ILLUME

ACCOUNTING FOR PERSISTENCE IN A METER-BASED MEASUREMENT ENVIRONMENT

Amanda Dwelley

Prepared for the California Public Utilities Commission
AB 802 Normalized Metered Energy Consumption Workshop
January 27, 2016

Motivating question

What factors should be considered when **claiming or accounting for lifecycle savings** from NMEC, when

(a) a customer could take multiple actions through multiple programs over time, and

(b) the baseline (counterfactual) is changing?

* *behavioral programs have been dealing with this for awhile – can't pinpoint specific actions*

Considerations

Savings persistence accounting methods can paint much different pictures of program cost-effectiveness **over time**.

Therefore the method you use for **assigning savings to costs over time** will have significant implications for portfolio design and system planning.

Where We Are

- Evidence suggests that under continued treatment with effective behavioral messaging (i.e., multi-year HER program) some portion of savings achieved by prior-year messaging persists from year-to-year, while some portion of savings is "incremental" and attributable to in-year spending
  - Savings tend to grow over time; savings persist with decay; mix of actions includes measures and behaviors (conservation, maintenance, etc)

- The traditional framework of using Effective Useful Life to distribute lifecycle savings for behavioral/O&M/retrocommissioning is likely not an accurate representation of what's going on at the meter (vs. baseline)
  - EUL of 1 year is too conservative (at least for HERs)
  - Assigning a measure life >1 without accounting for the partial effect of prior-year spending could result in double-counting

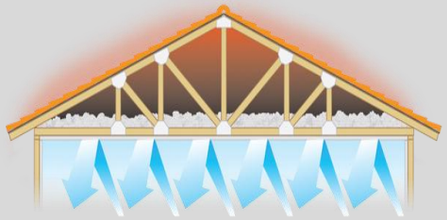
For more details, see:
ILLUME Advising, Dr. Susan Mazur-Stommen, Dr. Edward Vine. Energy Efficiency Behavioral Programs: Literature Review, Benchmarking Analysis, and Evaluation Guidelines. Prepared for the Minnesota Department of Commerce. May 2015.

The Cadmus Group. *Long-Run Savings and Cost-Effectiveness of Home Energy Report Programs.* Prepared by M. Sami Khawaja Ph.D. and James Stewart Ph.D. Winter 2014/2015.

Household example: Behavioral program influences behavior change, maintenance and retrofits

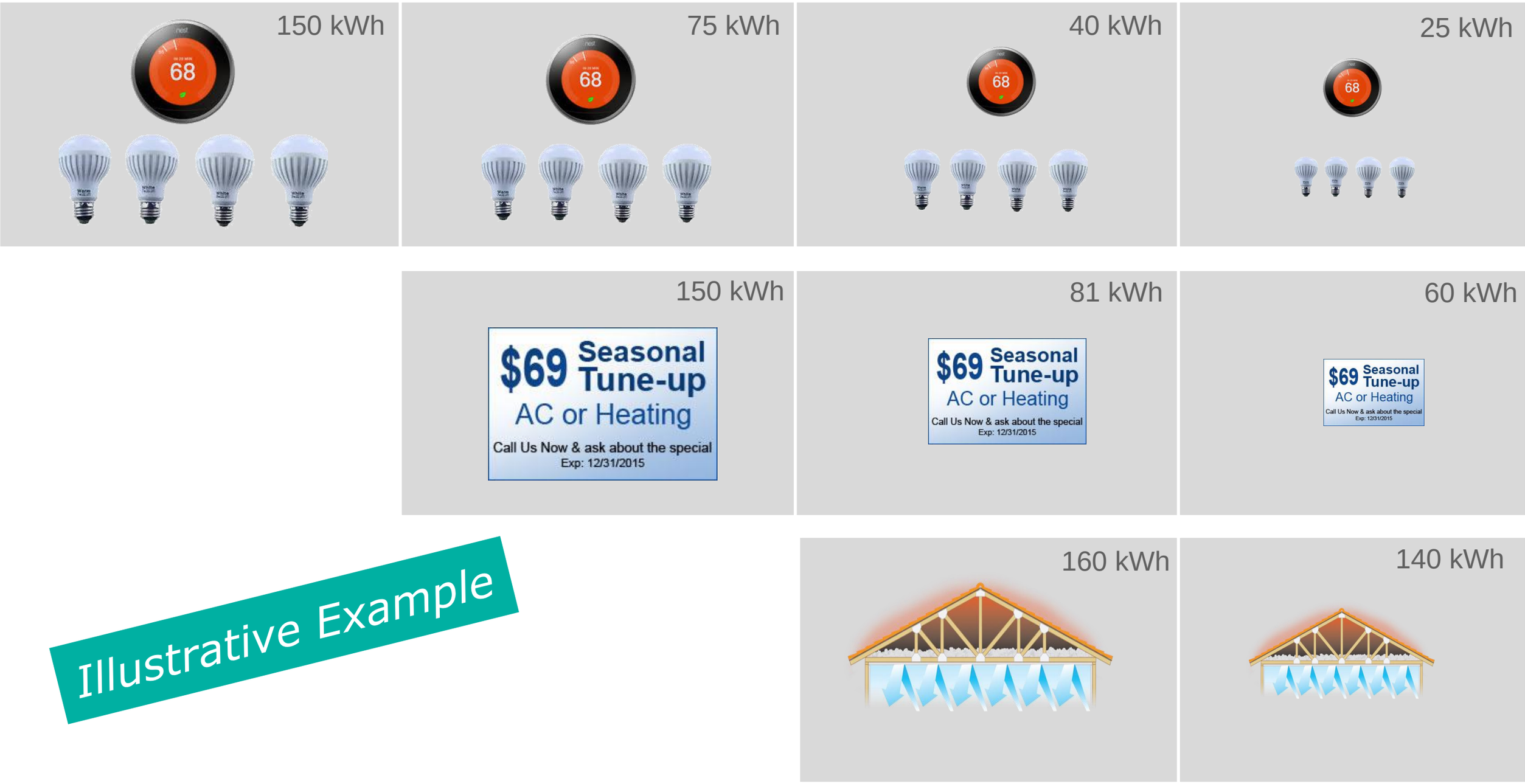
Year 1 | Year 2 | Year 3 | Year 4

Illustrative Example



Net savings decay from <u>each year's actions</u> decay as (1) behaviors decay, and (2) counterfactual adopts measures and behaviors (baseline shifts)

Year 1	Year 2	Year 3	Year 4
150 kWh	75 kWh	40 kWh	25 kWh
	150 kWh	81 kWh	60 kWh
		160 kWh	140 kWh
150 kWh	225 kWh	281 kWh	225 kWh



Illustrative Example

Multiple accounting approaches in use and under consideration

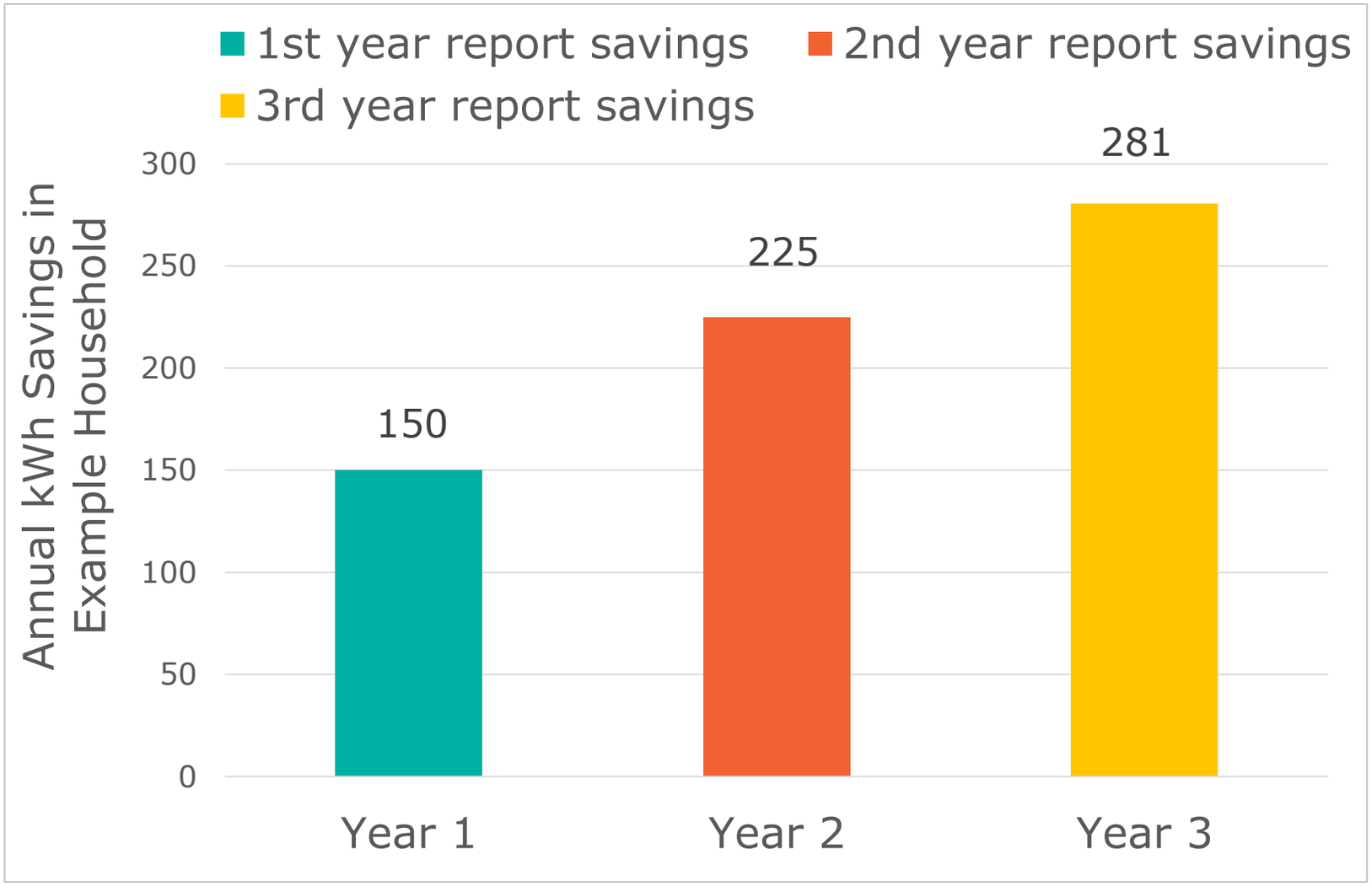
- Most states assume a 1-year measure life for behavior, and place all savings in the program year in which they are achieved (**"Status Quo"** method)
- Some states have adopted alternative, "stopgap" approaches within traditional "measure life" framework (not discussed here)
- Some researchers and evaluators recommend making assumptions about persistence and decay in each year, to apportion savings to each year (**"Avoided Decay"** approach)

ILLUME Advising, Dr. Susan Mazur-Stommen, Dr. Edward Vine. Energy Efficiency Behavioral Programs: Literature Review, Benchmarking Analysis, and Evaluation Guidelines. Prepared for the Minnesota Department of Commerce. May 2015.

MINNESOTA DEPARTMENT OF COMMERCE
DIVISION OF ENERGY RESOURCES

Status Quo Accounting Method: One-Year Measure Life

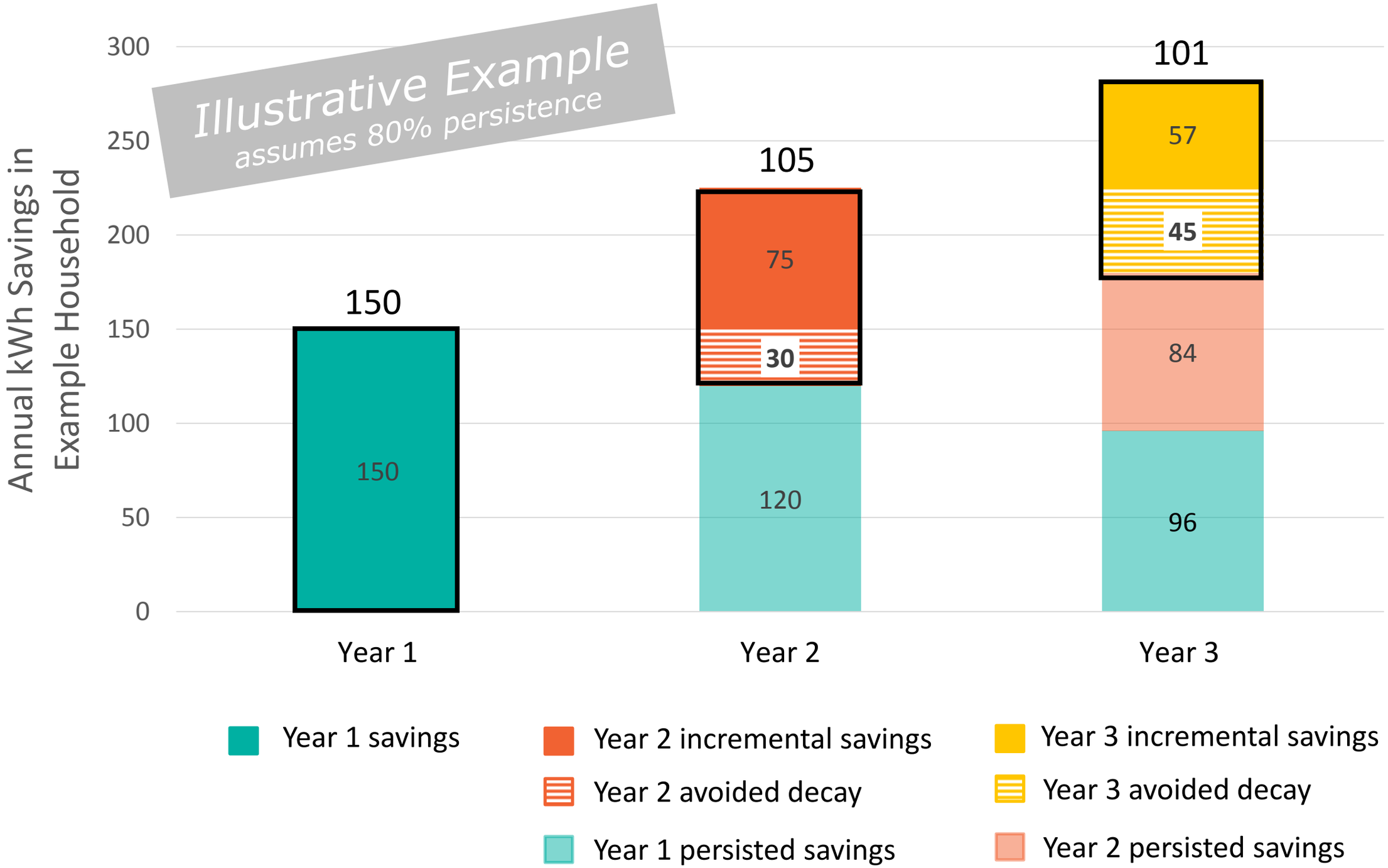
Illustrative Example
assumes continued treatment @ same frequency



- All savings observed in each program year are counted as "first-year savings" toward goals
- No persisted savings are claimed
- However, we know from research that some portion of savings in years 2+ are attributable to prior-year investment

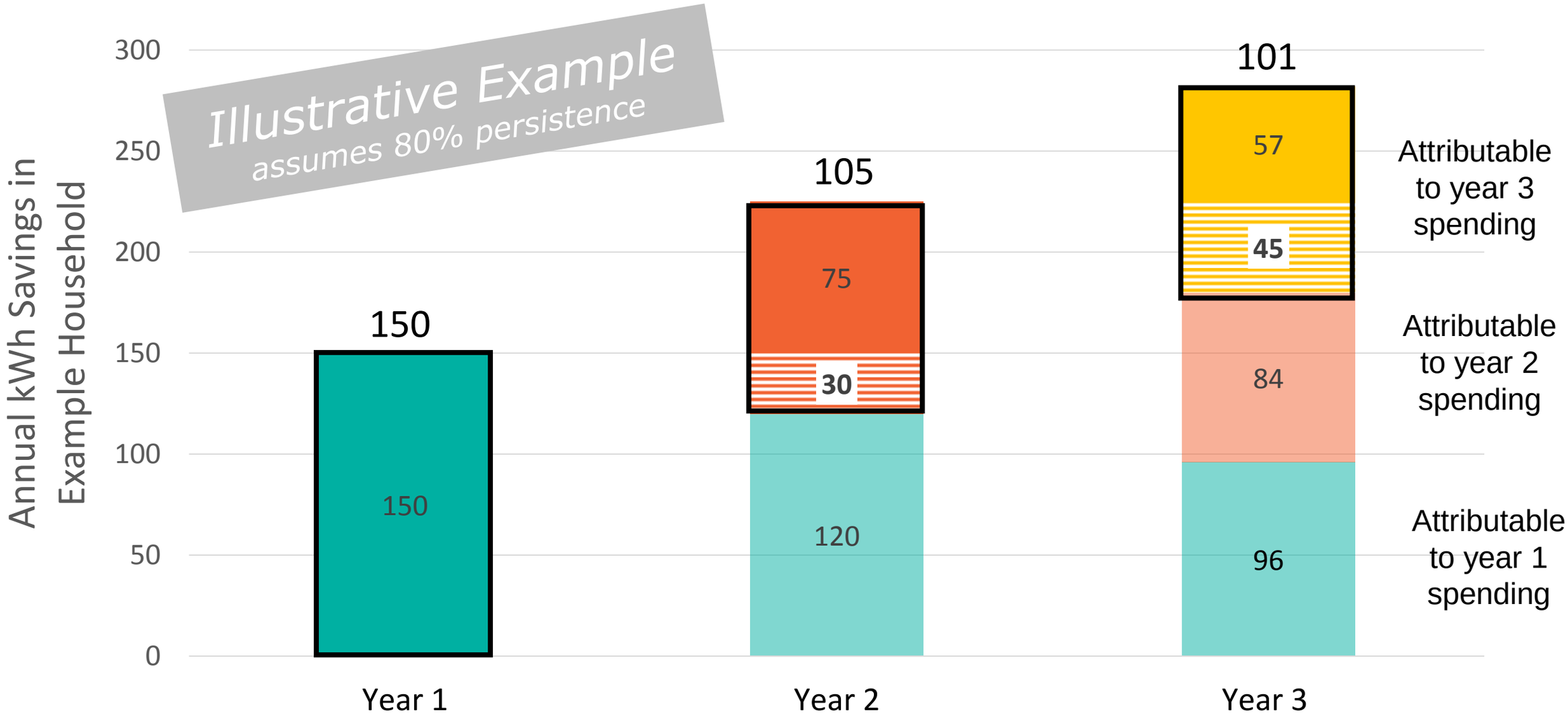
This method distorts cost of saved energy in years 2, 3, etc.

The Avoided Decay Method uses persistence research to apportion savings between years



For more details, see: The Cadmus Group. *Long-Run Savings and Cost-Effectiveness of Home Energy Report Programs.* Prepared by M. Sami Khawaja Ph.D. and James Stewart Ph.D. Winter 2014/2015

The Avoided Decay Method provides a framework for parsing savings between

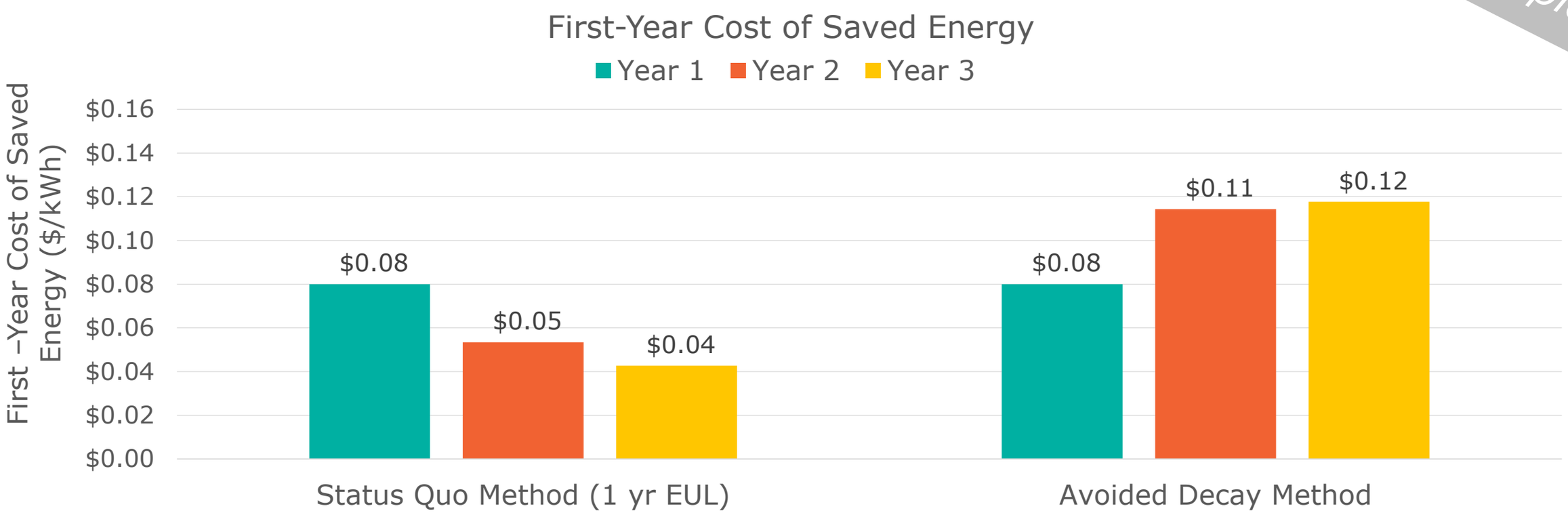


*Claimed savings from years two and three could be the sum of what program efforts either **maintain** ("avoided decay") or **add** ("incremental savings") in each year.*

For more details, see: The Cadmus Group. *Long-Run Savings and Cost-Effectiveness of Home Energy Report Programs.* Prepared by M. Sami Khawaja Ph.D. and James Stewart Ph.D. Winter 2014/2015

The status quo method distorts trends in the cost of saved energy

Illustrative Example*



Draws down CoSE in years 2+

Reflects trend of increasing CoSE

Accounting method leads to different conclusions on program cost-effectiveness over time

*Assumes same frequency of treatment from year to year, same costs per report delivered, and 80% persistence

ILLUME Advising, Dr. Susan Mazur-Stommen, Dr. Edward Vine. Energy Efficiency Behavioral Programs: Literature Review, Benchmarking Analysis, and Evaluation Guidelines. Prepared for the Minnesota Department of Commerce. May 2015.

Considerations for Claiming Lifecycle Savings for Behavioral, Retrocommissioning and O&M Programs

- The traditional EUL framework does not seem to capture what's happening at the meter, given the nature of actions taken
- Accounting approach should take into consideration that in years 2+, some portion of savings is attributable to in-year $, while some is attributable to prior-year $
  - Well-planned field trials could inform persistence assumptions for each year's program investment (e.g., stop treatment after 1, 2, 3 years)
  - However, each program design would likely need trials/experiments
- Need to decide how important it is to attribute savings across years vs. across programs

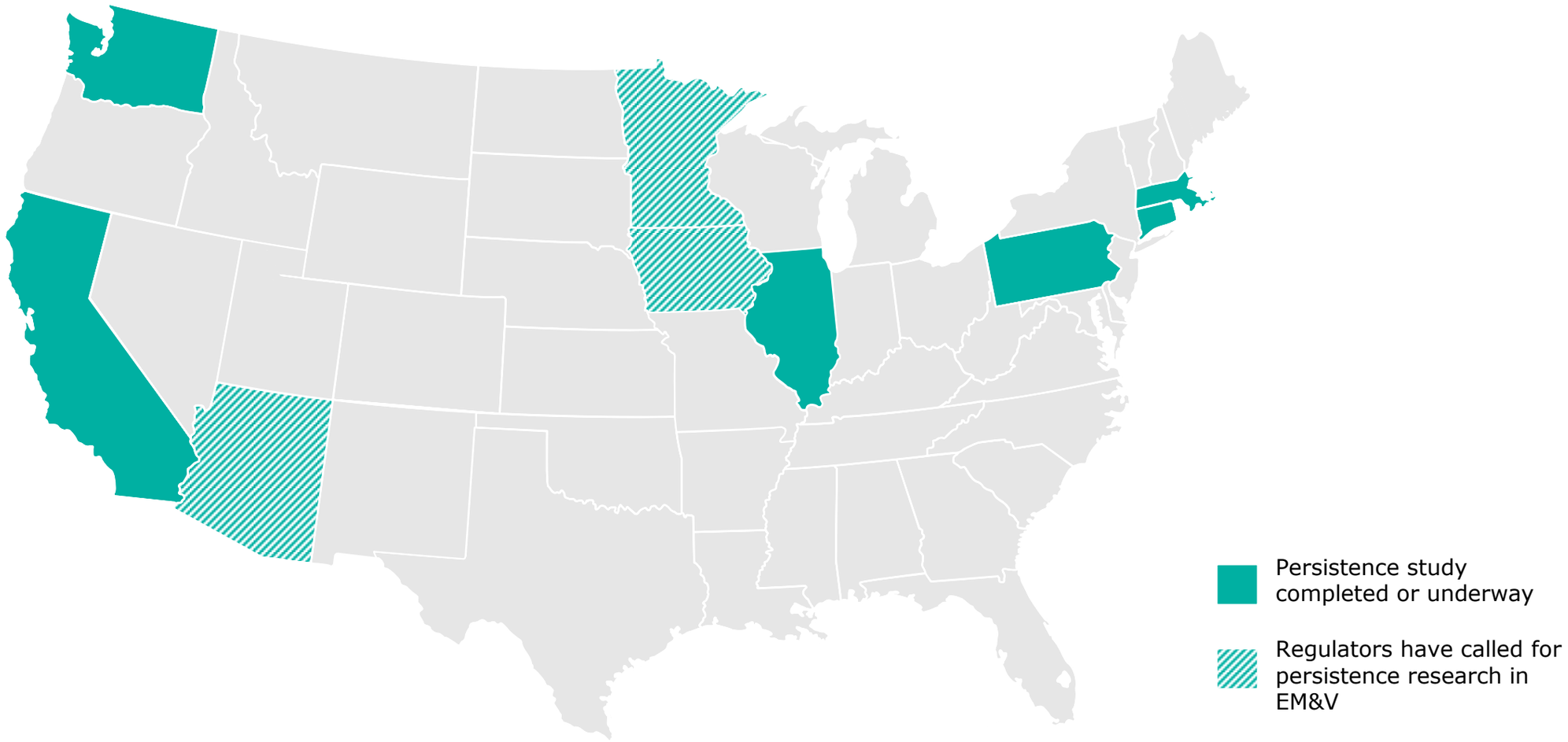
ILLUME

We create actionable insights out of the seemingly unpredictable behavior of people, businesses and markets using advanced data analytics and tactical consulting.

Amanda Dwelley
Directing Advisor

m: 802 448 2992
e: amanda@illumeadvising.com

Other states have measured, and are grappling with, behavioral program persistence



- Few states have adopted measure life and/or persistence assumptions for Res. Behavior programs that assign persistence or measure life more than 1 year
- Most HER experiments have stopped treatment after two years; fewer have discontinued treatment after 1 year or 3+ years (see list in Appendix)

Multiple HER decay studies have demonstrated that savings persist beyond one year

Authors	Utility or Service Area	Frequency of Reports	Number of Treatment Months	Number of Post-Treatment Savings Analysis Months	Key Findings About Savings Decay	Source
Allcott and Rogers (2014)	Upper Midwest	Monthly and Quarterly	24–25	26	Average annual savings decay of 21%	A
	West Coast	Monthly and Quarterly	24	29	Average annual savings decay of 18%	A
	West Coast	Monthly and quarterly	25–28	34	Average annual savings decay of 15%	A
Integral Analytics (2012)	SMUD	Monthly and Quarterly	27	12	Savings decay of 32% one year after treatment stopped	B
DNV-GL (2014)	Puget Sound Energy	Monthly and Quarterly	24	36	Average annual savings decay of 11%	C
Navigant (2015a)[1]	ComEd Wave 1	Bimonthly	~48	12	Decay of 2% in first year following termination [1]	D
Navigant (2015a)	ComEd Wave 3	Bimonthly	~24	12	Decay of 0.4% in first year following termination [1]	D
Navigant (2015a)	ComEd Wave 5	Bimonthly	~12	12	Decay of 18% in first year following termination [1]	D
Cadmus (2015)	PPL Electric	unknown	2-3 years	18	Savings decayed by 7-13% during period when program stopped sending all reports for 1.5 years.	E
Navigant (2015b)	Nicor Gas	Heating Season Only	~6 heating season reports [2]	6	Savings decayed by 50% in the first 6 months [2] after treatment stopped	F
NMR Group, Tetra Tech, and Allcott (2013)	Connecticut Light & Power	Monthly	6	6	Savings decay of 83% five months after treatment stopped	G
ODC (2014)	National Grid - Massachusetts	Bi-monthly and Quarterly	12-24	10	Reduced treatment leads to reduced observed savings. Effect is sharper for gas cohort	H

[1] None of the decay rates are statistically significant. Evaluators believe terminated group sizes (10,000 each) were not large enough to detect change.
[2] Though the evaluator calls this period the first 6 months, it is actually the second 6-month period after treatment stopped. Participants received reports from Oct 2013-March 2014, and the persistence study looked at savings from Oct 2014-March 2015.

A: Khawaja, M.S. and J. Stewart. *Long-Run Savings Cost-Effectiveness of Home Energy Report Programs.* The Cadmus Group. Winter 2014/2015.
B: Integral Analytics. Impact & Persistence Evaluation Report: Sacramento Municipal Utility District Home Energy Report Program. November 2012.
C: DNV-GL. Puget Sound Energy Home Energy Report Program: 2013 Impact Evaluation. April 2014.
D: Navigant. Home Energy Reports Program PY6 Evaluation Report. January 2, 2015.
E The Cadmus Group. PPL PY6 Annual Report. November 15, 2015.
F: Navigant. Behavioral Energy Savings Programs: Home Energy Reports Persistence Study Part 1 – October 2014 to March 2015. July 2, 2015.
G NMR Group, Tetra Tech, and Hunt Allcott. Evaluation of Year 1 of the CL&P Pilot Customer Behavior Program (Draft). 2013.
H: Arnold, H. Massachusetts Cross-Cutting Evaluation: Home Energy Report Savings Decay Analysis. Opinion Dynamics. September 2014.

The Avoided Decay Method uses persistence research to apportion savings between years

Accounts for savings stemming from three sources:

(1) **Persistent savings** over time as a result of installed equipment or habituated behaviors (prior-year spending)

(2) **Avoided savings decay**, which accounts for the retention of behavioral savings due to continued treatment (in-year spending)

(3) **Incremental savings** attributable to new behaviors or measures adopted each year (in-year spending)

- EACH YEAR's PERSISTENCE ASSUMPTIONS WOULD NEED TO BE DETERMINED EMPIRICALLY -

For more details, see: The Cadmus Group. *Long-Run Savings and Cost-Effectiveness of Home Energy Report Programs.* Prepared by M. Sami Khawaja Ph.D. and James Stewart Ph.D. Winter 2014/2015

The Avoided Decay Method uses persistence research to apportion savings between years

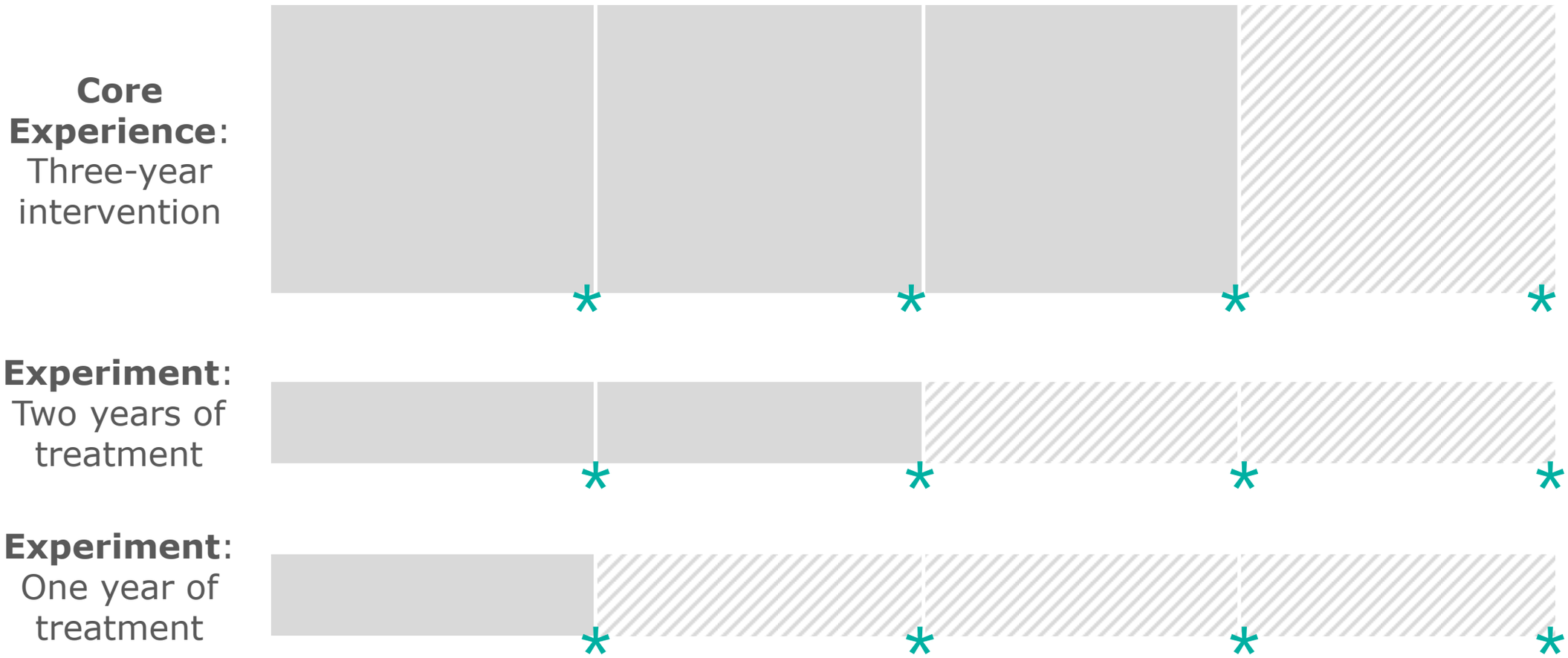
Avoided Decay Method	Year 1	Year 2	Year 3	Year 4	Year 5
Observed Savings	150	225	281	225 *(=80% of previous year)*	180 *(=80% of previous year)*
Savings due to year 1 efforts	150	120 *(=80% of previous year)*	96 *(=80% of previous year)*		
Savings due to year 2 efforts		105 *(remainder)*	84 *(=80% of previous year)*	67 *(=80% of previous year)*	
Savings due to year 3 efforts			101 *(remainder)*	81 *(=80% of previous year)*	65 *(=80% of previous year)*
Savings Claimed toward First-Year goals	150	105	101	0	0

*Claimed savings from years two and three are the sum of what program efforts either **maintain** ("avoided decay") or **add** ("incremental savings") in each year.*

For more details, see: The Cadmus Group. *Long-Run Savings and Cost-Effectiveness of Home Energy Report Programs.* Prepared by M. Sami Khawaja Ph.D. and James Stewart Ph.D. Winter 2014/2015

Example of how to get to annualized cost-effectiveness inputs

"The forecast longevity of the impact should be grounded in evidence from past studies or data collected from the field" – CPUC HOPPs whitepaper



** Measure savings difference between experimental groups each year to estimate annual decay from first, second and third-year expenditures*