Survival –

Why Cost Effectiveness is Becoming the Biggest Challenge Facing Energy Efficiency Programs

Adam Scheer, PhD
Director
Recurve

Julie Michals
Director of Clean Energy Valuation
E4TheFuture

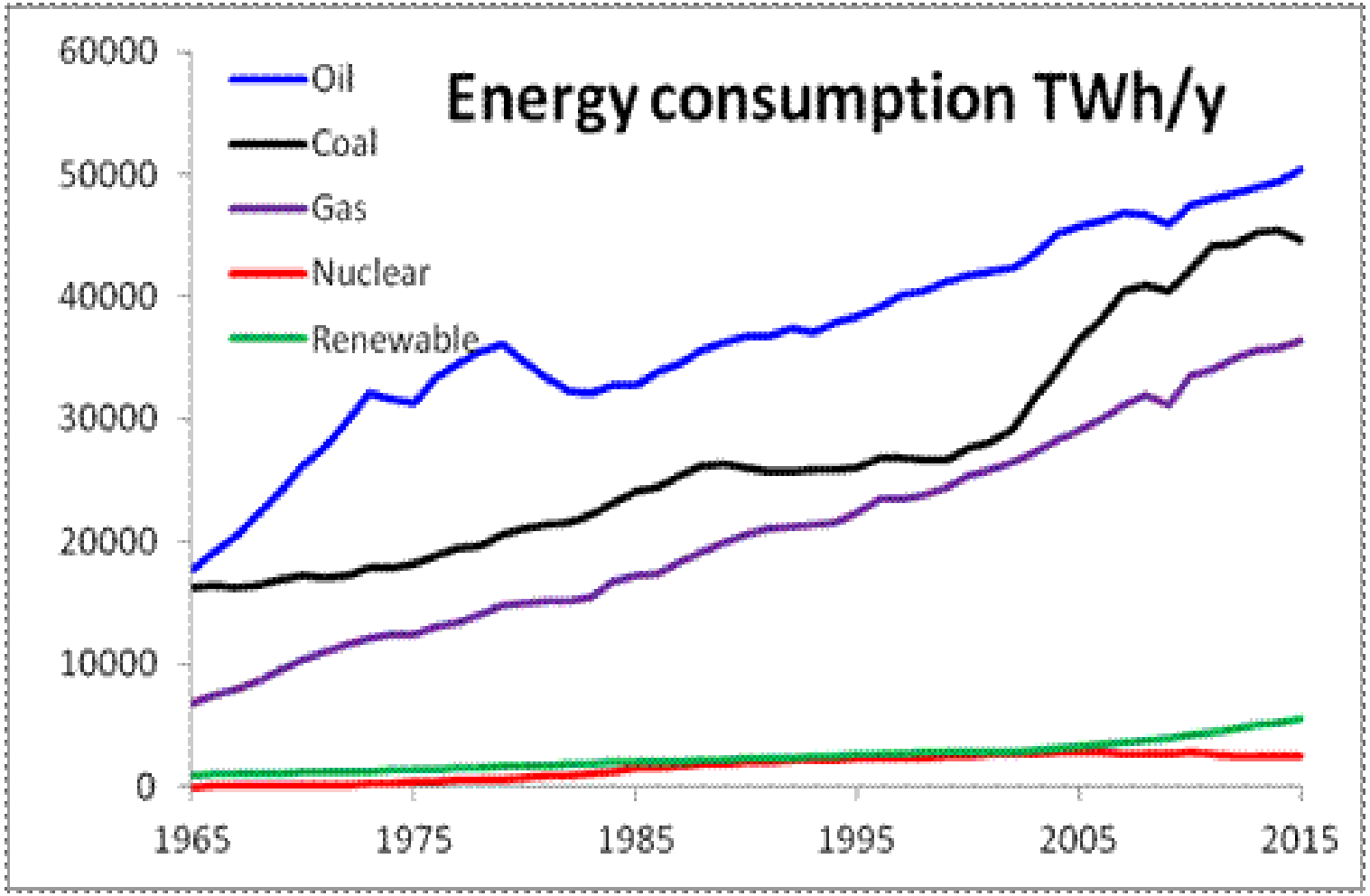
Alison LaBonte, PhD
Supervisor
CPUC

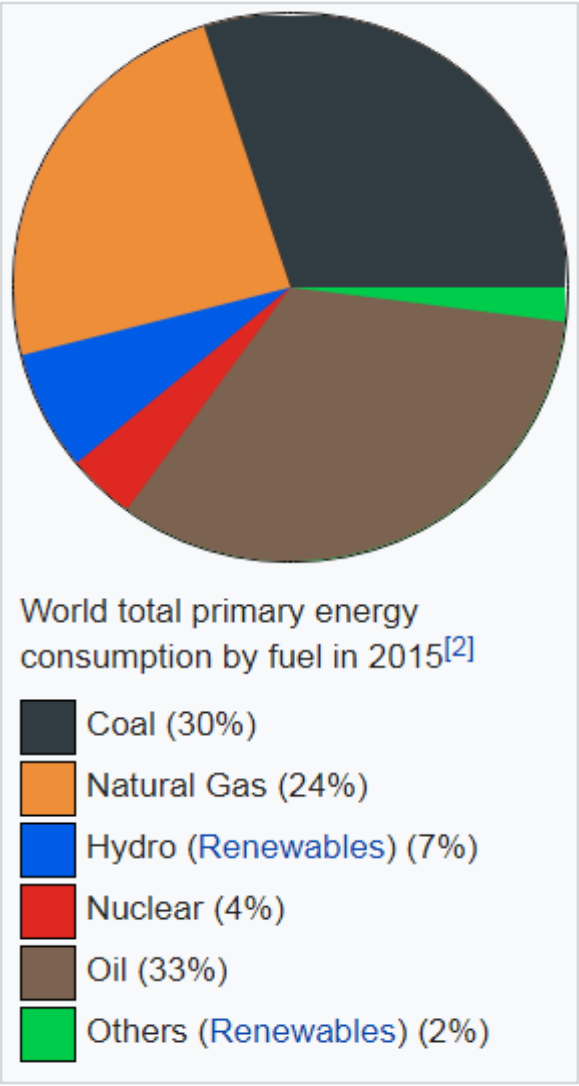
Dan Violette, PhD
Director, Energy
Lumina Decision Systems, Inc.

Moderator:
Robert Kasman
Principal, EM&V
Pacific Gas and Electric Company

Global Electricity Sources

87% Fossil Fuels
4% Nuclear
9% Hydro and Renewables





Highest CO2 levels in a million years


now you see it
now you don't
photo: William O. Field
photo: Bruce F. Molnia
Muir Glacier, Alaska: August 13, 1941 and August 31, 2004
CLIMATE 365
climate365.tumblr.com | go.nasa.gov/climate365

Oceans' Health Collapsing; Over-fished and Over-polluted

The New York Times

Dead Whale Found With 88 Pounds of Plastic Inside Body in the Philippines

A dead whale was found in the Philippines on Saturday with 88 pounds of plastic bags and other disposable plastic products in its stomach. The Philippines is the world's third-biggest contributor of plastic to oceans. Mary Gay Blatchley

By Daniel Victor

March 18, 2019

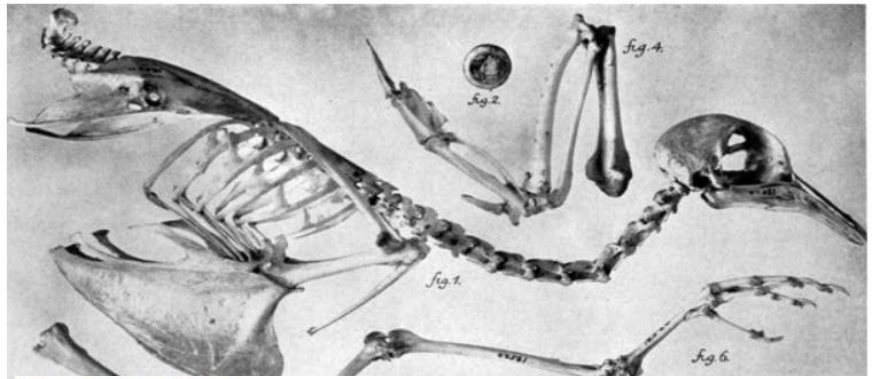
Nature declining globally at rates unprecedented in human history

"1,000,000 Species threatened by extinction…"

(Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), May, 2019)

West African Black Rhinoceros

Passenger Pigeon

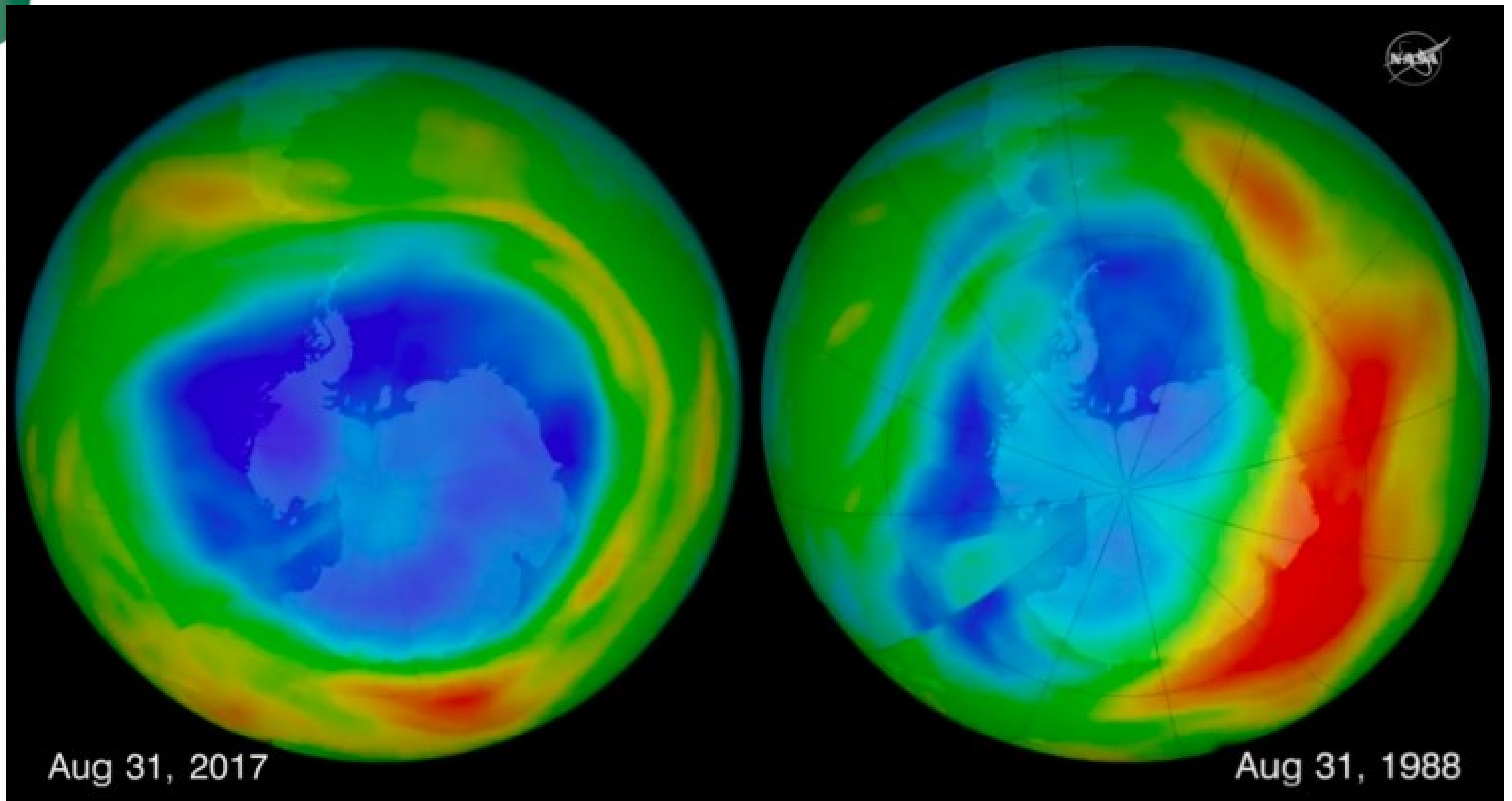


Tasmanian Tiger

Javan Tiger

Pyrenean Ibex

Ozone Hole – Disaster and Partial Success Story



Photograph of earth by Voyager 1, from beyond Neptune (6 billion km), Feb 14, 1990

“Look again at that dot. That's here. That's home. That's us…

…Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.”

-- Carl Sagan, Pale Blue Dot, 1994

Survival – Why Cost Effectiveness is Becoming the Biggest Challenge Facing Energy Efficiency Programs

1. What's changing? Why is cost effectiveness suddenly becoming so challenging? What are the drivers?
2. What do different cost effectiveness tests (Participant, RIM, PAC, and TRC) actually measure, and therefore prioritize?
    a) Overview of theoretical intent of these tests, and common modifications thereof in state practice.
    b) Do the cost effectiveness tests in use today typically align with the policy goals of the jurisdictions using them?
    c) What constitutes best practice in performing cost effectiveness evaluation – not the tests themselves, but how the analyses are done and the information produced?
3. What can program managers and evaluators do to enhance understanding or increase program cost-effectiveness in the immediate term? What are common cost-effectiveness "myths" that have confused the conversation?
4. Should benefit cost analysis (BCA) be re-formulated or inputs re-defined?
    a) Does it make sense to have a consistent BCA framework across distributed and supply side energy resources?
    b) What other cost-effectiveness formulations/inputs/changes should be considered?
    c) What does NSPM application to date look like across the country? What has been the role of regulators, program administrators, evaluators, and other stakeholders?
    d) How does the new National Standard Practice Manual (NSPM) framework define BCA differently from the California Standard Practice Manual (CSPM)? Why? How would adoption of the NSPM framework affect EE program cost- effectiveness compared to CSPM?
    e) Should non-energy benefits (NEBs, such as GHG reductions, job creation, comfort, health, etc.) be included in program benefits? If so, how, given that valuing NEBs is challenging?

Cost Effectiveness Myths

Adam Scheer

IEPEC 2019

RECURVE

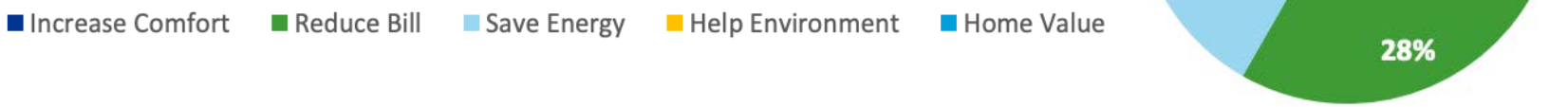
Myth 1: The TRC is a Comprehensive, Balanced Test

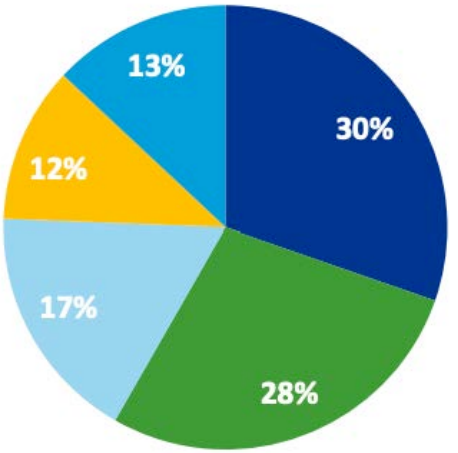
Two Residential Programs in PG&E's 2017 Portfolio[1]:

Program	$ Net Private Invest. per $ Program Spend	$ Benefits* per $ Program Spend
A	$2.85	$1.56
B	$0.03	$0.68

*Utility Avoided Costs

Figure 5-15. Point allocation for benefits experienced on the HUP/AHUP program





Impact Evaluation Report: Home Upgrade Program – Residential Program Year 2017, DNV GL, 2019.

Which program is more cost-effective?

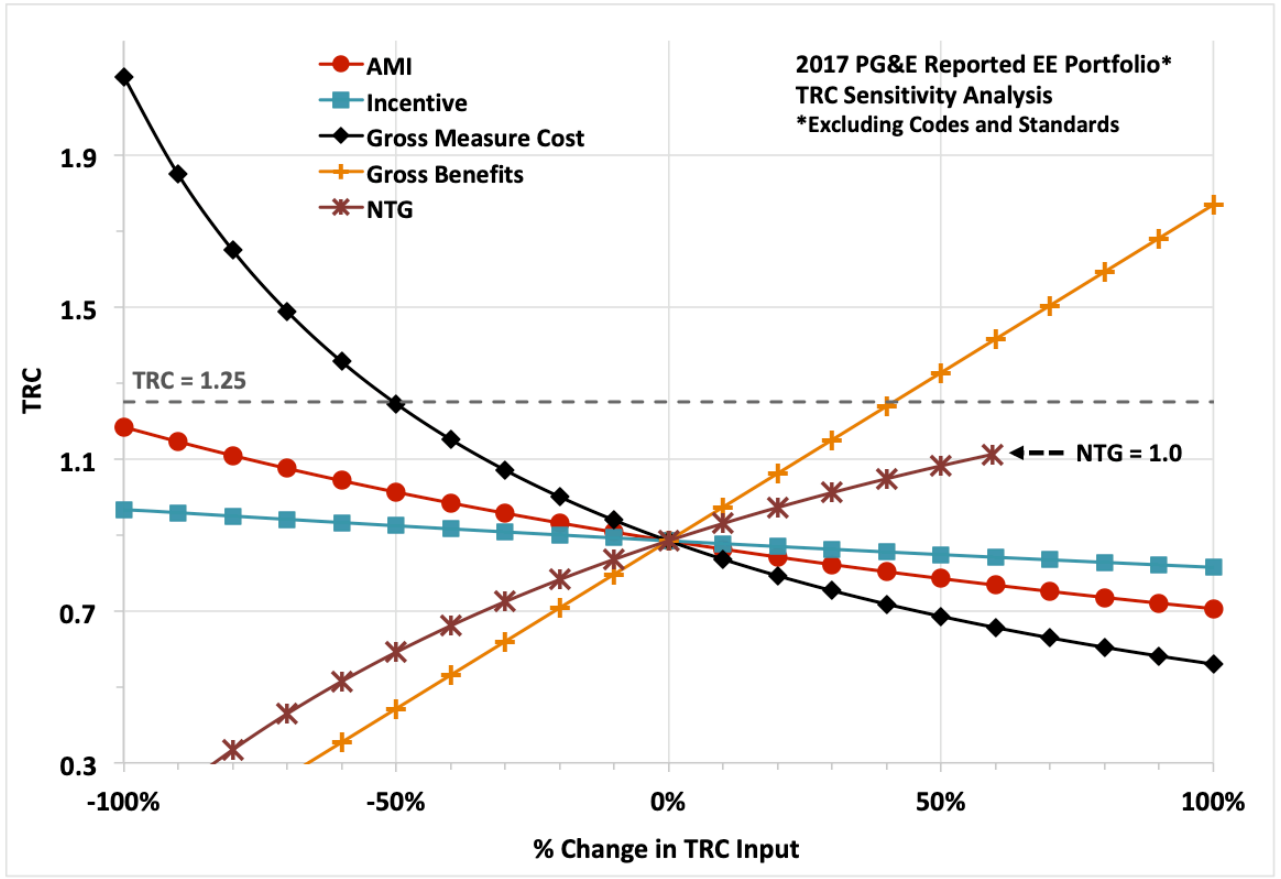
A = Advanced Home Upgrade
B = Residential Energy Fitness

[1]Data from PG&E's 2017 CEDARS Annual Filing

RECURVE

Myth 2: Cutting Program Costs Will Get Us to Cost-Effectiveness Targets

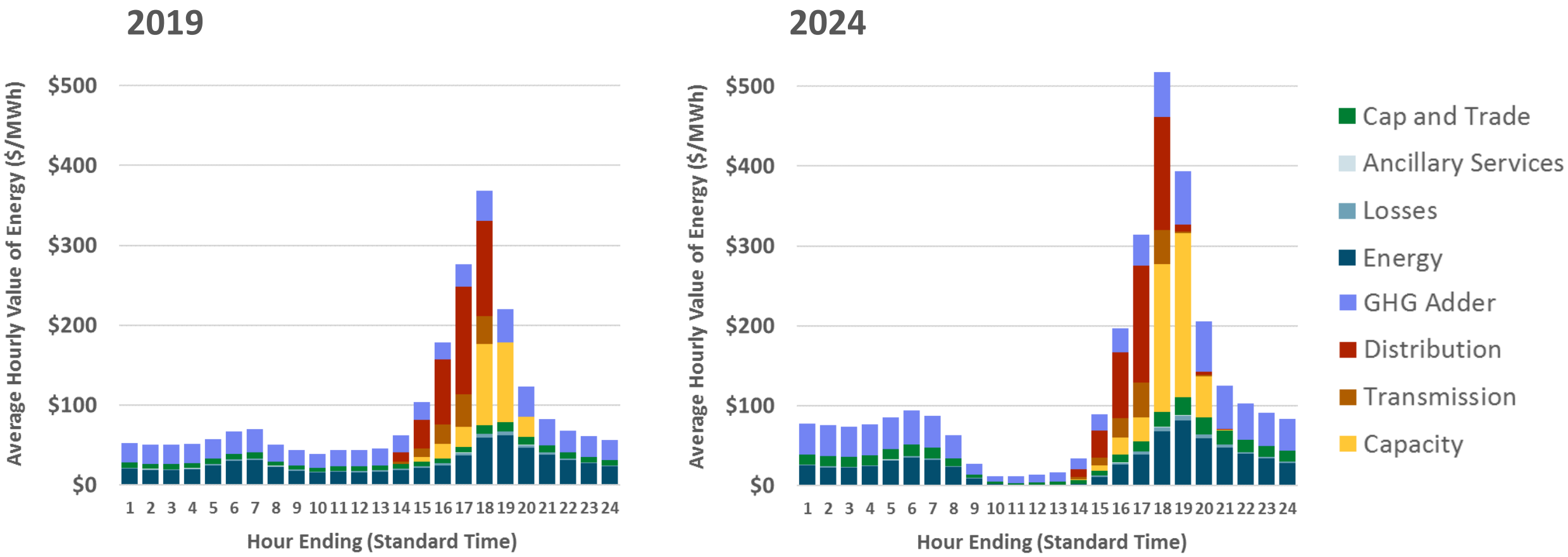
2017 PG&E EE Portfolio TRC: Sensitivity Analysis



- **Elimination of all Admin, Marketing, and Implementation costs would still not yield TRC of 1.25**

RECURVE

Myth 3: Avoided Costs are Going Down



- Mid-day avoided costs disappearing due to over-generation/solar curtailment
- Evening ramp and peak-period avoided costs are up!

RECURVE

EE Portfolios Haven't Evolved to meet Avoided Cost Trends

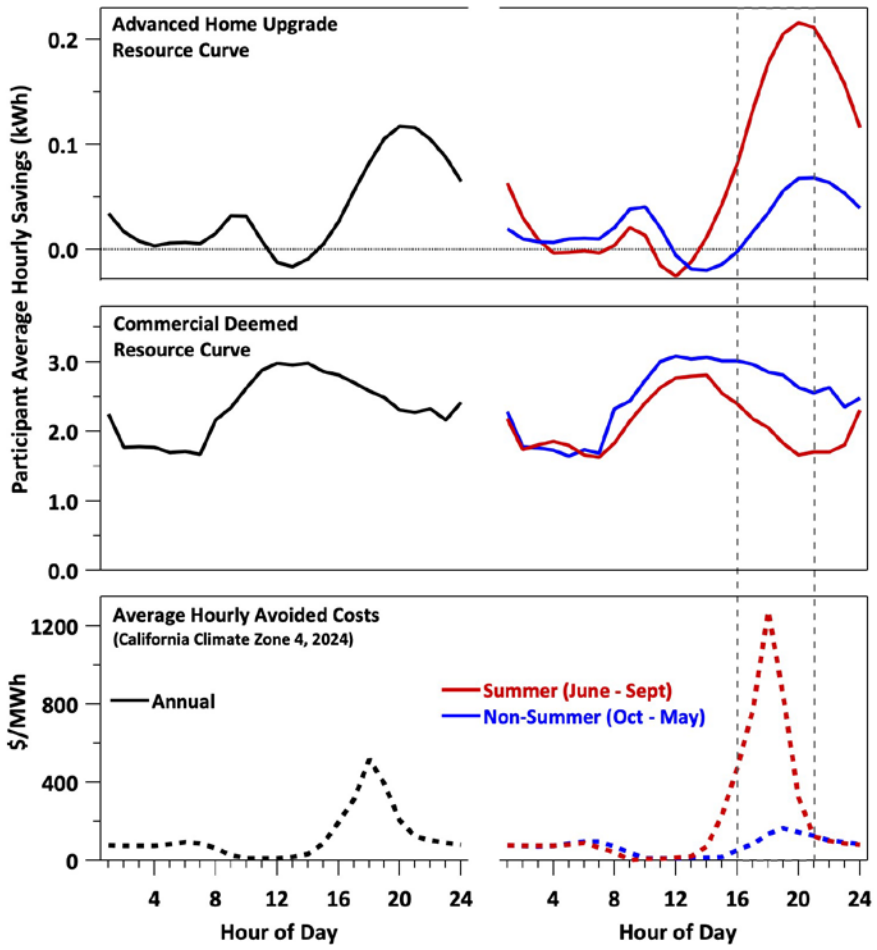
PG&E's EE Portfolio

$ Elec Benefits / Net LC kWh Savings

Sector	2017 CEDARS	2019 Forecast	2019/2017
Agricultural	$ 0.107	$ 0.063	0.59
Commercial	$ 0.109	$ 0.063	0.58
Industrial	$ 0.096	$ 0.060	0.62
Residential	$ 0.115	$ 0.104	0.90
Public	$ 0.093	$ 0.064	0.69
Total	**$ 0.105**	**$ 0.074**	**0.70**

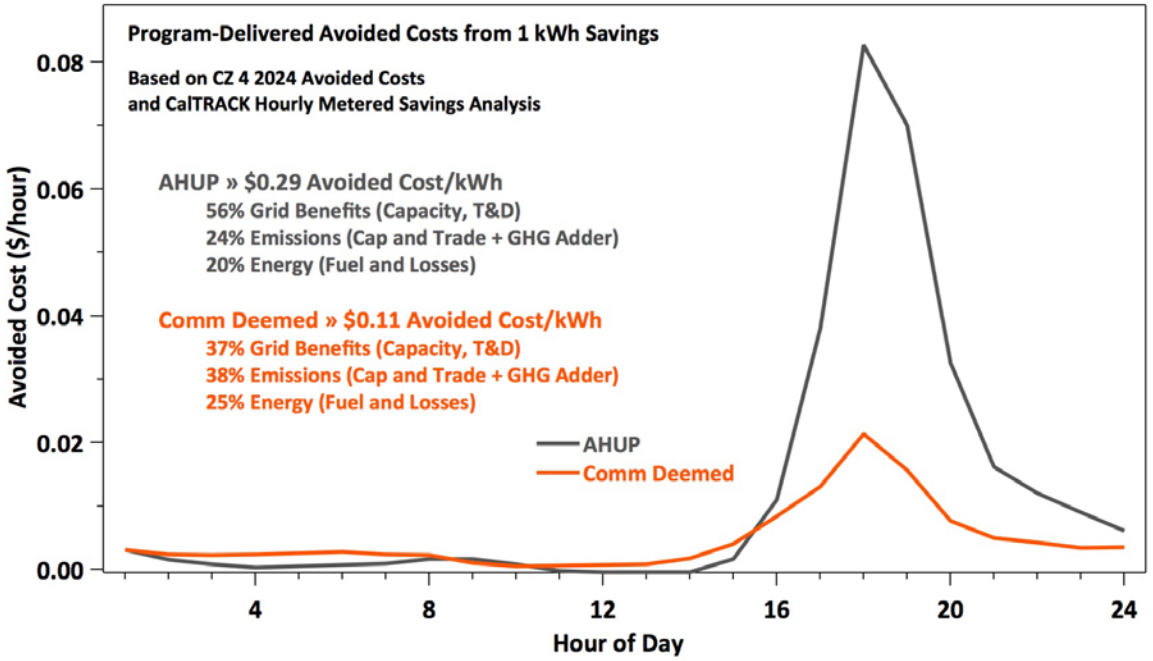
- A kWh saved in 2019 yields only 70% of the benefits of a kWh saved in 2017 – Despite new GHG adder!

Myth 4: There is Nothing We can Do



Solutions:

- Align C/E metrics with policy goals
- Integrate EE with other DERs
- Target customers and peak savings
- Modernize measurement



RECURVE

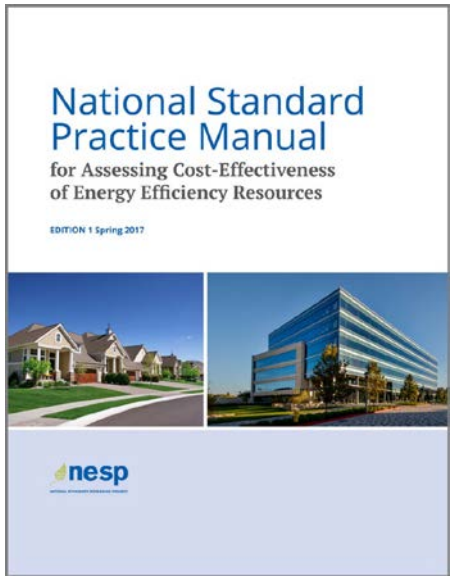
Cost Effectiveness as a Challenge for EE:

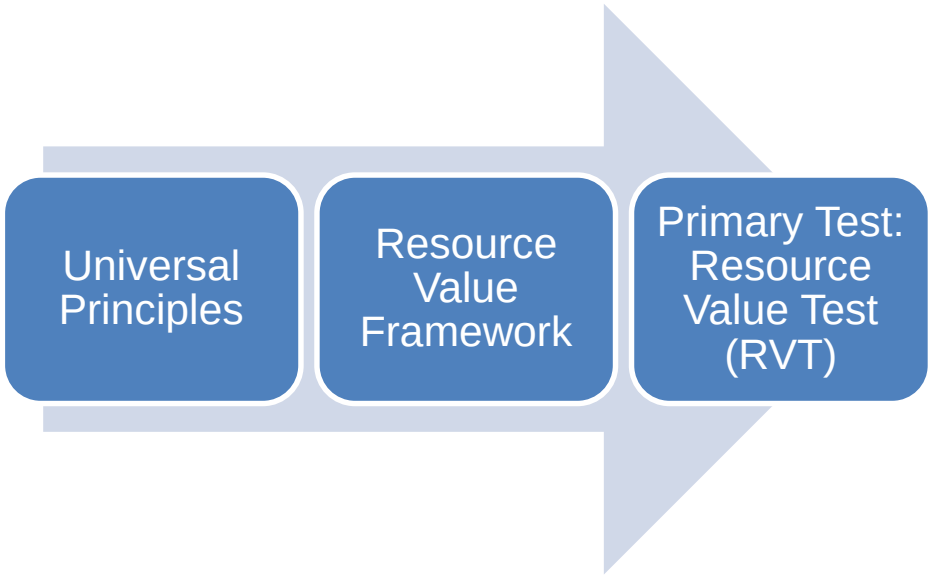
Applying a New Framework to Improve Practices

Julie Michals – E4TheFuture

IEPEC 2019

NSPM for EE (May 2017)





NSPM Principles:

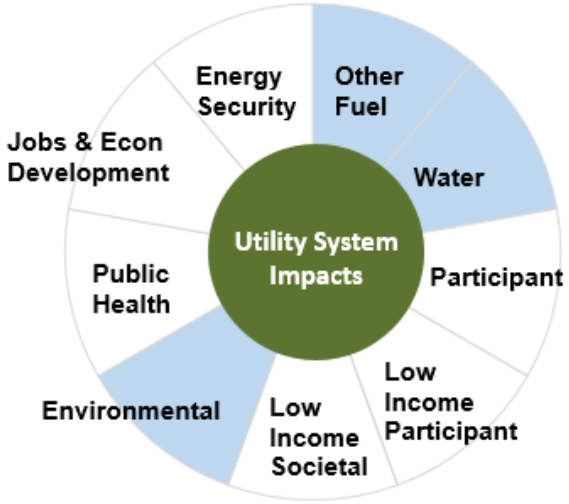
1. Treat EE as a resource
2. Align with applicable state policies
3. Account for relevant impacts (based on applicable policies) even if hard to quantify)
4. Treat costs and benefits symmetrically
5. Conduct forward-looking analysis (that captures incremental impacts of EE
6. Ensure transparency in assumptions and results

A state's test may align with a traditional test... or not.

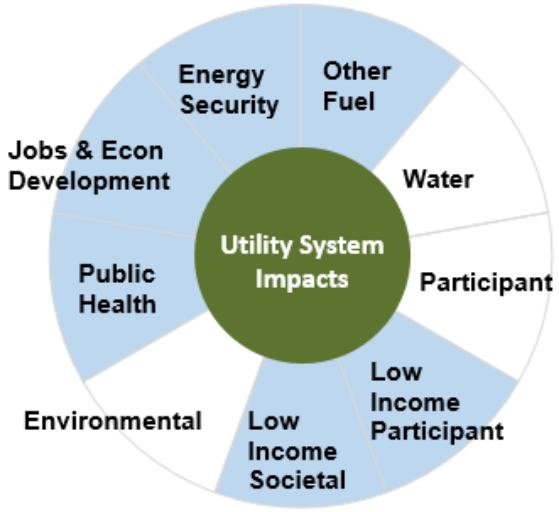
Does my state's RVT = UCT, TRCT, SCT…

or something else?

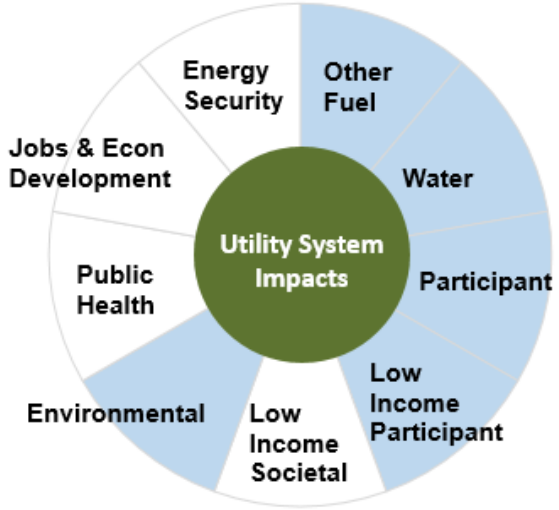
JURISDICTION 1: RVT



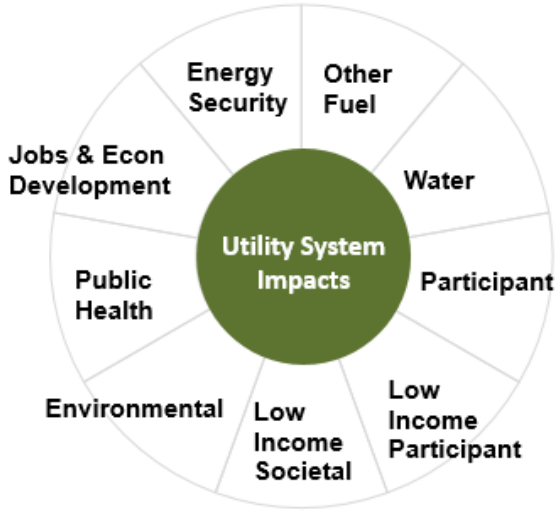
JURISDICTION 2: RVT



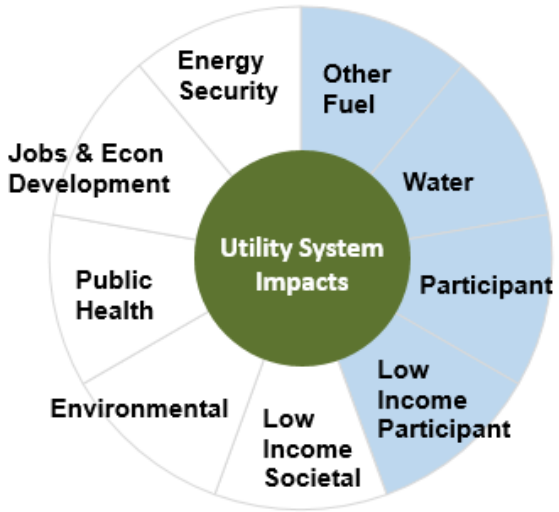
JURISDICTION 3: RVT



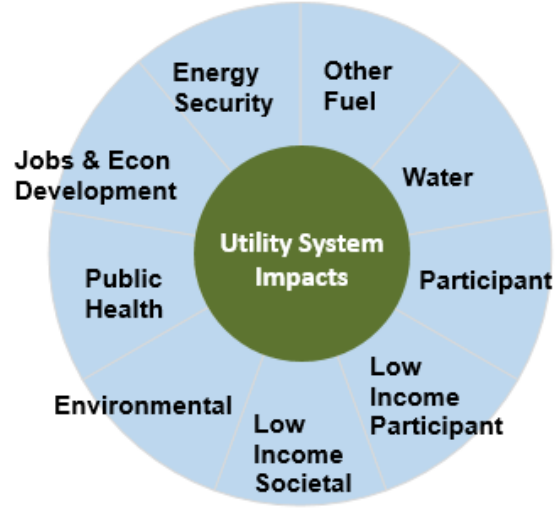
JURISDICTION 4: RVT = UCT



JURISDICTION 5: RVT = TRC

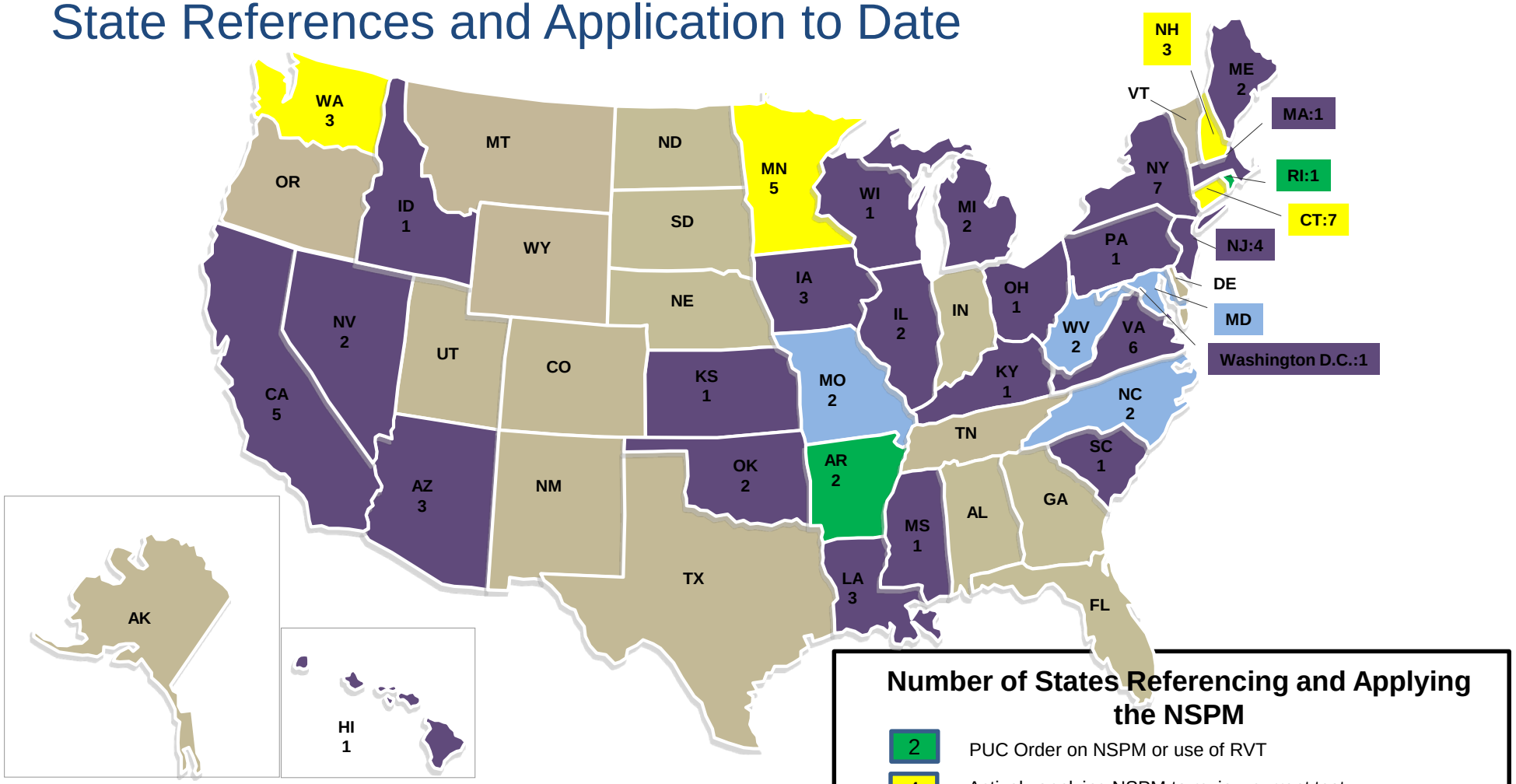


JURISDICTION 6: RVT = SCT



NSPM for Energy Efficiency

State References and Application to Date



Number of States Referencing and Applying the NSPM

2	PUC Order on NSPM or use of RVT
4	Actively applying NSPM to review current test
4	In process of learning about the NSPM
31	References have been made in PUC or legislative proceedings

*Numbers next to state abbreviations in map indicate number of NSPM references in state formal proceedings

Breaking down the silos: NSPM for Distributed Energy Resources

- DERs as grid resources and in distribution planning → need common framework to prioritize DER investments
- States currently use different techniques, methodologies, and assumptions for DER BCA → inconsistency even within states

- NSPM for DERs project (July 2019-June 2020)
  - Single and multi-DERs: EE, distributed gen (PV, CHP), demand response, electric vehicles, storage
  - Non-wires solutions, temporal and locational BCA
  - Integrated, fuel-neutral DER investments
  - Grid-interactive EE buildings (e.g., advanced controls, sensors and data analytics) and optimizing energy use for flexible building loads

Policies needed to support:
iDER investments/programs → iDER BCA → iDER evaluation

NSPM Resources

NSPM for EE: https://nationalefficiencyscreening.org/the-national-standard-practice-manual-for-energy-efficiency/

NSPM Case Studies: https://nationalefficiencyscreening.org/resources/case-studies/

NSPM and BCA Modeling:
https://nationalefficiencyscreening.org/resources/nspm-and-models/

Database of State Efficiency Screening Practices (DSESP):
https://nationalefficiencyscreening.org/state-database-dsesp/

NSPM for DERs (Overview):
https://nationalefficiencyscreening.org/the-national-standard-practice-manual-for-ders/

Julie Michals
jmichals@e4thefuture.org

www.nationalefficiencyscreening.org

Panel: Cost Effectiveness as a challenge for energy efficiency

By: Daniel M. Violette Ph.D.
dan.violette@lumina.com

Lumina®
DECISION SYSTEMS

What do we mean by C-E as a challenge?

- For portfolio program planning and design.
- Evolving C-E to meet changing needs in DSM and DER.
  - Matching the analyses to the policy questions being asked.
- Some drivers in the evolution of C-E:
  - Lower costs of supply, e.g., gas turbines.
  - Migration of EE measures into codes and standards.
  - Changes in DSM markets.
  - Assessing EE as a DER resource.

Evolving C-E

- C-E is more than selecting a formula or equation.
- We need to focus on providing information in C-E that helps decision makers assess investments in DSM.
  - Conduct threshold analyses.
    - How large do the non-quantified benefits have to be for the C-E to exceed one (e.g., carbon or other NEBs).
  - Perform sensitivity analyses to illustrate the drivers of C-E
  - Appropriately address uncertainty in inputs.
    - Avoided costs
    - Classes of benefits
  - Ask the question: Are C-E analyses providing context and information needed by decision makers?

Selected issues in this Evolution

- Folding EE into a DER framework:
  - How does this impact benefits and costs?
  - Look at how micro-grids assess EE.
- Appropriately estimating avoided costs:
  - Not easily done and transparency can be an issue.
  - Are there supply-side risks that are being hedged by EE/DSM?
  - Use of value-at-risk metrics to assess risk?
- Dealing with more certain near-term costs and less certain longer-term benefits.
  - We need a framework for addressing uncertainty.

Survival –

Why Cost Effectiveness is Becoming the Biggest Challenge Facing Energy Efficiency Programs

Adam Scheer, PhD
Director
Recurve

Julie Michals
Director of Clean Energy Valuation
E4TheFuture

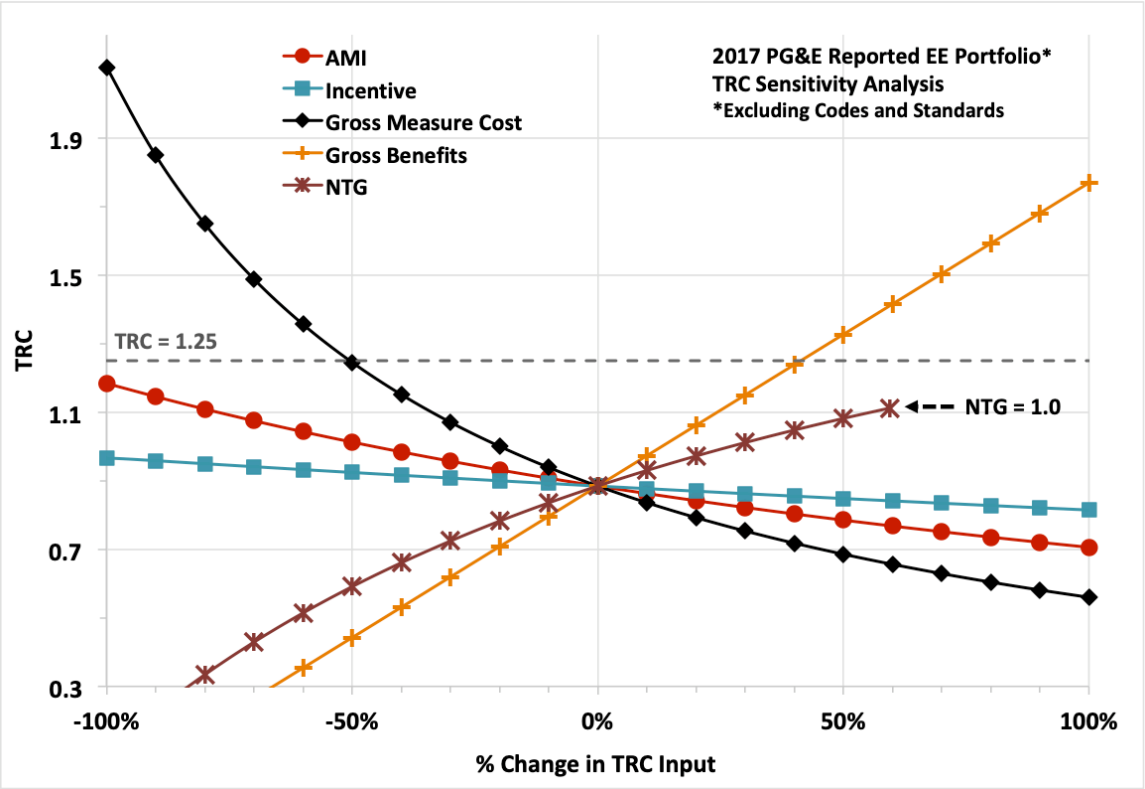
Alison LaBonte, PhD
Supervisor
CPUC

Dan Violette, PhD
Director, Energy
Lumina Decision Systems, Inc.

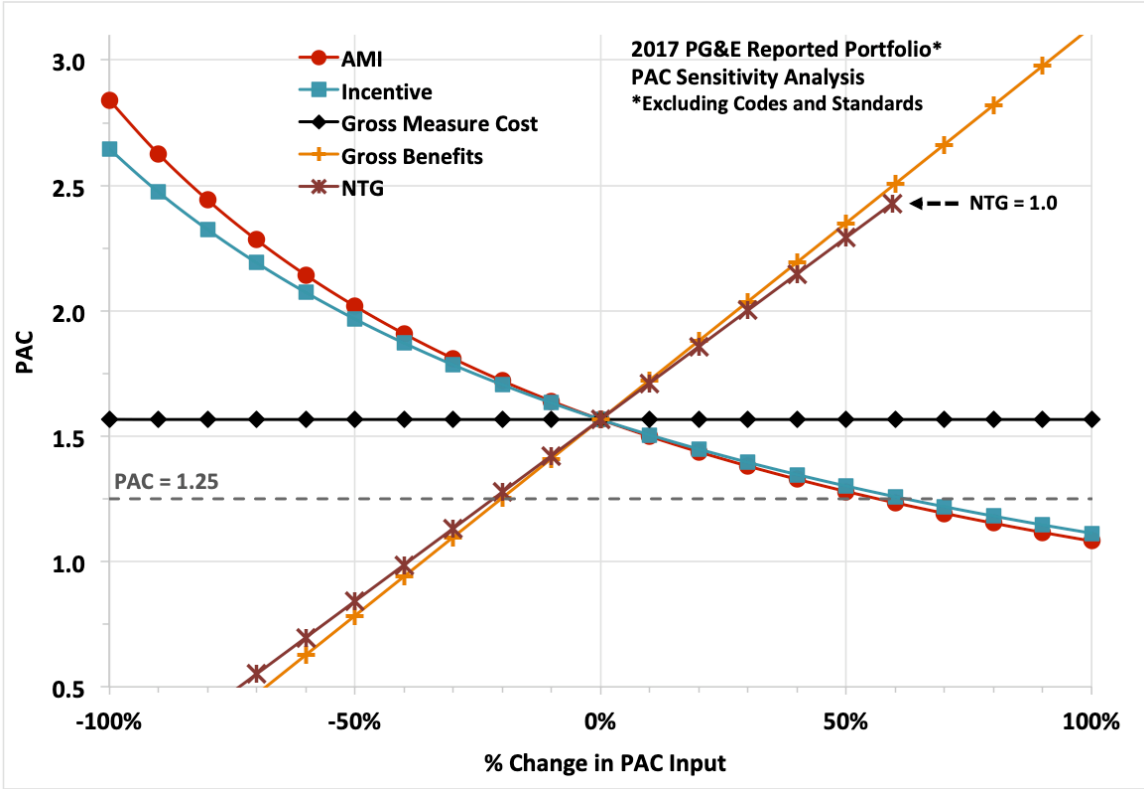
Moderator:
Robert Kasman
Principal, EM&V
Pacific Gas and Electric Company

Cost-Effectiveness Sensitivity Analysis

2017 PG&E EE Portfolio TRC



2017 PG&E EE Portfolio PAC



- **Elimination of all Admin, Marketing, and Implementation costs would still not yield TRC of 1.25**
- **TRC is most sensitive to measure costs; PAC insensitive to measure costs**
- **TRC is insensitive to incentives; PAC highly sensitive to incentives**

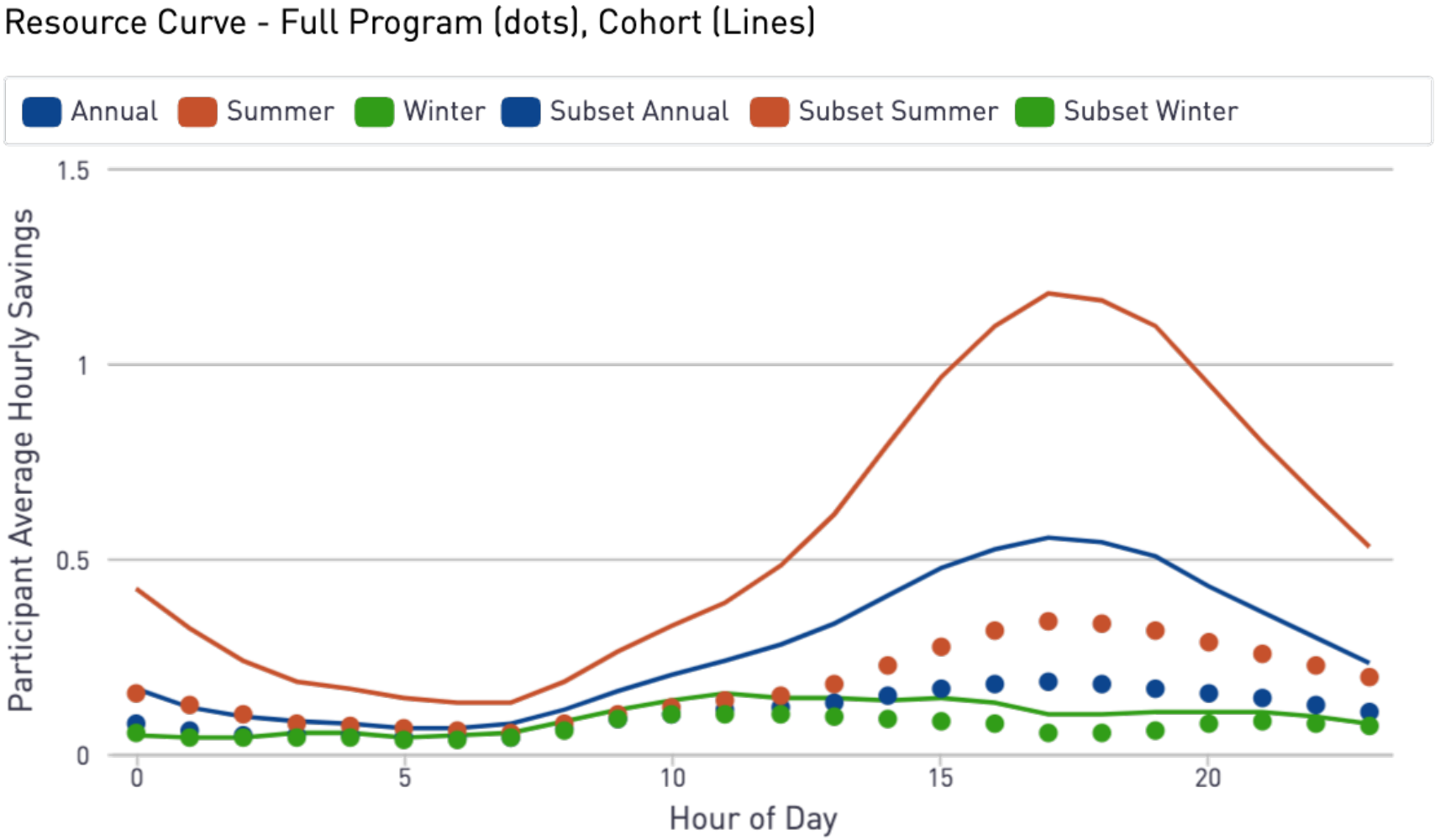
RECURVE

Customer Targeting to Enhance Cost Effectiveness: an Example

Advanced home Upgrade:

Targeting top quartile of summer kWh and top half of temp-to-load correlation

Average project metered savings increase by a factor of 2.4



RECURVE