

Total Cost of Ownership Maintenance of Essential Data

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Agenda

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- *Total Cost of Ownership* fundamentals
- Source(s) of inputs
- Assumptions required
- Sensitivity of assumptions
- Overcoming sensitivities
- Maintaining relevance
- Research opportunities

TCO Fundamentals

Why Use Total Cost of Ownership

- Awareness of costs and commitments
- Planning for future costs
- Compare improvement/renewal costs
- Demonstrate ROI (return on investment)
- Track capital construction/renovation decisions
- Document capital construction value

Total Cost of Ownership

$$TCO = \sum C_a + \sum C_b + \sum C_c + \sum C_d + \sum C_e$$

Where:

C_a = **Initial Asset Costs** (first cost, one-time)

C_b = Cost of **Operations and Maintenance** (recurring)

C_c = Cost of **Utilities** (recurring)

C_d = Cost of **Renewal** (periodic)

C_e = Cost at **End-of-Useful/Functional Life** (one-time)

Inputs

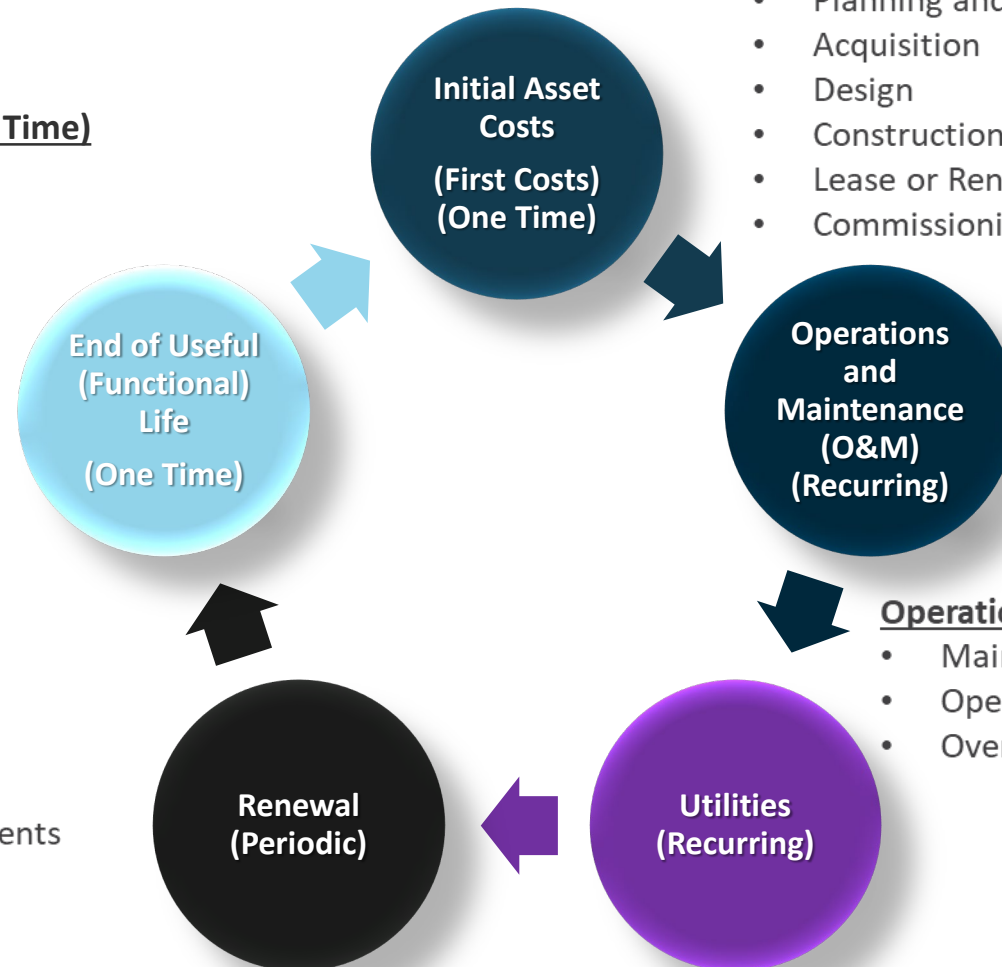
TCO Framework

End of Useful (Functional) Life (One Time)

- Sale/Adaptive Re-Use
- Re-sale Value/Salvage Value
- Removal
- Site Restoration/Remediation
- Deconstruction/Recycling

Renewal (Periodic)

- Replacement
- Programmatic Upgrades
- Improvements/Enhancements



Initial Asset Costs (First Costs) (One Time)

- Planning and Programming
- Acquisition
- Design
- Construction/Site Development
- Lease or Rental
- Commissioning

Operations and Maintenance (O&M) (Recurring)

- Maintenance
- Operations
- Overhead and Administration

C_a Initial Asset Costs – Planning and Programming, Acquisition, Design, Construction/Site Development, Commissioning



Inputs

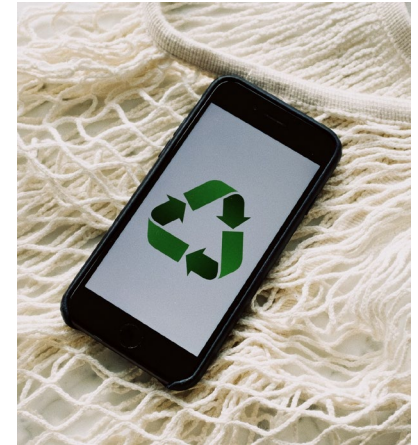
C_b Cost of Operations and Maintenance – Lease or Rental, Maintenance, Operations, Overhead & Administration

C_c Cost of Utilities – Annual utility costs/expenditures

C_d Cost of Renewal – Replacement, Programmatic Upgrades, Improvements/Enhancements

Inputs-end of life

C_e Cost at End-of-Useful/Functional Life – Sale/Adaptive Reuse, Re-sale Value/Salvage Value, Removal, Site Restoration/Remediation, Deconstruction/Recycling



TCO process can begin anywhere

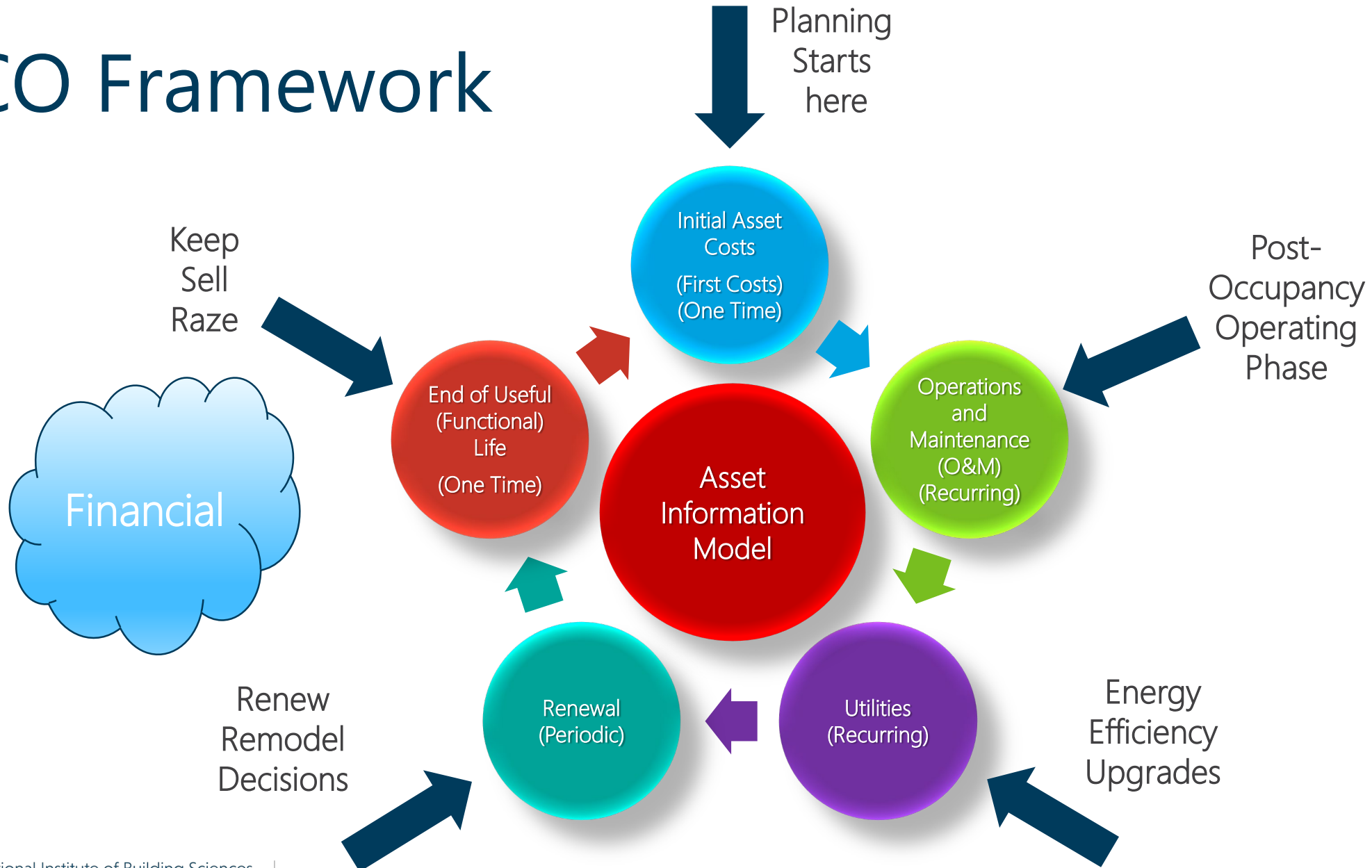
Planning stage – identify or manage a budget

Design stage – make value decisions

Post-acquisition – analyze commitments and make keep/remodel/ dispose decisions

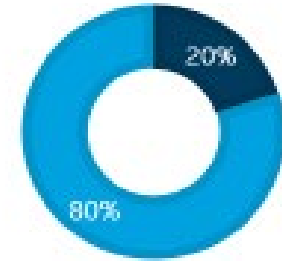
Financial – planning for future budgets and cost allocation

TCO Framework

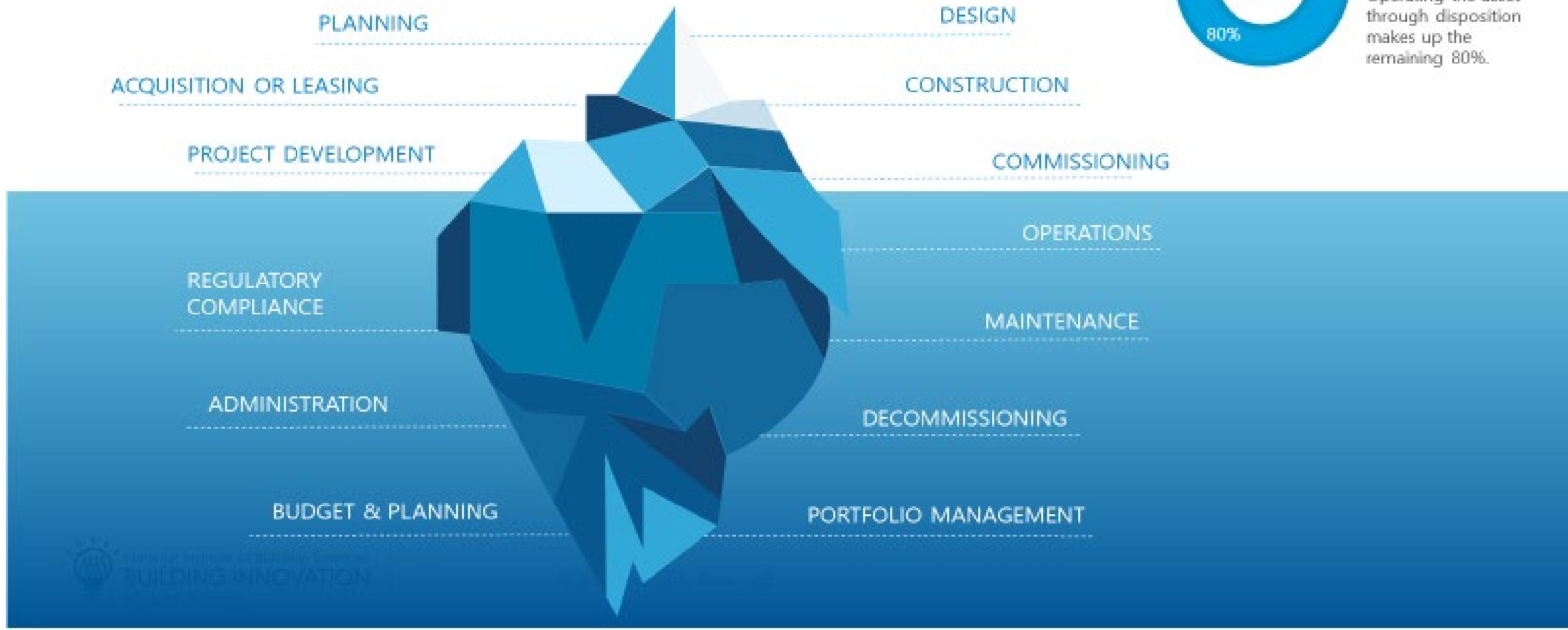


Operations & Maintenance (Facility Management)

TCO ICEBERG



First costs make up approximately 20% of the total cost of owning the asset. Operating the asset through disposition makes up the remaining 80%.



Facility Management

$$TCO = \sum C_a + \underbrace{\sum C_b + \sum C_c + \sum C_d}_{\text{Operations and Maintenance (Facility Management)}} + \sum C_e$$

FACILITY MANAGEMENT

OPERATIONS

- Monitoring Operations
- Building Inspections
- O&M Inspections
- Troubleshooting
- Customer Service
- Custodial
- Grounds
- Pest Management
- Utilities
- Work Management
- Emergency Response
- Event Support

MAINTENANCE

- Preventative Maintenance
- Corrective Maintenance
- Repair/Replacement
- Emergency Maintenance
- Building Inspections

PORTFOLIO MANAGEMENT

- Asset Visibility/Asset Inventory
- Asset/Portfolio Condition
- Capital Planning

REGULATORY COMPLIANCE

- Occupational Safety and Health
- Fire and Life Safety
- Environmental and Sustainability
- FRPP Reporting

BUDGET & PLANNING

- Short- and Long-term Capital Investment planning
- Resource Management
- Risk Based Prioritization

ADMINISTRATION

- Professional Development
- Salaries
- Contracts Management and Execution

Facility Management

$$\text{TCO} = \sum C_a + \underbrace{\sum C_b + \sum C_c + \sum C_d}_{\text{Facility Management}} + \sum C_e$$

Where does this number come from?

1. Initial TCO analysis at start of design project
2. From YOU!

Facility Management

How will this number be used?

1. Develop a target cost that shows progress towards efficiency?
2. Develop a cost that represents industry best practice?
3. Represent the actual cost of ownership today?

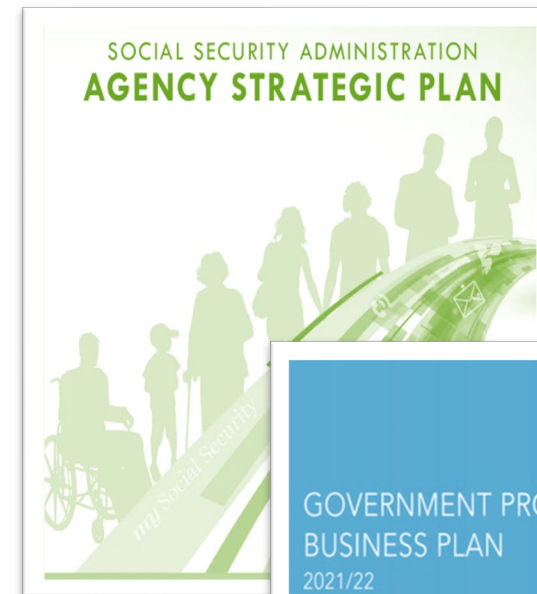
Facility Management

There's no one "right" way to calculate costs

Things to consider:

- Agency/Organizations Strategic Plan
- Agency/Organizations Investment Strategy
- Strategic Asset Management Plan

WHY? Strategic Plans may have an influence on how you operate and maintain a facility.

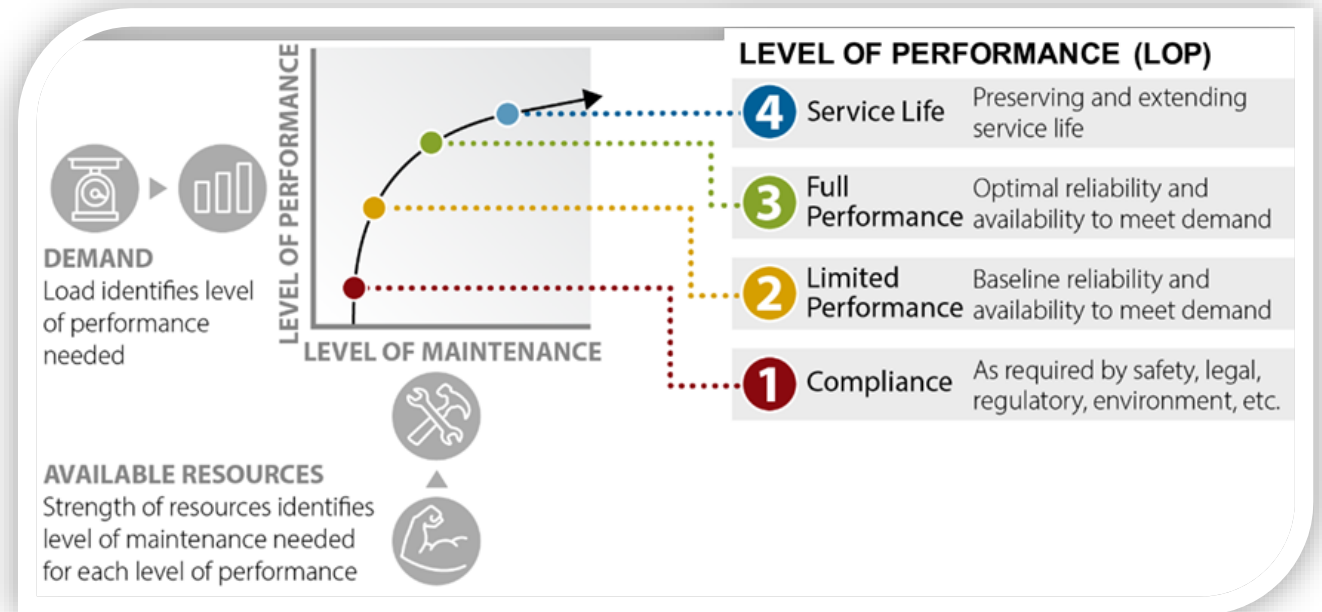


Facility Management

Things to consider:

- Mission of your facility or facilities
- Expected level of performance

WHY? Mission criticality and EOP will affect your maintenance strategy



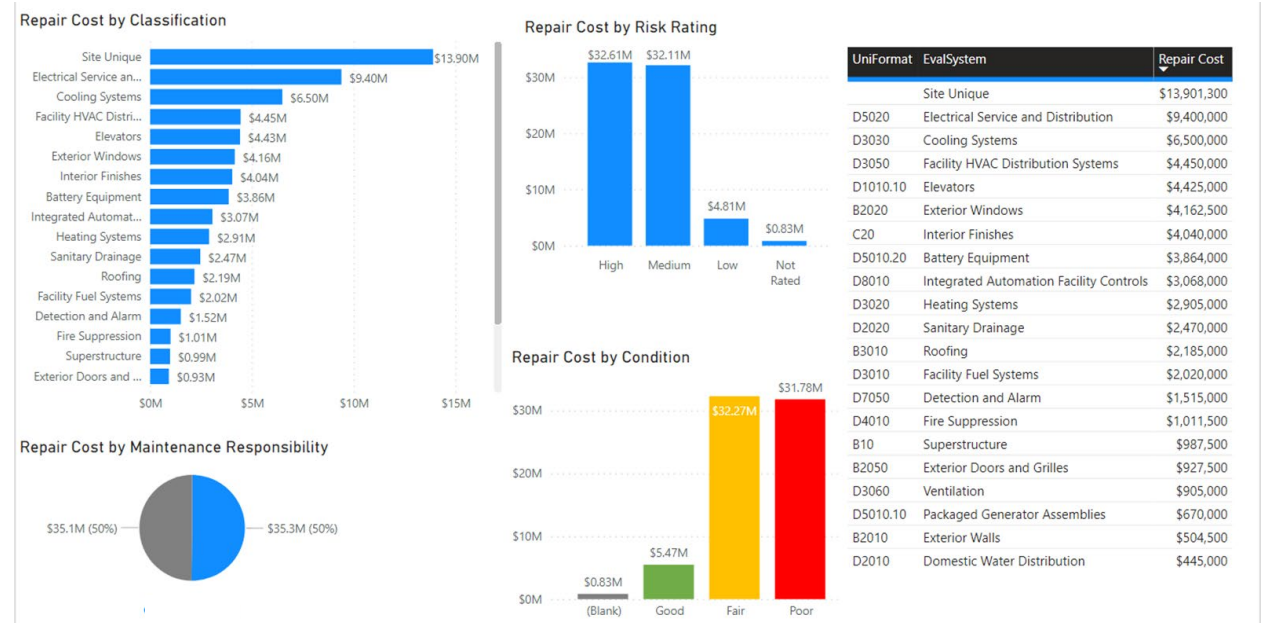
Facility Management

Things to consider:

- Condition of your asset portfolio
- Condition of your asset data
- Component renewal schedules
- PM/CM ratio
- Existing maintenance costs
- Deferred maintenance costs

WHY?

Your maintenance strategy at your facility ultimately make-up your maintenance cost.



Facility Management

Things to consider:

- Existing known costs
 - Utilities
 - Cleaning/Custodial
 - Groundskeeping
 - Waste Removal
 - Regulatory Compliance
 - Technology
 - Administration
 - Supplies
 - Training
 - Equipment Rental
 - Vehicles
 - Salaries & personnel

Tools and Resources

Computerized Maintenance
Management System (CMMS)
Analytics dashboards/reporting
Energy management software
Utility bills
Contract values
Historical data

[NIST Building Life Cycle Cost \(BLCC\)](#)

[Program](#)

[Handbook 135](#): FEMP Life Cycle
Costing Manual

Final Thoughts

Calculating TCO across an enterprise or at a facility can be challenging but doesn't have to be overwhelming.

With the right data, tools and processes in place, your organization can make data-driven decisions to calculate and manage TCO.

Research Opportunities

Research Opportunities

- Connections between each input
 - First Cost, Operation & Maintenance, Energy/Utilities, Renewal, End-of-Life
- Data needs
 - inputs and outputs
- Operating models
 - Reliability, Predictive, Preventive, Reactive, Run-to-Fail, Other
- Occupant (customer) driven results
- Effect of IoT

Discussion