Is Simple Best

CAN PROGRAMS GET MORE DONE BY SIMPLIFYING CALCULATIONS?

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Background

Bonneville Power Administration (BPA) is a federal power marketing administration that markets wholesale electric power at cost.

BPA Serves Washington, Oregon, Idaho, Western Montana, and portions of California, Nevada, Utah, and Wyoming

BPA provides Measurement and Verification support to small public utilities (124)

Small publics had 109 Custom energy savings projects in 2023 amounting to ~14 GWh of savings

All Custom Energy Projects directly supported by BPA must follow BPA M&V protocols

Grand Coulee Dam - photo by Gregory Wilder

BPA Custom M&V Protocols

Unit Energy Savings & Standard Protocol Calculators – NOT CUSTOM

End Use Metering – IPVMP Option A or B

Meter Based Energy Modeling – IPMVP Option C

Calibrated Energy Simulations – Option D

Energy Calculations with Verification (ECwV) - Not IPMVP adherent

What are Energy Calculations with Verification?

	ECwV	All other custom M&V
Savings Size	< 400,000 kWh estimated savings	≥400,000 kWh estimated savings
IPMVP Adherence	Not IPMVP adherent	IPMVP adherent
Post install metering	Little or no pre/post energy metering	Pre/post energy metering needed
Timeframe	Short time frame for implementation	Longer time frame for implementation
Cost	Lower cost for M&V	Higher costs for M&V
Year to Year Savings Variance	Low expected variance in savings (year to year)	Can have any variance

Why use ECwV?

Bottom line: it's easier and cheaper

- No post install metering required
- Faster to implement

Why not use it?

- Not ideal for high variance scenarios
- Risk of inaccuracy is high for "high savings projects"

Example Measure 1: Air Handler

A new building will add variable frequency drives (VFDs) and demand control ventilation to air handlers.

ECwV Approach

A spreadsheet analysis of heating and cooling loads based on operating schedules. Assume ventilation fans run at full speed when the building is occupied.

End Use Metering Approach

Build a model based on a year of post install fan speeds. Create a baseline model from data assuming fixed speed.

Example Measure 2: Air Compressor

An industrial air compressor is replaced with a high efficiency variable speed air compressor Operator starts and shuts off compressor based on shift schedule.

ECwV Approach

A spreadsheet analysis using nameplate compressor efficiencies. Assume operating hours based on scheduled shifts. Check the average speeds post install

End Use Metering Approach

Install true power metering for 4 weeks to collect baseline data. Collect post install data for 4 weeks. Baseline and EEM models constructed from data.

Example measure 3: New Chiller and Controls

A chiller plant at a university is replaced along with the chilled water control system with heat recovery.

ECwV Approach

A spreadsheet analysis using existing chilled water loop flow data and nameplate efficiencies. Create separate bin model for heat recovery.

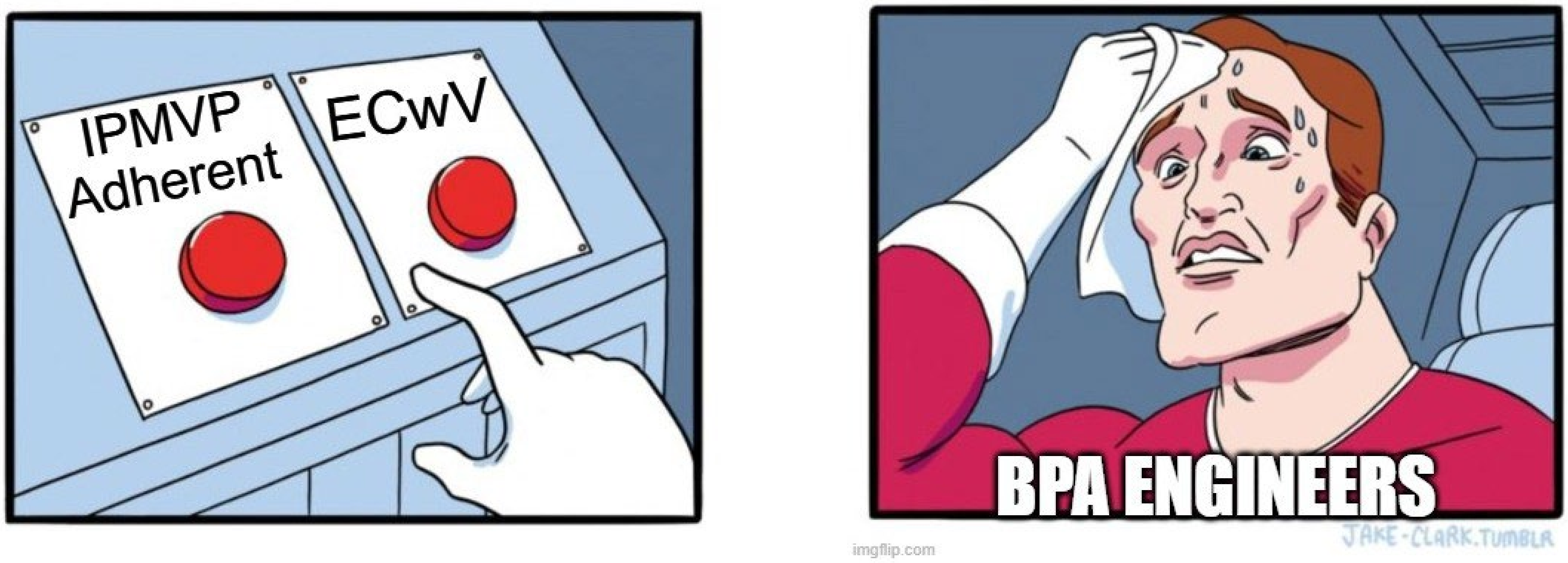
Meter Based Model

Collect 1-2 years pre and post install data and perform a regression analysis. Estimate savings for measures with different EULs

Differential M&V inputs

ECwV	End Use Metering	Meter Based Modeling
Baseline operations data or Estimate	4-6 weeks or more of pre/post install metering for each key variable	1+ years of meter data
Post install one-time measurements		
Optional: Short periods (up to 2 weeks) of post install data collection		
Nameplate efficiencies		

Engineering Judgment



The Studies

Three impact evaluations from project implemented 2019-2023

- 87 Energy Efficiency Measures
- Commercial, industrial, Agricultural applications
- Refrigeration, Process improvement, Fans, Pumps, Air compressors, HVAC, Whole building improvements

All measures evaluated using IPMVP adherent and ECwV protocols

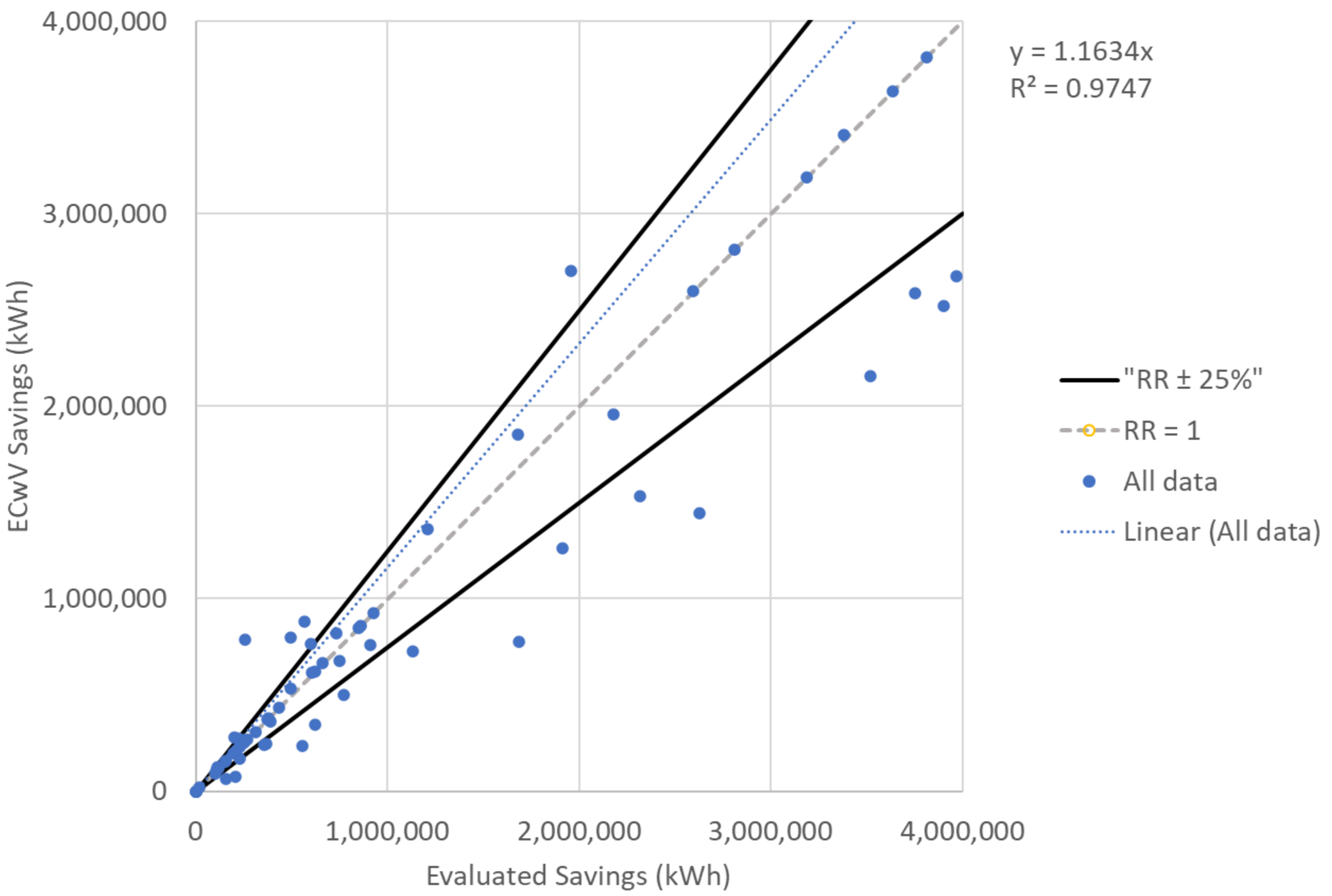
The Studies

Study	Strata	Average Size (kWh)	Population	Sample count
1	1	199,675	22	15
1	2	495,339	33	17
1	99	2,929,241	6	6
2	1	49,158	6	3
2	99	448,227	19	19
3	1	98,814	104	13
3	2	399,841	26	13
3	99	2,021,533	1	1

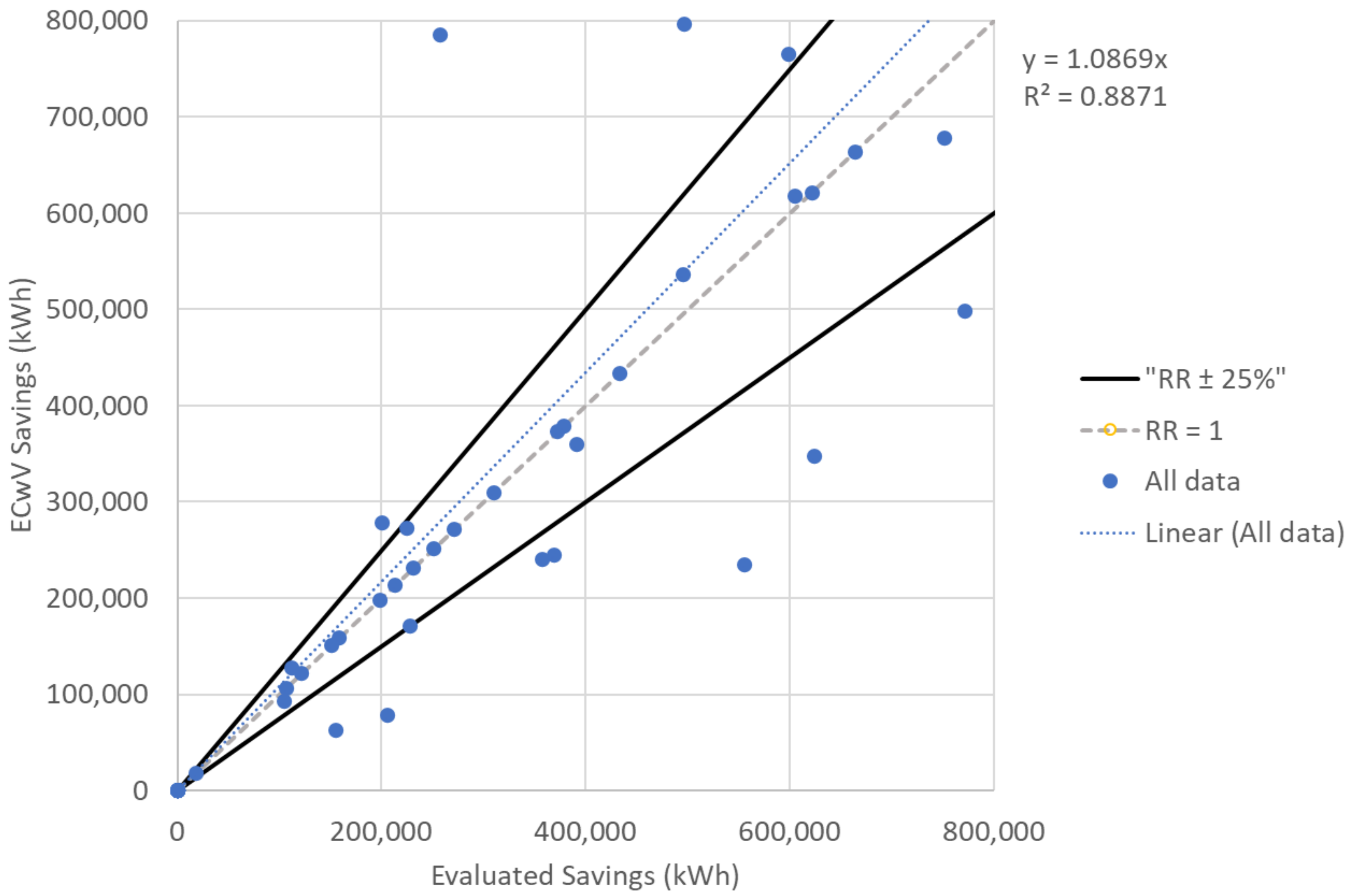
Results

Study	Strata	Sample count	Sample Weighted Evaluated Savings (MWh)	Sample Weighted ECwV Savings (MWh)	Ratio of ECwV to Evaluated Savings
1	1	15	3,612	3,428	95%
1	2	17	12,168	10,580	87%
1	99	6	15,882	10,344	65%
2	1	3	601	601	100%
2	99	19	33,811	35,562	105%
3	1	13	116,400	136,784	118%
3	2	13	77,506	80,959	104%
3	99	1	1,677	1,854	110%
Total		**87**	**261,658**	**280,111**	**107%**

Evaluated model and ECwV model savings results for all measures



Evaluated model and ECwV model savings results for measures less than 800,000 kWh evaluated savings



Conclusion

Savings reasonably close at portfolio level although variance can be high

- Low risk for utility as a whole
- Higher risk for individual customers

Higher variance for high savings projects

- Size restrictions are important

Further analysis needed to test impacts on engineering costs

- Are we really getting the intended engineering value

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Questions?