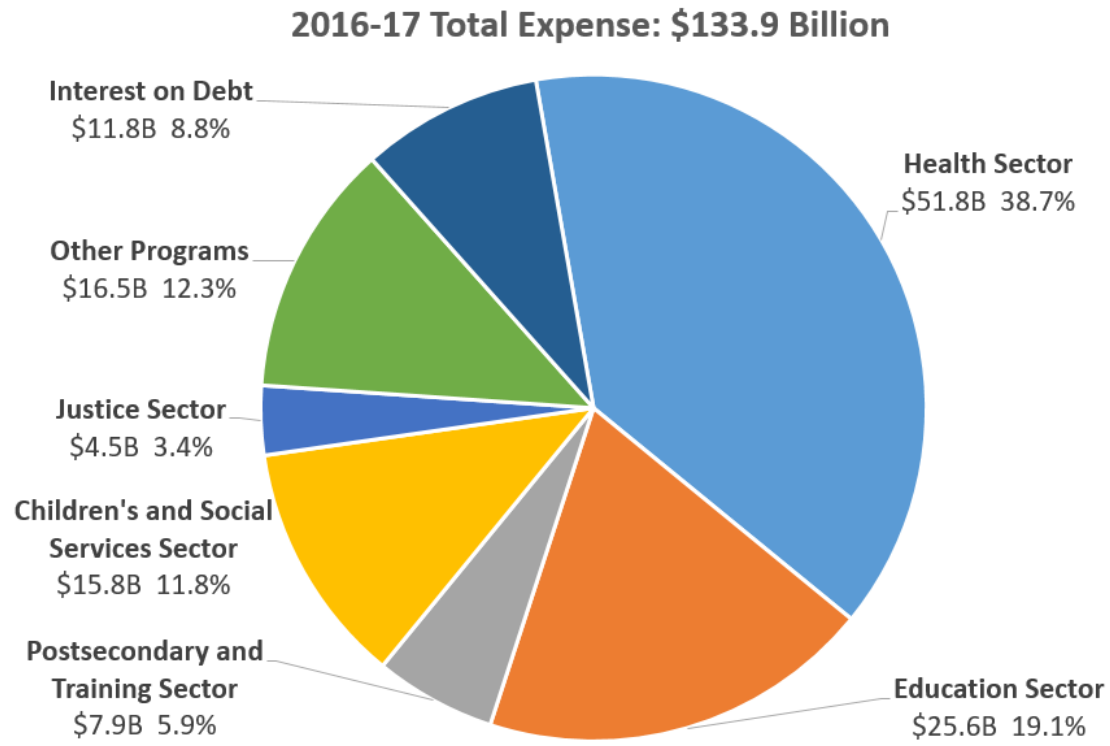
Live Poll – Question 1

- “My facility has a formal Energy Efficiency Program / Energy Manager.”

https://manage.eventmobi.com/en/ars/results/question/17500/340775/3f8a8c3352f53e411c7186c22740efac/

Ontario Provincial Budget 2016-17



2016 Ontario Budget, Chapter III: Economic and Fiscal Outlook, Table 3.22 Total Expenses

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Ontario Provincial Budget 2016-17

Health Sector

- $52B: 42% of budget (excl. interest on debt)
- $26B: Health Service Provider Operating Budget
- $2.6B: Capital Projects (includes P3)
- $175M: Health Infrastructure Renewal Fund ('HIRF')
  - (<1% of Operating Budget)

2017-2018 Published Plan and 2016-2017 Annual Report, Ontario Ministry of Health and Long-Term Care
Expenditure Estimates for the Ministry of Health and Long Term Care (2016-17)

Today's Challenges

- Age of Facilities
- Limited Budgets
- Condition Assessments
- Current Standards Compliance
- Structured Methodology for Prioritizing Mechanical and Electrical Systems (MES) Investments

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ADDRESSING CHANGE

Addressing Change

- *Innovation* is either an improvement of the known or discovery of the new.
  - Core
  - Translational
  - Transformative
- *Conservatism* is the resistance or opposition to change or innovation.

Addressing Change

- Examples of Changes at Different Stages
  - Research
  - Codes and Standards
  - Clinical Observations

Addressing Change

Example

IMPLEMENTING RESEARCH

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Research on Healthcare Associated Infections

- % Relative Humidity in Patient Rooms
- Current standard 30-60% RH
  - Designed for survivability of pathogens on surfaces
- Research shows <40% RH
  - Patient immune system compromised
- Compelling evidence? – Codes/Standards to adopt?
- Long Process: Conservatism

Addressing Change

Example

CODES AND STANDARDS

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Code Adoption

- Code requirements are dynamic
  - New editions on 3- to 5-year cycle
- Healthcare Standards
  - Challenging new requirements (ex: redundancy)
  - Opportunities (ex: reduced air change rates)
- Planning of improvements needs to be adaptable to the code reality

Codes and Standards

- Standards affect new construction / major renovations
- Majority of hospitals are existing and unaffected by code changes
- Operational opportunities
- Stakeholder buy-in

Healthcare Standards – CSA Z317.2

- 6.19 Energy Efficiency and Sustainability

6.19.2 Unoccupied periods

During unoccupied periods,

a) air-handling systems serving Type I areas may be operated at minimum levels (see Clause 6.5.4.1); and

b) air-handling systems serving Type II and III areas may be reduced or shut down provided that relative space pressurization and humidity in adjacent zones is not affected (see Clause 6.5.4.2).

Note: *Sudden changes in airflow might discharge particulate material from duct distribution systems and trigger a need for cleaning.*

- 6.5 Air-handling Systems

6.5.4.1 Minimum operation — Type I areas

6.5.4.1.1

Air-handling systems for Type I areas may be operated at a reduced level when the space is unoccupied.

Live Poll – Question 2

- “Our facility makes use of reduced ventilation rates.”

https://manage.eventmobi.com/en/ars/results/question/17500/340777/b0a10d3abd9eda3ffe06a196168522e5/

Addressing Change

Example

CLINICAL OBSERVATIONS

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Healthcare Standards – CSA Z317.2

- Operating Rooms: Table 1 prescribes 20 ACH

Reference	Function	Type	Minimum outdoor air changes/h*	Minimum total air changes/h*	Relative pressurization	Temperature†, ‡, §, °C	Relative humidity**, %	Exhaust††
37.1	Clean corridors	II	2	6	Pos	22–24	30–60	—
37.2	Day surgery (Stage 2 recovery)	II	3	9	Eq	22–24	30–60	
37.3	Operating rooms	I	6	20	Pos	18–23	30–60	—

Healthcare Standards – CSA Z317.2

- 6.5 Minimum Operation
  - ‘maintain at least six…’
  - ‘Where circulation systems maintain less than six…’

6.5.4.1.1

Air-handling systems for Type I areas may be operated at a reduced level when the space is unoccupied. The air circulation system should maintain at least six air changes per hour unless the space is continuously monitored for temperature, humidity, and (where applicable) relative pressurization and airflow. Where circulation systems maintain less than six air changes per hour, these parameters shall be kept within the design ranges specified in Table 1.

Live Poll – Question 3

- “Unoccupied Operating Rooms in my health care facility...”

https://manage.eventmobi.com/en/ars/results/question/17500/340776/3713c8b9dd713d98b11a95fc41f6e7da/

Study: Unoccupied Operating Room Air Changes

Hospital #	# of Operating Rooms	Unoccupied			
		Maximum	Minimum	Average	Note
1	12	12	9	11	All ORs are higher than the standard
2	16	23	9	15	All ORs are higher than the standard
3	15	21	10	18	All ORs are higher than the standard
4	20	20	20	20	
CSA Requirement		N/A	6	N/A	

Operating Room Ventilation Systems Best Practices Guide for Energy Efficiency, Health and Safety; 2017 April; Greening Health Care; Enerlife Consulting: Jarvis, Vahabi.

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Addressing Change Examples

- %RH – Potential for New Requirements
- Codes and Standards – Constant Change
- Unoccupied ORs – Barriers to Implementation

- Decisions for Prioritizing
  - Maintenance
  - Upgrades

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Case Study

PRIORITIZING IMPROVEMENTS

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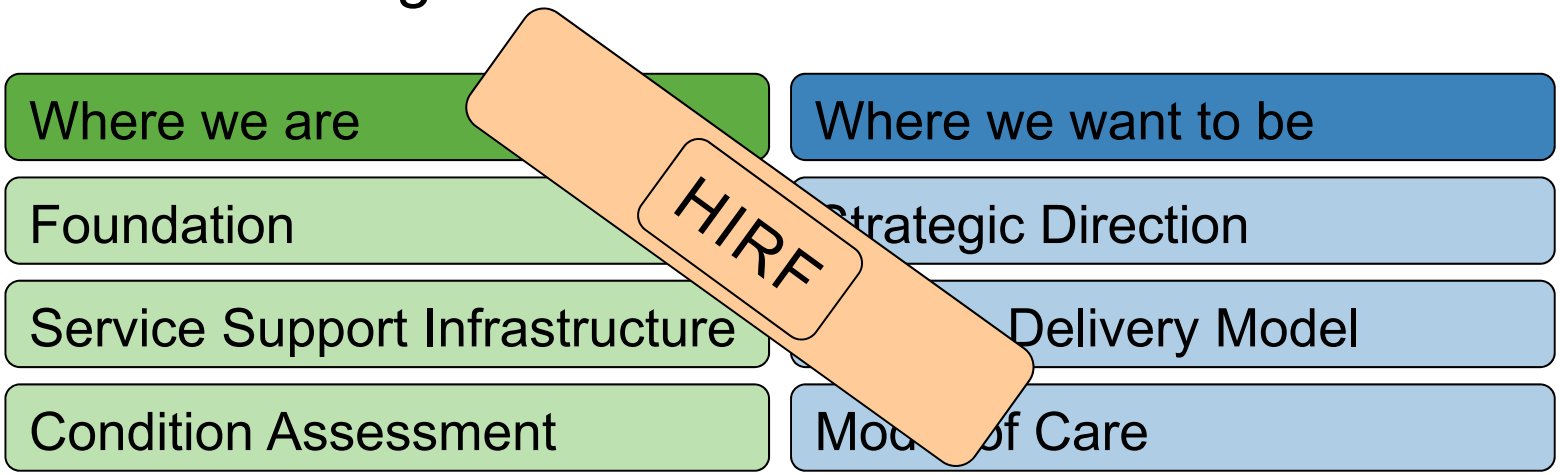
Prioritizing Improvements

- A Master Plan outlines the capital response to the strategic direction of an organization.



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Prioritizing Improvements

- Architectural Master Plan (Service Support Infrastructure)

Spatial Requirements	Master Site Plan
Multi-year Infrastructure Plan	Master Building Plan
Technical Building Assessment	Various Master Plan Options

Prioritizing Improvements

- Prioritization Process
- Options

Create New	Maintain	Renew
Retire	Repurpose	Recapitalize

Prioritizing Improvements

- Health Care Facilities are
  - Mechanical and Electrical Systems (MES) Intensive
- Strong MES Leadership Required
- Policy-based Governance
  - Capture the process: MES Master Plan

Prioritizing Improvements

Master Program (in Service Delivery Model)

Support Services Infrastructure Report

Mechanical and Electrical Systems Master Plan

Project Priorities

Coordinated Facility Upgrades & Renewal

Live Poll – Question 4

- “Our facility has a Mechanical and Electrical System Master Plan.”

https://manage.eventmobi.com/en/ars/results/question/17500/340778/5c52cac06146a4a4d575f1eddc6cff8b/

MES Master Plan

- Steering Committee: Collective Experience

Plant Operations	Risk Management
Best Practices / Industry	Auditing
Energy Management	
Medical Equipment	Controls and Automation
Security	Information Technology
Asset Management	Testing & Verification

MES Master Plan

Project Requirements

- Document the Status
- Risk Management Matrix
- Timeframe for Renewal
- Budget Planning Estimates
- Examine Existing **Systems**, Identify and Rank **Projects**
- Prioritize Renewal with Gradation Risk = Investment Priorities

MES Master Plan

Existing **System** **Condition Assessment Criteria**

- Age and Apparent Condition
- Known Performance Issues
- Code Compliance
- Potential Effects of System Failure
- Cost Estimates
- Recommendations and Recommended Budgets

MES Master Plan

Project Ranking Parameters

- Priority Class
  - Regulatory Requirements
  - Safety Concerns
  - Operational / Functionality

MES Master Plan

Project Ranking Parameters

- Priority Class
- Building Priority
  - Critical Patient Building
  - In-Patient Building
  - Operations Building

MES Master Plan

Project Ranking Parameters

- Priority Class
- Building Priority
- Consequences of Failure / Urgency to Pursue
  - Multiple Patients/Staff/Visitors Affected
  - Single Patient/Staff/Visitor Affected
  - Degraded Operations

MES Master Plan

Project Ranking Parameters

- Priority Class
- Building Priority
- Consequences of Failure / Urgency to Pursue
- Estimated Likelihood of Failure
- Time Past BOMA End of Life

MES Master Plan

Project Ranking Parameters

- Priority Class
- Building Priority
- Consequences of Failure / Urgency to Pursue
- Estimated Likelihood of Failure
- Time Past BOMA End of Life

MES Master Plan

Priority Ranking

	Priority Rankings										
System	Priority Class		Building Priority		Consequences of failure		Estimated likelihood of failure / Urgency to pursue		Time Passed BOMA		Overall Priority Rank
	Code/Standard Compliance	10	Critical Patient & Operatic	20	Degraded operations - cam	10	Within 2 years	15	Over 10 years	20	**75**
	Code/Standard Compliance	10	Critical Patient & Operatic	20	Degraded operations - cam	10	Within 2 years	15	Over 10 years	20	**75**
	Code/Standard Compliance	10	Critical Patient & Operatic	20	Degraded operations - cam	10	Within 2 years	15	Over 10 years	20	**75**
	Safety concern - Person	20	Critical Patient & Operatic	20	Degraded operations - cam	10	Over 10 years	2	Over 10 years	20	**72**
	Safety concern - Person	20	Critical Patient & Operatic	20	Degraded operations - cam	10	Over 10 years	2	Over 10 years	20	**72**
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	Safety concern - Person	20	Hospital/In Patient Sector	15	Degraded operations - cam	10	Within 10 years	5	Over 10 years	20	**70**
	Safety concern - Person	20	Hospital/In Patient Sector	15	Degraded operations - cam	10	Within 10 years	5	Over 10 years	20	**70**
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	Safety concern - Person	20	Hospital/In Patient Sector	15	Degraded operations - cam	10	Within 10 years	5	Over 10 years	20	**70**
	Safety concern - Person	20	Hospital/In Patient Sector	15	Degraded operations or rel	5	Within 5 years	10	Over 10 years	20	**70**

MES Master Plan

Lessons

- Process favours tangible
- Low-sensitivity to environmental
- Risks favoured over Project Economics – (ROI, IRR)
- Identifying facilities for retirement

MES Master Plan

Conclusion

- Directing Change is Difficult
- Stakeholder engagement to overcome Conservatism
- Rigorous and defensible approach
  - Objective Process with Professional Judgment

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Resources

- Operations and Maintenance Benchmarks for Health Care Facilities Report, 2010, International Facilities Management Association, Adams, Epstein, Gregory, Wilkening
- 2016 Ontario Budget, Chapter III: Economic and Fiscal Outlook, Table 3.22 Total Expenses, https://www.fin.gov.on.ca/en/budget/ontariobudgets/2016/ch3b.html
- *2017-2018 Published Plan and 2016-2017 Annual Report,* Ontario Ministry of Health and Long-Term Care http://www.health.gov.on.ca/en/common/ministry/publications/plans/ppar17/
- *Expenditure Estimates for the Ministry of Health and Long Term Care (2016-17)* https://www.ontario.ca/page/expenditure-estimates-ministry-health-and-long-term-care-2016-17
- "The answer is 17 years, what is the question: understanding time lags in translational research", JRSM 2011-12; Morris, Wooding, Grant
- Hospital Microbiome Project, University of Chicago. Is low indoor humidity a driver for healthcare-associated infections? Stephanie Taylor, MD Harvard Medical School; Walter Hugentobler, MD University of Zurich.
- Operating Room Ventilation Systems Best Practices Guide for Energy Efficiency, Health and Safety; 2017 April; Greening Health Care; Enerlife Consulting: Jarvis, Vahabi.
- High Performance Cleanrooms, A Design Guidelines Sourcebook, Pacific Gas & Electric, January 2011