



What To Do Next....

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We want to explore two themes

- Communications
- The Math Problem

Communications



It starts with the realization rate.....



It starts with the realization rate.....

42%

“Answer to the Ultimate Question of Life, the Universe, and Everything.” – Douglas Adams, The Hitchhiker’s Guide to the Galaxy

Method 1: The Big List

2006-08 Retro-Commissioning Impact Evaluation						
SBW ID	IOU ID	Case Weight	Reason 1	Reason 2	Reason 3	Reason 4
P00020	1006-05	9.7	I P M Program calculations underestimated fan savings			
P00033	1015-01	9.7	I P M Anti-sweat heater control had lower duty cycle	I C Changes to lighting operation		
P00243	V3057901	1.0	R C M Fans operating during unoccupied periods			
P00244	V3057902	1.0	R C M Fans operating during unoccupied periods	R P Lower baseline for static pressure control		
P00250	V3057901	4.0	R C Change in scheduled occupied times	R C M Economizers not operational	R C Chiller/boiler lockout not functioning	
P00253	V3096901	1.0	R C M Scheduled lighting hours increased	R C Chiller sequence optimization did not occur	R C Less condensing water supply temperature reduction than recommended	R C Less aggressive discharge air temperature reset than recommended
P00266	V3127902	4.3	R C M HVAC rescheduling did not occur	R C Cold deck temperature reset did not occur	R C Chilled water temperature reset did not occur	

SBW ID	IOU ID	Case Weight	Reason 1	Reason 2	Reason 3	Reason 4
P00136	2	1.1	R P Boilers operating at low loads	I P Simultaneous heating/cooling larger than estimated	R P Heating loads lower than estimated	I P M Chiller efficiency improvement higher than estimated
P00140	2	12.5	R P Supply air temperature control strategy for fan speed was not successful	I P Server room curtains to separate supply and return air saved more than anticipated by program calculation	R P M Savings estimated for economizer operation were unrealistic	
P00145	1	6.0	R C M Economizer not operational			
P00150	1	1.1	R P M Occupancy sensor control of fume hoods uses more energy than previous manual sash operation			
P00278	2K6UCR002	1.1	R P Filter changes were disallowed as regular maintenance	I P M Modeling error underestimated the fan energy savings		
P00281	2K0700071	1.1	I P M The steam production efficiency factor was omitted from program calculation resulting in greater natural gas savings			
P00285	2K6UCR013	1.1	R P M Enhanced post data in whole building analysis showed greatly reduced savings			
P00289	2K0701231	1.1	R P M Enhanced post data in whole building analysis showed greatly reduced savings			
P00292	2K6UCR012	12.5	R P M Enhanced post data in whole building analysis showed greatly reduced savings			
P01137	2K08007653	22.5	R C HVAC rescheduling did not occur	R P M Natural gas savings eliminated because HVAC units had electric resistance heat	I P Higher efficiency heat pump units installed than reported by program resulting in greater savings	
P01770	2K08004335	1.0	None			

More...

P01982	2K07001074	1.0	R P M Economizer operation unchanged	R P Discharge air reset unchanged from pre-implementation condition for 3 AHUs	R P AHU schedule changes partially implemented
P01987	2K0806875	22.5	R C M Nighttime setback strategy defeated during part of the post-implementation monitoring period		
P04407	TAA0001235	8.0	R P M Program calculations overestimated savings		
P04434	2K0809839	8.0	R C M HVAC rescheduling did not occur		
P04435	2K07000456	1.0	R C Improved chiller sequencing not implemented.	R C Fan speed and temperature setpoint changes not implemented.	
P04665	TBA0001604	1.0	R C Reductions in HVAC hours less than estimated	R C Supply air temperature reset did not occur	R C Economizers not working
P04671	TBA0001779	1.0	R C M Reductions in HVAC and lighting hours less than estimated	R C Economizers not fully working	R C Fan speeds not reduced as much as estimated


















More...

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






Method 2: Cascaded List

	Change in Value	Discrepancy Percentage	Discrepancy Impact (MWh)	Description
Program tracking savings		-	100,000	
Installation rate	10%	-10.0%	-10,000	Number of units installed vs. tracked
Calculation adjustment	10%	-9.0%	-9,000	Wattage, technology, HVAC differences
Hours of adjustment	10%	-8.1%	-8,100	Operating hours differences
Program Evaluated Savings		-27.1%	72,900	

Method 3: Proposed Method

Discrepancy Category	Discrepancy Sub-Category	Counts	Impact on RR	Net Impact (kWh/yr)
Tracking	Tracking	11		-1,288,647
Application review	Difference in cooling or heating interactivity	9		2,587,320
	Difference in equipment hours of operation	7		-102,256
	Inaccurate normalization to typical weather	4		-259,023
	Ineligible measure	1		-341,087
	Inaccurate estimation from applicant model	13		-469,945
	Inaccurate pre-project characterization	5		-2,813,851
	Incorrect baseline reference	2		-3,119,460
Measure installation verification	Difference in quantity installed	9		836,433
	Difference in installed equipment technology	2		384,105
	Difference in installed control strategy	2		132,060
	Difference in cooling or heating interactivity	2		108,203
	Difference in installed equipment size	3		-55,381
Measure performance	Difference in cooling or heating interactivity	18		5,142,293
	Difference in installed equipment efficiency	13		-215,485
	Difference in equipment hours of operation	57		-444,212
	Difference in equipment load profile	11		-779,258

Method 3: Refined findings

Discrepancy Category	Discrepancy Sub-Category	Counts	Impact on RR	Net Impact (kWh/yr)
Tracking	Tracking	11		-1,288,647
Application review	Difference in cooling or heating interactivity	9		2,587,320
	Difference in equipment hours of operation	7		-102,256
	Inaccurate normalization to typical weather	4		-259,023
	Ineligible measure	1		-341,087
	Inaccurate estimation from applicant model	13		-469,945
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	Difference in installed equipment technology	2		384,105
	Difference in installed control strategy	2		132,060
	Difference in cooling or heating interactivity	2		108,203
	Difference in installed equipment size	3		-55,381
Measure performance	Difference in cooling or heating interactivity	18		5,142,293
	Difference in installed equipment efficiency	13		-215,485
	Difference in lead lag	17		-4,109,649
	Difference in equipment hours of operation	40		3,665,437
	Difference in equipment load profile	11		-779,258

The Math Problem

Savings and savings discrepancies are interactive

Installation rate ordered first				Hours of operation ordered first			
Discrepancy category	Discrepancy Ratio	Discrepancy Impact (MWh)	Discrepancy (Pct)	Discrepancy category	Discrepancy Percentage	Discrepancy Impact (MWh)	Discrepancy (Pct)
Program tracking savings	-	8,800		Program tracking savings	-	8,800	
Installation rate	40%	3,520	40%	Hours of operation	40%	3,520	40%
Hours of operation	40%	2,112	24%	Installation rate	40%	2,112	24%
Program Evaluated Savings	36%	3,168		Program Evaluated Savings	36%	3,168	

- Cascading is accurate, but order dependent

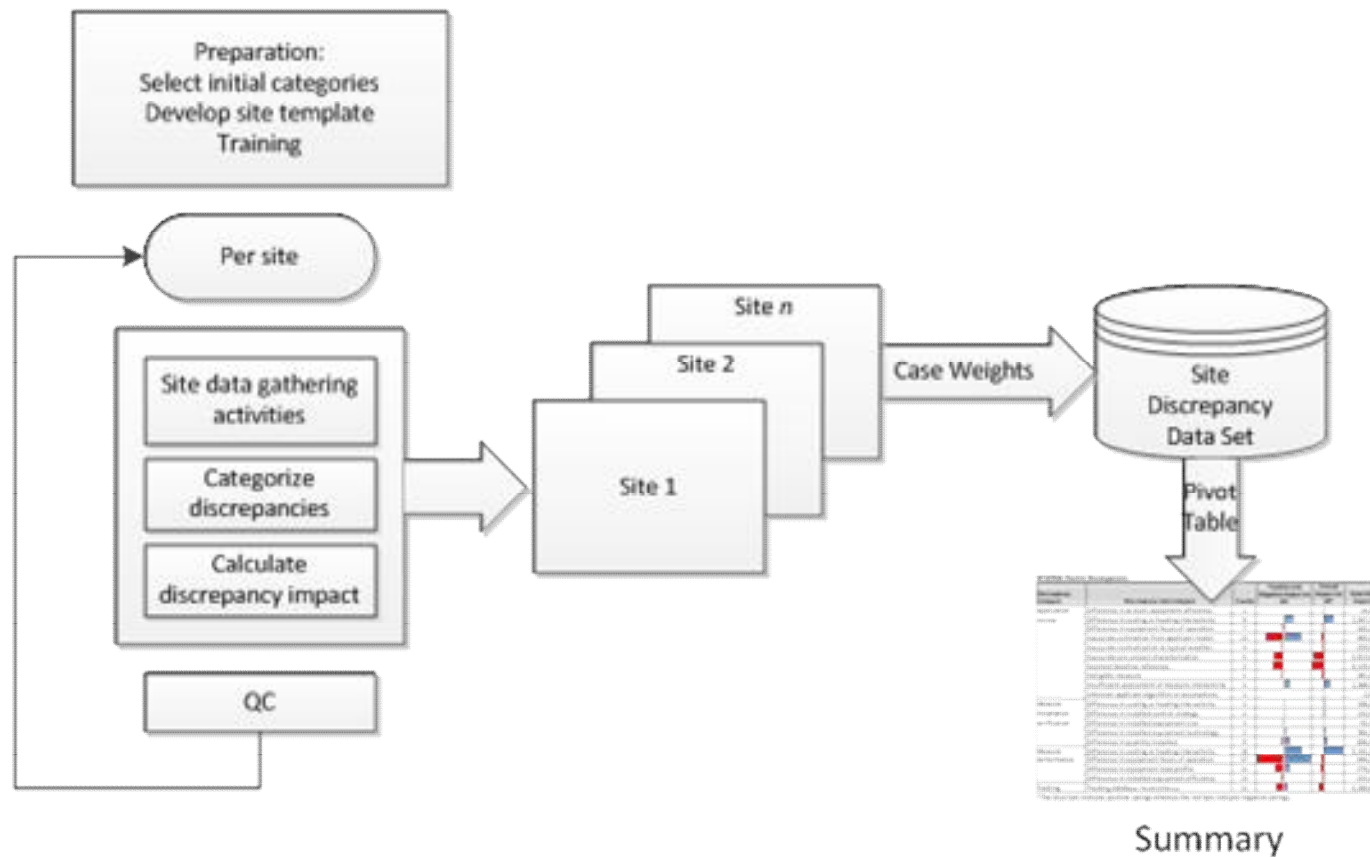
A better way

Independent estimates

Tracking savings	8800				Site	#100
Evaluated savings	4100					
Discrepancy category	Tracking value	Evaluated value		Parameter Percentage Impact	Independent Savings impact	Residual
Installation rate	100	60	units	-40%	-3520	5280
Hours of operation	4000	2400	hours	-40%	-3520	3168
Interactivity	100%	108%	Pct	8%	704	3421
Residual						679

- Compute the impact for each factor independently
- Track the residual error

Aggregate site results





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