State/Provincial Regulation in 2030: Gazing into the Crystal Ball

Charles Goldman
Staff Scientist and Department Head

November 13, 2014

Legislative Energy Horizon Institute
Washington, DC

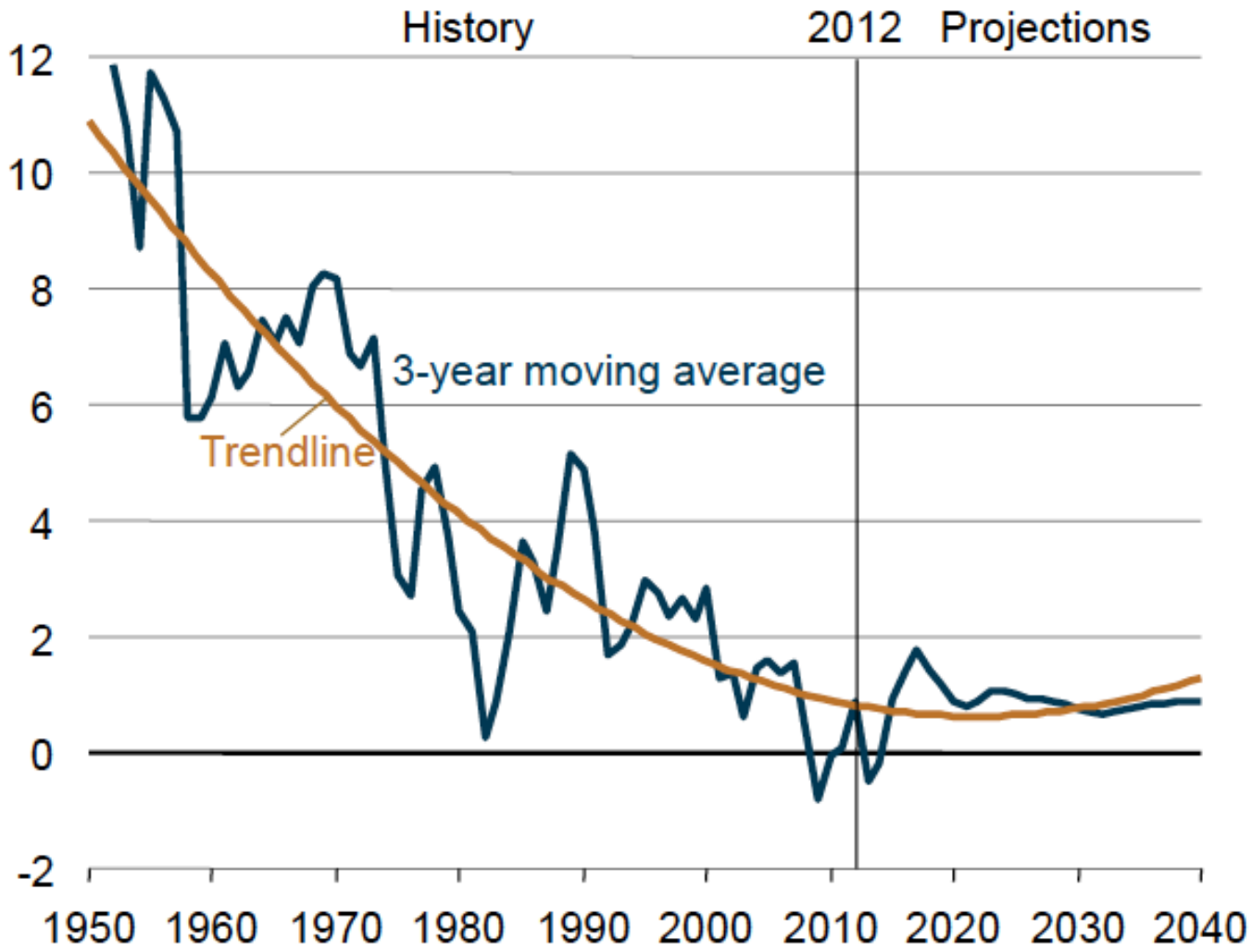
Project funded by DOE Office of Electricity Delivery and Energy, National Electricity Delivery Division

Outline

- Implications for utilities of a future with low load growth, high DG, and new “demands”
- Conceptual overview of incremental and fundamental changes to cost of service regulation and utility business models that are being discussed
- Summary of “leading edge” states and current regulatory/legislative activities

What are the key drivers of a possible low load growth/high DG future?

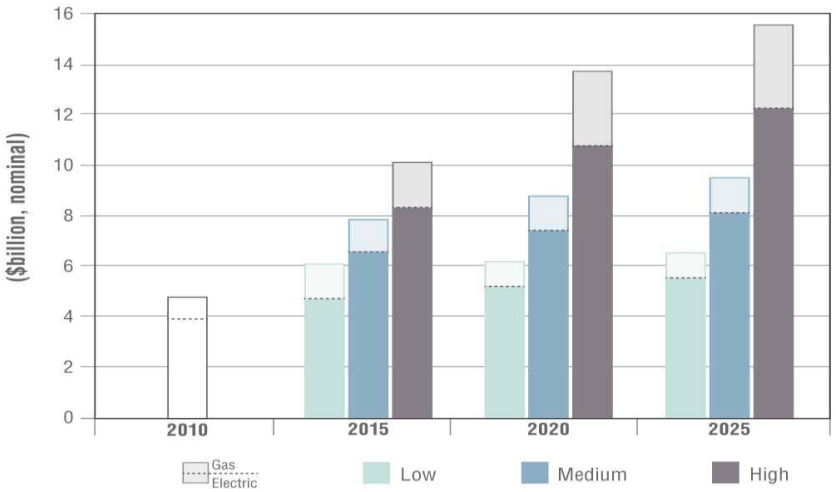
Declining Electricity Load Growth



Source: Energy Information Administration 2014

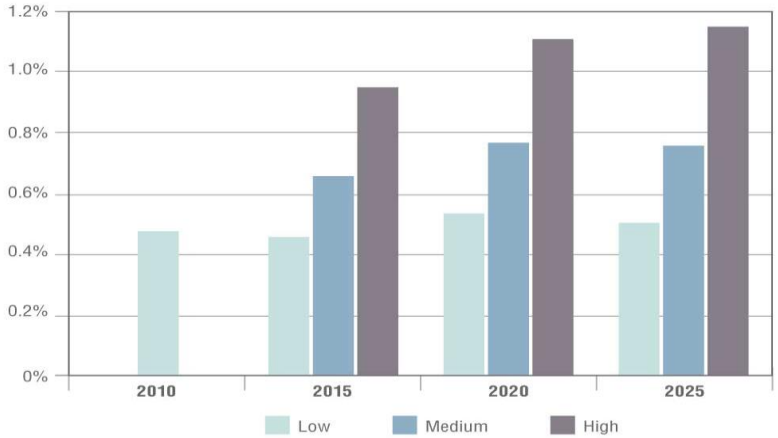
Electric Savings Could Offset a Large Portion of Projected Load Growth

Projected Utility Customer Funding for Electric and Gas EE Programs



Source: Barbose et al. (2013)

Projected Incremental Annual Electric EE Savings from Customer-Funded Programs (% of Retail Sales)

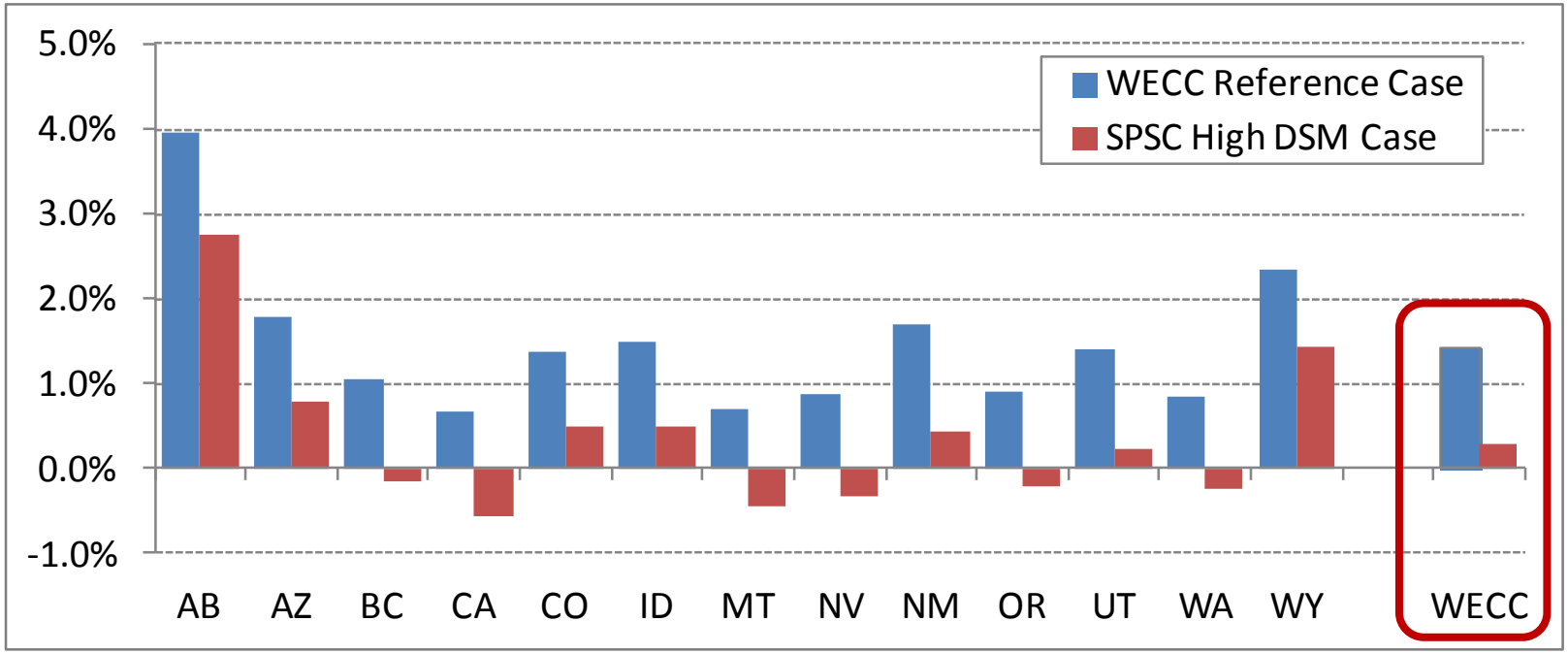


- Total electric & gas spending doubles to $9.5B in 2025 in the medium case (low: $6.5B, high: $15.6B)
- Projected annual incremental savings rise to 0.76% per year by 2025 in medium case
- Projected EE savings in the medium case would offset much of electric load growth forecasted by EIA

Energy Efficiency Potential in the West

- Load growth in West is almost flat (0.3%/year) over next 20 years in High DSM case (compared to WECC reference case (1.4%/year)
- High DSM case growth rates range from -0.6% to 2.8% across states and provinces

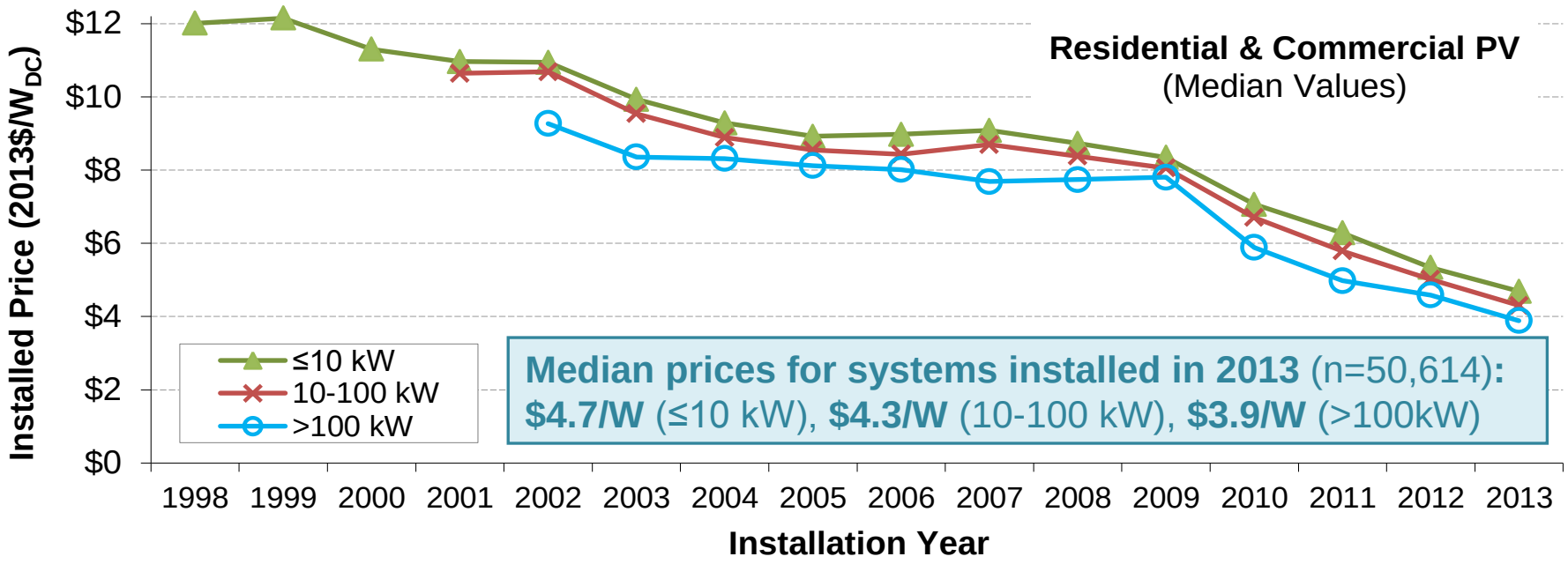
Compound Annual Growth Rates (Annual Energy, 2010-2032)



Source: Barbose et al, 2014, "Incorporating EE into Western Interconnection Planning, LBNL, January.

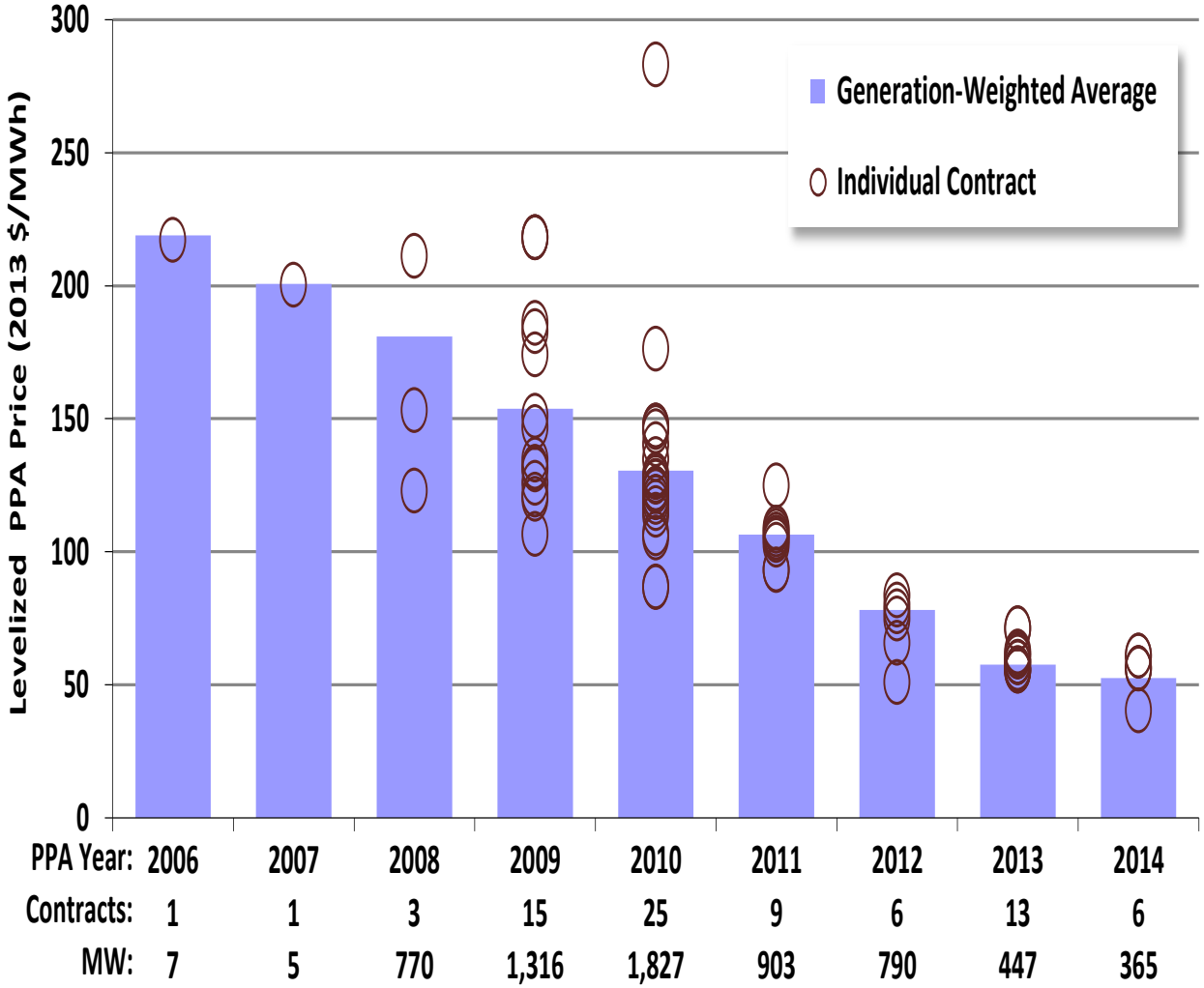
Installed Distributed PV prices continued to decline in 2013

Median installed prices fell by $0.7/W (12-15%) from 2012-2013, across the three size ranges shown, and have fallen by an average of $0.5/W (6-8%) annually over the full historical period



Note: Median installed prices are shown only if 15 or more observations are available for the individual size range
Source: Barbose et al, LBNL, "Tracking the Sun VII," 2014

Utility-scale Solar: Downward Price Trends



- Levelized PPA prices now down around $50/MWh
- Two-thirds of sample has flat annual PPA pricing (in nominal dollars), while the rest escalate mostly at low rates intended to keep pace with inflation – this means that average sample PPA prices ***decline*** over time in real dollars

Source: M. Bolinger and S. Weaver, LBNL 2014, "Utility Scale Solar 2013: Empirical Analysis of Project Cost, Performance and Pricing Trends in the U.S."

Changing Demands Driving Increased Utility Investments

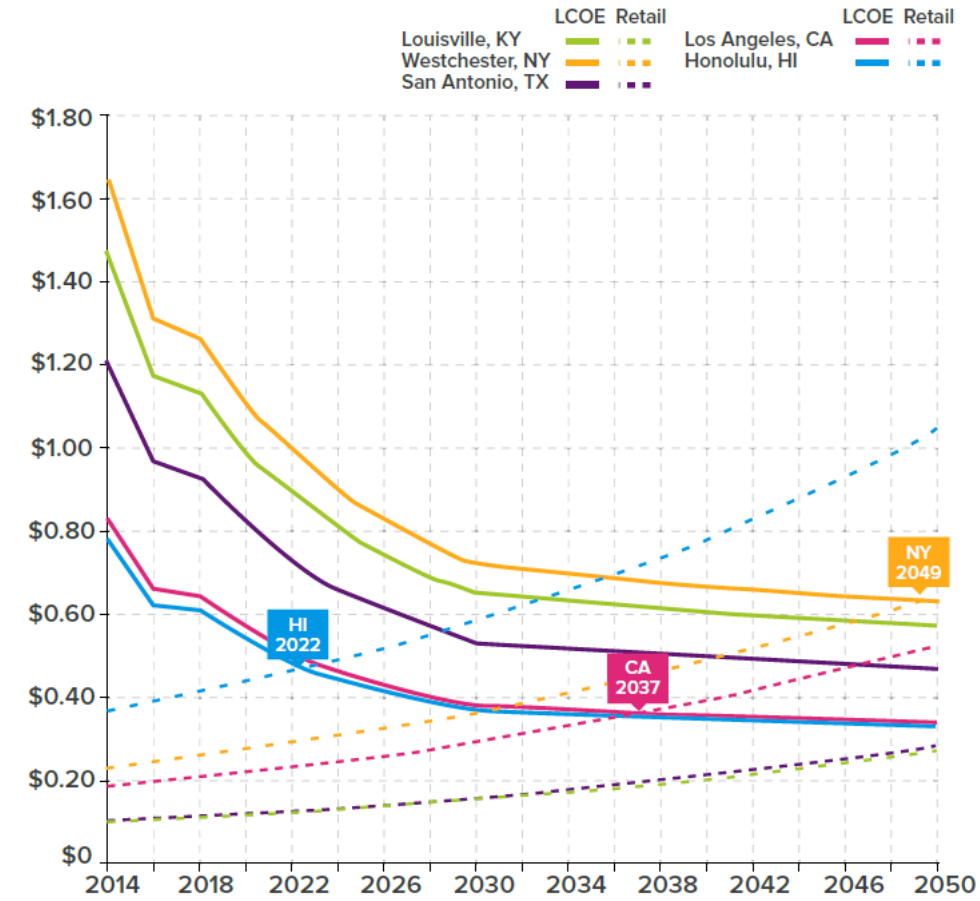
- Replace aging distribution system with smart grid: **$600B**
- New transmission to maintain reliability and integrate renewables: **~$250B**
- 350 TWh new green energy from state RPS by 2030: **~$120B**
- Estimated cumulative investment in customer-funded EE programs due to EERS and other policies in 2025: **~$100B**
- Cumulative grid investments, combined with decreasing utility sales growth, puts **upward pressure on retail electric rates**

Source: Fox-Penner. P and Chang, J. (2012); Barbose et al. (2013)

Possible "Customer Defection" Scenarios

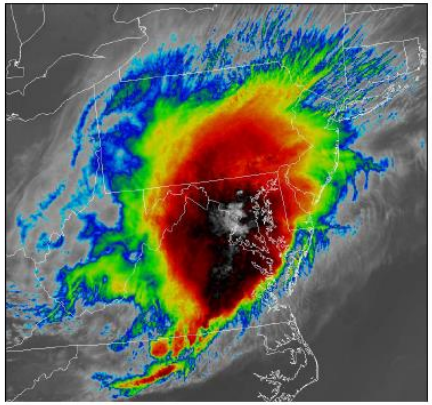
- Conditions under which a "utility death spiral" might occur include massive "customer defection"
- Combination of customer-sited solar and storage could reach "grid parity" in several states

FIGURE 2: OFF-GRID VS. UTILITY PRICE PROJECTIONS
RESIDENTIAL - BASE CASE
[Y-AXIS 2012$/kWh]



Source: RMI, The Economics of Grid Defection (2014)

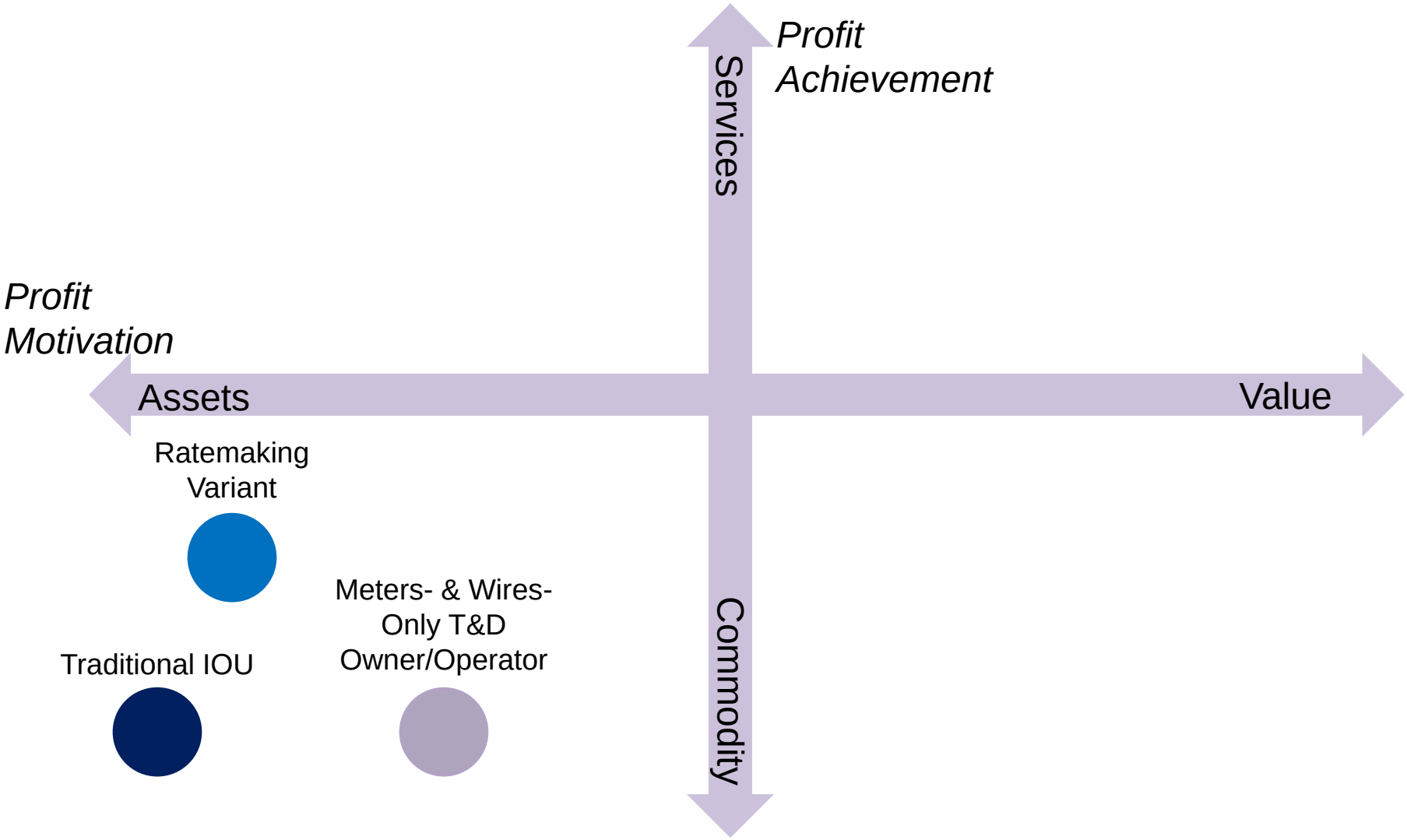
Crisis-Driven Changes to Utility Business Models



- Gov. Cuomo created Moreland Commission in response to extended power outages after Hurricanes Sandy & Irene
- Gov. O'Malley created this Task force after the "derecho" thunderstorms in the summer of 2012

What incremental changes to regulatory approaches and utility business models have been deployed?

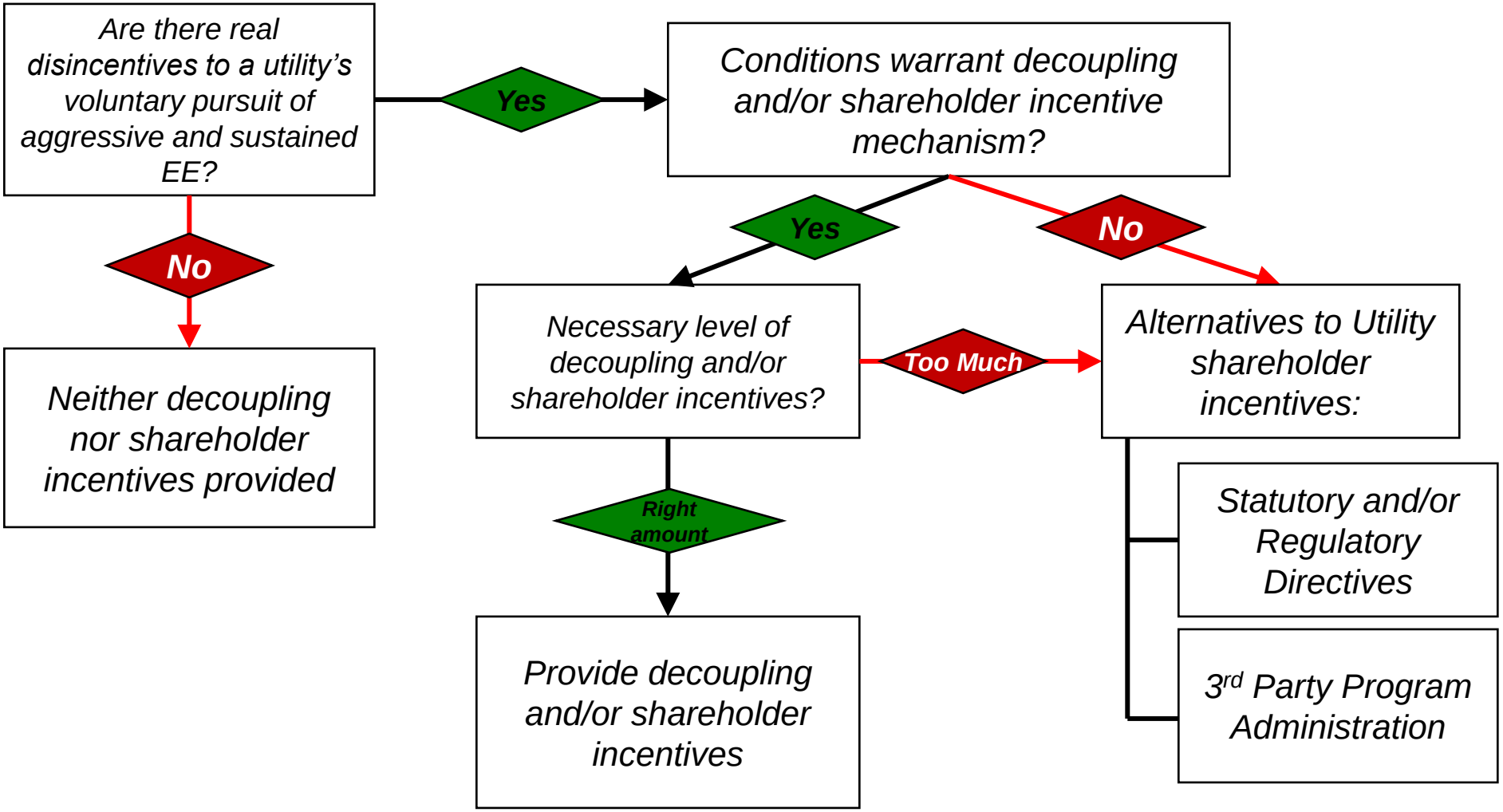
Alternative Regulatory and Electric Utility Business Models: Conceptual Overview



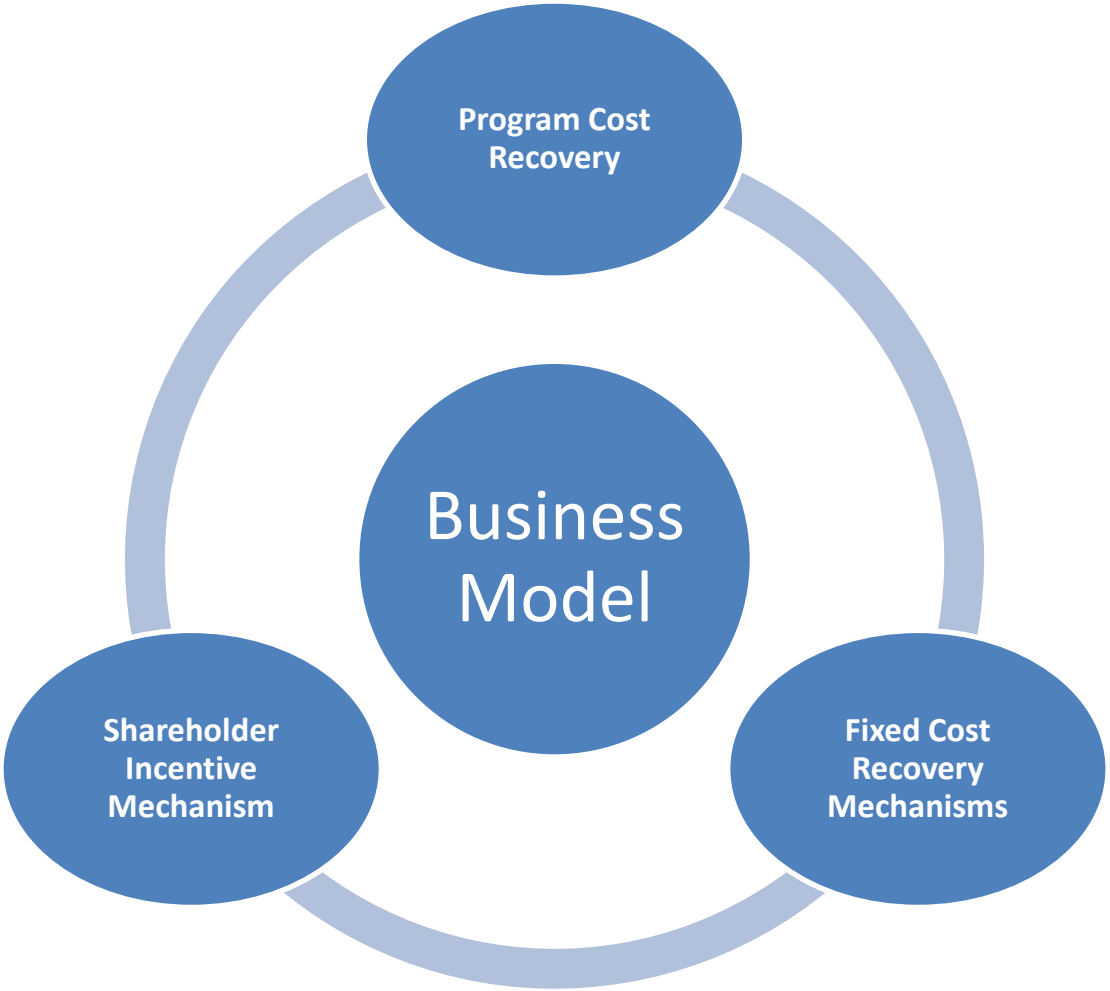
Hurdles to be overcome with Energy Efficiency

- Level of sales has direct impact on utility level of earnings under traditional regulatory framework
  - Utility earnings increase between rate cases if sales are greater than forecast
- Energy efficiency can defer the need for investment that provides the utility with a rate of return
  - Less money flowing into rate base compared to "business as usual"
- Existing corporate and regulatory institutions are slow to embrace change
  - Corporate culture, management/investor expectations, and regulatory inertia need to be overcome

Conceptual Framework to think about EE Business Models



“Three-legged stool” of EE business models



Possible Incremental Solutions

- Fix the way rates are designed
  - Allow for all fixed costs to be recovered through fixed charges and variable costs to be collected through variable charges
- Break the linkage between revenues and sales volume (decouple)
  - Allow for revenue requirement to be collected regardless of sales volume
- Incent utilities to undertake energy efficiency
  - Provide a financial incentive for utilities to achieve EE program goals
- Have an independent third-party develop and administer programs
  - Utilities no longer responsible for achieving EE savings goals

EE Business Model:

Common Lost Fixed Cost Recovery Approaches

- **Revenue-per-Customer (RPC) Decoupling**
  - Regulator establishes an amount of revenues the utility may collect from ratepayers on a per customer basis
  - Decline in sales may be a result of EE, or other factors (e.g., business cycle fluctuations, inaccurate forecasts)
  - Most common form of decoupling in the U.S.
- **Sales Decoupling (i.e., "Full Decoupling")**
  - Regulator establishes an amount of revenues the utility may collect from ratepayers on a per kWh basis
  - Decline in sales may be a result of EE, or other factors (e.g., business cycle fluctuations, inaccurate forecasts)
- **Lost Revenue Recovery (e.g., "Lost Revenue Adjustment Mechanism")**
  - Utility collects only the amount of lost revenues attributable to EE programs
  - Requires expensive and robust measurement and evaluation of EE program savings and often leads to contentious litigation

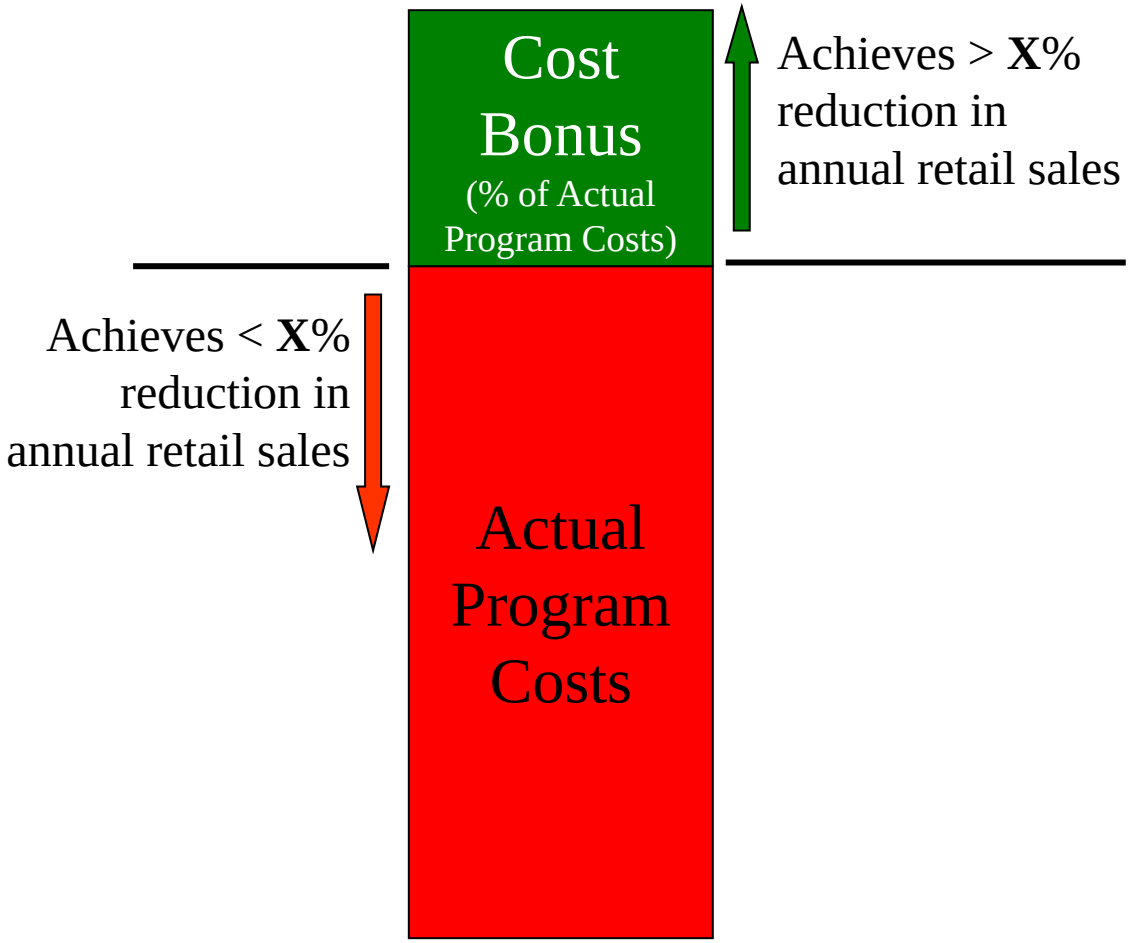
EE Business Model:

Common Shareholder Incentives

- **Performance Target**
  - Utility receives "performance-based incentive" of an additional X% of program costs if it achieves EE portfolio goals
  - Program costs and shareholder incentive are explicitly recovered through a tariff rider
- **Shared Net Benefits**
  - Utility retains X% of the PV of net forecasted total resource benefits from the portfolio of EE programs
- **Cost Capitalization**
  - Utility capitalizes the annual cost of the program over the first Y years of the lifetime of the installed measures
  - Authorized ROE is increased by B basis points for these EE investments

Performance Target Incentive Mechanism: Bonus

- Utility able to fully recover program costs
- As an incentive, utility is rewarded an additional % of total program costs
- Incentive level typically tied to achievement of energy (and/or demand) savings goals



LBNL scoping study on financial impacts of customer-sited PV on utilities and ratepayers

Impacts of Net-Metered PV Study: Project Scope and Objectives

- Scoping analysis of two prototypical investor-owned utilities:
  - characterize the scale of potential financial impacts of distributed solar on utility shareholders and customers
  - identify and explore key **sensitivities** and potential **mitigation** strategies
- Leverages LBNL pro-forma financial model of utility costs and revenues
  - Three metrics: changes in (1) achieved earnings, (2) return-on-equity, and (3) average retail rates
- Objectives
  - Help to frame, organize and inform ongoing discussions among policymakers, utilities, and stakeholders

Impacts of Net-metered PV Study: Structure of the analysis

Two "prototypical" investor-owned utilities

- Southwestern vertically integrated utility
- Northeastern wires-only utility and default service provider

Analytical elements

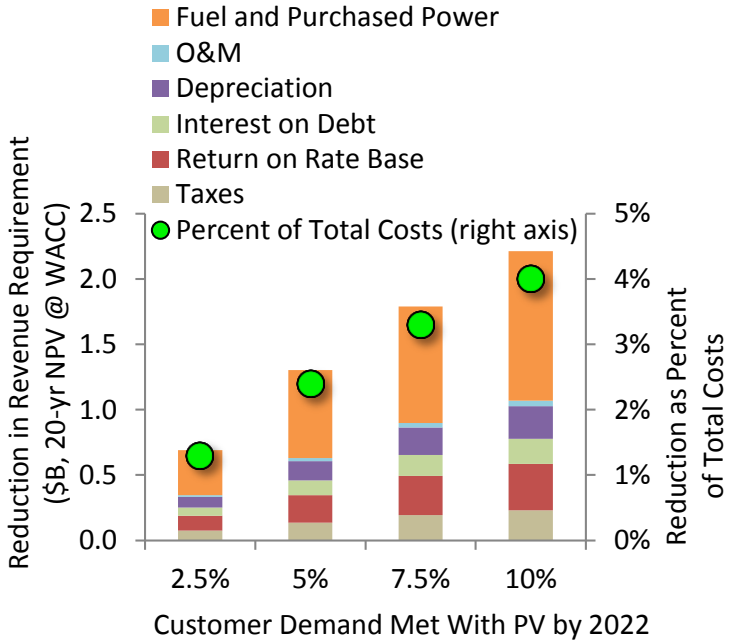
- **Base case**: A reference point against which sensitivities and mitigation measures can be measured
- **Sensitivity cases**: How do the impacts of PV depend on the utility operating and regulatory environment?
- **Mitigation cases**: To what extent can the impacts of PV be mitigated through regulatory and ratemaking measures?

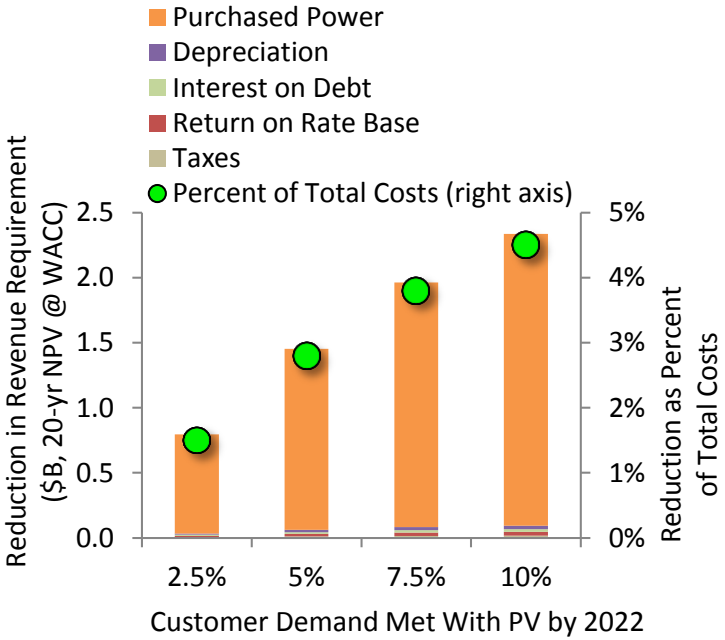
Key parameters of the analysis

- Distributed PV ramps up over 10 years, but utility costs and revenues modeled over 20 years to capture end-effects
- Consider range of PV penetration (2.5% to 10% of retail sales) in Base Case, while Sensitivity and Mitigation cases focus on 10% trajectory

Modeled utility cost reductions from PV

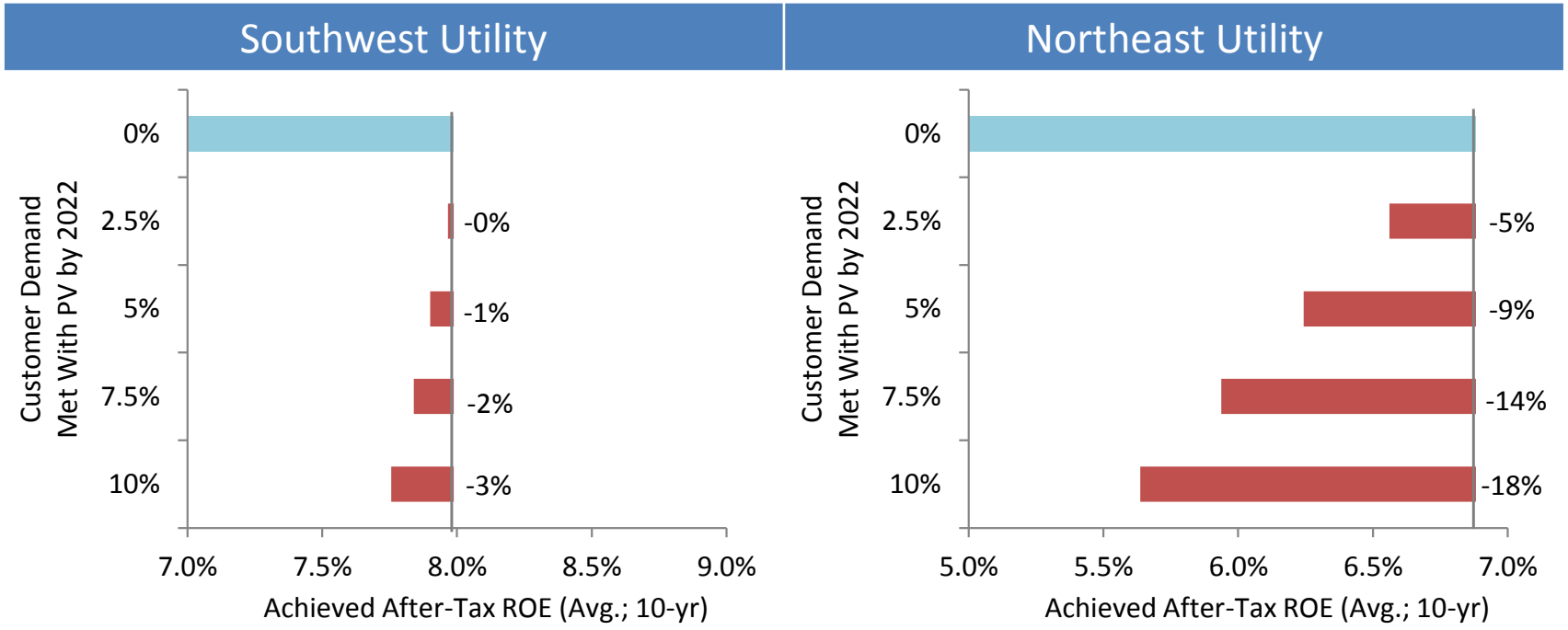
Southwest Utility	Northeast Utility





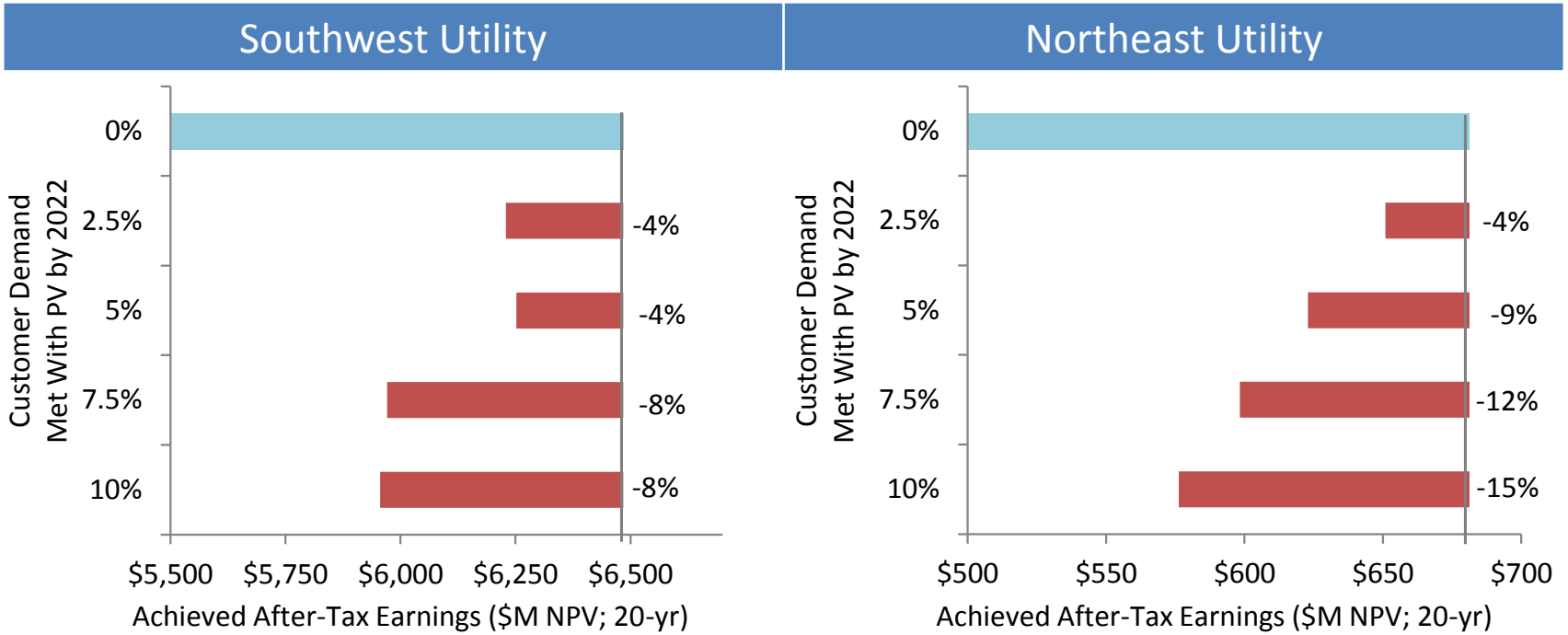
- Differences in composition of cost reductions between utilities are due to their differing cost structures: SW Utility owns generation while NE Utility procures all generation requirements via purchased power
- Assumptions related to deferral of generation and T&D investments, and to fuel and purchased power costs, are explored in sensitivity analysis

Under base-case assumptions, PV reduces achieved ROE



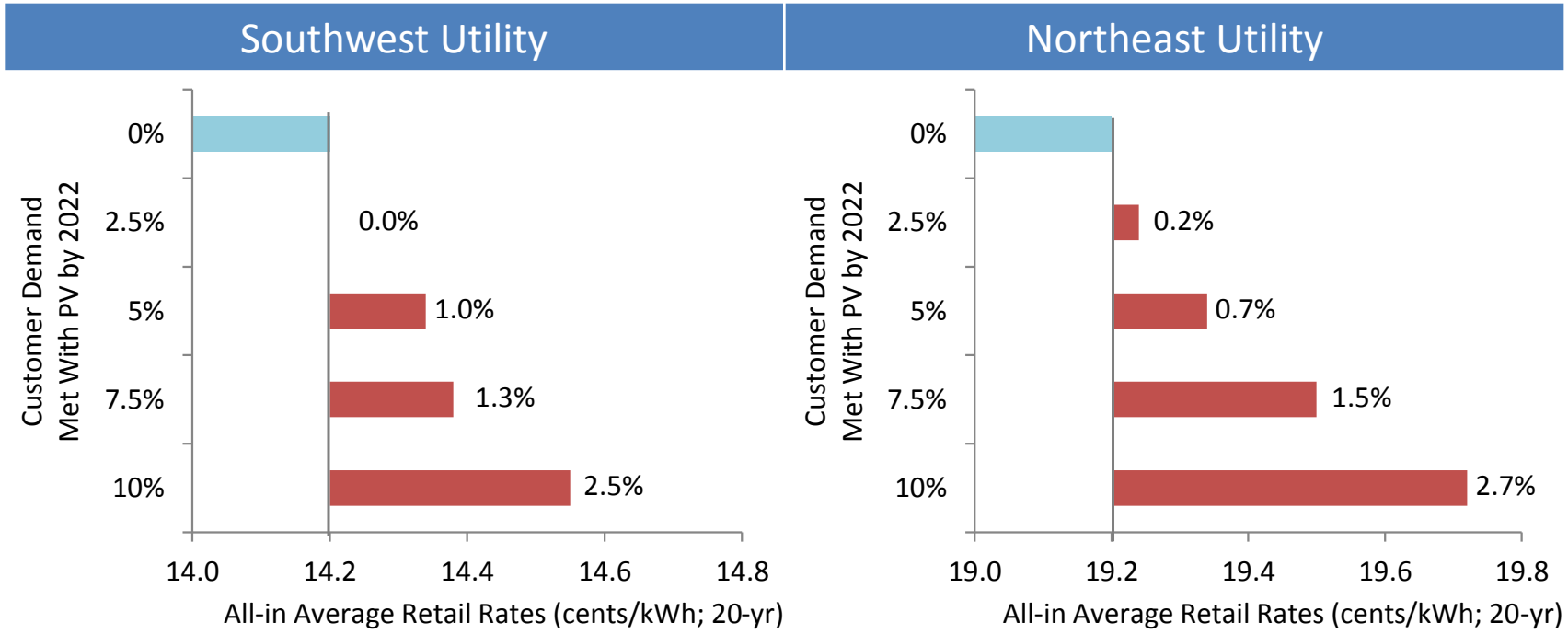
- Customer-sited PV reduces revenues by a greater amount than it reduces costs, leading to reduction in ROE ("revenue erosion effect")
- Impacts are larger for the NE utility, because of its higher assumed growth in fixed costs and its proportionally smaller rate base

Achieved earnings reduced by lost future investment opportunities



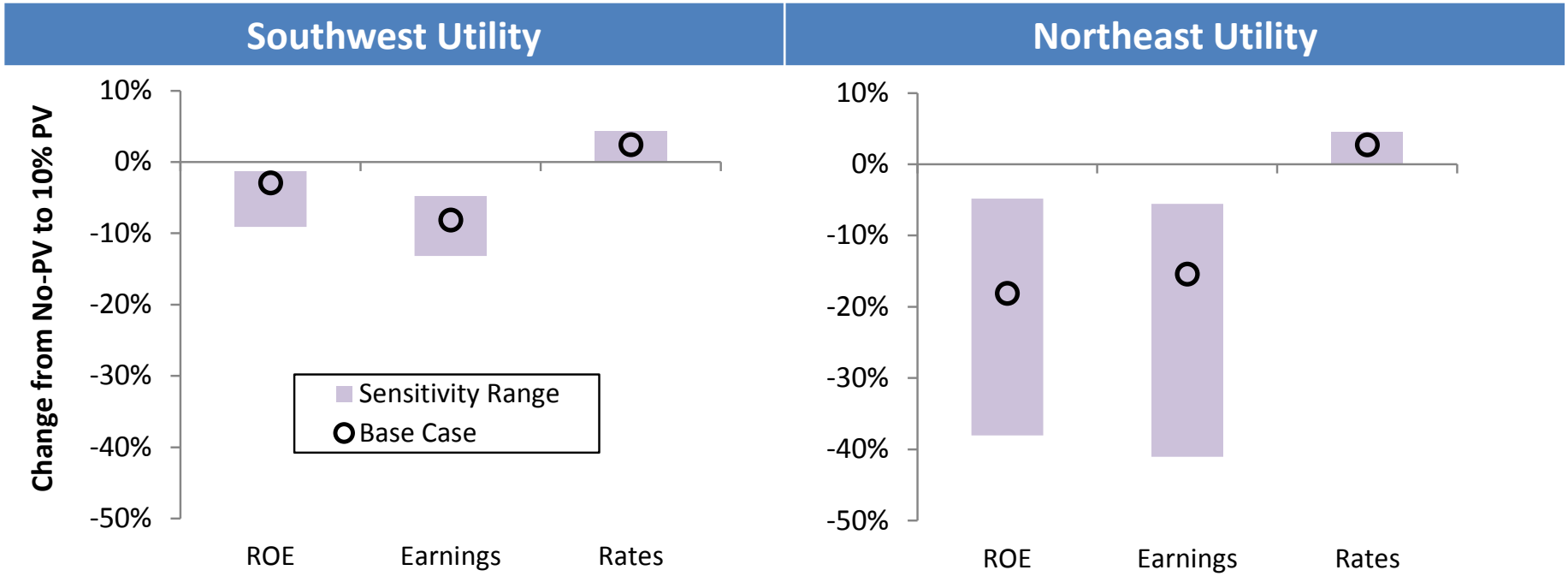
- PV reduces earnings as a result of both revenue erosion and also deferred capital investments ("lost earnings opportunity effect")
- Earnings impacts from deferred capital investments are most relevant to the SW Utility, which owns generation and transmission, though both utilities also experience earnings erosion from deferred distribution investments (in the base case)

Average customer rates increase slightly under base case assumptions



- Under base case assumptions, PV reduces sales and peak demand by a greater amount than it reduces costs, which causes average retail rates to increase
- Note, though, that these estimated rate impacts represent average impacts across all customers, thus do not directly measure cost shifting between PV and non-PV customers or for any individual customer class

Impacts depend on utility-specific conditions



**All sensitivity cases focus on impacts under 10% PV trajectory for illustrative purposes*

- Impacts are directionally consistent, but their magnitude varies widely
- Shareholder impacts (ROE and earnings) are particularly sensitive to utility operating and regulatory environment, especially for NE Utility
- Greatest sources of sensitivity vary by metric and utility: for NE utility, choice of test year and load growth causes large swings in shareholder impacts, but value of PV is key for ratepayer impacts

Mitigation analysis overview

Objective: Explore the efficacy and potential tradeoffs associated with regulatory and ratemaking measures for mitigating the impacts of PV

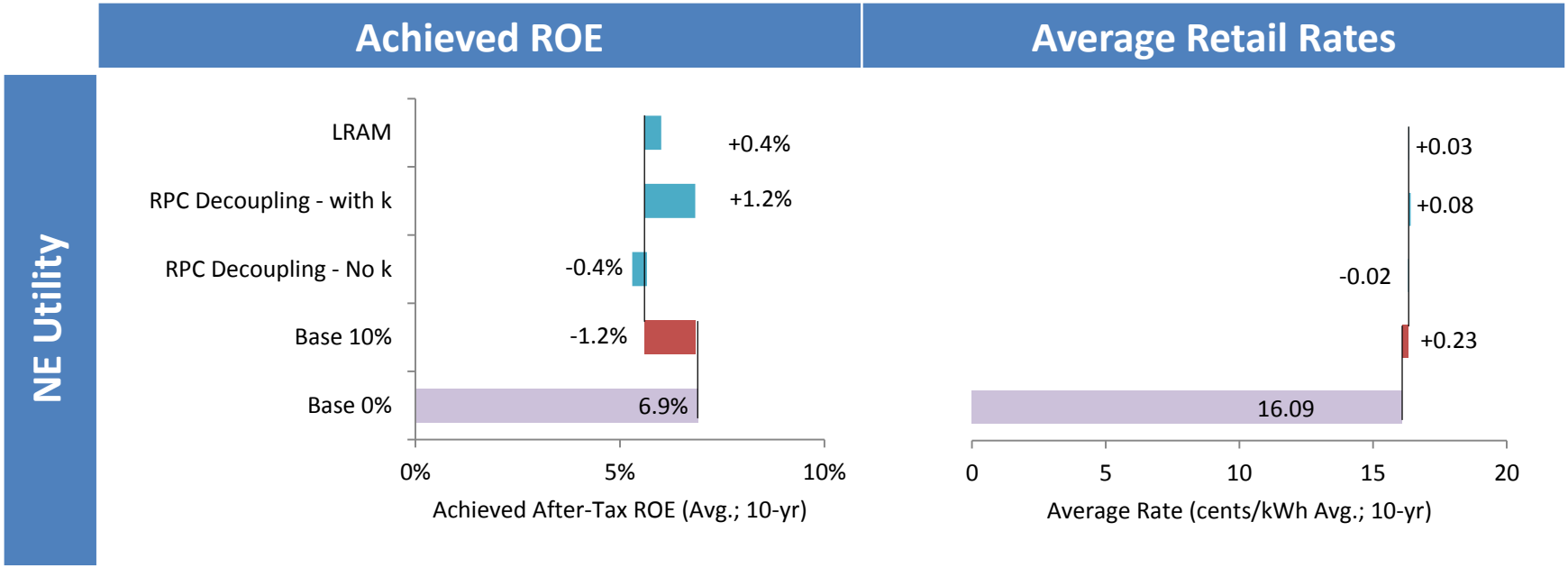
Mitigation Measure	Revenue Erosion	Lost Earnings Opportunities	Increased Rates
Revenue-per-Customer (RPC) Decoupling	●		○
Lost Revenue Adjustment Mechanism (LRAM)	●		○
Shareholder Incentive		●	○
Shorter Rate Case Filing Frequency	●		○
No Regulatory Lag	●		○
Current & Future Test Years	●		○
Increased Demand Charge & Fixed Charge	●		○
Utility Ownership of Customer-Sited PV		●	○
Customer-Sited PV Counted toward RPS			●

Example results

● Primary intended target of mitigation measure
○ May exacerbate impacts of customer-sited PV

- Mitigation scenarios borrow from measures implemented with energy efficiency programs, though are not an exhaustive set of options
- Mitigation analysis focuses on impacts under 10% PV trajectory, for illustrative purposes

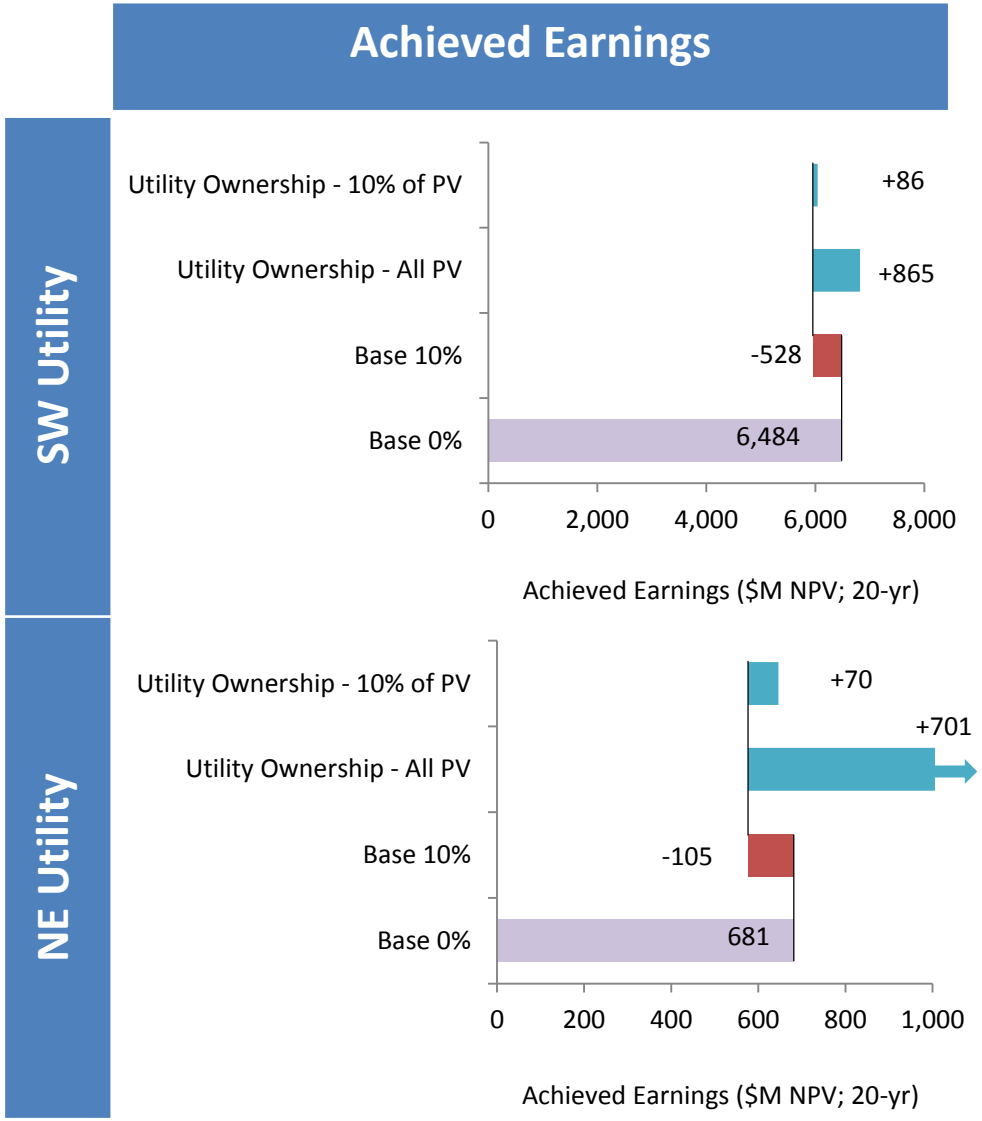
Decoupling and LRAM mitigate revenue erosion effect



- RPC decoupling and LRAM mitigate revenue erosion impacts from customer-sited PV, thereby improving ROE, but degree of mitigation varies by utility and depends on design (e.g., k-factor)
- Mitigation of shareholder impacts in these cases necessarily entails an increase in average retail rates, illustrating one form of tradeoff

Utility ownership of PV may provide substantial earnings opportunities offsetting the impacts

- Utility ownership and capitalization of customer-sited PV provides increased earnings, offsetting most or all the financial impacts to shareholders
- NE Utility could see substantial increases in earnings by investing in customer-sited PV
- Utility ownership or financing of customer-sited PV may raise significant policy and/or regulatory issues around risk sharing, competition, and generation asset ownership



What fundamental changes to regulatory approaches and utility business models are being considered?

Incremental changes to existing utility business model: Are they sufficient and sustainable?

Shareholder incentives

Lost fixed cost recovery

Rate base PV investments

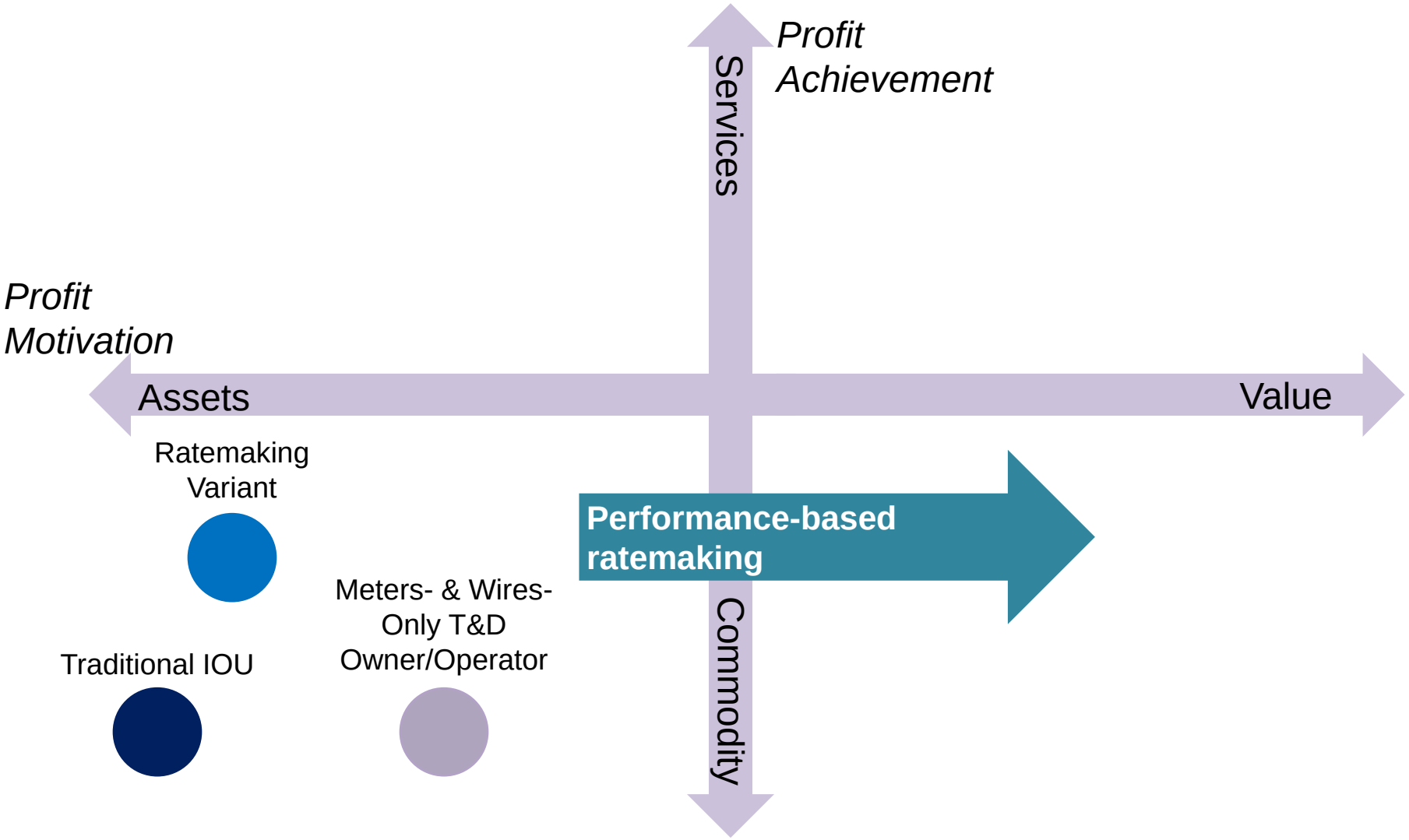
Retail rate design changes

Profit from wholesale off-system sales

Regulatory paradigms and utility business models depend upon…

Profit Motivation	Assets	Value
Profit Achievement	Sales	Services
Market structure/Scope of asset ownership	Vertical integration	Retail competition
Role of utility in providing value-added services	Utility provides value-added services	Utility does **not** provide value added services
Degree to which utility networks are “open” and “accessible” to third parties	“Open” and “accessible”	“Closed” and “inaccessible
Risk to utility shareholders, customers and non-utility service providers	Less risk	More risk

Alternative Regulatory and Electric Utility Business Models: Conceptual Overview



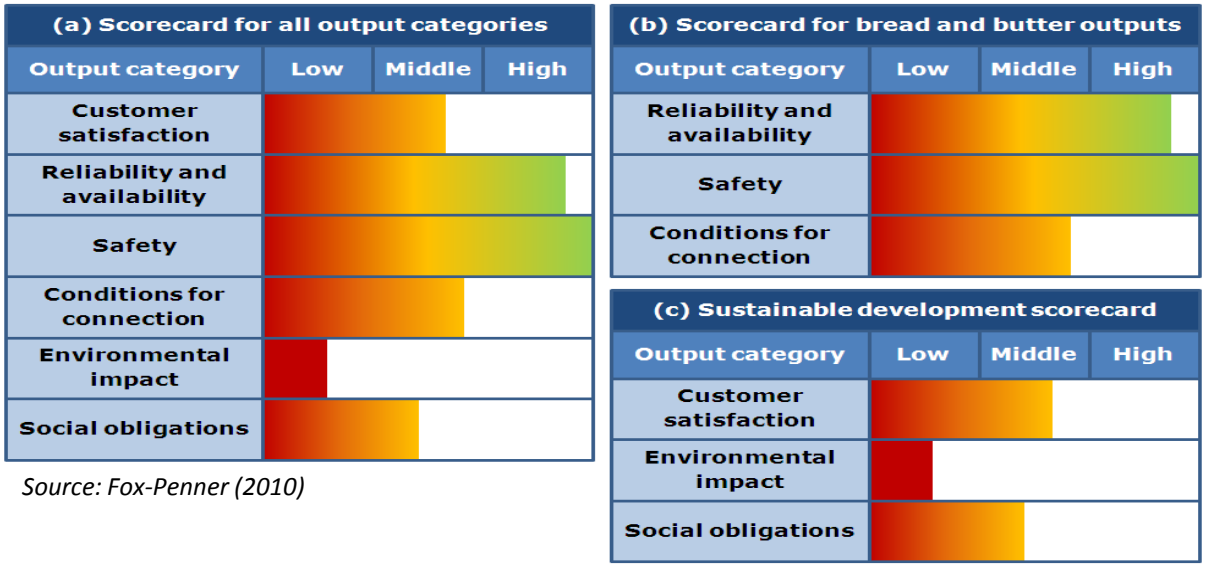
UK Approach to PBR: RIIO

RIIO → Revenue = Incentives + Innovation + Outputs

- A "Regulatory Contract" – Measure of certainty for investors and consumers
- 8 Year up-front price control regime with elaborate system of incentives, penalties and adjustment mechanisms to account for uncertainties
- Regulator sets outputs that reflect what consumers want and enables a sustainable energy sector
- Similar to US, UK faces large future investments: £32 Billion in next decade or twice the historical pace of investments

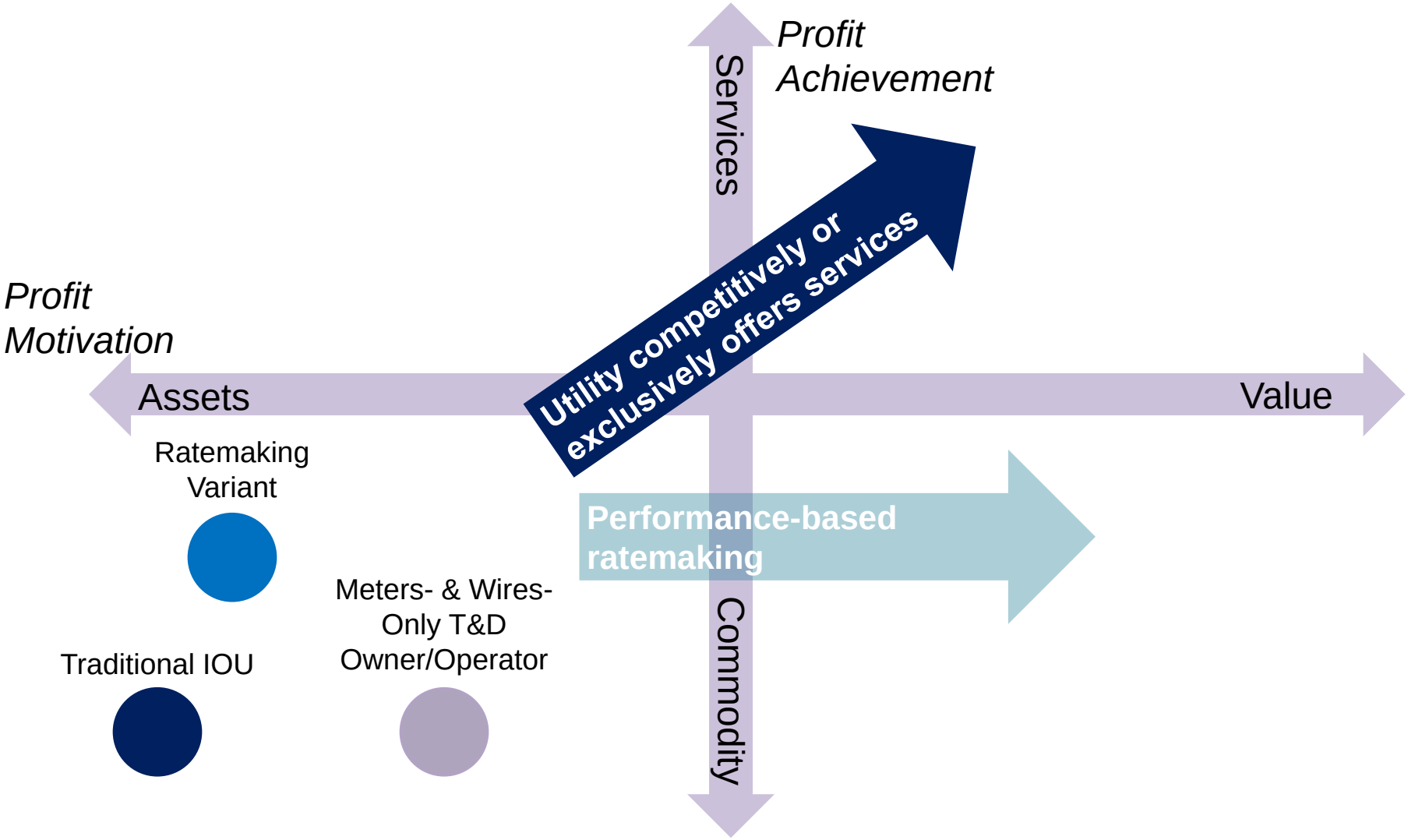
UK Approach under RIIO:
Role of the Regulator (Ofgem)

- Significant role of the regulator in multiple parts of the process
  - Regulator sets primary outputs and baseline performance, reviews and approve business plans, performs inspections, and ultimately decides on incentives and penalties to be awarded
  - May revoke distribution company (DISTCO) license to operate
- Ofgem will develop a report card for performance of all 14 DISTCOs

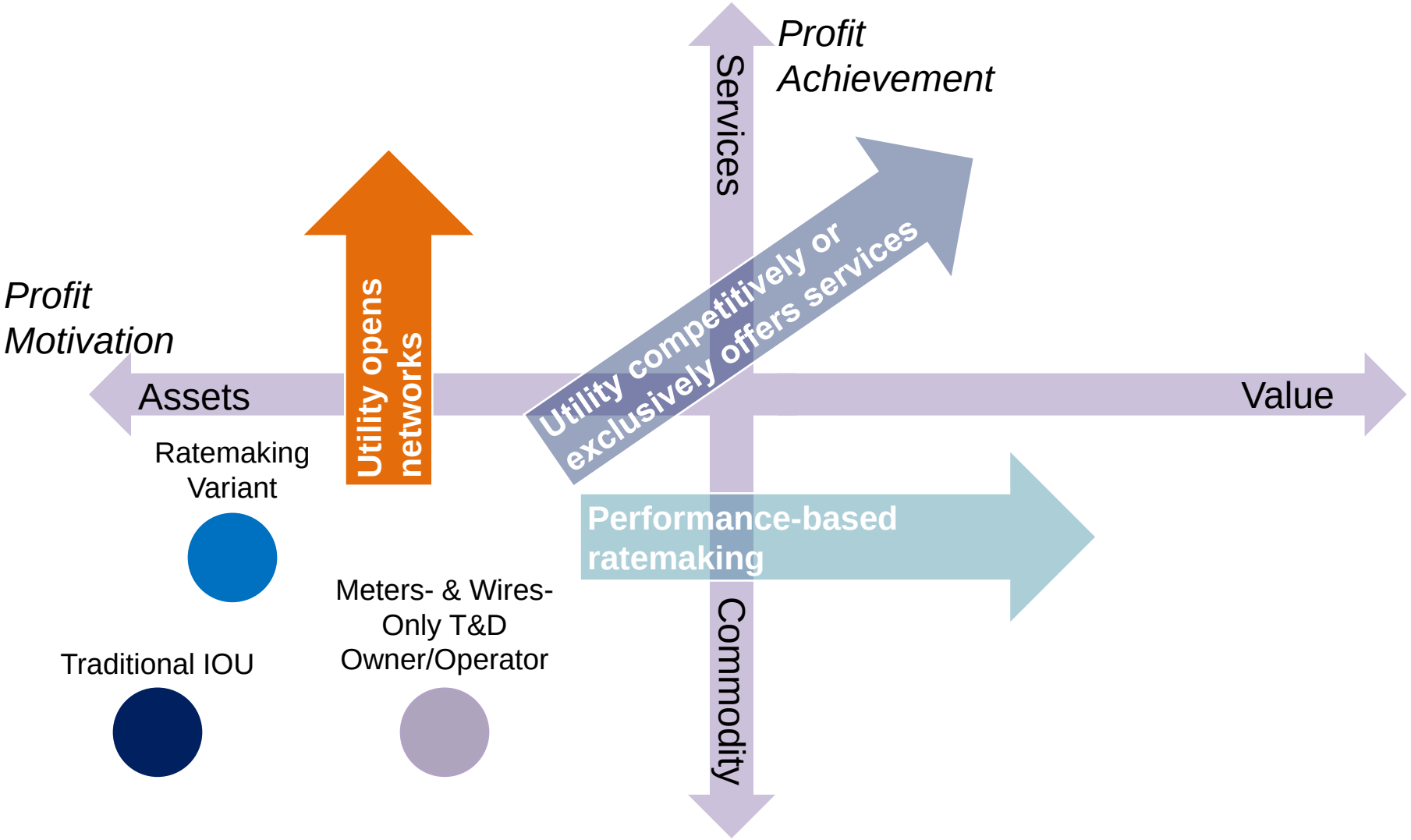


Source: Fox-Penner (2010)

Alternative Regulatory and Electric Utility Business Models: Conceptual Overview



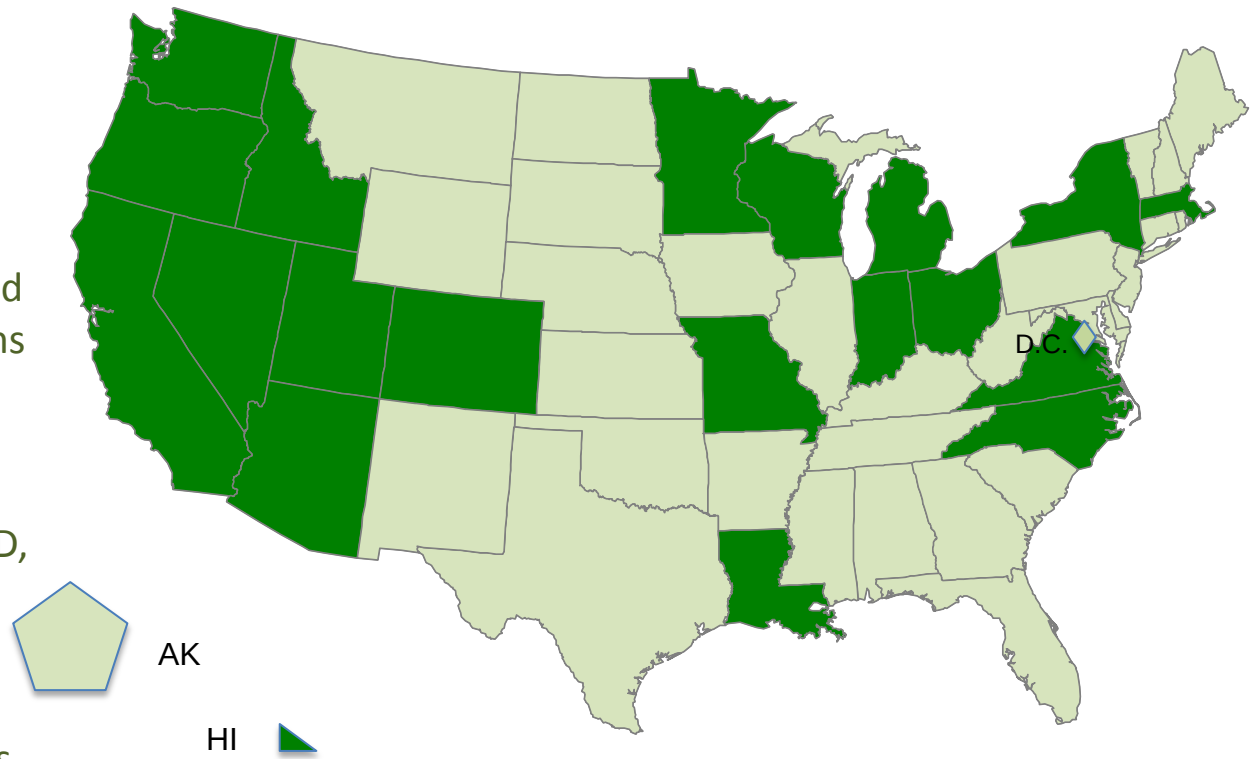
Alternative Regulatory and Electric Utility Business Models: Conceptual Overview



How are states addressing challenges to utility business models within existing frameworks?

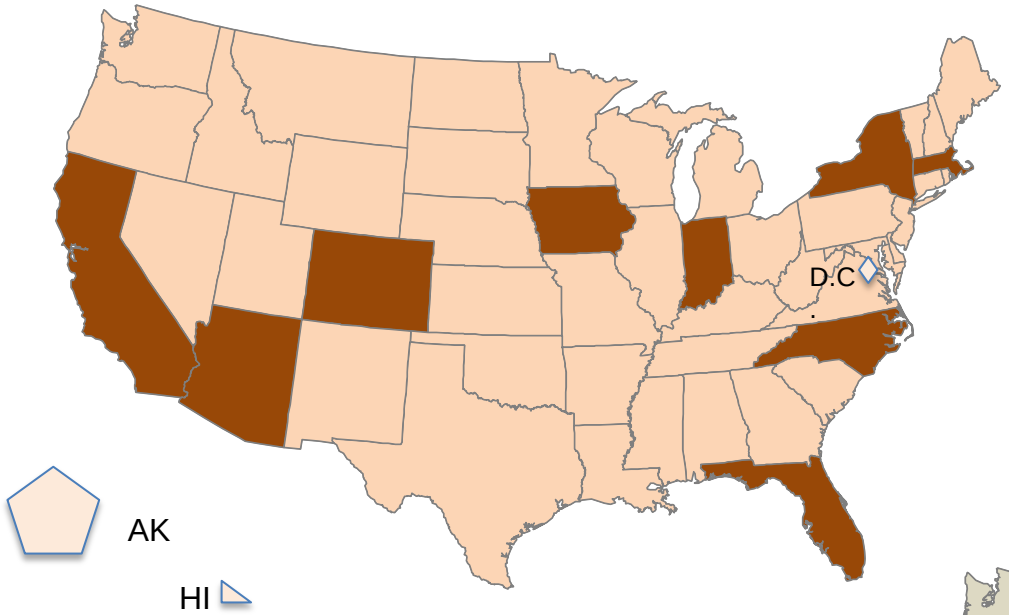
Rate design

- Several states are considering changes to rate design and compensation mechanisms for DG, including:
  - increasing fixed charges and other proposed rate designs intended to address cost-shifting from DG participants to non-participants (e.g., AZ, CA, ID, WI)
  - DG compensation mechanisms, like net metering and feed-in tariffs (e.g., CA, HI, IN, LA, MN)
  - time-varying rates (e.g., CA, MA)



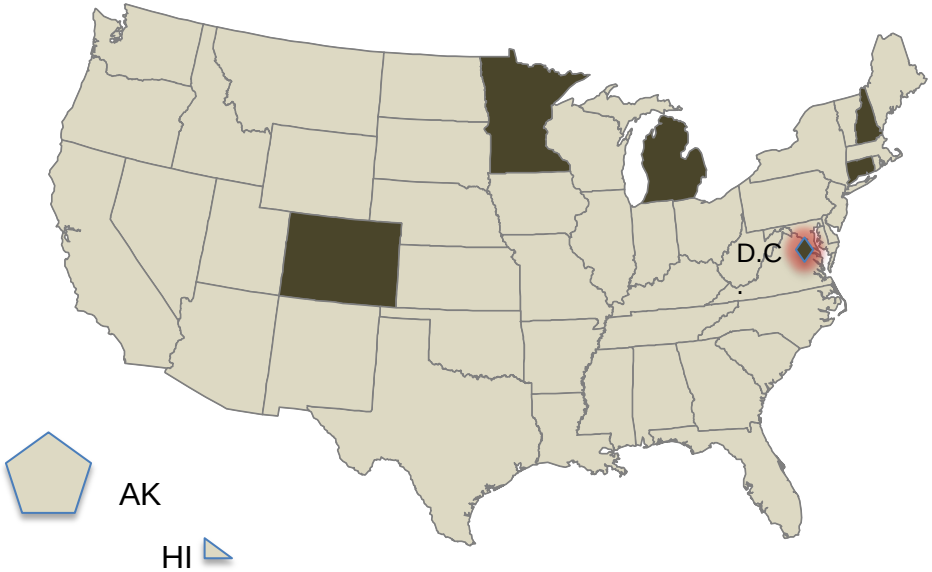
Source: e9 Insight analysis for LBNL

Utility and community ownership of DG



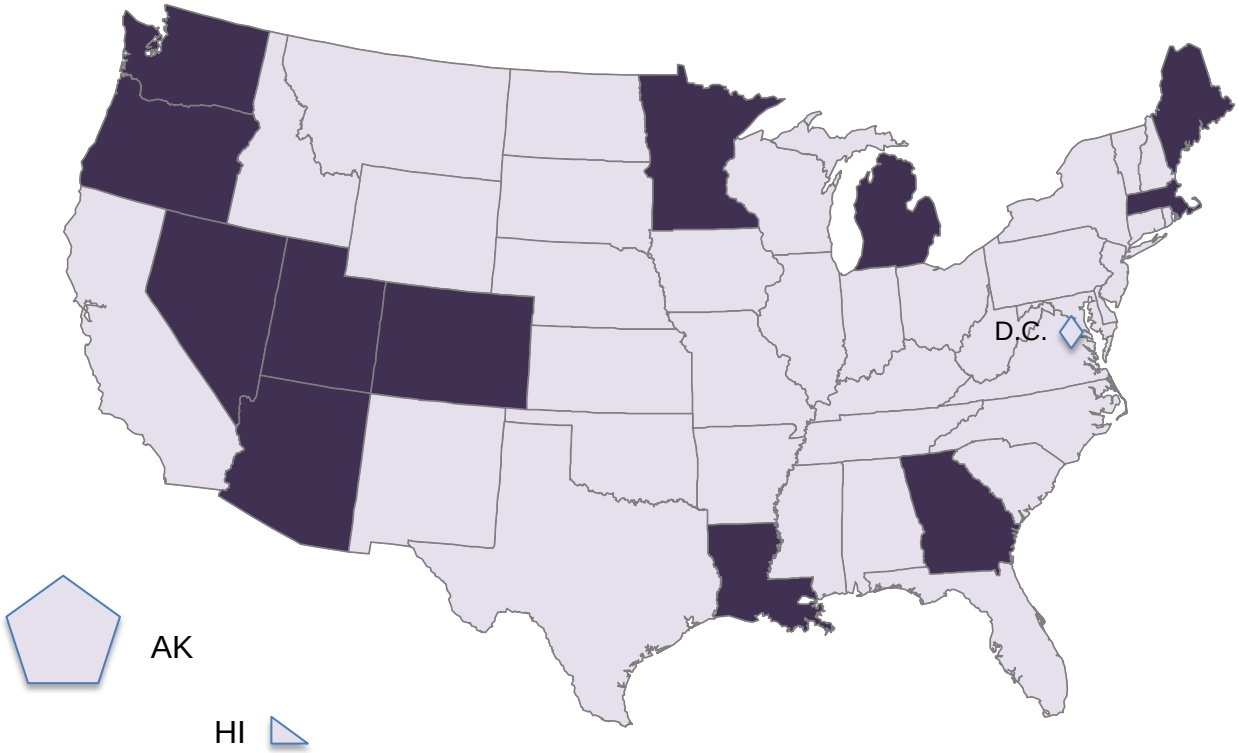
Proposals for utility ownership of distributed solar, both on utility and customer side of the meter

Proposals for shared solar, community ownership, and aggregated net metering



Source: e9 Insight analysis for LBNL

Valuation of DG



- New or updated methods to assess the value of DG (i.e., costs and benefits)
- Largely focused on methodology and has implications for program rules and compensation mechanisms
- Typically involves a financial analysis of changes in participant and non-participant bills and/or power engineering studies at distribution system-level

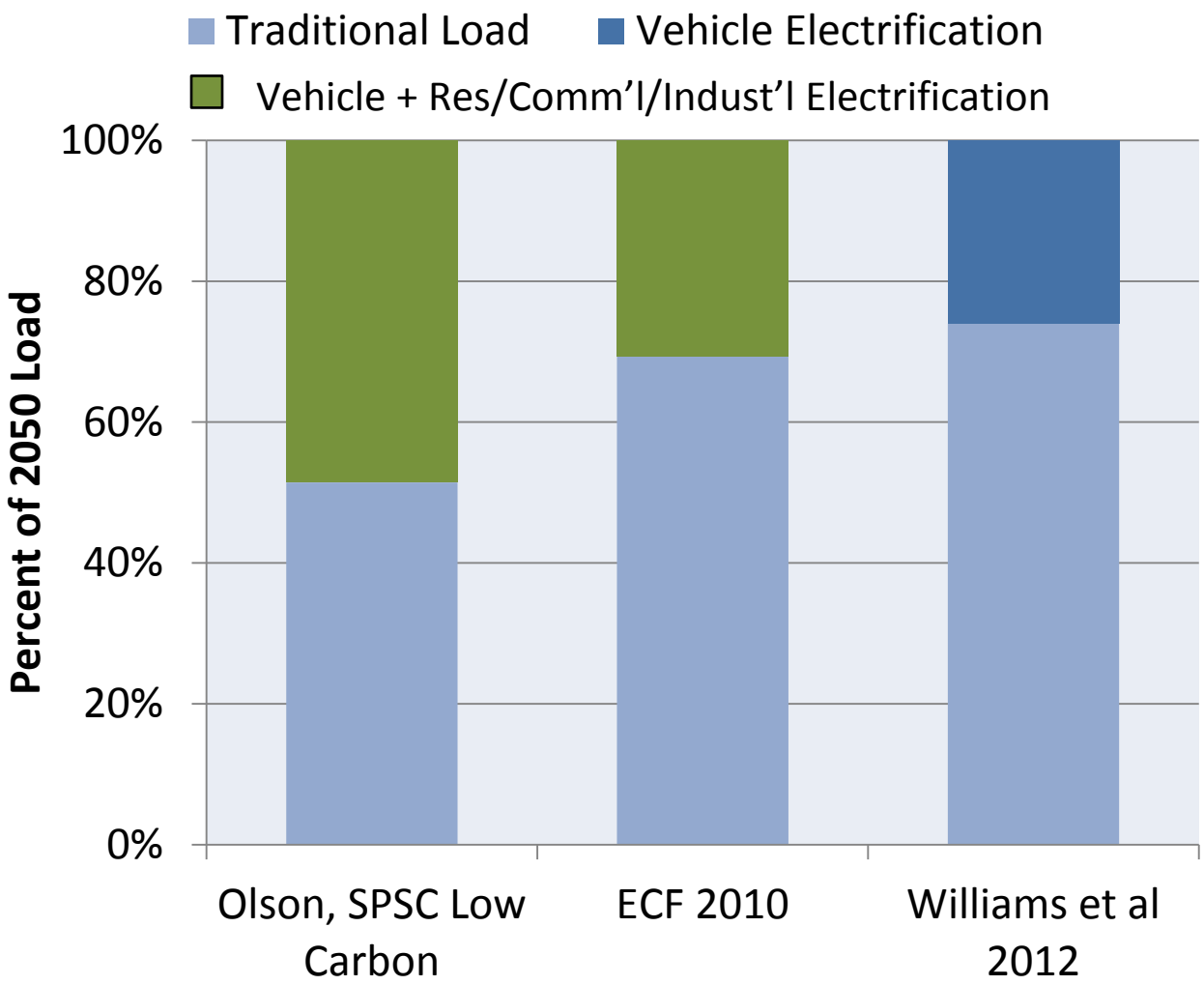
Source: e9 Insight analysis for LBNL

Concluding thoughts

Under What Conditions will Utility Propose Significant Changes to its Business Model?

- Utilities likely to pursue other (incremental) strategies to mitigate "threats" to their business model/revenues (e.g., high customer charges, limit net metering) before proposing fundamental changes to regulatory compact
- Many proposals would require a fundamental change to the regulatory compact and natural monopolies
  - What situations would prompt such changes?
    - Crisis and catastrophic events
    - Financial "Death spiral" for utility
  - Do we want utilities to still OWN, MANAGE and OPERATE distribution systems?
  - Relative merits and "characterization" of alternative business models (e.g., "government-run" utilities)

Electrification of Transport and Fuel Switching Could Significantly Increase Electric Loads Over Long Term



Sources: Olson (2012); ECF (2010); Williams et al. (2012)

- **Uncertainty in adoption of electric vehicles and market growth**
- **Fuel switching may be limited to only certain end-uses**

Utility Regulation in 2030?

- Regulatory models likely to vary significantly among states
  - Likely to see more examples of incremental changes to cost-of-service regulation and some states that explore more fundamental changes to utility regulation
- Appropriate roles for Legislatures vs. state commissions (and federal regulators/govt) in electric power sector??
  - Articulating and balance among public goals for electric sector (e.g. universal, reliable, and affordable service, customer choice, and environmentally sustainable)
  - Facilitate technology and service innovation
  - Ask hard questions of your utilities

Questions/Comments

Chuck Goldman

Phone: (510) 486-4637

Email: CAGoldman@lbl.gov

Resources: LBNL Publications

LBNL – EE Business Model Quantitative Financial Analysis

- Satchwell, A., P. Cappers, and C. Goldman (2011). "Carrots and Sticks: A Comprehensive Business Model for the Successful Achievement of Energy Efficiency Resource Standards." Utilities Policy; Volume 19, Number 4 (218-225).
- Cappers, P., A. Satchwell, C. Goldman, and J. Schlegel (2010). "Benefits and Costs of Aggressive Energy Efficiency Programs and the Impacts of Alternative Sources of Funding: Case Study of Massachusetts." LBNL-3833E. August.
- Cappers, P. and C. Goldman (2009). "Empirical Assessment of Shareholder Incentive Mechanisms Designs under Aggressive Savings Goals: Case Study of a Kansas 'Super-Utility.'" LBNL-2492E. August.
- Cappers, P., C. Goldman, M. Chait, G. Edgar, J. Schlegel, and W. Shirley (2008). "Financial Analysis of Incentive Mechanisms to Promote Energy Efficiency: Case Study of a Prototypical Southwest Utility." LBNL-1598E. March.
- Cappers, P., C. Goldman, M. Chait, G. Edgar, J. Schlegel, and W. Shirley (2008). "Quantitative Analysis of Alternative Energy Efficiency Shareholder Incentive Mechanisms." LBNL-2590E. August.

LBNL – DER Valuation and Business Model Quantitative Financial Analysis

- Satchwell, A., A. Mills, G. Barbose, R. Wiser, P. Cappers, and N. Darghouth (2014). "Financial Impacts of Net-Metered PV on Utilities and Ratepayers: A Scoping Study of Two Prototypical U.S. Utilities." September.
- Mills, A. and R. Wiser. (2014) "Strategies for Mitigating the Reduction in Economic Value of Variable Generation with Increasing Penetration Levels." LBNL-6590E. March.
- Darghouth, N., G. Barbose, and R. Wiser (2013). "Electricity Bill Savings from Residential Photovoltaic Systems: Sensitivities to Changes in Future Electricity Market Conditions." LBNL-6017E. January.
- Darghouth, N., G. Barbose, and R. Wiser (2012). "The Potential Impact of Increased Renewable Energy Penetration Levels on Electricity Bill Savings From Residential Photovoltaic Systems." LBNL-6188E. November.

LBNL – Future Regulatory and Utility Business Models

- Schwartz, L., P. Cappers, A. Satchwell, and C. Goldman (Forthcoming). "A Typology of Current and Future Electric Utility Regulatory and Business Models"

Presentations

- California Municipal Utilities Association Annual Conference. April 2, 2014. Utility Business Models in a Low Load Growth/High DG Future. Napa, CA
- Legislative Energy Horizon Institute. October 24, 2013. State/Province Regulation in 2030: Gazing Into the Crystal Ball? Washington, D.C.
- CA Energy Efficiency Industry Council's Member Forum. September 17, 2013. Utility Business Models in a Low Load Growth/High DG Future. San Francisco, CA.
- NGA Policy Institute. September 11-12, 2013. Emerging Ideas to Modernize Utility Business Models. Denver, CO
- NARUC Summer Committee Meeting. July 23, 2013. Utility Business Models in a Low Load Growth/High DG Future. Denver, CO.
- WIEB Committee on Regional Electric Power Cooperation/State-Provincial Steering Committee Meeting. April 10, 2013. Utility Business Models in a Low Load Growth/High DG Future: Gazing Into the Crystal Ball? Boise, ID.