

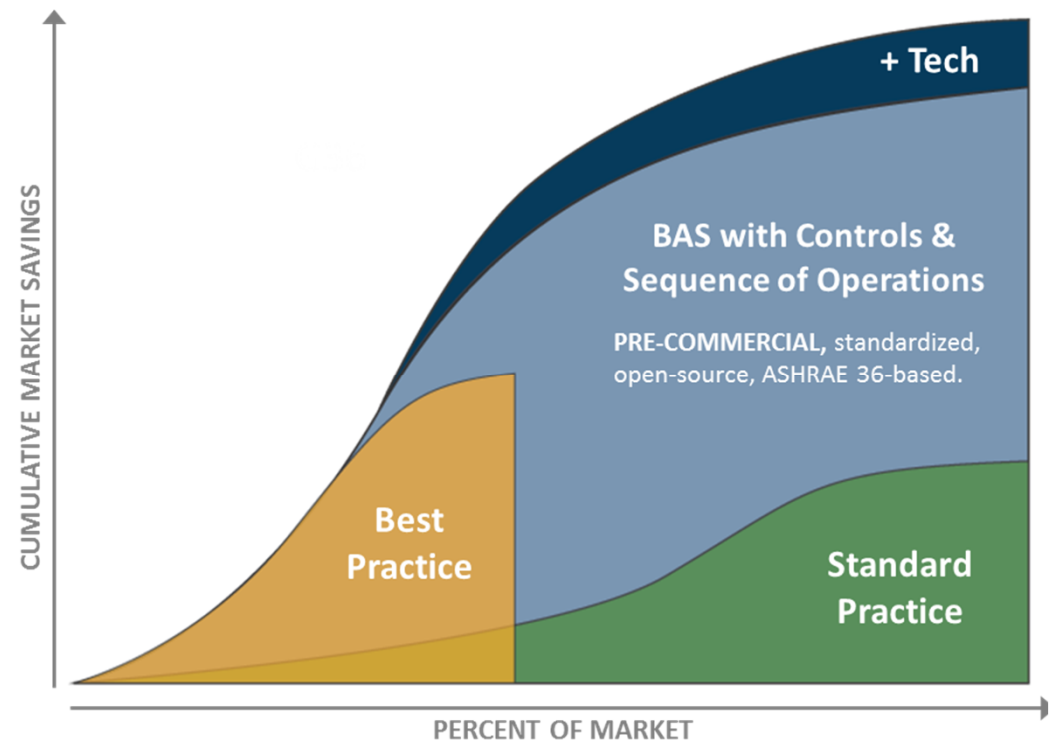


Transforming Market Delivery for Building Automation Systems

ASHRAE Guideline 36 and EPIC Best in Class

Created by Reece Kiriou, PE
Presented by Glenn Friedman,
PE, FASHRAE

May 23, 2019





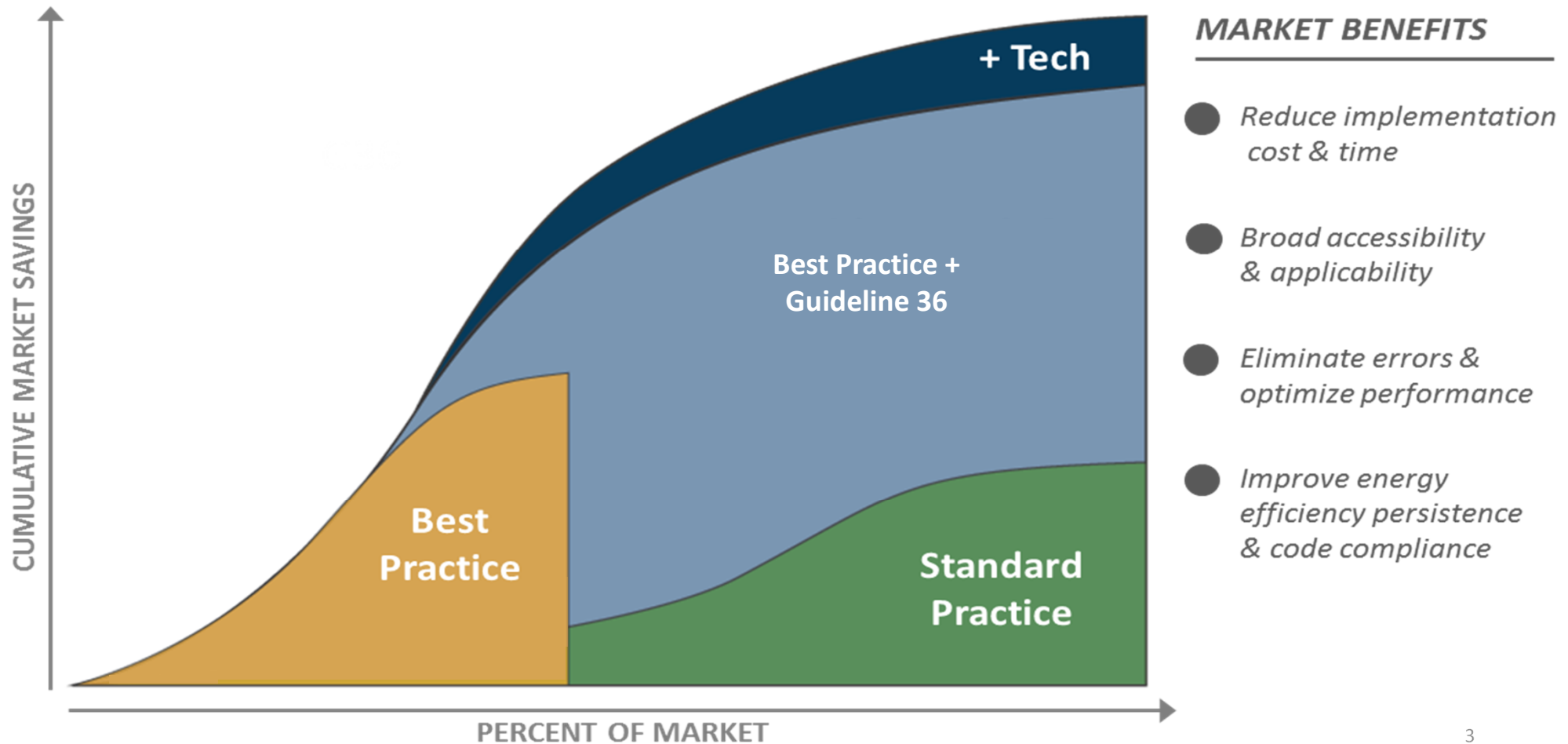
EPIC Best in Class Demonstration Project



- Promote effectiveness of G36, industry standardization
- Evaluate energy and IEQ impact at test sites
- G36 enhancement
- Plug-and-Play solutions to maintain persistence of savings, provide integration, etc.
- Industry Collaboration > Market Transformation

(EPIC – Electric Program Investment Charge, grant funded through the CEC)

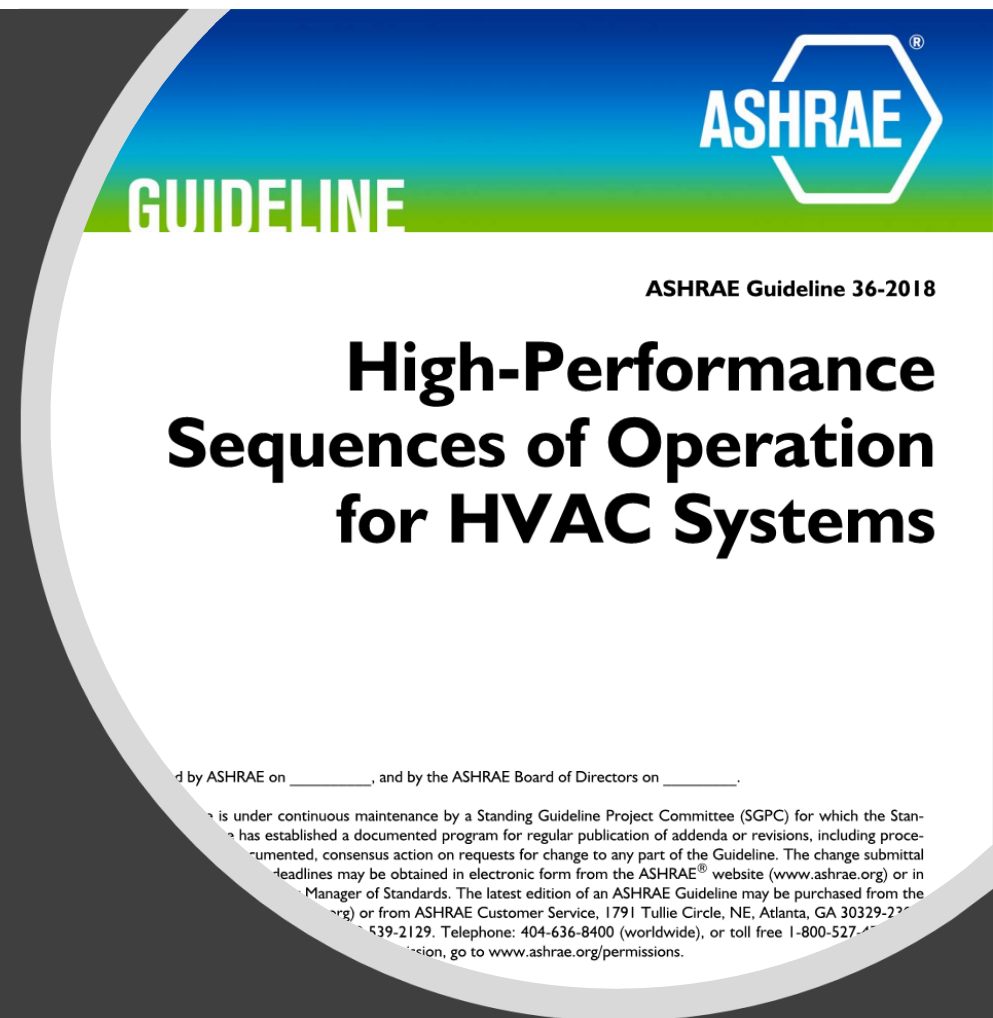
Goal: Develop a New Industry Standard for BAS and Controls Upgrades



ASHRAE Guideline 36

Current Status

- Published in June 2018
- Adoption
 - 3 ASHRAE/ANSI public reviews
 - Prescriptively required by WA state energy code
 - Sales ~700 since June
 - Many customers asking for G36 sequences
- Updated Copyright policy
 - OK to “copy/paste” and reproduce

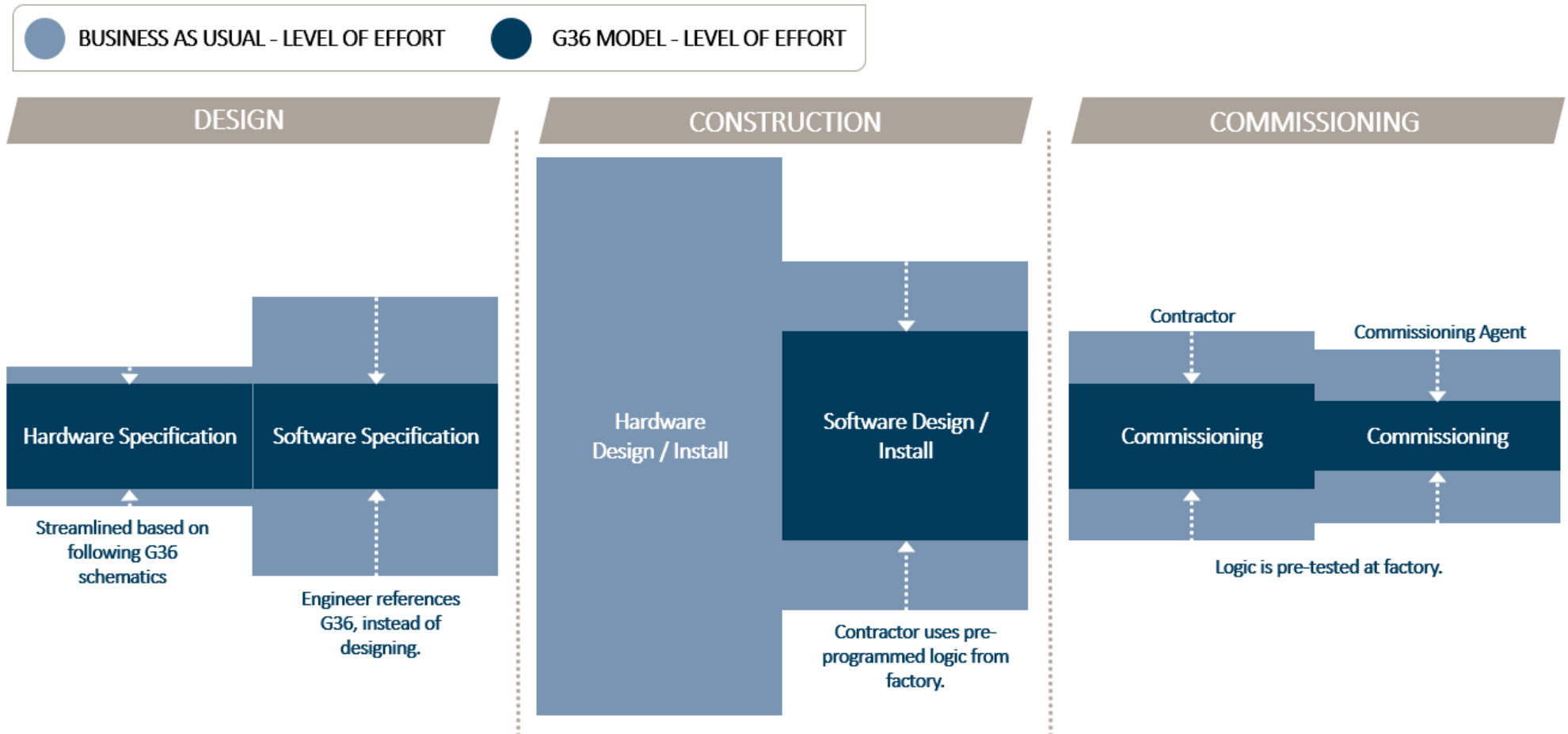




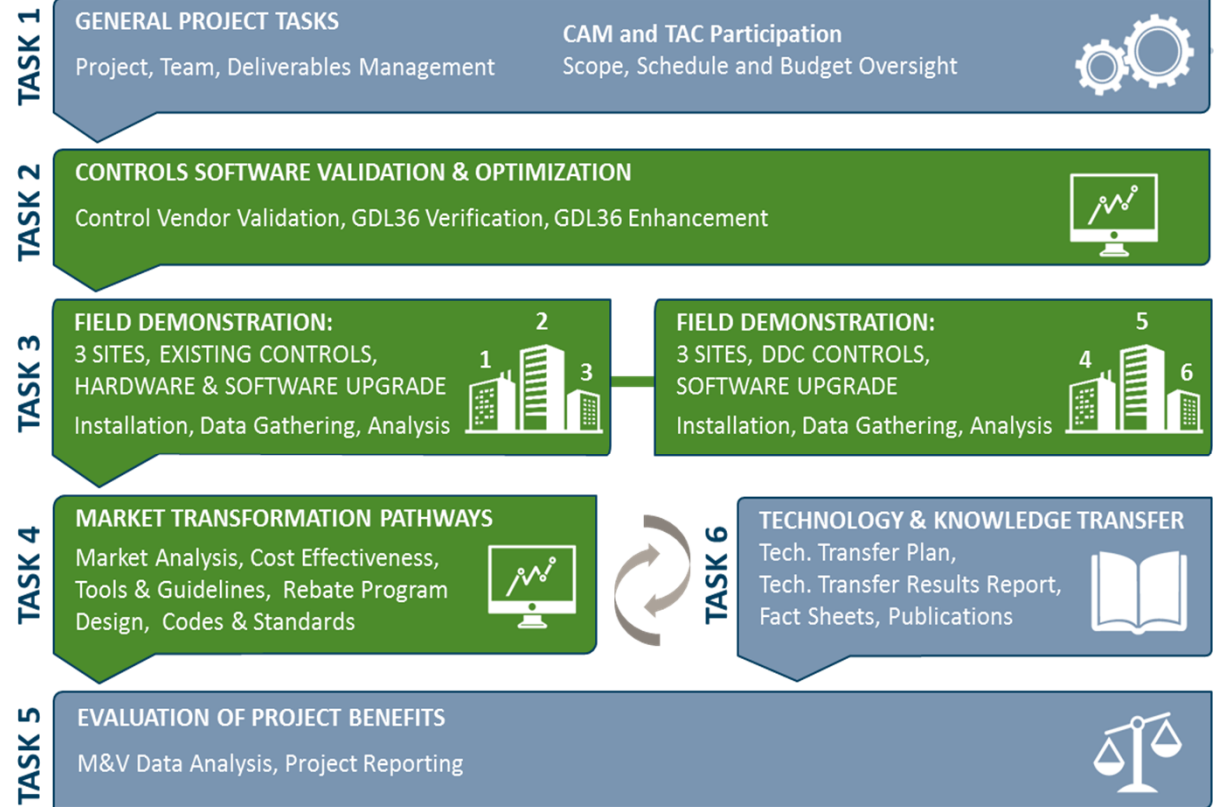
ASHRAE Guideline 36 Future Vision

- Use
 - Specified and used correctly by Engineers
 - Recommended by BAS Vendors
 - Requested by Owners/Operators
- Programming
 - Pre-programmed and pre-tested by BAS Manufacturers
 - 3rd Party Validation
- Sequence of Operations Development
 - Selection software
 - Expanded sequences
- Functional Test Scripts

Guideline 36 Value Proposition



EPIC Project Tasks





Task Detail

Task 2: Controls Software Validation & Optimization

- G36 Performance Validation Method
- Enhancement of G36

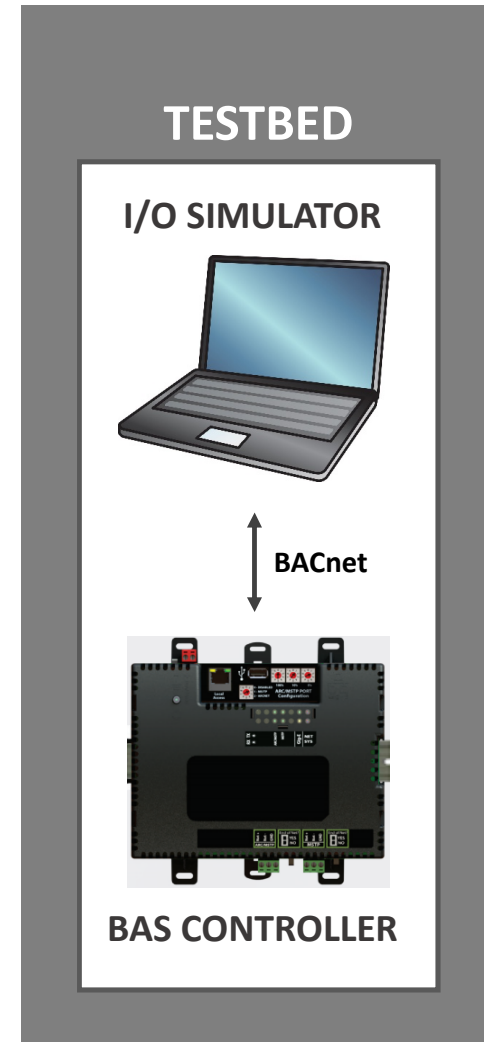
Task 3: Field Demonstrations

- Design & Installation
- Energy & IEQ Monitoring

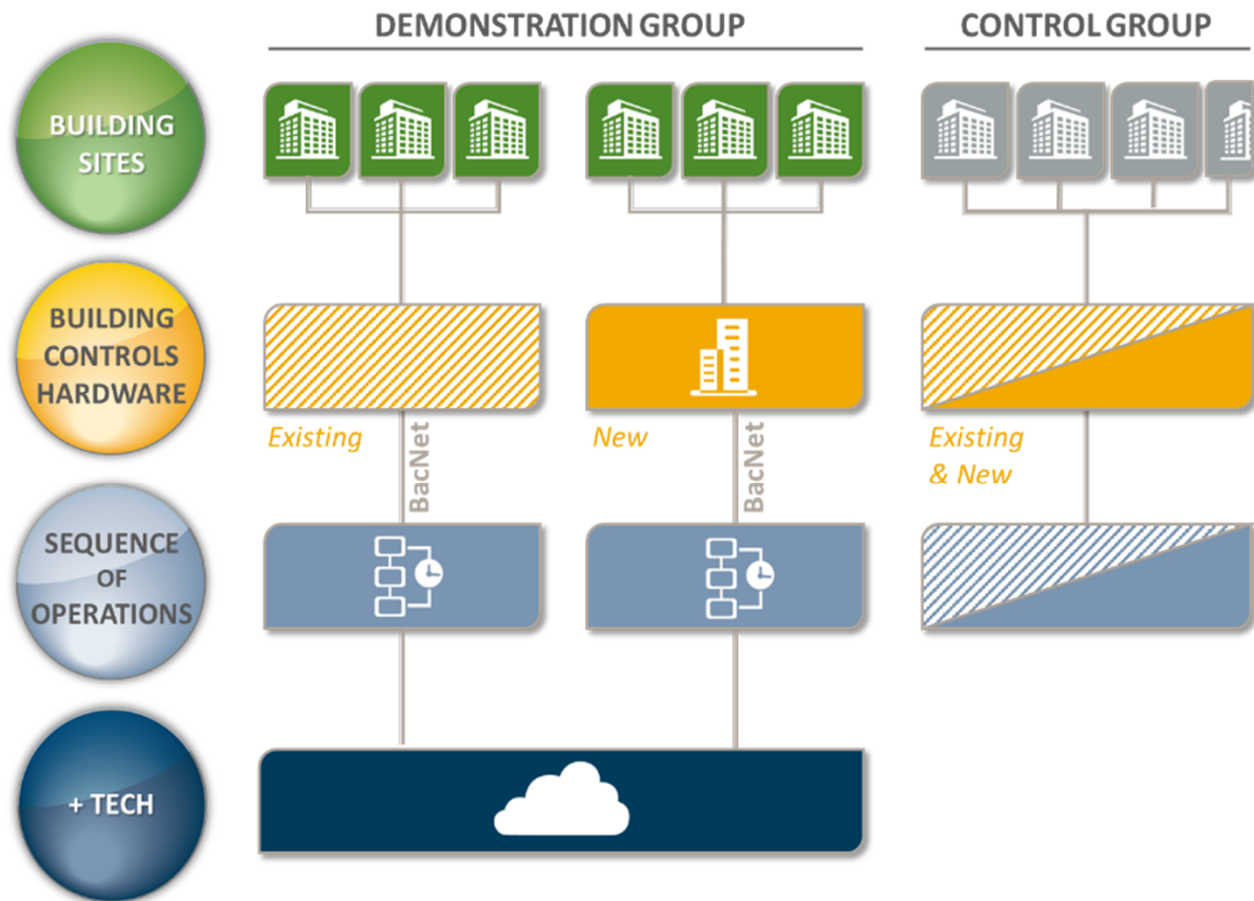
Automated Functional Tests

Goal: objective, repeatable tests of G36 programming

- Test programming on physical controller
- Interface over BACnet with “testbed”
- Detailed test scripts with all inputs and expected outputs defined
- Individual test blocks for modularization
- Pilot testbed in development
- Potential certification for G36 programming (similar to BTL)



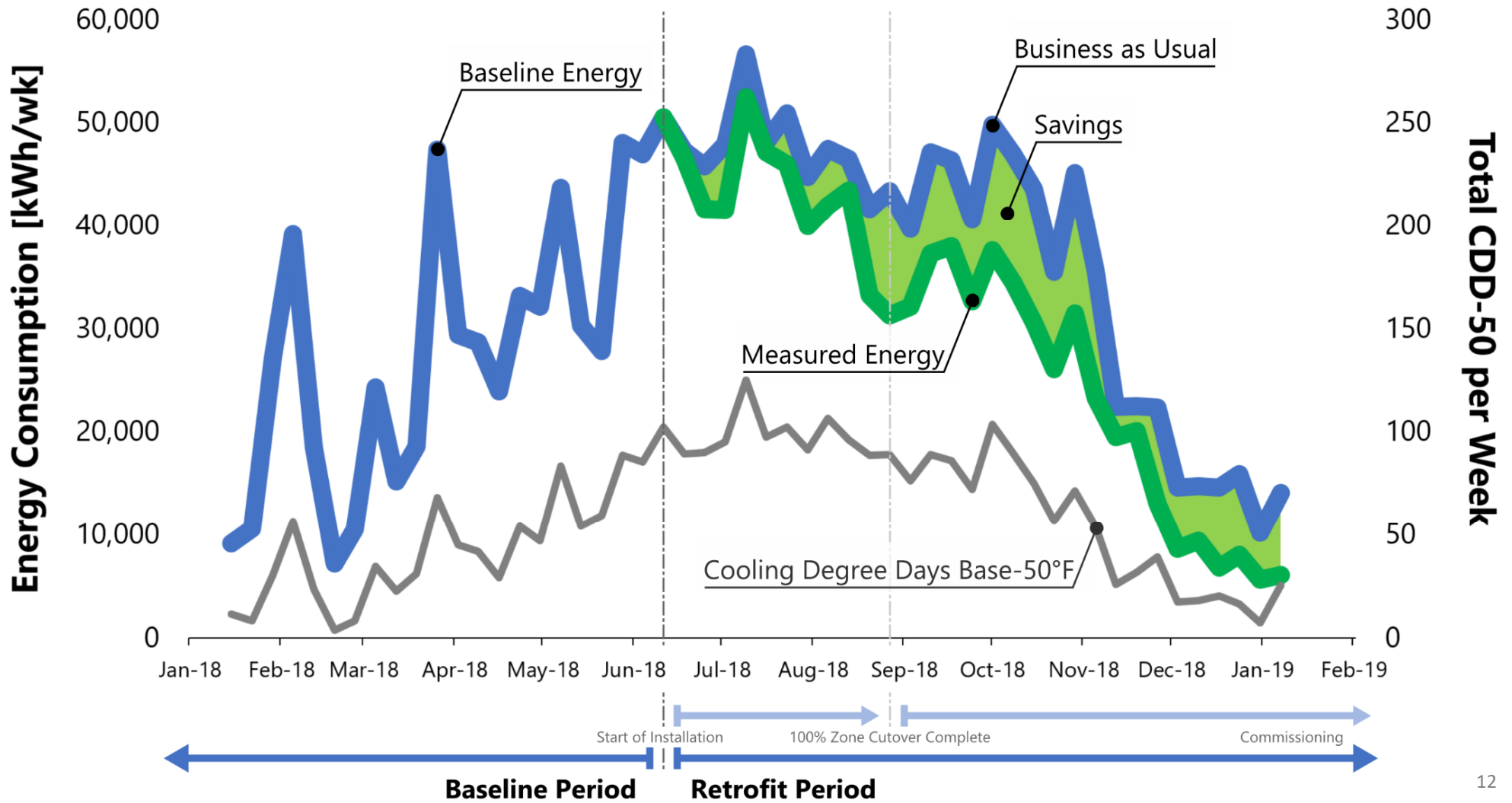
Task 3: Field Demonstrations



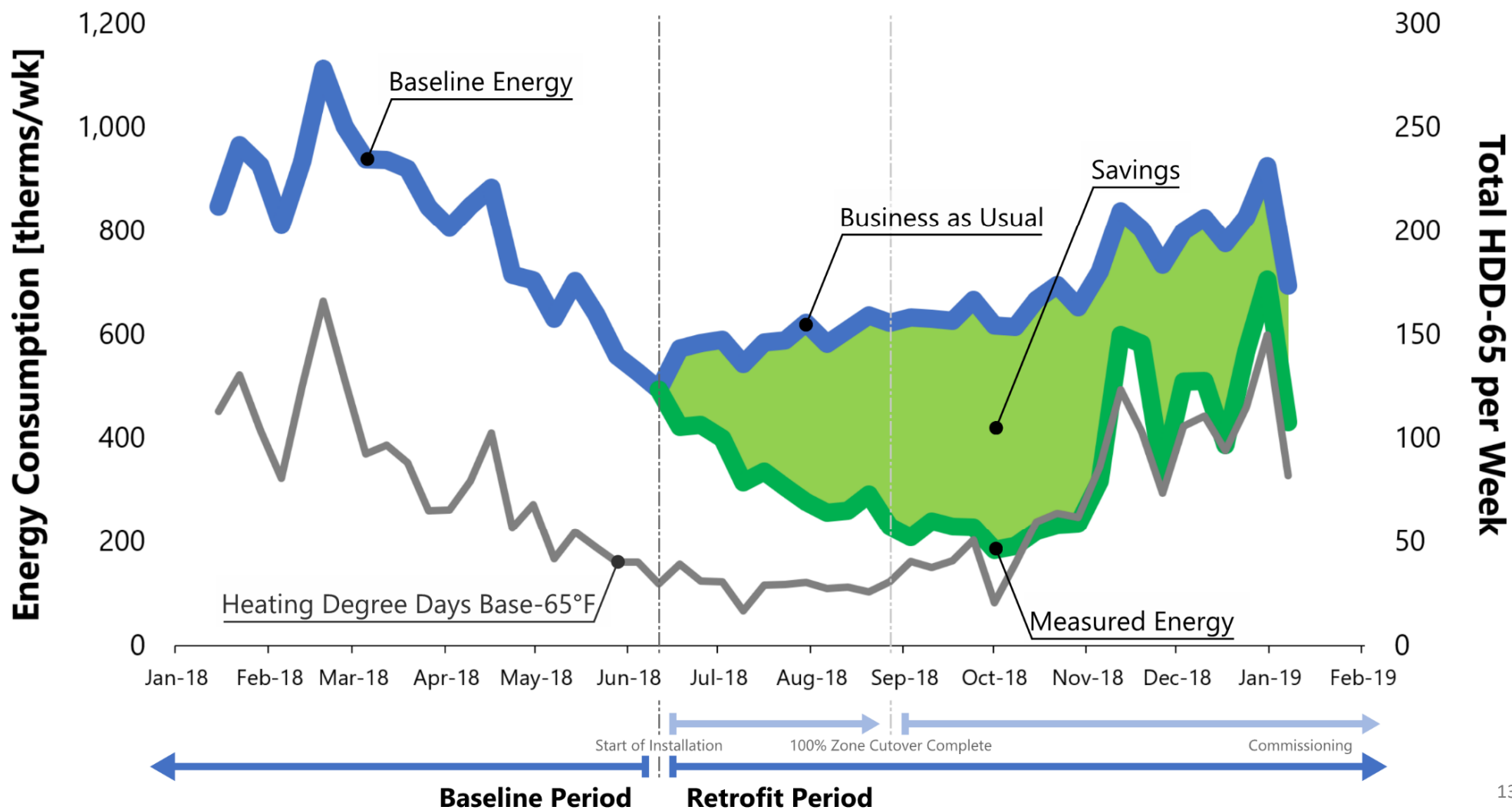
Task 3: Field Demonstration Schedule

		2018												2019												2020											
		March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October				
Task 3 Field Demonstration																																					
Full Retrofit	KP Vallejo																																				
	KP Whittier																																				
	KP Fresno																																				
	CSUDH LaCorte Hall																																				
Software	Pleasanton Data Center																																				
	CCC Student & Admin Building																																				
	Oakland SMOB																																				

CHW Energy Savings



HW Energy Savings



Task 4/6: Market Transformation / Tech Transfer

Market Assessment

- Assess Market Potential
- Identify Market Barriers
- Economic Analysis
- Market Adoption Feasibility

Market Transformation Pathways

- Utility Program Design
- Best Practices Guides
- Functional Specifications

ASHRAE Guideline 36 Future Vision



ASHRAE Guideline 36-2018

High-Performance Sequences of Operation for HVAC Systems

FACILITIES MANAGEMENT	OWNER/ CUSTOMER	DESIGN ENGINEER	CONTROLS CONTRACTOR	CONTROLS MANUFACTURER	COMMISSIONING AGENT
	Reduced energy use & costs				
Reduced staff training and maintenance cost	Lower design & construction costs	Less effort to design	Less effort to implement		Less effort to test
			Increased market demand		
		Increased customer satisfaction			
Fewer occupant complaints	Improved thermal comfort				
Improved operations	Higher quality				

G36 Functional Test Scripts

- In Scope of G36
- Developing FPTs for demonstration sites
- Spreadsheet format
- Focus on testing logic (not loop tuning, calibration, point-to-point)

A		B	C	D	E	F
1	Test Sequence for VAV Reheat Boxes		TRAINING VIDEO FOR USING THIS FORM: CLICK HERE		Open Table of Contents	
2	Please be sure to indicate the DATE, TIME, and PASS/FAIL status of the test in each case.				Reveal Hidden Rows	
3	Technician Name:			BAS Spec		
4	Tested Equipment Tag(s):		VAV-RH-x-xx	Test Template	VAV_RH	
5	Last Test Completed at:					
6	Step #	Test	Expected Response	Result	Comments	Pass?
7	A. Occupied Operation					
8	i. Deadband Mode					
9	1	Select a zone with the following criteria:	Date: Insert Date & Time			Inc.
10		• served by a VAV reheat box	Time:			
11		• has no occupants in the space	Occupied zone airflow setpoints:	*		
12		• has a heating max > the minimum setpoint	Cooling maximum (CFM):			
13			Cooling minimum (CFM):			
14		Modify cell C4 after a VAV reheat box is selected.	Minimum (CFM):			
15			Heating minimum (CFM):			
16		Schedule the zone group including this VAV box to occupied.	Heating maximum (CFM):			
17			VAV-RH-x-xx goes into occupied deadband mode (Y/N):			
18			Expected airflow setpoint (CFM):	Auto-calc		
19		If necessary, override the occupied cooling setpoint to 75.0°F.	Actual airflow setpoint (CFM):			
20			Damper position at end of test (%; do not wait for damper loop to stabilize):			
21			HW valve shuts if open (Y/N):			
22		Override the cooling PID loop output to 0%.				

CHOOSE YOUR OWN ADVENTURE

ASHRAE Guideline 36-2018

High-Performance Sequences of Operation for HVAC Systems

Approved by ASHRAE on _____, and by the ASHRAE Board of Directors on _____.

This Guideline is under continuous maintenance by a Standing Guideline Project Committee (SGPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Guideline. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE® website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Guideline may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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Notes in italics between thin lines provide guidance or additional information about specific sequences.

These notes are not a part of this guideline. They are merely informative and do not contain requirements necessary for conformance to the guideline.

Notes in bold between thick lines provide direction to the editor of these sequences so that they are properly implemented (e.g., identifying mutually exclusive options).

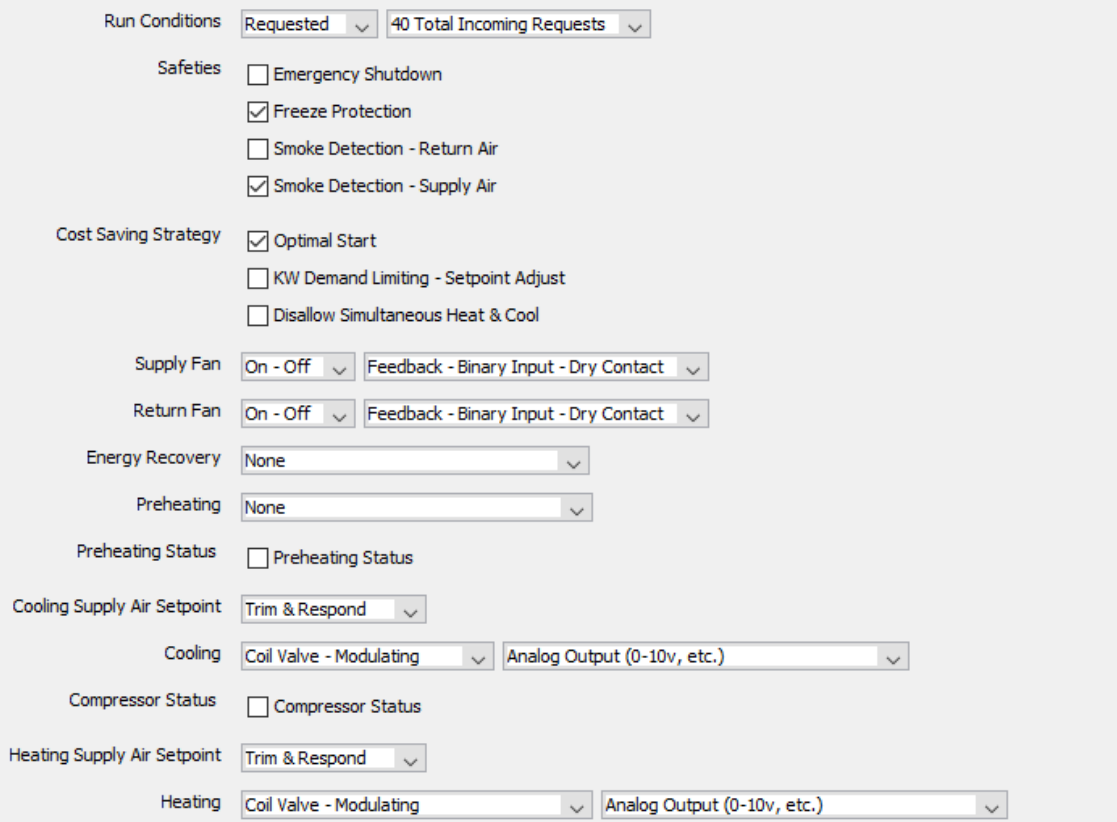
The engineer must select between ventilation logic options:

- **If the project is to comply with ASHRAE Standard 62.1 ventilation requirements, keep subsection (a) and delete subsection (b).**
 - **If the project is to comply with California Title 24 ventilation requirements, keep subsection (b) and delete subsection (a).**
-

G36 Selection Software

Pick from Menus:

Auto-generated Output:



The screenshot displays the G36 Selection Software interface with the following configuration options:

- Run Conditions:** Requested (dropdown), 40 Total Incoming Requests (dropdown)
- Safeties:**
 - ☐ Emergency Shutdown
 - ☒ Freeze Protection
 - ☐ Smoke Detection - Return Air
 - ☒ Smoke Detection - Supply Air
- Cost Saving Strategy:**
 - ☒ Optimal Start
 - ☐ KW Demand Limiting - Setpoint Adjust
 - ☐ Disallow Simultaneous Heat & Cool
- Supply Fan:** On - Off (dropdown), Feedback - Binary Input - Dry Contact (dropdown)
- Return Fan:** On - Off (dropdown), Feedback - Binary Input - Dry Contact (dropdown)
- Energy Recovery:** None (dropdown)
- Preheating:** None (dropdown)
- Preheating Status:** ☐ Preheating Status
- Cooling Supply Air Setpoint:** Trim & Respond (dropdown)
- Cooling:** Coil Valve - Modulating (dropdown), Analog Output (0-10v, etc.) (dropdown)
- Compressor Status:** ☐ Compressor Status
- Heating Supply Air Setpoint:** Trim & Respond (dropdown)
- Heating:** Coil Valve - Modulating (dropdown), Analog Output (0-10v, etc.) (dropdown)



**Sequences of
Operation**

**Functional
Performance Test
Scripts**

Control Schematics

**Programming and
Graphics Files**

(from ctrlspecbuilder.com)

Questions?

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