Using Monitoring-Based Commissioning to Deliver Successful Controls Upgrade Projects for Existing Buildings

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Learning Objectives

1. Identify the tools required for successful monitoring based commissioning

2. Differentiate between existing BAS capabilities and MBCx

3. Describe how analytics can be used to help justify controls modernization projects

4. Express how to integrate data analytics into legacy control systems, and understand the common pitfalls

Traditional Procurement Approach

Design

- Mechanical Engineer and/or Architect is the first consultant hired by owner
- Contract documents typically focus on hardware, less on results
- Cx Provider hired to commission systems identified by design engineer

Bid

- Cx Provider scrambles to incorporate commissioning requirements into contract documents
- Little time available to identify issues before project is released for bids

Build

- Functional Testing happening while contractors and owner are getting anxious
- Finger pointing and change orders
- Schedule delays and budget overruns

Using MBCx to Define Project Scope

Development & Planning

- Cx Provider is first consultant hired by owner
- Cx Provider develops OPR and MBCx Guideline
- Focus on desired outcomes, not hardware upgrades

Diagnostics Testing

- MBCx platform deployed
- Preliminary system testing
- Project Deficiency Report (PDR) populated to inform OPR.

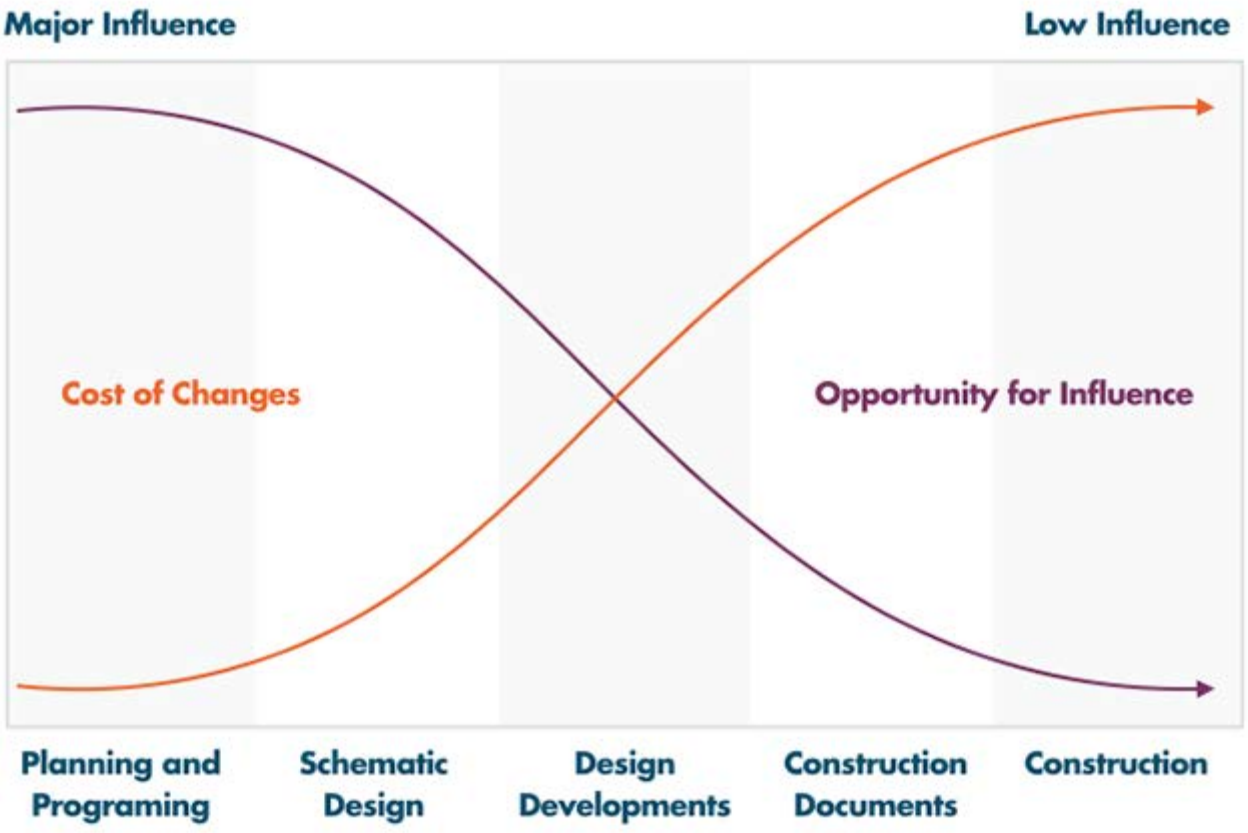
Design

- Contract documents developed based on updated OPR
- Cx Provider reviews contract documents
- Less contingency required as most issues have already been identified

Build

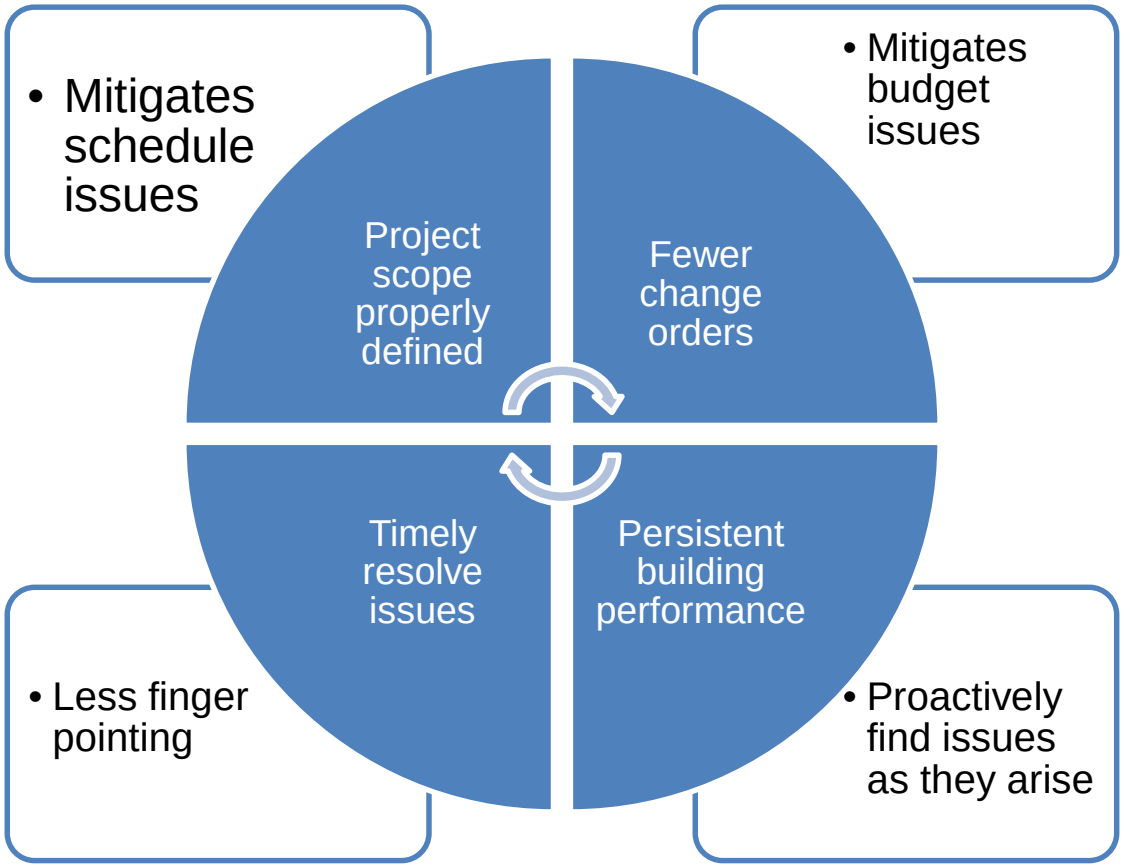
- Testing happens in parallel to construction instead of at the very end
- Fewer change orders
- Cost effectively transition monitoring into warranty period

MBCx Saves Time and Money



Source: WBDG, www.wbdg.org

The MBCx Advantage



Process vs Technical Commissioning

	Process Commissioning	Technical Commissioning
Inspections	CxA reviews inspection forms completed by contractor. Spot checks TAB report and point-to-point.	CxA fills out own forms and performs 100% point-to-point. No sampling
Functional Performance Test	Tests are performed and documented by contractors.	CxA personally tests or helps contractor test all systems. Follows up till issue is resolved.
Completion	Cx Report verifies that building has been commissioned but does not ensure functional building	CxA is able to look owner in the eye and say “Your building is complete and functions as designed”

Step 1. Establish Goals

Step 2: Establish Key Performance Indicators

How will you measure success?

Reduced Energy Cost

Reduced Occupant Complaints

Reduced work orders and maintenance cost

Step 3: Organize Your Automation Data

It’s your data!

Normalize data and give it meaning

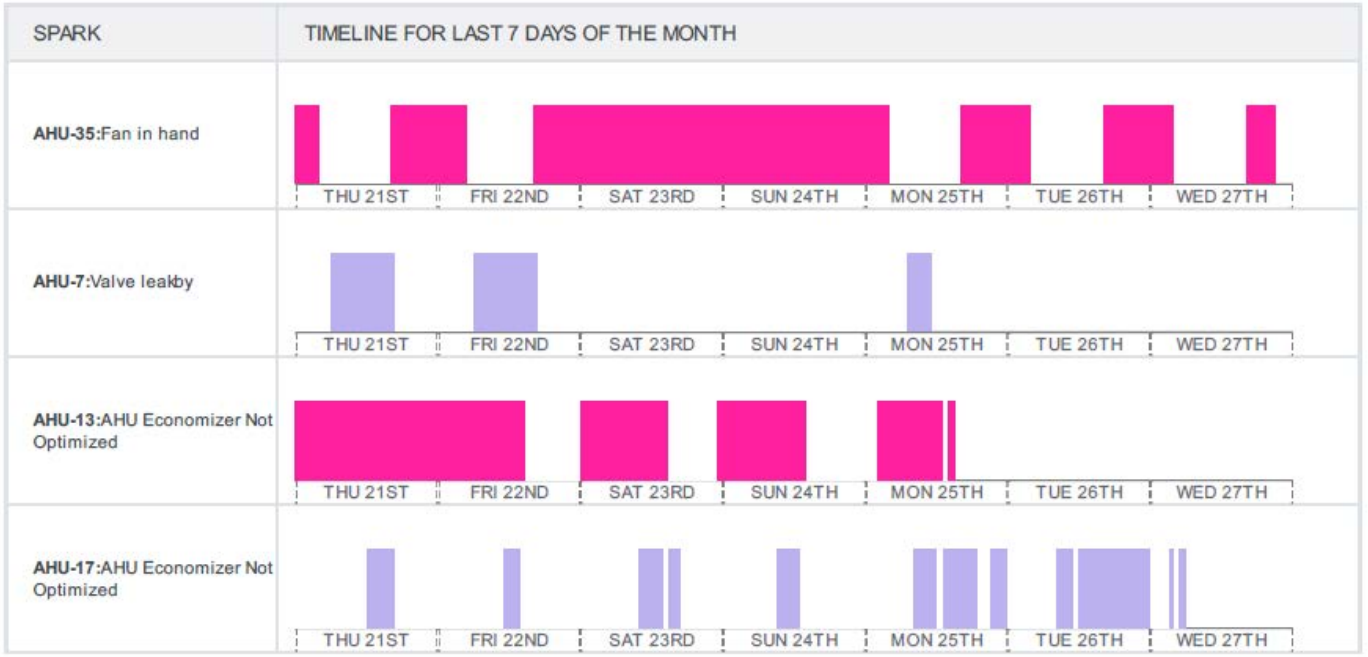
Find issues that standard alarm consoles can’t

Step 4: Identify Issues Early

Rules	dur	priority	severity	Timelines	Targets
AHU Economizer Not Optimized	23.93hr				(4)
No change in sensor value	240hr	360	10		(10)
				12a 1a 2a 3a 4a 5a 6a 7a 8a 9a 10a 11a 12p 1p 2p 3p 4p 5p 6p 7p 8p 9p 10p 11p	
AHU Economizer Not Optimized	87.87hr				(10)
Boiler Failure or Alarm	6.76hr				Boiler 4
Boiler Or Chiller Pump Mismatch	6.39hr				(2)
Chiller Failure or Alarm	21.53hr				ARU-3
Chiller Short Cycling	11.47hr				(2)
Cycling Damper, VFD Speed or Valve	5hr	15	3		AHU-38 (UMF MAU) CLG1-O
Fan failed	4.36hr	8.726	2		AHU-5
Fan in hand	12.72hr	63.58	5		AHU-35
High discharge air temp	6.42hr	10.29	1.604		AHU-7
No change in sensor value	70.75hr	97.5	3		(3)
Sensor out of range	24hr	48	2		AHU-28 FILTER DP
Valve leakby	5.75hr	33.47	5.82		AHU-7
				12a 1a 2a 3a 4a 5a 6a 7a 8a 9a 10a 11a 12p 1p 2p 3p 4p 5p 6p 7p 8p 9p 10p 11p	

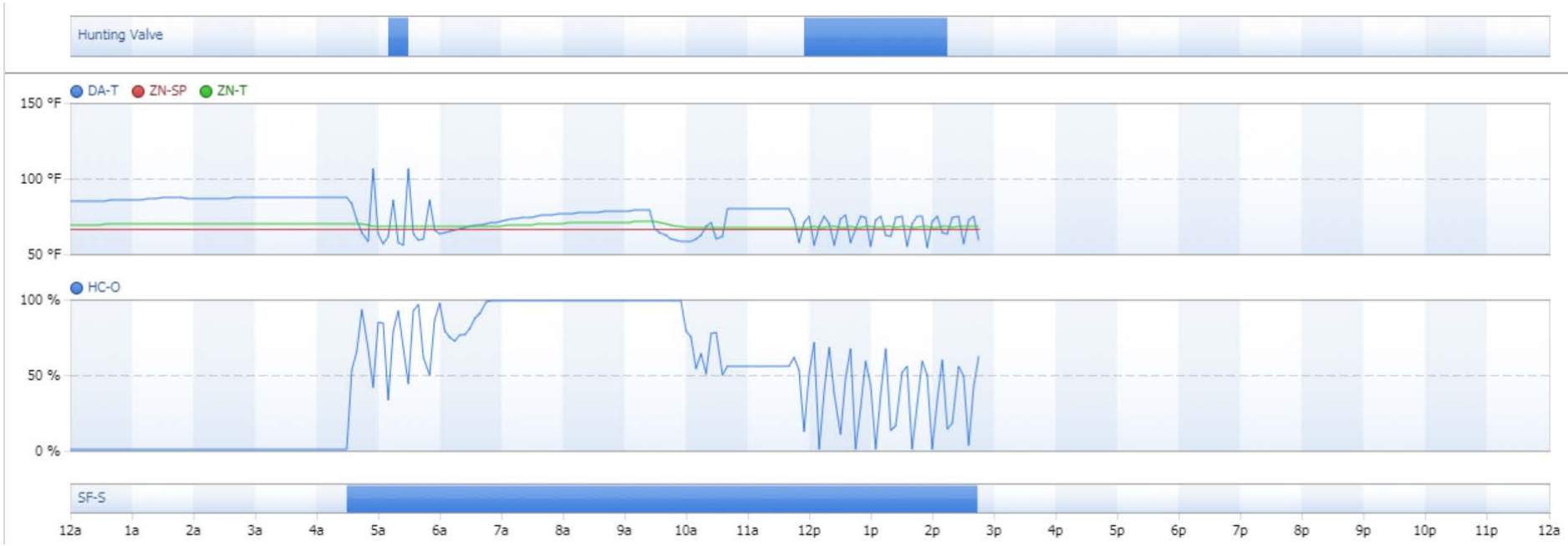
Step 4: Identify Issues Early

Decide what issues should be included in project or what issue will be resolved by maintenance staff before the project begins



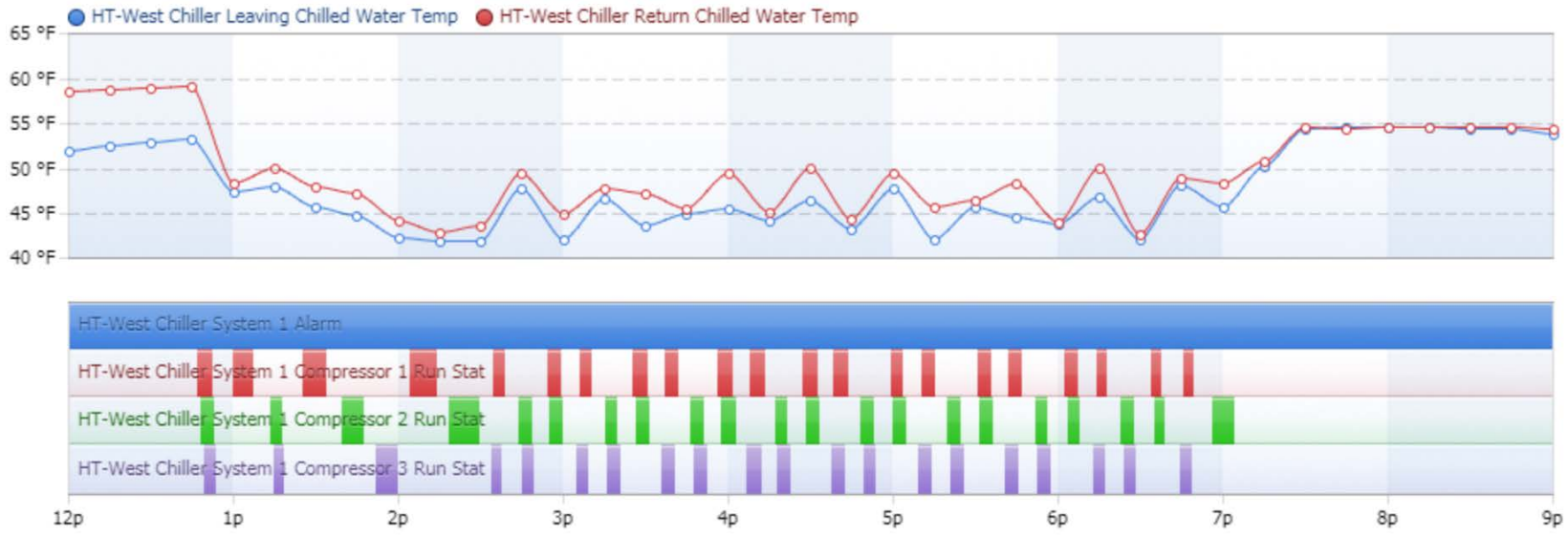
Step 4: Identify Issues Early

Determine why control valves are failing prematurely before replacing them…



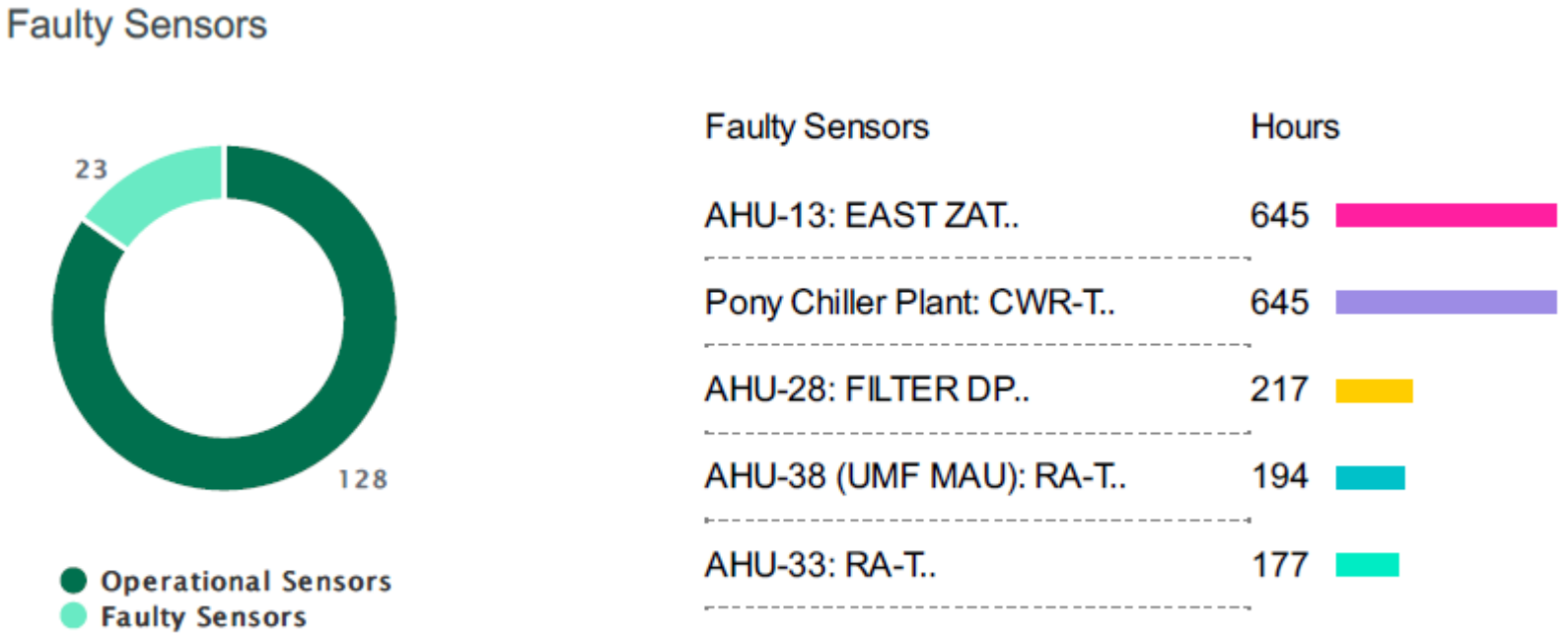
Step 4: Identify Issues Early

Brand new chiller short cycling. Compressor staging needs to be addressed as part of the controls upgrade

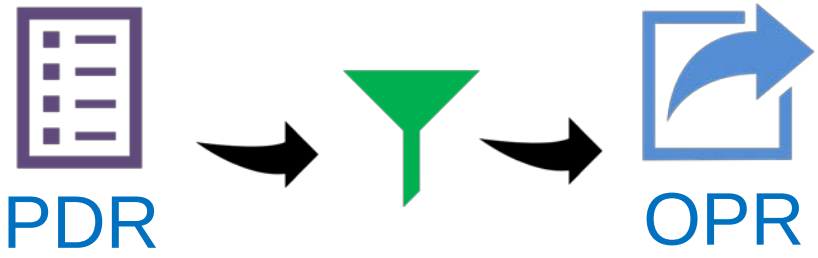


Step 4: Identify Issues Early

Fixing faulty sensors can now be included in control vendor's scope from the start



Step 5: Integrate PDR into OPR

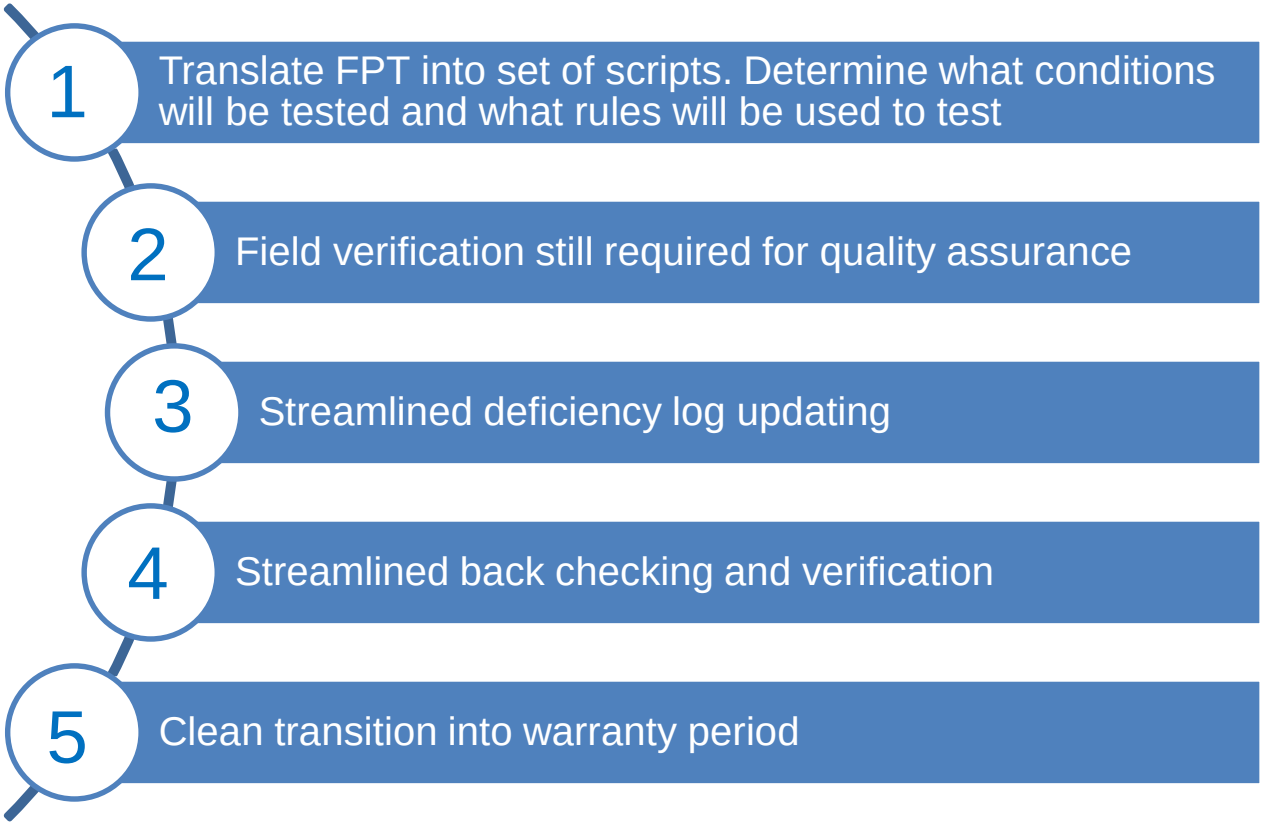


Owner knows what they're getting and contractor knows what they're bidding on

Will data need to be remapped into analytics engine after upgrade? All data needs to be named/tagged consistently

Put in the project specifications and plan heavy coordination with controls vendor

Step 6: Continuous Testing During Construction

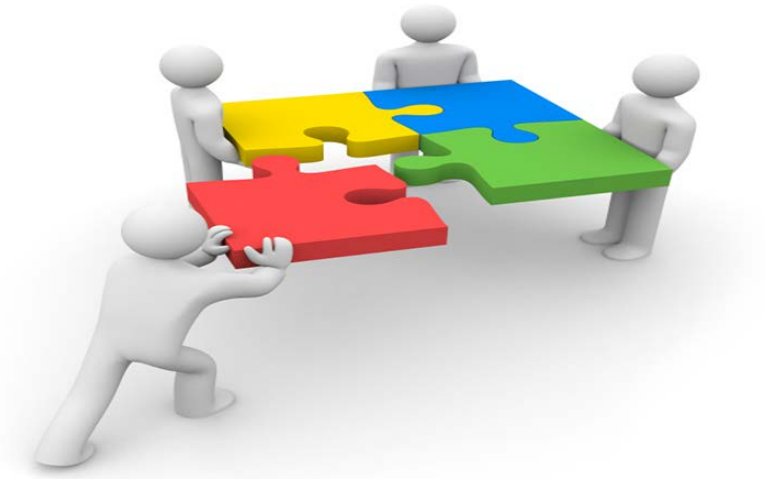


Step 7: How did we do?

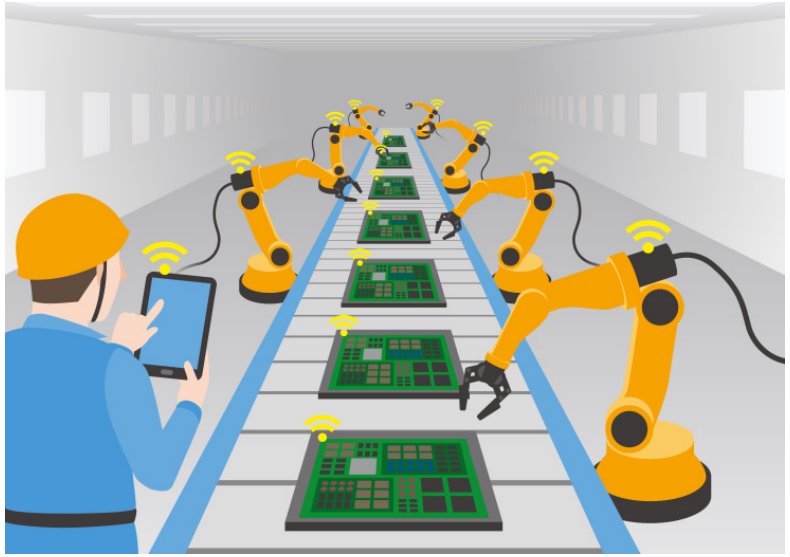
- Go beyond occupant surveys
- Quantify and track comfort metrics
- Monitoring & Verification
- Energy & Maintenance cost
- Prove the value of commissioning

Site	kW	kW Norm	kWh	kWh Norm	Spark Cost	Sparks Count	watts/sq ft
Carytown	75 346	0.001 0.005	3k	0.041	$0	1	23.8 110
Gaithersburg	88 493	0.001 0.003	4k	0.024	$0	4	11 61.5
Headquarters	196 659	0 0	7k	0.002	$0	0	1.392 4.68
Short Pump	139 543	0 0.002	5k	0.014	$24	1	8.118 31.7
Woodley Park	49 285	0 0.002	2k	0.015	$0	0	6.906 40.2

Need to Standardize Before Considering Automating



Standardization



Automation?

ASHRAE Guideline 36 – Standardized Sequences and Functional Testing Procedures

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