Change Culture, Save Energy:

1st Smart Labs Utility Incentive Program Lessons

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I²SL, Panel G2: Smart Labs
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kW ENGINEERING

Agenda

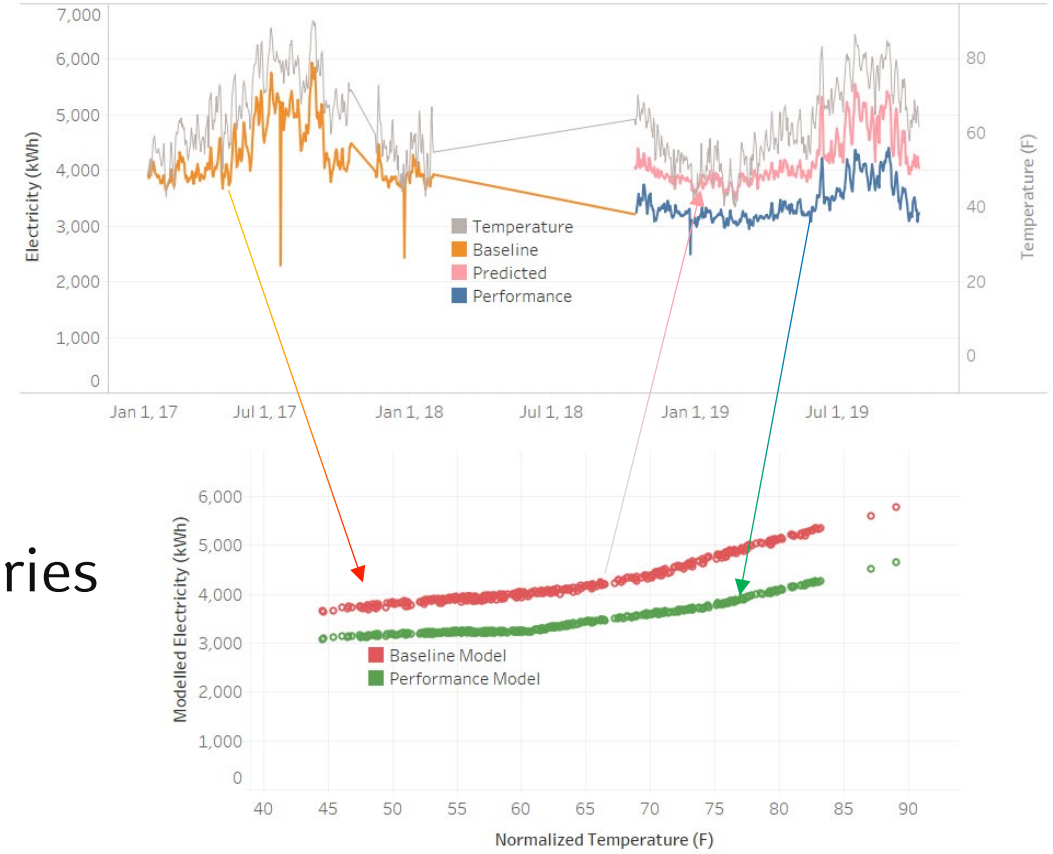
- Smart Labs Program: Who, What and Why
- Successes and Timelines
- Challenges and Lessons Learned

Main Take-Aways

- Projects move slowly because labs are complicated and deep cultural change takes time
- Proper ventilation rates can save a lot of energy but represent a new way to how safety is addressed in the laboratory
- Future program iterations should adapt by accommodating for long schedules and funding the change management process

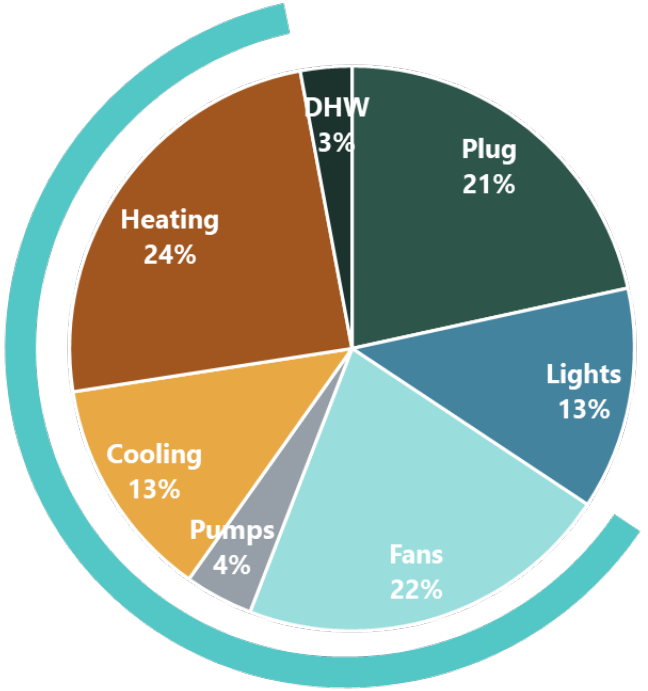
Smart Labs Incentive Program Basics

- PG&E Service Territory
- NMEC - Meter Based
- Goal: 8,400,000 kWh, 400,000 therms
- Specific (not blanket) Ventilation Setpoints
  - Cover most RCx and Capital improvements
- Medium to large R&D and Teaching Laboratories
  - 50,000+ s.f., 8+ air changes per hour (ACH)
- 2021 – 2026 (now closed for enrollment)

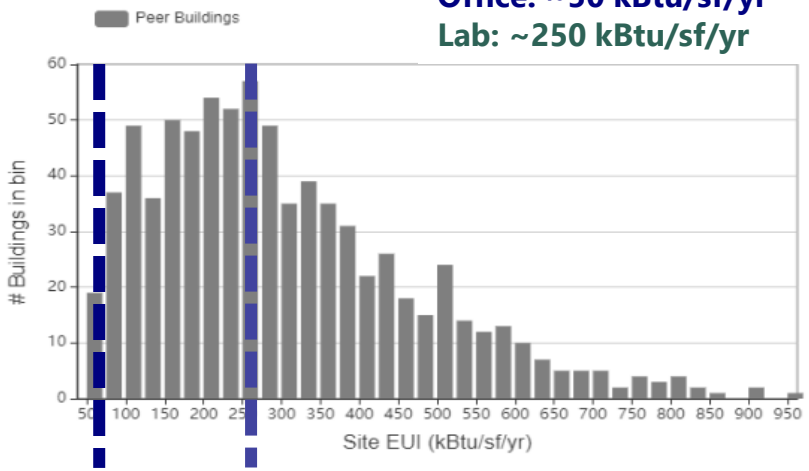


Why Target Labs?

- Labs are high intensity and complex energy users
- Good fit with Meter-Based
- Smart Labs is an established process but still emerging in adoption
- Labs need help overcoming inertia



Office: ~50 kBtu/sf/yr
Lab: ~250 kBtu/sf/yr



Why Target Labs?

- Blanket ventilation rates don't cut it
- Smart Labs establishes ventilation by zone

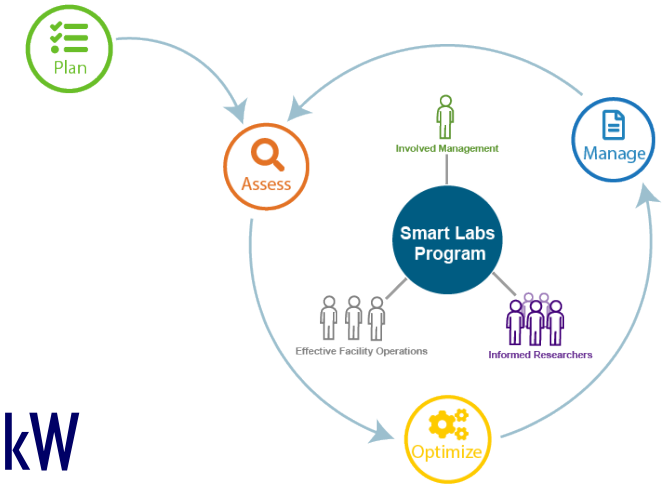
Risk Factor Score	Risk Control Band (RCB)	Description
< 16	0	Negligible
16-40	1	Low
41-64	2	Moderate
65-88	3	High
89-120	4	Extreme "Special"

System Feature	Parameter	Risk Control Band				
		0	1	2	3	4
Fume Hood	ASHRAE 110 Tracer Gas Control Level	n/a	4 lpm AU < 0.1 ppm	4 lpm AU < 0.1 ppm	4 lpm AU < 0.05 ppm	<8 lpm AU < 0.01 ppm
	Fume Hood Face Velocity [1]	n/a	60 fpm	60 fpm	60 fpm	>80 fpm
	Maximum Cross Draft Velocity	n/a	< 30 fpm	< 30 fpm	< 30 fpm	<30 fpm
	Minimum Fume Hood Exhaust Flow w/Sash Closed [2]	Turn off or Hibernate	> 150 ACH_{FH}	> 250 ACH_{FH}	> 375 ACH_{FH}	CAV
	VAV Response Time	n/a	< 5 sec	< 5 sec	< 5 sec	< 5 sec
	VAV Stability (% Variation)	n/a	< 20%	< 20%	< 20%	< 20%
	Monitor	n/a	Yes	Yes	Yes	Yes
Lab Environment	Min. Effective ACH – Occ.	n/a	4	6	8	10+
	Min. Effective ACH – Unocc.		2	3	4	
	Recirculation of Lab Air	Yes	Filtered	Internal	Internal	No
	Lab Pressurization	Neutral	< -0.005 iwg	< -0.01 iwg	< -0.05 iwg	≥ -0.05 iwg
	Room Monitor	n/a	n/a	Review	Yes	Yes
	Airlock/Vestibule	n/a	n/a	n/a	n/a	Yes
	Flow Setback (DCV)	Yes	Yes	Yes	Review	No
	Emergency Purge Mode	No	No	No	Review	Yes
	Ventilation Effectiveness [3]	<= 2	< =1.5	<= 1	< 1	<< 1
System	Duct Velocity	< 200 fpm	200 fpm	300 fpm	500 fpm	>500 fpm
	VAV Controls Accuracy/Precision	+/- 10%	+/- 10%	+/- 5%	+/- 5%	+/- 5%
	Enthalpy Wheels	Yes	Review	No	No	No
	Stack Discharge	N/A	Review	Review Min. 10 ft, 3000 fpm	Wind Wake Model	Wind Wake Model

Program Structure

- Technical Assistance Program with Bonus Incentives

2-4 months	4-5 months	**~12 months**	After Project Implementation
Plan	Assess	Optimize	Manage
Free Scoping study	Free Lab ventilation risk assessment (LVRA) and system testing	Free Check-ins and engineering assistance during implementation	Free Lab ventilation management plan $ Incentives Incentives: $0.10/kWh and $0.50/therm saved



$ Note: Building owner bids, funds, and implements upgrade project

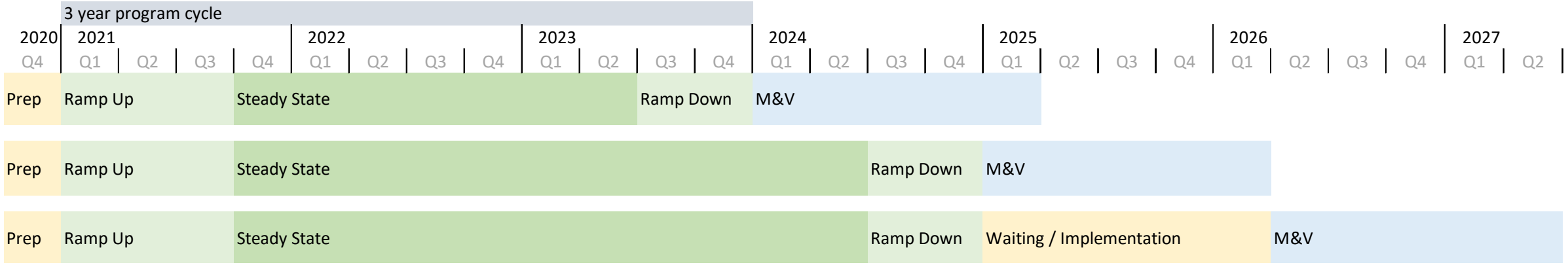
Who's Running the Program

- kW Engineering
  - Energy efficiency experts
  - Independent, owner's rep
  - PG&E Audit and Retro-Commissioning History
  - First (of 2) as a program implementer

- 3 Flow (formerly Exposure Control Technologies)
  - Ventilation specialists
  - Airflow analysis, testing, and implementation
  - Zone-by-zone air flow alignment with chemical inventory & lab practices

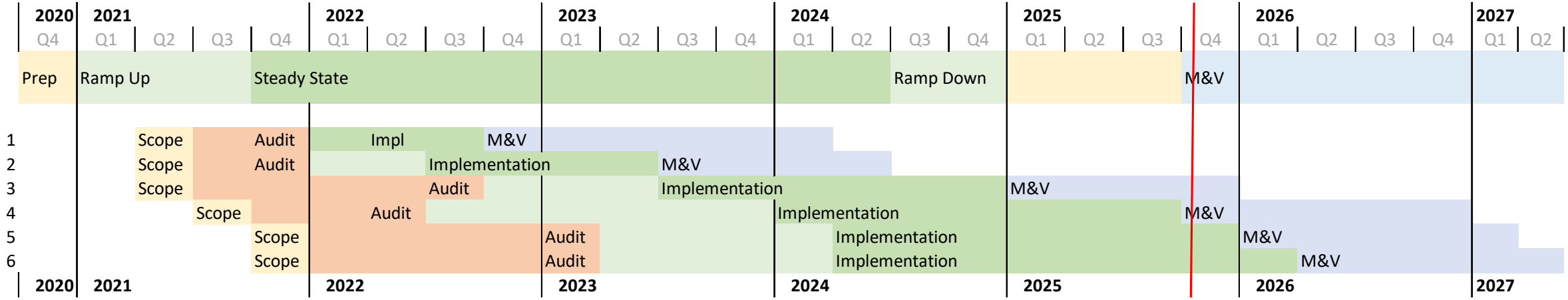
Program Expectations

- Budget $4,378,000; Customer Incentives are $1,216,000 (28%)
- Commercial, Downstream, NMEC
- Target 28 Facilities
- Program Extensions



Project Timelines

- Lots of prep time and lots of implementation time



Results

- Completed 16 Scoping Studies
- LVRA and HVAC Testing for 7 Sites
- 3 projects completed through M&V
- 3 projects completing in 2025
  - 1 dropped out 2025

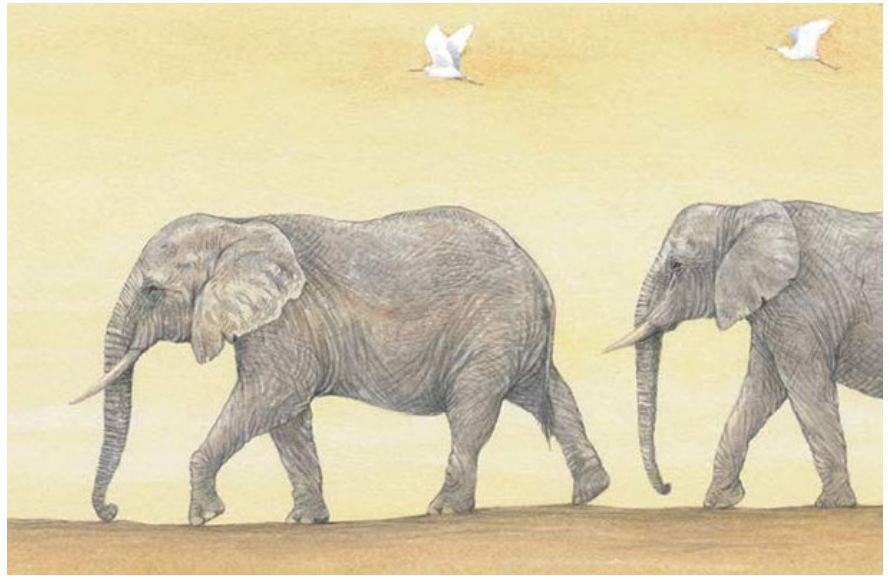
	Savings		
Project	kWh	therms	% kBtu
1 University	**719,593**	**15,275**	**17%**
2 University	**31,490**	**6,173**	**12%**
3 Corp	**2,614,463**	**224,577**	**24%**
4 Corp	626,976	44,753	19%+
5 Corp	1,629,150	60,150	15%-
6 University	903,803	17,133	14%+
~~7 University~~	~~114,006~~	~~1,419~~	
	6,639,481	369,480	
	75%	87%	
	8,820,000	425,880	

		Annual Energy Savings				
Measure Number	Measure Description	Peak Demand (kW)	Electricity (kWh)	Chilled Water (ton-hr)	Steam (lbs)	Total Energy (kBtu)
1	Airflow Rebalancing and Minimum Airflow Reductions	-	213,474	8,693	795,453	1,628,139
2	Fume Hood Airflow Reductions	-	-	-	-	-
3	Exhaust Fan System Optimization	52	460,500	-	-	1,571,226
4	AHU Controls Optimization	-	3,909	53,561	487,661	1,143,729
Total		**46.8**	**593,680**	**85,772**	**2,800,454**	5,855,354
	Savings Percentage of Annual Usage		19%	13%	18%	**17%**
	Annual Usage (site)		3,049,000	683,000	15,156,000	**33,755,188**

kW

Lessons Learned: Big and Slow

- Slow: Holistic lab retrofits include RCx and capital measures (which takes time)
- Smart/Stubborn: Specialized and difficult retrofits are what we're targeting (takes time)
- Big: Just a few big projects with deep savings make up our annual goals
- Own Pace: They don't care about when their trainers think they will cross the finish line



Lessons Learned: Ventilation Rates

- New risk assessment and ventilation rates are not set in stone
  - We suggest a process, but the customer needs to adopt their own
- EH&S needs to change the way they look at safe ventilation
- Interpreted differently by institutions, by departments, and fire marshals
- Cross-disciplinary new process

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Lessons Learned: Culture Change

- Ventilation rates are no longer static; institute needs to continuously respond
  - This is an entirely new way of doing this – cultural change
- Team has to be formed, understand, document and iterate
- Cultural/Institutional change is hard to do quickly
  - Time for concept development/percolation
  - Time for department buy-in
- Our program is only there for one round;
  - Ventilation management plan is a series of workshops

Lessons Learned: Utility Program

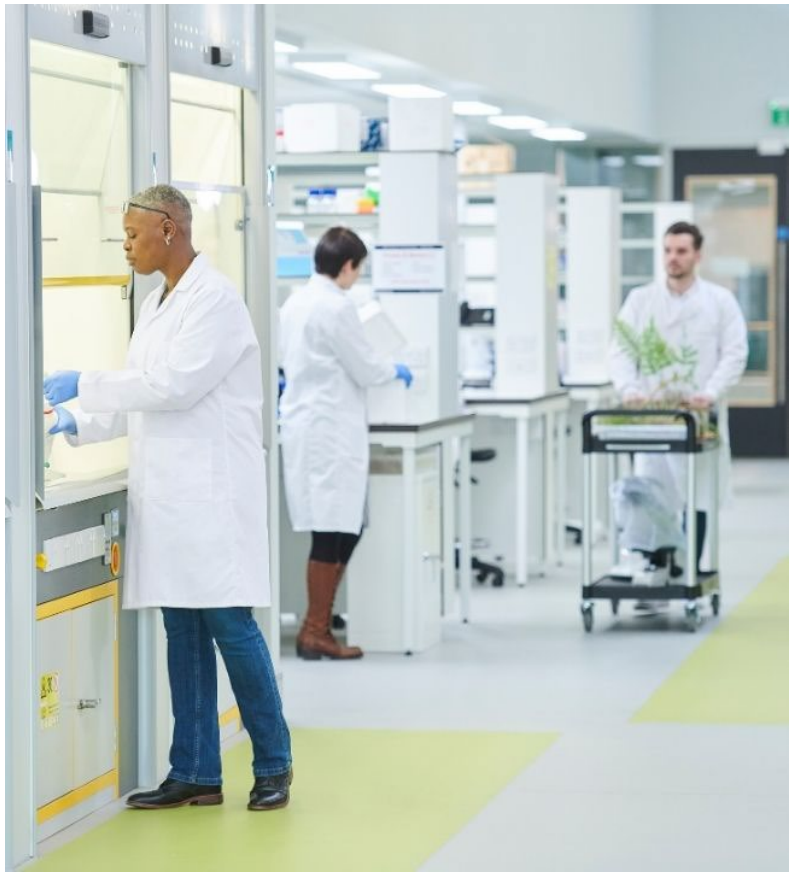
- The long time-frame conflicts with utility savings objectives within their short program cycles
  - 18-month NMEC implementation period
  - 3-year program cycle
- Ventilation rate changes treated as operational (with 3-year life)
  - This severely impairs cost effectiveness calculations

Lessons Learned: Incentive Payments

- Current payments are:
  - at project completion – good for Customer (after implementation)
  - after 1-year monitoring – true-up payment
- Some institutions got stuck with funding change management.
- Strategic Energy Management (SEM) program model is ideal
  - Ongoing annual payments for sustained energy savings

Other Challenges

- New program with multiple involved steps
- General delays (Covid, labor, global shipping delays)
- NMEC new and still being ironed out
- NMEC treated like Custom
- Finding enough customers

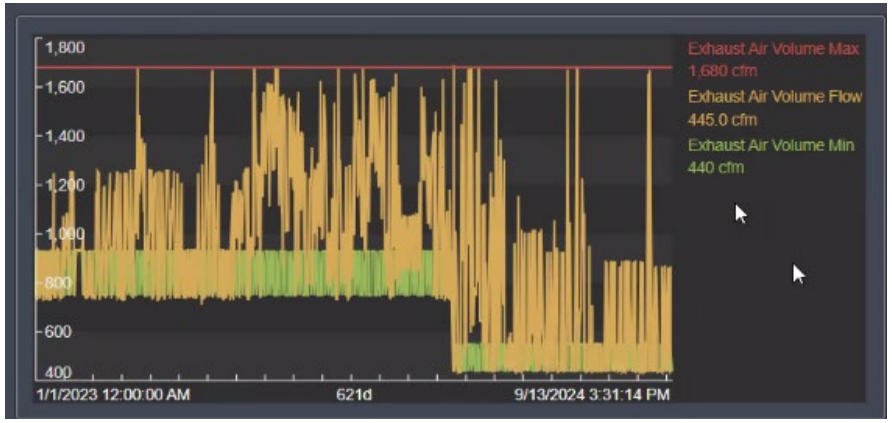


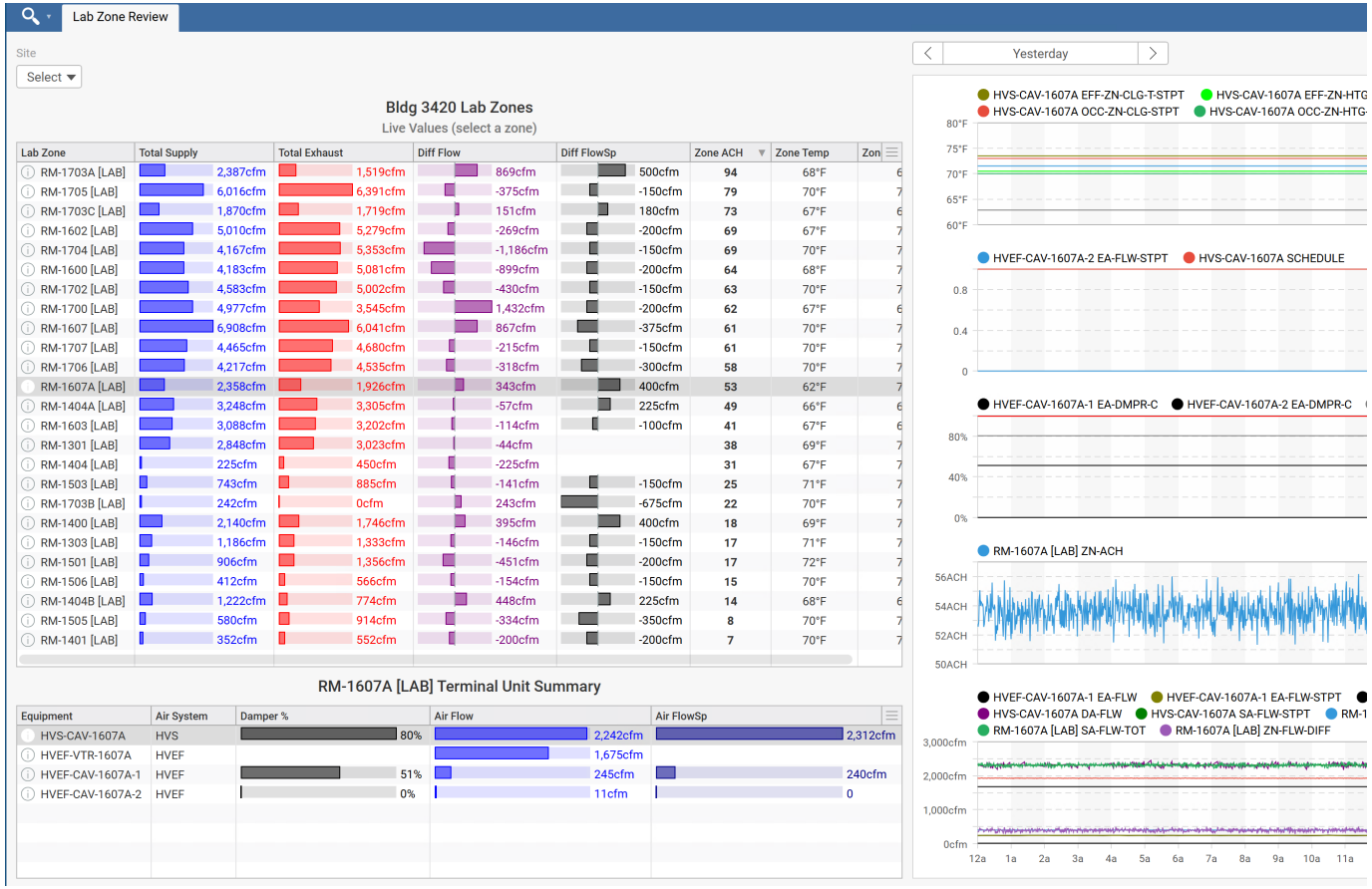
Future Programs Should:

- Be flexible for long timelines for changing ventilation rates in laboratories
  - Big savings are worth the wait
- Consider annual rolling funding for change management
  - This could look more like an SEM program model with on-going annual payments.
- Have a way to claim (and verify) long term savings
- Find a way to streamline an NMEC approach
- Have some hooks in the implementation timeline

Lab Visuals

- No shiny new widget when you're done
- Budget for graphics improvements

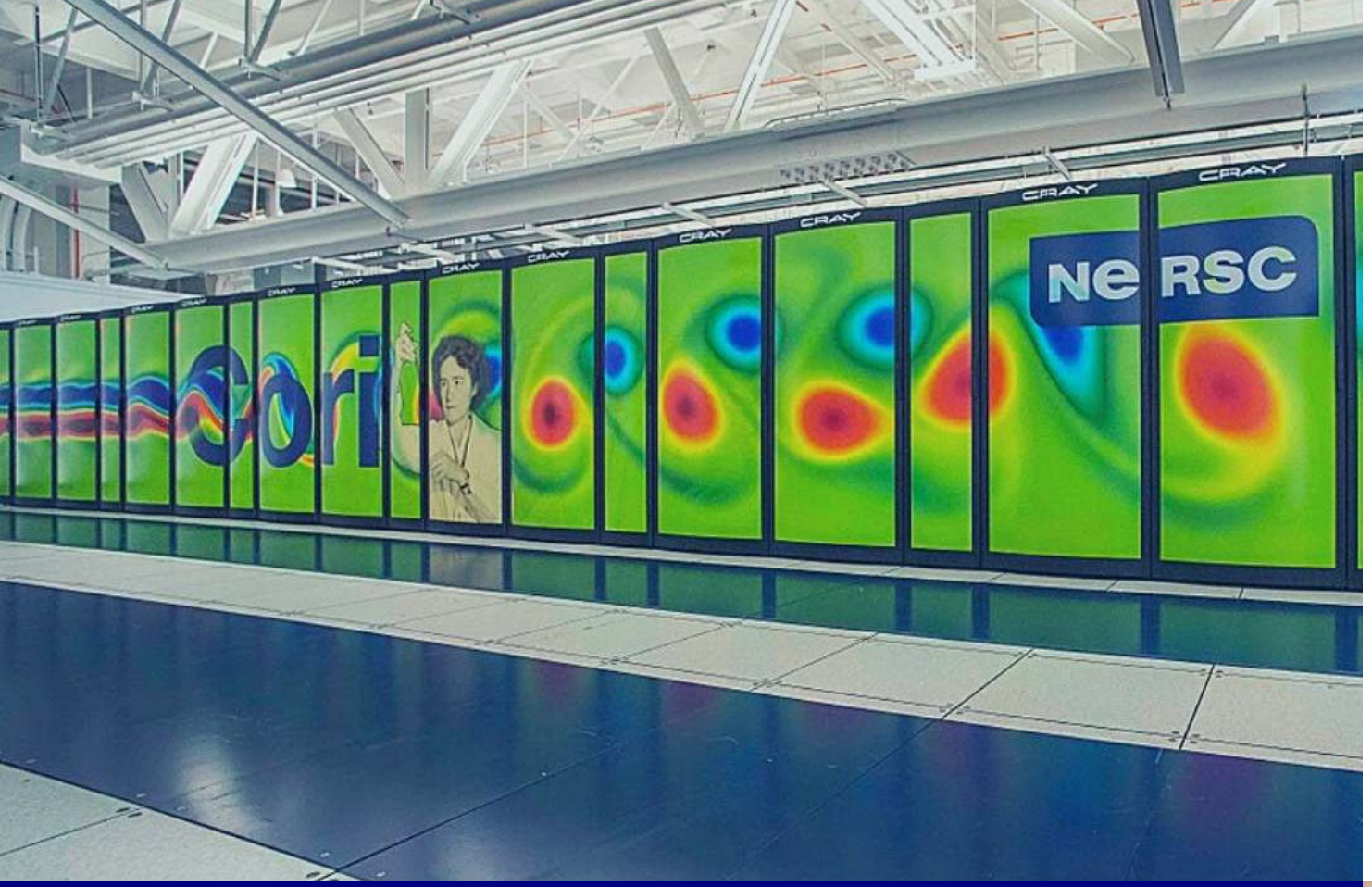




Lessons Learned Summary

- Start Early
  - Include EH&S
  - Start with an easy building
- Be Patient
  - Teams need time to absorb and adapt to new process
- Build and budget for change management

- Bonus: Budget for graphics improvements



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Questions

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HVAC Controls, Guideline 36, Visualizations

16 years in Efficiency

RCx, Audits, Whole Building, NMEC