



Energy Technologies Area

Lawrence Berkeley National Laboratory

Financial Impacts of a Combined Energy Efficiency and Net-Metered PV Portfolio on a Prototypical Northeast Utility

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Context for analysis

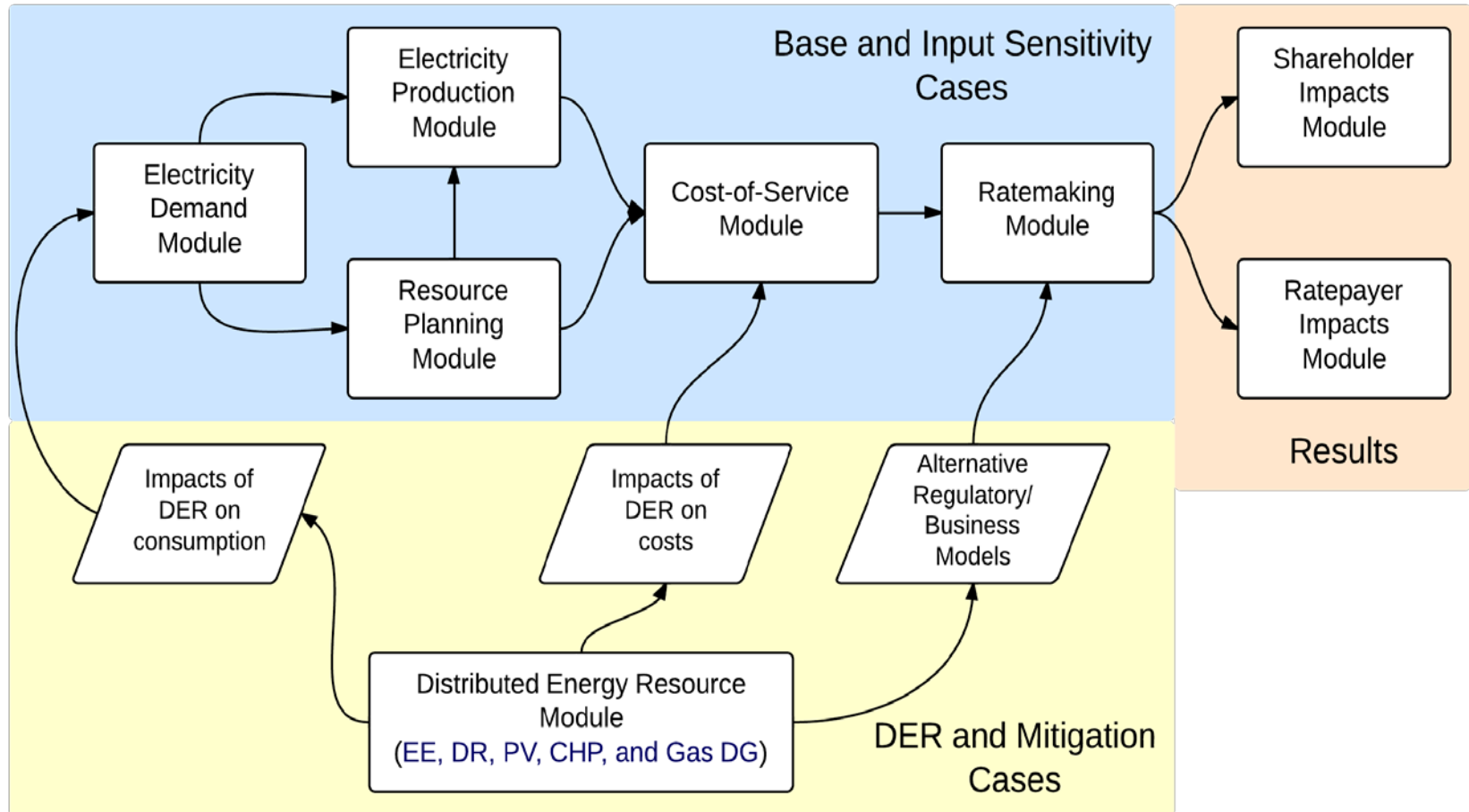
- ◆ Utilities are concerned about stagnant or declining sales growth driven by policy goals mandating energy savings and policy- and market-driven customer-sited PV
- ◆ Regulators and policymakers are balancing the benefits of energy efficiency (EE) and distributed energy resources (DERs) to reduce sales and peak demand growth with maintaining the utility's financial viability
- ◆ Approaches to maintain the utility's financial viability may come at an increased cost to customers and erosion of bill savings

How does this analysis compare to prior LBNL studies?

Present study	Prior LBNL studies
Develops aggressive combined EE and PV scenario	Considered EE and PV in isolation
Estimates average participant and non-participant bills	Estimated total customer bills
Calculates <i>hourly</i> EE and PV impacts on utility load	Calculated <i>annual</i> EE and PV impacts on utility sales and peak demand

FINancial impacts of DER (FINDER) Model

Model Architecture



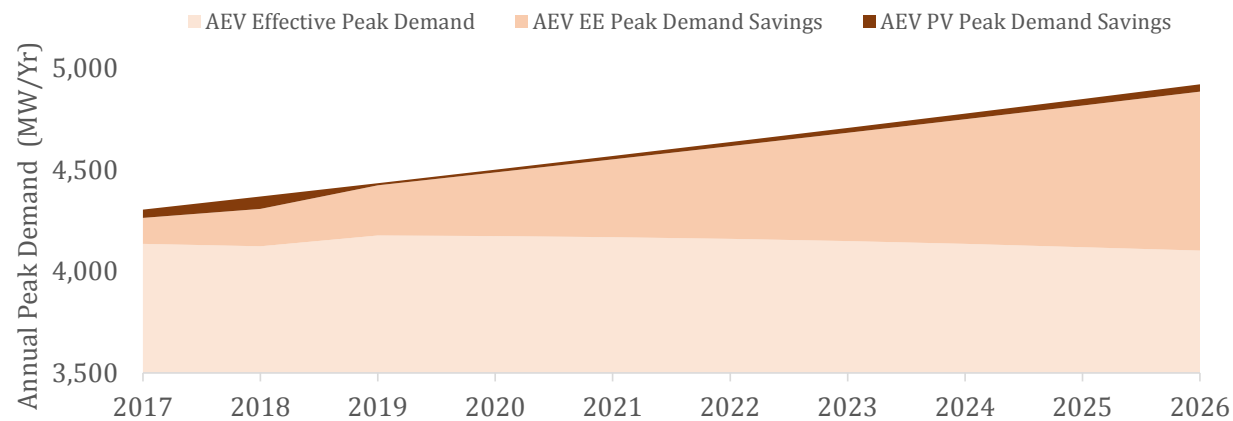
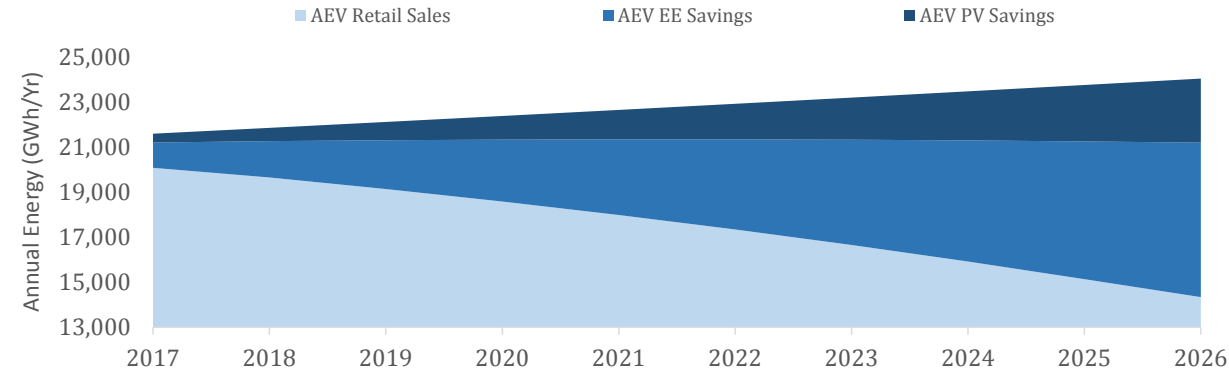
Approach and scenario definitions

- ◆ Estimate the financial impacts when going from the existing utility with moderate EE and PV savings (BAU scenario) to highly aggressive EE and PV savings (AEV scenario)
 - ▣ EE and PV ramp up and installed over ten years (2017 to 2026) with impacts quantified over 20-year period (2017-2036) to capture economic end-effects
- ◆ We are interested in direction and magnitude of:
 - ▣ Change from BAU to AEV scenario; and
 - ▣ Application of mitigation approaches to AEV scenario

AEV Scenario	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
EE	2.00%	2.25%	2.50%	2.60%	2.70%	2.80%	2.90%	3.00%	3.10%	3.10%
PV	0.73%	0.90%	1.01%	1.06%	1.13%	1.19%	1.26%	1.31%	1.38%	1.40%

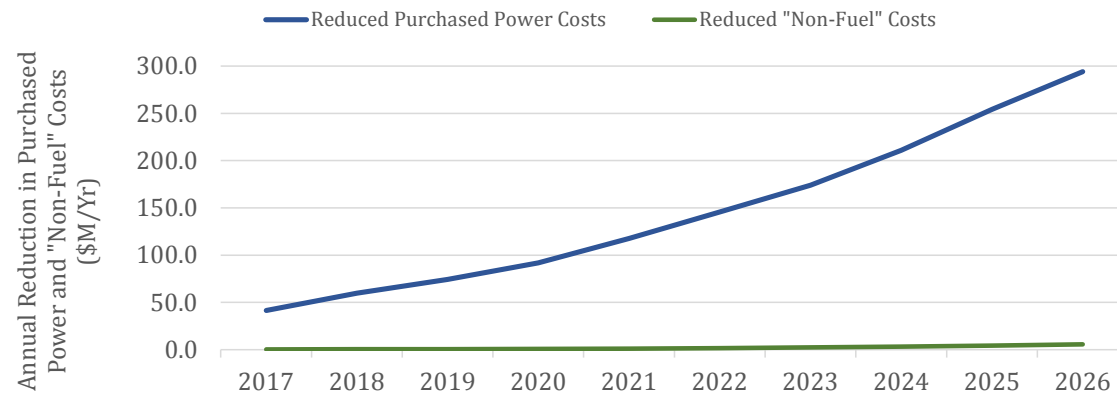
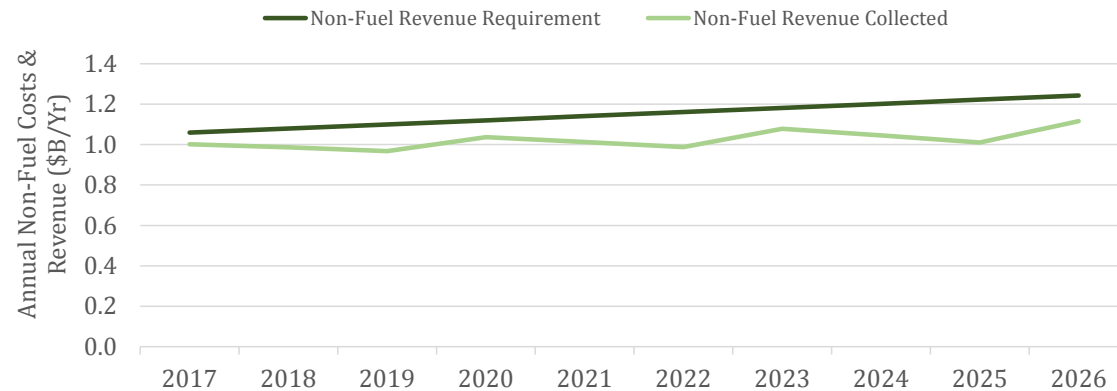
Aggressive EE and PV savings levels produce significant decline in utility sales and peak demand

- ◆ Aggressive EE and PV savings result in declining retail sales and peak demand during the ten years of increasing EE program and PV system installations
- ◆ Retail sales decline at 3.7% per year and peak demand declines at 0.1% per year from 2017 to 2026

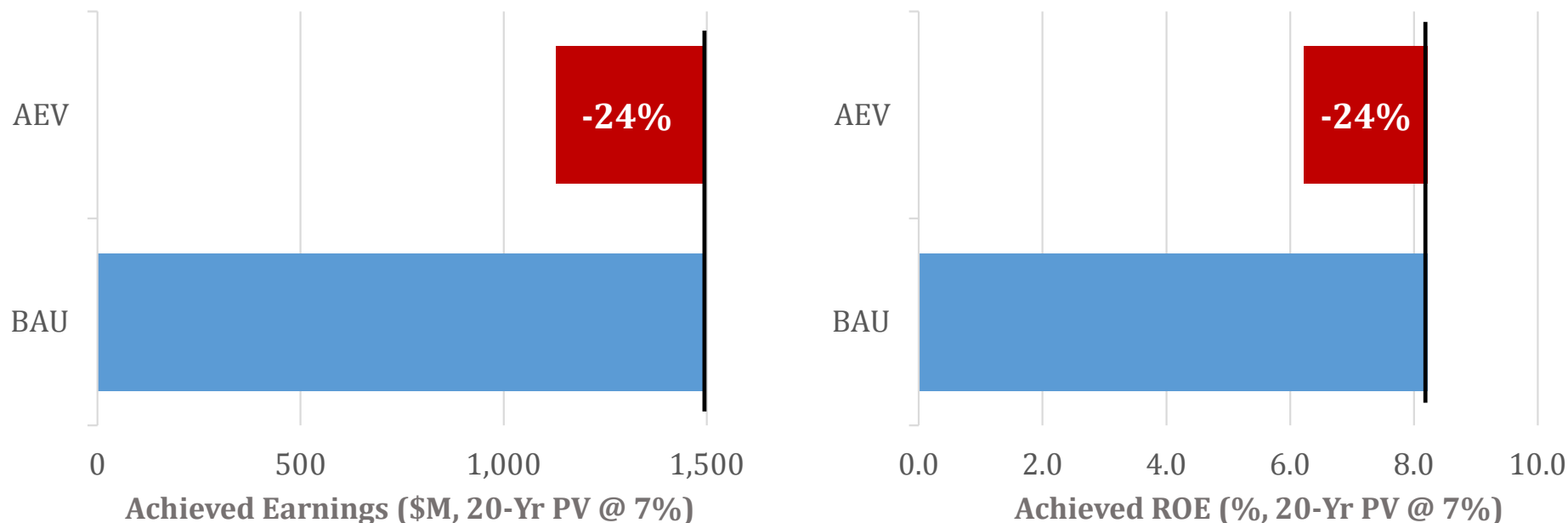


EE and PV savings reduce “non-fuel” revenues by greater amount than “non-fuel” costs

- ◆ Aggressive EE and PV savings reduce total utility costs by 3%, as compared to the BAU case
- ◆ Total collected revenues decrease by 5%
- ◆ Reduced purchased power (“fuel”) costs account for almost all utility cost reductions

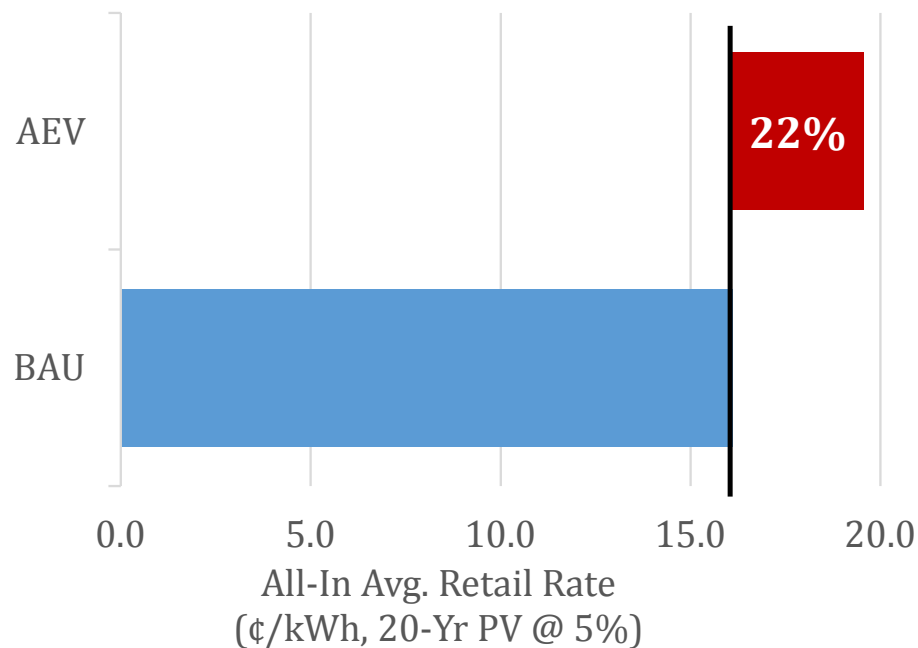


Aggressive EE and PV significantly reduce utility profitability



- ◆ Erosion in collected revenue is much greater than reductions in utility costs leading to substantial impacts to achieved earnings and ROE
- ◆ Achieved earnings are reduced by \$364M and achieved ROE is reduced, on average, by 200 basis points taking into account 20 years of cost and revenue reductions

Average all-in retail rates increase as the NE utility spreads its costs over a declining sales base



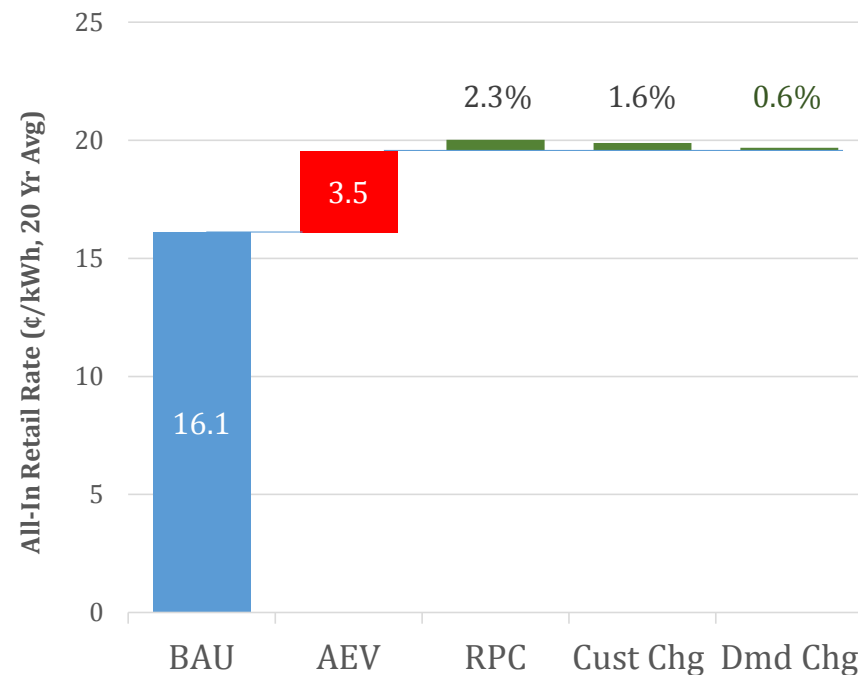
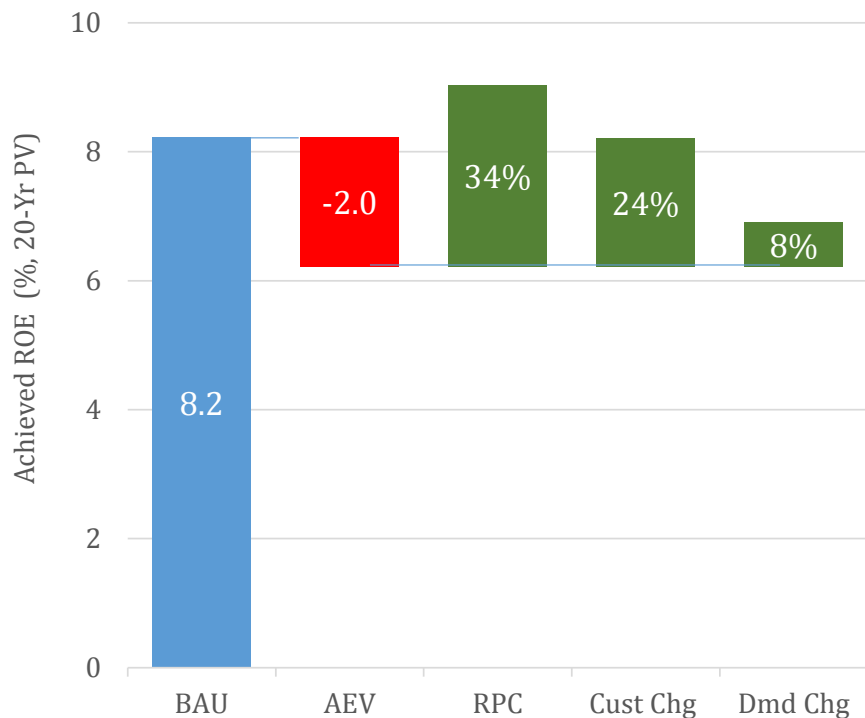
- ◆ Retail sales decline faster than costs, resulting in an increase in average all-in retail rates

Ratemaking and regulatory approaches target specific shareholder impacts

Mitigation Measure	Description	Revenue Erosion	Lost Earnings Opportunity	Increased Rates
Revenue-per customer (RPC) decoupling	Revenue decoupling is implemented by setting a revenue per-customer target in rate cases and adjusting rates annually between cases to collect revenues at the target level	●		○
Increased demand & customer charges	An increased share of non-fuel revenues are collected via demand or fixed customer charges	●		○
Shareholder incentives	Utility shareholders receive additional earnings for the successful achievement of policy goals (in this case, related to EE and customer-sited PV deployment)		●	○

- Primary intended target of mitigation measure
- May exacerbate impacts of EE and customer-sited PV

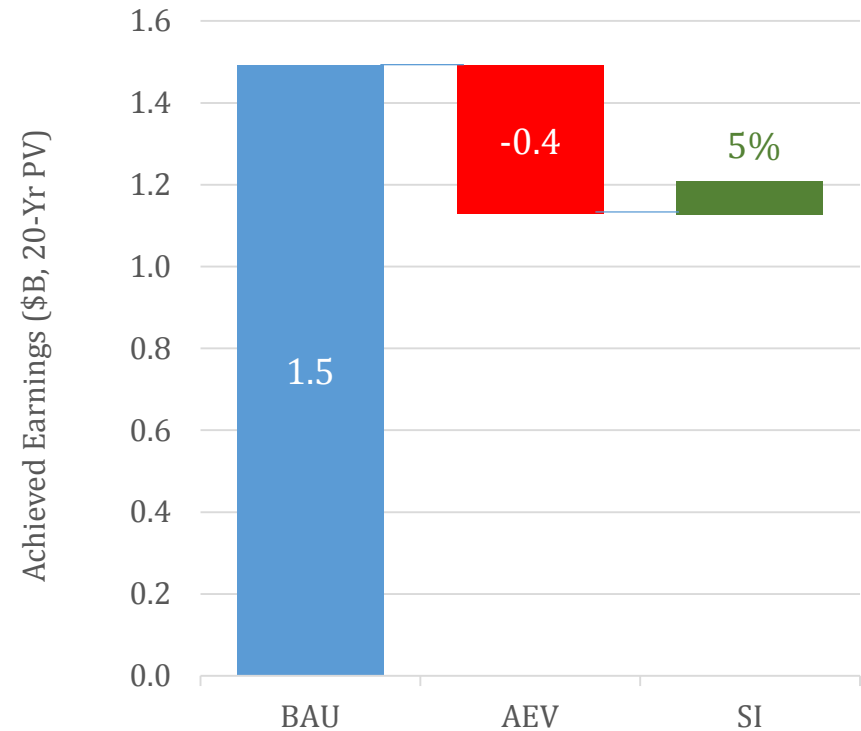
RPC decoupling and increased customer charge collect additional revenues that restore all or more ROE erosion



- ◆ Improved utility achieved average ROE comes at additional cost to ratepayers as average all-in retail rates increase 0.6% to 2.3% in addition to retail rate increase in the AEV scenario

Shareholder incentives likewise improve utility achieved earnings

- ◆ Shareholder incentives equal to 10% annual EE program administrator costs and equal to 10% of the installed distributed PV system costs
- ◆ We do not quantify retail rate impacts as the additional costs of utility PV ownership would be passed through to PV customers only



Takeaways from base results and mitigation cases

- ◆ Results are directionally consistent with prior LBNL studies
 - Magnitudes are larger because of combined EE and PV portfolio and more aggressive penetration assumptions
- ◆ Results are primarily driven by lack of alignment of EE and PV demand savings with utility system peak
 - Less alignment means lower non-fuel cost reductions, as demand is assumed to be a major cost driver
- ◆ Tradeoffs between improving utility profitability and further increasing retail rates exists to achieve AEV savings goals and is an important policy consideration
 - RPC decoupling can more than restore utility ROE but by further increasing retail rate levels

Why calculate participant and non-participant customer bills?

- ◆ Customers who install EE measures or PV systems (i.e., participants) will see greater bill reductions than those who do not (i.e., non-participants) as they are able to reduce energy consumption
- ◆ Participant and non-participant bill impacts tell you how the customer bill savings are distributed and informs regulators about issues related to fairness and equity

Constructing an illustrative analysis

Represent distribution of customers likely to participate in EE programs or install PV systems

- Segment participating customers into common EE program type and PV sub-populations
- Each sub-population has higher/lower than average baseline usage
- Each sub-population also has varying annual energy and demand savings



Take into account timing of when participation decision is made

- Differentiate customers into three groups:
 - **Non-Participant:** chooses not to participate
 - **Prior Participant:** invested prior to analysis period
 - **New Participant:** invests in EE measure or PV system during analysis period



Assess impacts of retail rate increases on participating and non-participating customer bills

- Keep annual savings percentage constant during analysis period
- Focus on customer bills in 2017-2026 timeframe as new EE measures and PV systems are installed

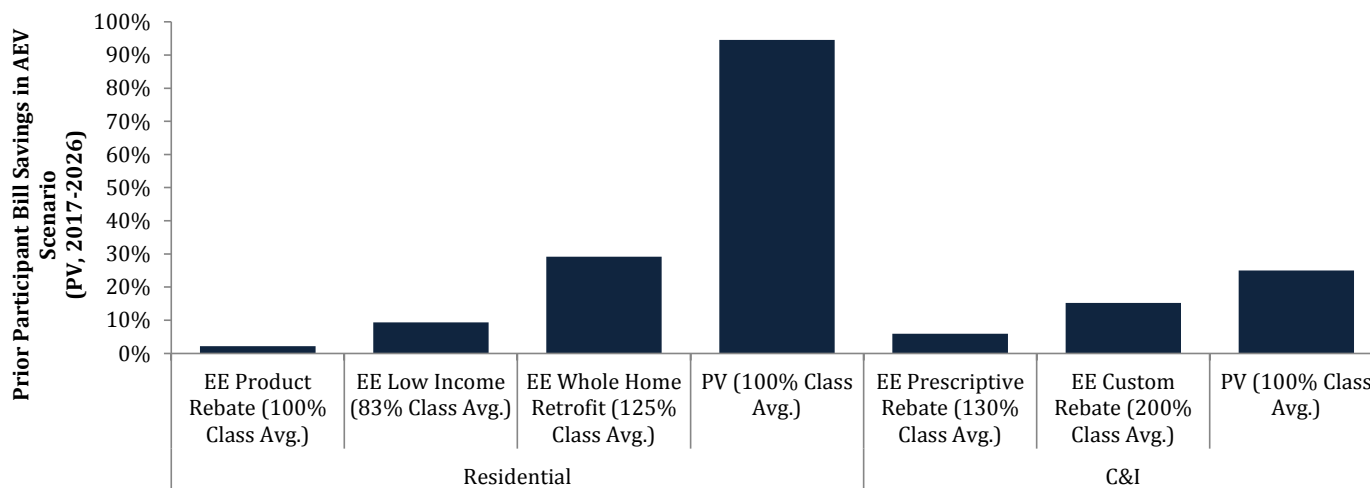
Non-participants see bills increase over time regardless of average consumption level

- ◆ Retail rates increase over time as the utility achieves its incremental AEV savings goals and customers who never make EE and PV investments are fully exposed to the rate increases that occur
- ◆ These customers' bills rise by ~16% on a PV basis between 2017 and 2026 with little diversity in bill impacts based on size of customer relative to class-average



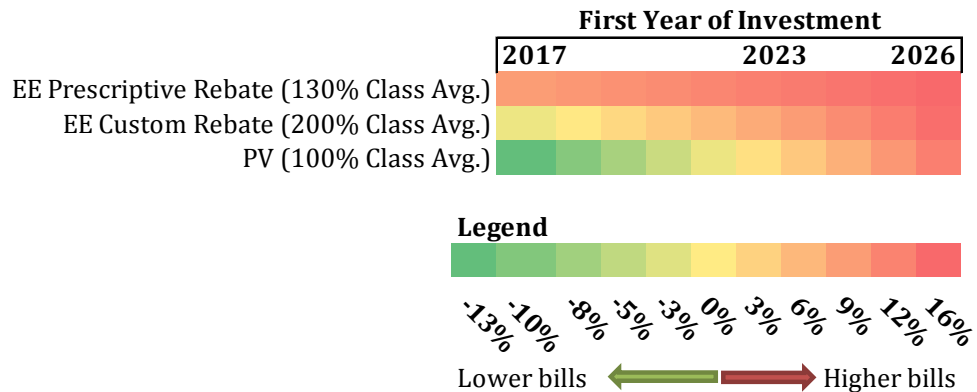
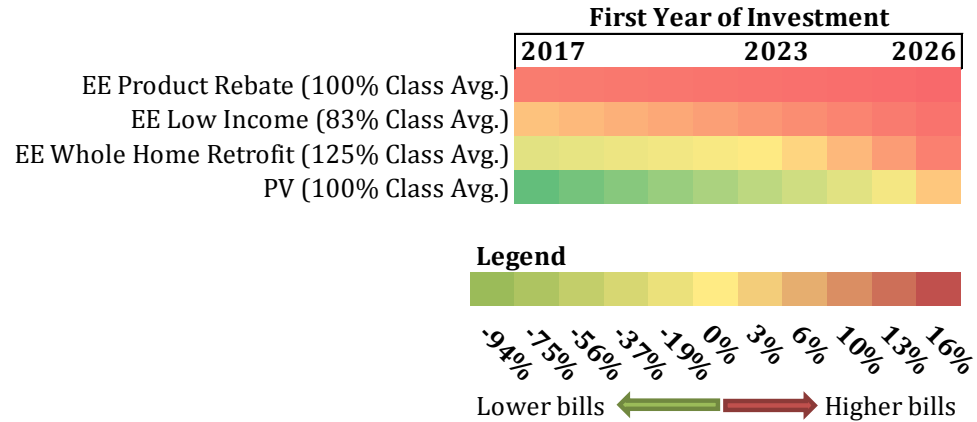
Prior participants that install PV see greater bill savings than those that install EE measures

- ◆ Customers who already invested in EE and PV are somewhat hedged against the rate increases that occur when others invest in these technologies to achieve the incremental AEV savings goals
- ◆ EE programs with more modest savings provide a much smaller hedge than PV, which is assumed to cover 100% of a residential customer's annual energy usage and 30% of a C&I customer's annual energy usage



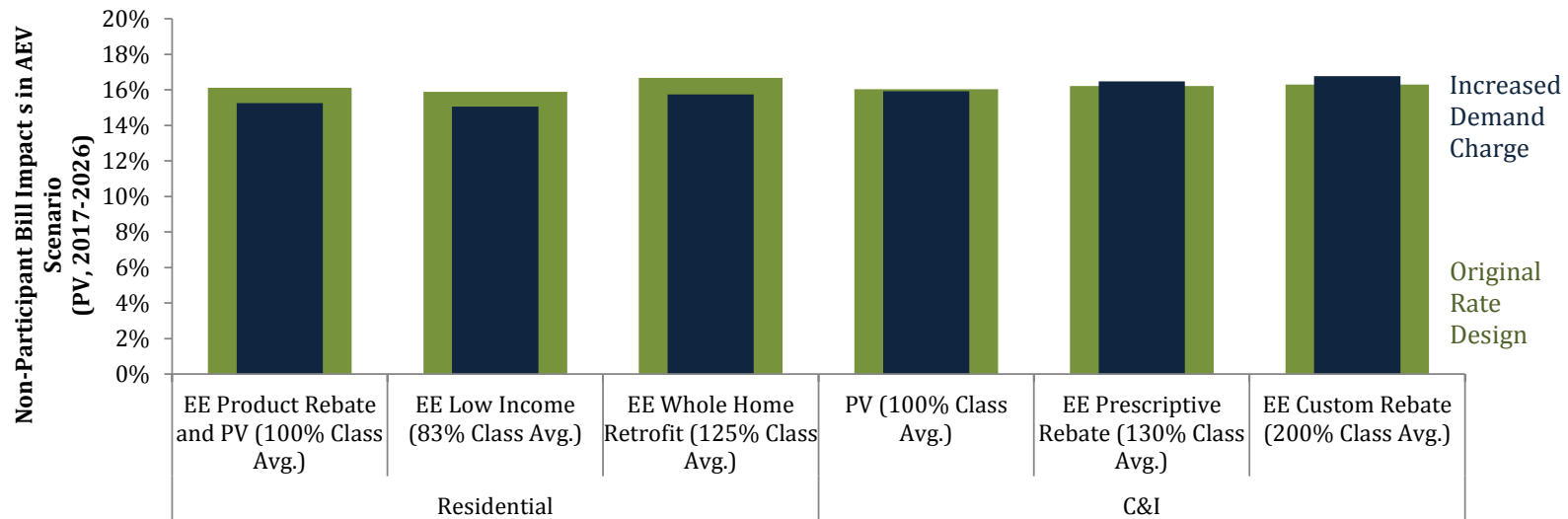
Bill savings for new participants are dependent on the timing of EE or PV investment

- ◆ Residential customers who participate in Whole Home Retrofit programs prior to 2023 or invest in PV prior to 2026 see lower bills over 10 years on a PV basis; C&I customers investing in Custom Rebate EE measures prior to 2018 or PV prior to 2023 also see lower bills
- ◆ Res. Standard Rebate and Low Income EE programs as well as C&I Prescriptive EE Programs produce savings too modest to keep pace with rate increases, regardless of when the investment is made



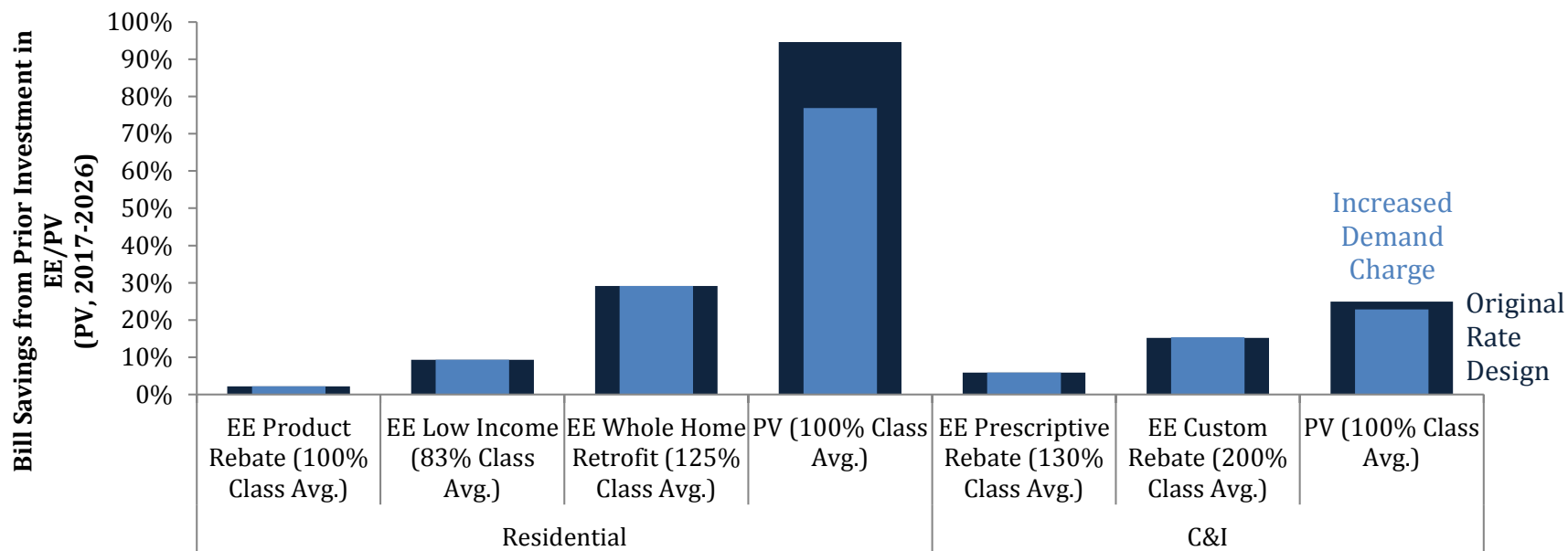
Demand charge rate design has little impact on non-participants

- ◆ Because rates are designed for the class-average customer and all customer sub-populations are scaled up or down from class-average, the impact of greater reliance on demand charges have very minor effects on size of non-participating customer bill impacts



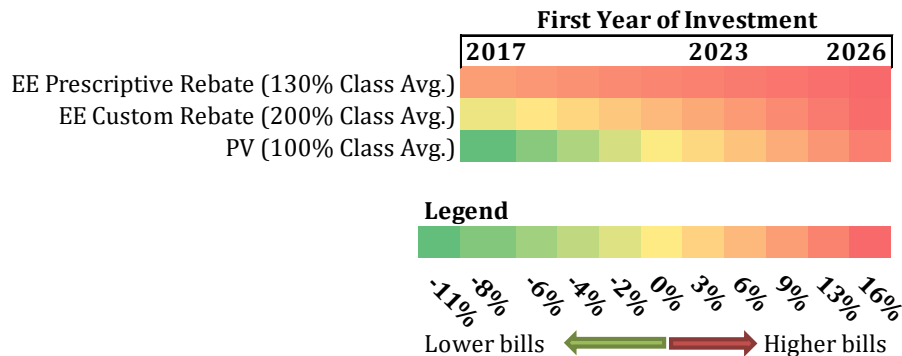
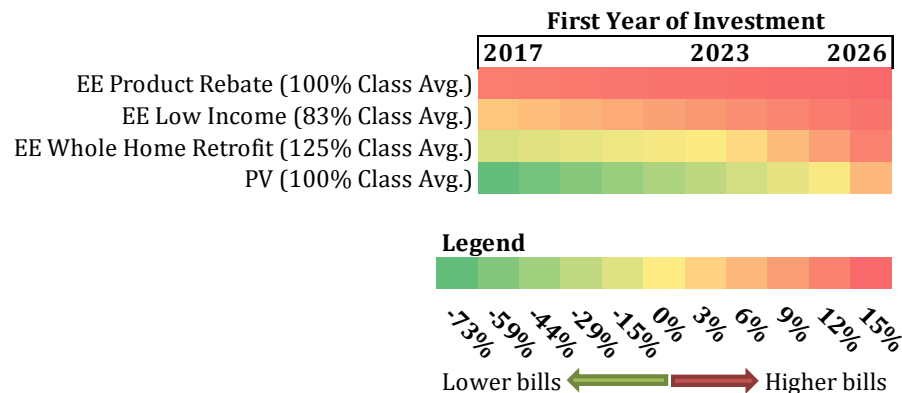
PV customers who invested prior to analysis period see erosion of bill savings under demand charge rate design

- ◆ Those who previously invested in PV retain fewer bill savings from changes in rate design that rely more heavily on demand charges than those who installed EE measures



Demand charge rate design also shifts the timing of bill savings for EE and PV new participants

- ◆ Transitioning to a larger demand charge component still results in Res. Standard Rebate and Low Income EE programs as well as C&I Prescriptive EE Programs seeing higher bills because savings are too modest to keep pace with rate increases
- ◆ Custom Rebate C&I programs become slightly less impactful, as only those who install measures prior to 2017 see lower bills over 10 years, whereas Residential Whole House Retrofit programs become slightly more impactful, as measures can now be installed through 2024 to achieve 10 year bill savings



Takeaways from participant/non-participant bill impacts analysis

- ◆ The timing of when a customer makes an EE or PV investment matters
- ◆ Increases in average retail rates due to achievement of savings goals has real financial implications for not just non-participants but also for those whose investments generate more modest savings of energy and demand (i.e., residential product rebate EE programs)
- ◆ A demand charge rate design dramatically reduces the bill savings for PV customers because of the way PV systems produce highly asymmetric reductions in energy and demand
- ◆ Utilities and regulators may need to reconsider EE portfolio designs to take into account the relationship between per-customer savings and rate increases with the objective of ensuring all participating customers see some amount of bill savings

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