



Retro-Commissioning of Data Centers

Agenda



- Unique traits of Data Centers (DCs)
- Benefits of Retro-Cx DCs
- Suitable candidates for Retro-Cx
- Phases of Retro-Cx
- Additional considerations for DCs



Unique Traits of Data Centers



- Very high energy consumption
- 24/7/365 operation
- Cooling-only mode
- Active high powered equipment
- Varied stakeholders (IT, Operations, Disaster Recovery, Facility, Sales etc.)
- Uptime is critical (supersedes energy consumption)
- High equipment refresh
- Advanced monitoring and controls

Benefits of Retro-Cx Data Centers



- Reduce energy and water consumption (PUE and WUE)
- Improve sustainability (CUE)
- Improve resiliency
- Increase realized capacity
- Optimize sequence of operation
- Reduce O&M costs
- Improve marketability
- Staff retraining and sensitization
- Financial incentives

Benefits of Retro-Cx Data Centers

Reduce Energy and Water Consumption



- Enhanced performance and synergy between infrastructure components will lead to reduction in energy and water usage

$$\text{PUE} = \frac{\text{Total DC Energy}}{\text{IT Equipment Energy}}$$

$$\text{WUE} = \frac{\text{Total DC Water Usage}}{\text{IT Equipment Energy}}$$

- PUE = 1.1, Support Infrastructure consumes 100 kWh per 1,000 kWh of IT Energy
- PUE = 1.3, Support Infrastructure consumes 300 kWh per 1,000 kWh of IT Energy
- PUE = 1.5, Support Infrastructure consumes 500 kWh per 1,000 kWh of IT Energy

Benefits of Retro-Cx Data Centers

Improve Sustainability



- Reduction in CO2 emissions is relevant to DC owners that are keen on reducing their environmental impact and marketing 'green' initiatives

$$\text{CUE} = \frac{\text{Total CO2 Emissions Caused by Total Data Center Energy}}{\text{IT Equipment Energy}}$$

Or

$$\text{CUE} = \text{CEF} \times \text{PUE}$$

CEF = Carbon Emissions Factor

Benefits of Retro-Cx Data Centers

Improve Resiliency



- Retro-Cx can uncover issues that could potentially lead to catastrophic failures. Correcting them can improve the resiliency of DC
- Opportunity to replace temporary workarounds with real fixes
- Opportunity to incorporate or improve failover scenarios

Benefits of Retro-Cx Data Centers

Increase Realized Capacity



- Optimizing the operating setpoints could lead to increase in cooling capacity and more hours of economizer operation
- DCs built 10+ years ago could be operating with legacy setpoints (44°F CHWS temperature, 55°F DB SAT from the CRAH units etc.)
 - Increasing temperatures per ASHRAE TC 9.9 recommendations will lead to an increase in realized cooling capacity

Benefits of Retro-Cx Data Centers

Optimize Sequence of Operation



- Retro-Cx allows for optimizing the sequence of operations, based on lessons learned, input from DC operators, and results of functional testing

Benefits of Retro-Cx Data Centers

Reduce O&M Costs



- Retro-Cx allows for improved performance of infrastructure components and will help reduce the O&M costs

Benefits of Retro-Cx Data Centers

Improve Marketability



- New tenants of colocation DCs typically require DC owners to provide proof of Cx. Retro-Cx will prove that facility operates as claimed
- Re-Cx Plan and Ongoing-Cx Plan could be included when responding to Request for Proposals (RFPs)

Benefits of Retro-Cx Data Centers

Staff Retraining and Sensitization



- Retro-Cx offers an excellent opportunity for DC operators to be retrained and exposed to situations they have not experienced
- Method of Procedures (MOPs), Standard Operating Procedures (SOPs), Critical Equipment Work Authorization (CEWA) etc. can be developed to deal with critical scenarios

Benefits of Retro-Cx Data Centers

Financial Incentives



- For colo DCs, cost of Retro-Cx could be treated as capital expenditure (CAPEX) or operating expenditure (OPEX) and passed along to the tenants (subject to lease requirements)
- Utility companies offer incentives that can partially offset the cost of Retro-Cx

Suitable Candidates



- DCs that have never been commissioned
- DCs with unjustifiable metrics (PUE, OPEX etc.)
- DCs experiencing frequent downtime
- DCs with new ownership or new operators
- DCs planning infrastructure upgrades
- DCs planning expansion

Phases of Retro-Cx

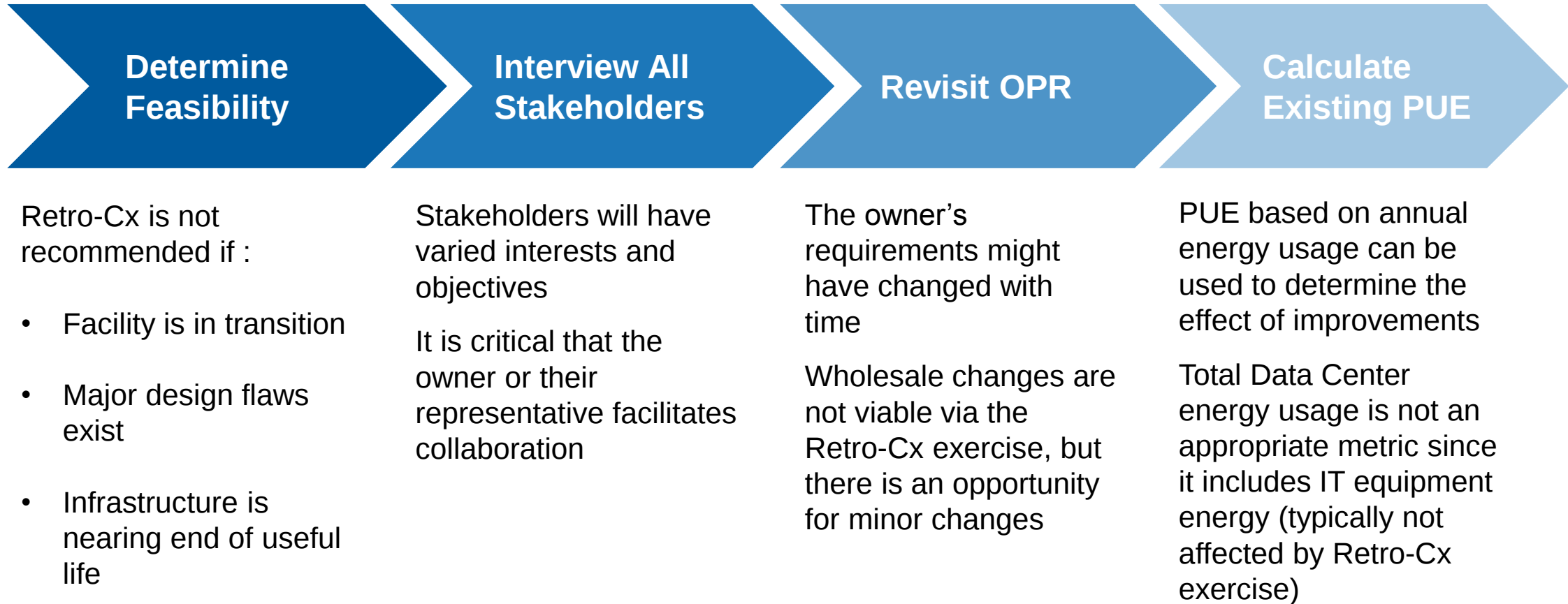


As Cx Agent:

- Interview stakeholders
- Define goals, objectives, and scope
- Survey DC
- Compile original drawings, sequence of operations, TAB reports etc.
- Review utility data
- Develop Retro-Cx plan

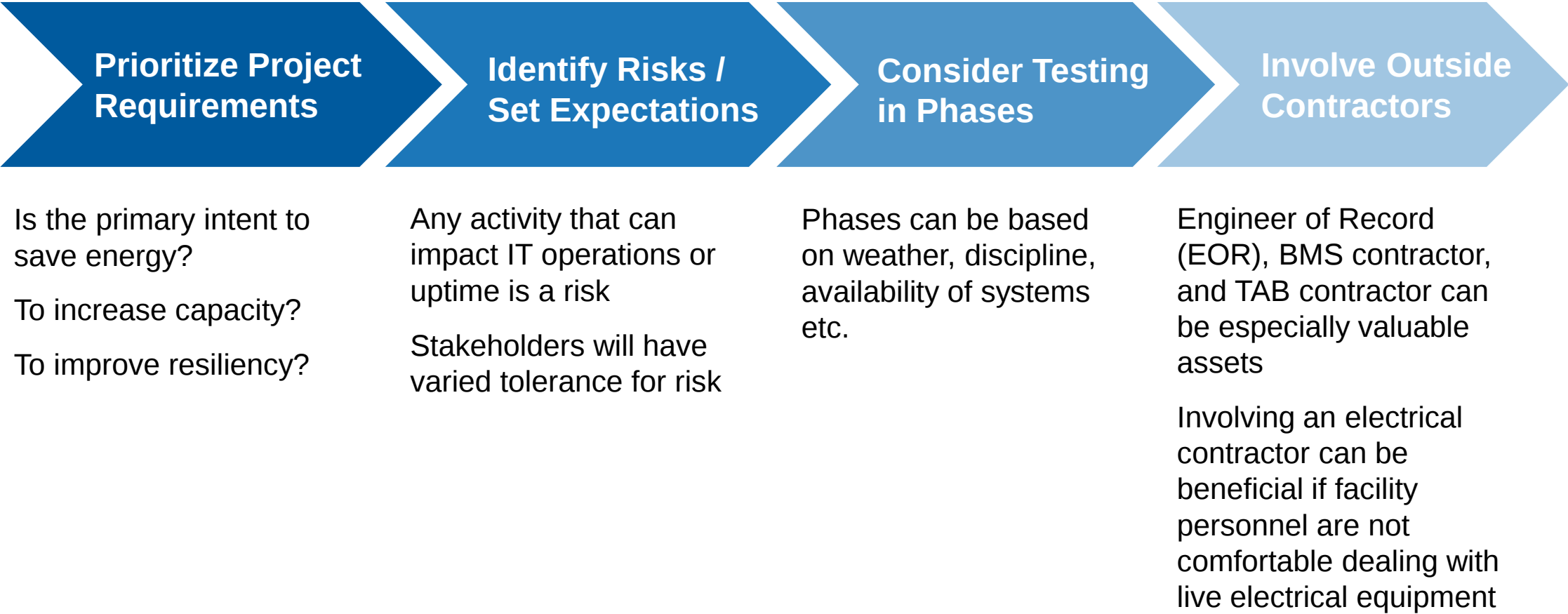
Planning Phase

Additional considerations for DCs



Planning Phase

Additional considerations for DCs



Investigation Phase

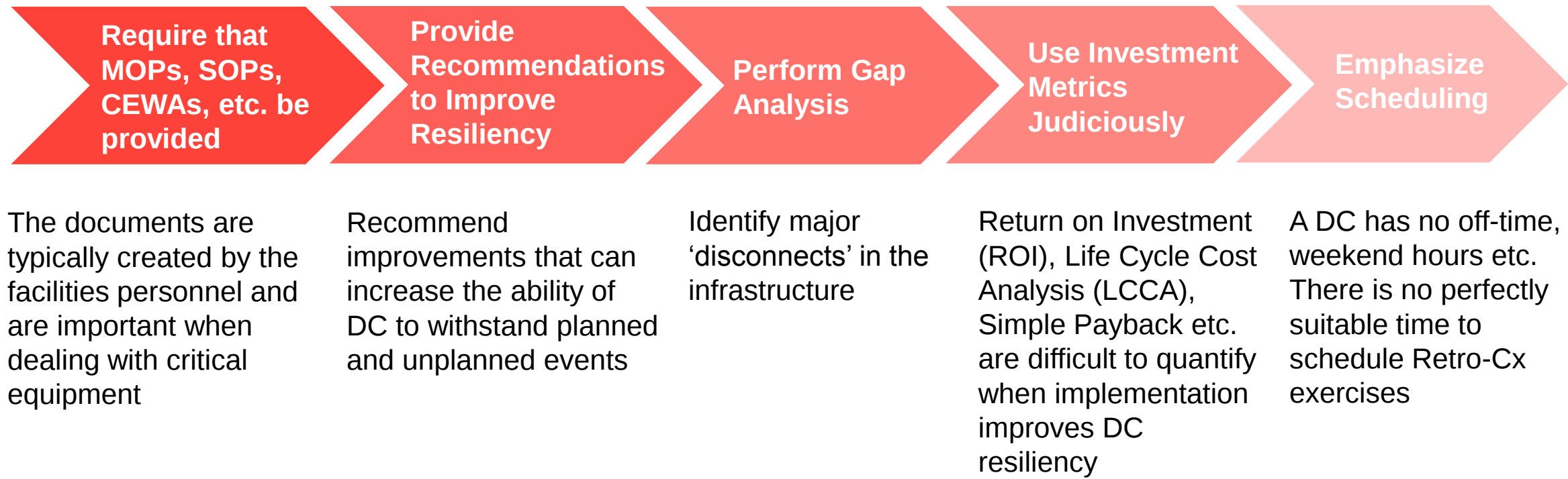


As Cx Agent:

- Discuss Retro-Cx plan with entire team
- Conduct in-depth building investigation
- Perform FPTs and IST
- Develop deficiency log
- Provide Retro-Cx report to owner

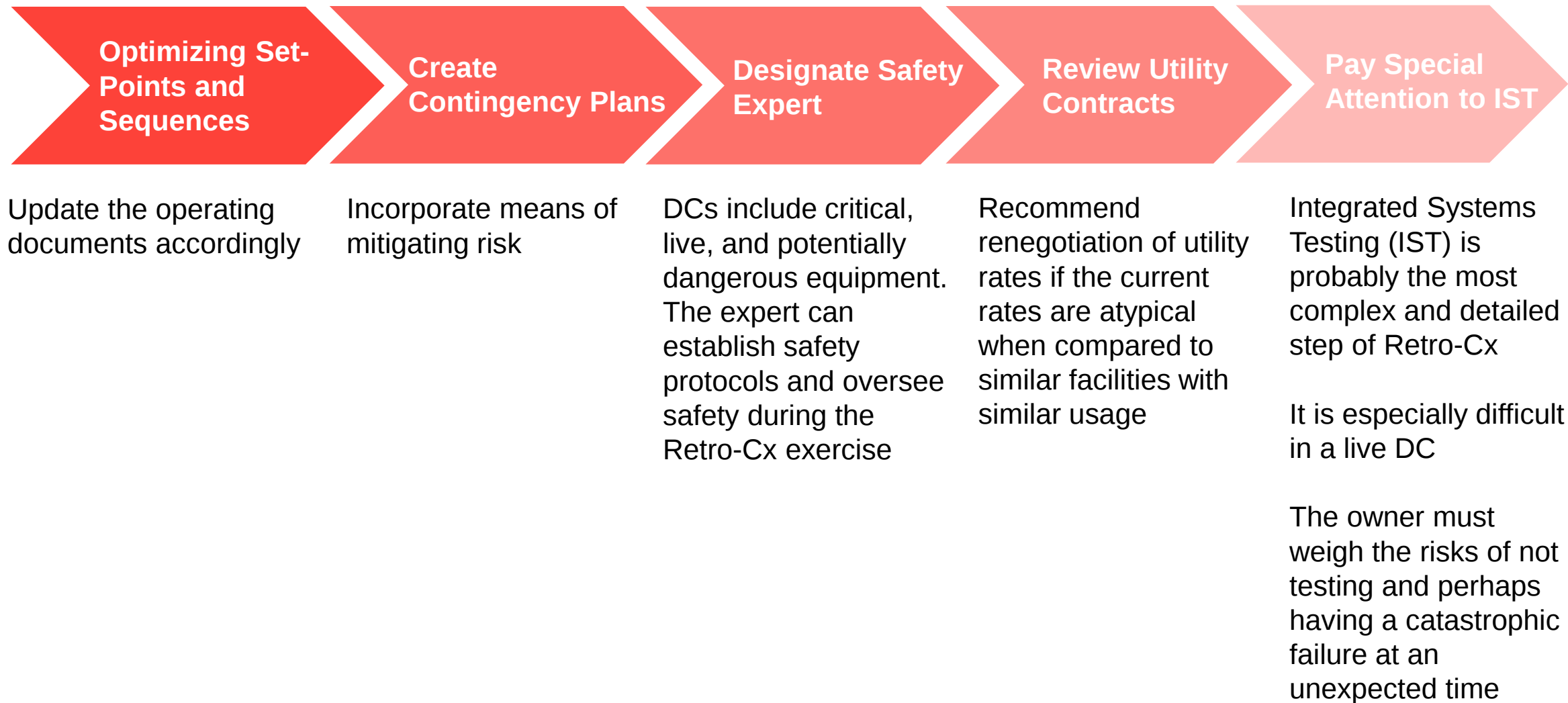
Investigation Phase

Additional considerations for DCs



Investigation Phase

Additional considerations for DCs

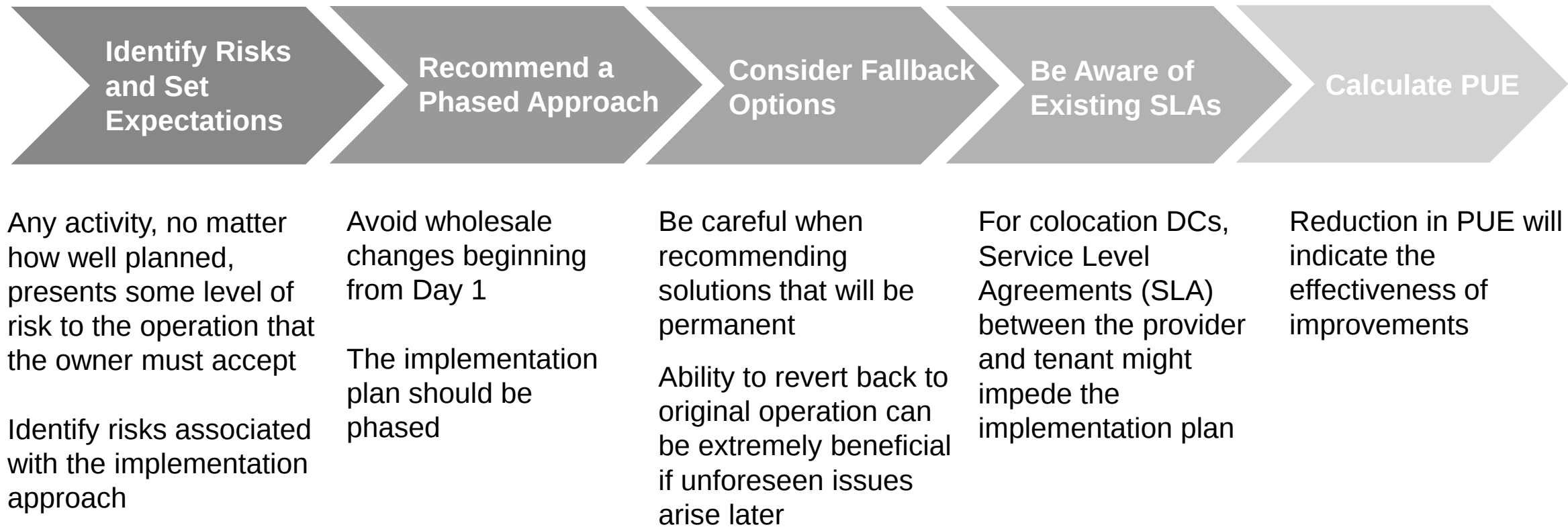


As Cx Agent:

- Develop and submit implementation plan
- Verify results

Implementation Phase

Additional considerations for DCs



Hand-Off Phase

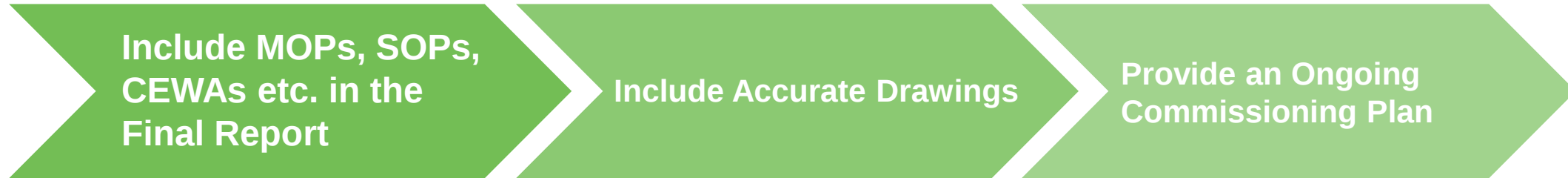


As Cx Agent:

- Develop and submit final report
- Hold close-out meeting

Hand-Off Phase

Additional considerations for DCs



Include MOPs, SOPs, CEWAs etc. in the Final Report

Include Accurate Drawings

Provide an Ongoing Commissioning Plan

Include the final iteration MOPs, SOPs, CEWAs etc. for dealing with critical situations and scenarios in the future

Include accurate drawings depicting the existing conditions

As a minimum, include mechanical and electrical single line diagrams

An ongoing commissioning plan will enable the building operators to operate the DC at an optimum level throughout its remaining life



Questions?

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