Integrating Energy Efficiency into the Distributed Energy Resource Mix

Marilyn Brown

Brook Byers Professor of Sustainability

School of Public Policy

Georgia Institute of Technology

Collaborators:

Ben Staver & Alex Smith (Georgia Tech)

John Sibley (Southface Energy Institute)

THE AGILE UTILITY: ALIGNING DISTRIBUTED GENERATION WITH CONSUMER DEMAND

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Southface

http://www.southface.org/

Georgia Institute of Technology

Background: Challenges to the Traditional Utility Business Model

- Recent trends are challenging the traditional cost-of-service utility business model:
  - Technologies
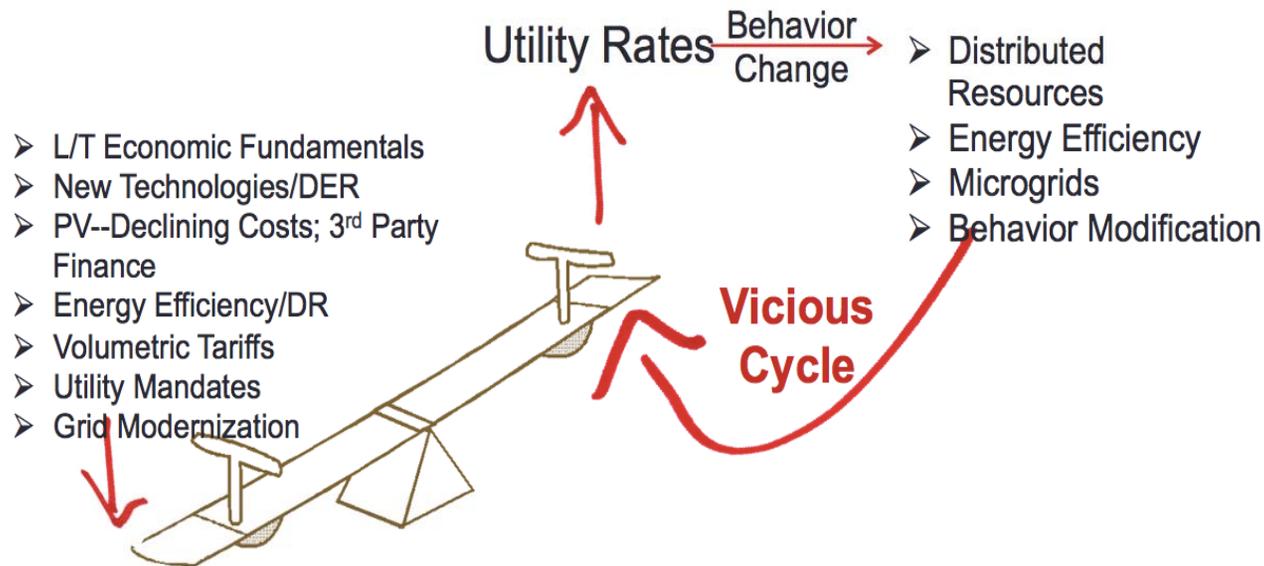 - Economics
  - Policies

Vicious or Virtuous Cycle?

- These trends ("disruptive threats") are placing upward pressure on utility rates:

- Are alternative business models needed?

Source: Peter Kind (2013). *Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business*. Edison Electric Institute.

Origins of our Research Project

- **Project goal:** develop a tool to illuminate the impacts of ratepayer-funded EE programs and advance the debate on best utility business practices

- What are the pros and cons of different approaches to allocating the costs and benefits of ratepayer-funded energy-efficiency (EE) programs.

Methodology

- Review business models in the Southeast and define a "prototypical" approach that uses three features:
  - the recovery of program costs,
  - the treatment of lost contributions to fixed costs, and
  - the provision of utility incentives.
- Compile public data on a "stereotypical" southeastern utility and EE program.
- Use GT-DSM to examine the prototypical approach
  - GT-DSM and its manual can be downloaded at:
  http://cepl.gatech.edu/drupal/node/69

The Prototypical Approach Used in the Southeast

- The prototypical approach is highlighted below for each "leg" of the three-legged stool:

- Straight Fixed Variable Rate
- *Lost Revenue Adjustment Mechanism*
- Per Customer Decoupling

Decoupling utility profits from electricity sales

Provision of Performance Incentives

Recovery of Program Costs

- *Shared Savings based on PAC test*
- Shared Savings based on TRC test
- Return on Program Costs

- Amortized w/ carrying cost
- *Expensed and Recovered Contemporaneously*

Examples in the Southeast

	Business Model Feature	Extent of Usage in the Southeast
Recovery of Program Costs	Amortized with a Carrying Cost	Not used by southeastern electric utilities
	Expensed and Recovered Contemporaneously	General practice across the Southeast
Decoupling Utility Profits from Electricity Sales	Straight Fixed Variable Rate	Used by some gas utilities in the Southeast but not used by southeastern electric utilities
	Lost Revenue Adjustment Mechanism	Arkansas, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Virginia
	Per Customer Decoupling	A number of states in the U.S., but none in the Southeast
Provision of Performance Incentives	Shared Savings based on net benefits from the Program Administrator Cost (PAC) test	Georgia, North Carolina, and South Carolina
	Shared Savings based on net benefits from the Total Resource Cost (TRC) test	Arkansas and Kentucky
	Return on Program Costs	Virginia

GT-DSM

- ## The GT-DSM model is laid out in three Sectors:

  - The Customer Sector focuses on the electricity rate and utility bill and how an EE program affects them. Residential and commercial programs can be modeled, either as bundled programs or as individual programs.

  - The Utility Sector focuses on the revenues and costs to the utility and how an EE program affects those revenues and costs. Three modules: the Performance Incentive Module, the Deferred Capital Investment Module, and the Rate Case Module.

  - The Cost-Benefit Analysis (CBA) Sector produces estimates of four of the standard cost-effectiveness tests for utility-operated EE programs that account for different stakeholder perspectives to energy efficiency.

The GT-DSM Model is Laid Out in Three Sectors

Customer Sector:
- Impact of EE program on electricity rate and utility bill.
- Two types of rate classes (Residential & C/I)
  - Bundled programs or individually

Utility Sector:
- Impact of EE program on revenues and utility costs.
  - Performance incentive
  - Deferred capital investment
  - Rate case

Cost-Benefit Analysis Sector:
- Estimate for four standard cost-effectiveness tests
  - Utility-operated EE programs
  - Alternate stakeholder perspectives for EE

The "Stereotypical" Southeast Utility

- Based on public filings describing the Georgia Power Company in 2012 and the energy-efficiency programs proposed by the company in its 2013 IRP filing.
  - The Georgia Power Company is the largest utility in Georgia. We do not purport to replicate it in GT-DSM.
  - Serves 2.4 million customers, with annual sales of 81.1 TWh and a peak demand of 15.4 GW. The number of customers is expected to grow by 1.0% per year, and sales and demand are expected to grow 1.24% annually. Annual earnings are $1.2 billion based on an 11.25% return on equity from a rate base of $19.5 billion.
  - Fuel and purchased power costs are assumed to increase by 6.5% per year. Major capital investments are programmed over the next several years to build out new baseload capacity, make environmental retrofits, and improve transmission and distribution facilities.

The "Stereotypical" Southeast Utility (cont.)

- Average rates are 12 ¢/kWh for residential customers and 8 ¢/kWh for commercial and industrial customers.
  - Residential rates are collected through volumetric charges.
  - The commercial and industrial rate includes a volumetric charge of 6 ¢/kWh, plus a demand charge, equal to $10/kW in the first year.
- The utility has a peak cost period of 2-7pm on weekdays from June to September. This represents roughly 3.7% of the year. Rate cases are filed every three years.
- The capital structure is 54% equity and 46% debt, with a cost of debt of 4.2%. The weighted average cost of capital is 8%.

The Portfolio of Residential EE Programs

- A collection of programs:
  - The end-use specific programs include lighting, air conditioning, and other large home appliances.
  - The whole home programs cover both existing and new homes and generally include insulation and select large appliances.
  - Annual costs of $8.3 million for incentives and $9.8 million for administrative costs.
  - Set to save 57.8 GWh and 10.2 MW annually for each year of the measure and program lifetimes.
  - Average measure life is assumed to be 10 years.
  - 8% of the residential energy-efficiency program savings occur during the utility's peak period, much more than the roughly 3.7% of the year that occurs during the peak.

The Portfolio of Commercial EE Programs

- Targets both small and large commercial buildings.
  - The small commercial program includes appliances, lighting, and insulation.
  - The other commercial programs are from either a long list of prescriptive facility improvements or from a custom built incentives program.
  - Annual costs of $13.7 million for incentives and $5.5 million for administrative costs.
  - Designed to save 241 GWh and 55.3 MW annually for each year of the measure and program lifetimes.
  - The average measure life is assumed to be 15 years. Since the programs are proposed to deploy measures for 10 years and the measures are assumed to operate for 15 years, our analysis of the impacts of these programs extends for 25 years.
  - 10% of program savings are during the utilities peak period, which is more than for the residential program and also much more than the roughly 3.7% of the year that constitutes the peak.

Results

The Impact of Commercial EE Programs

	Utility Economics		Customer Economics		
	Cumulative Earnings in $Billions	Return on Equity (%) (25-Year Average)	Average Commercial Energy Bill ($/year)	Participant Energy Bill ($/year)	Non-participant Energy Bill ($/year)	Average Commercial Energy Rate (¢/kWh)
Utility Without EE Programs	47.02	11.46	28,107	NA	NA	12.37
+ Commercial EE Programs	45.22	11.04	26,747	22,293	28,070	12.35
+ Program Cost Recovery & Shared Savings Incentives	45.51	11.10	26,782	22,322	28,106	12.37
+ Prototypical Business Model	46.79	11.41	27,015	22,516	28,351	12.50

- Utility economics can be hurt by EE programs, but all customers can benefit.
- The prototypical business model restores 99.7% of utility earnings, but rates rise by 1.0%. ROE exceeds authorized level of 11.25%.
- Rates still lowered after recovery of program costs and incentives.

The Impact of Residential EE Programs

	Utility Economics		Customer Economics			
	Cumulative Earnings in $Billions	Return on Equity (%) (25-Year Average)	Average Residential Energy Bill ($/year)	Participant Energy Bill ($/year)	Non-participant Energy Bill ($/year)	Average Residential Energy Rate (¢/kWh)
Utility Without EE Programs	47.02	11.46	2,533	NA	NA	19.23
+ Residential EE Programs	45.84	11.18	2,484	2,343	2,533	19.22
+ Program Cost Recovery & Shared Savings Incentives	45.98	11.22	2,488	2,346	2,537	19.25
+ Prototypical Business Model	46.88	11.43	2,511	2,367	2,560	19.42

- Utility economics can be hurt by EE programs, but all customers can benefit.
- The prototypical business model restores 99.7% of utility earnings, but rates rise by 1.0%. ROE exceeds authorized level of 11.25%.
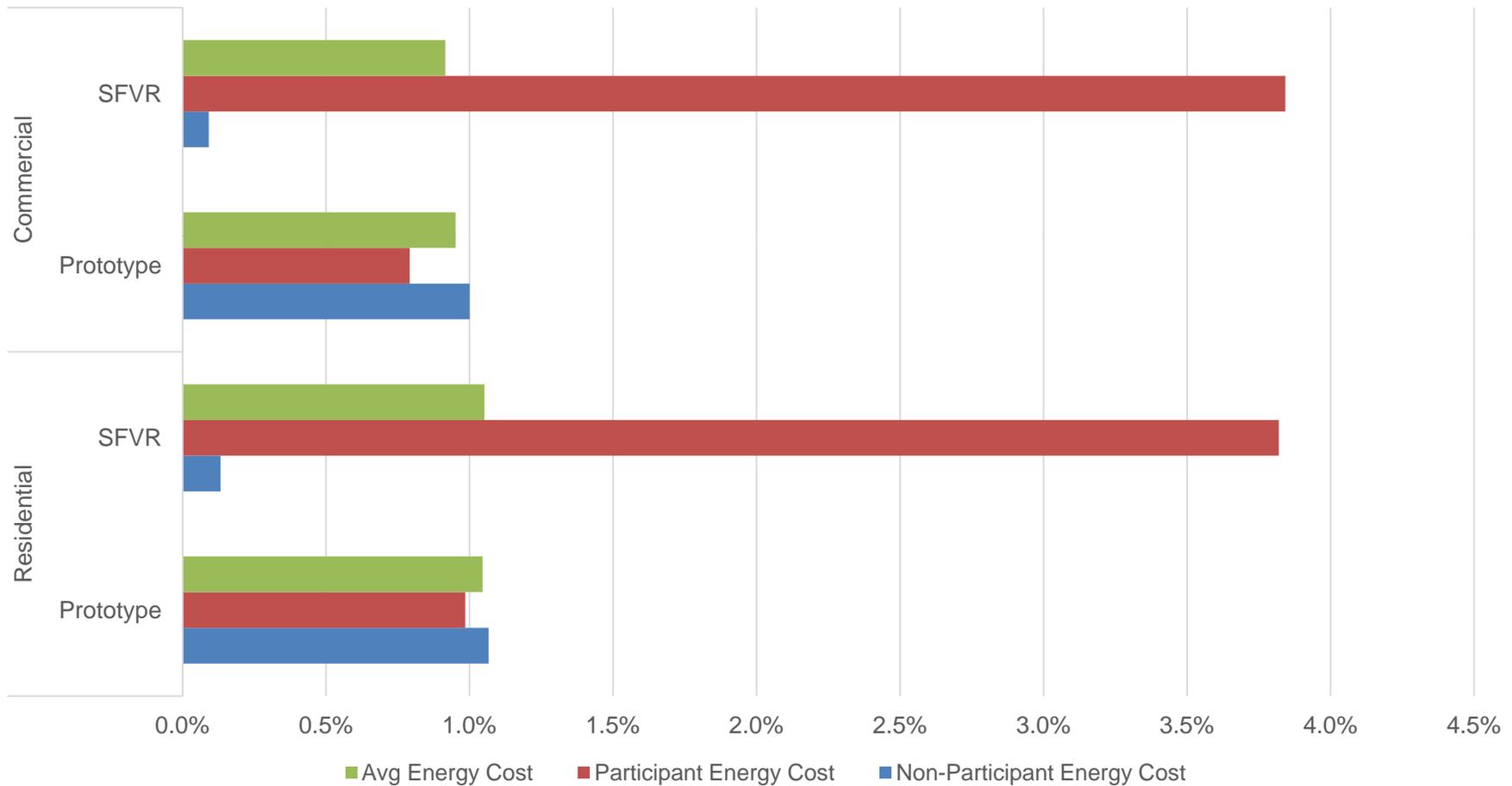
The Prototypical Business Model's Impact on Rates

- Rates decline with EE Programs, but increase when lost utility revenues are recovered.
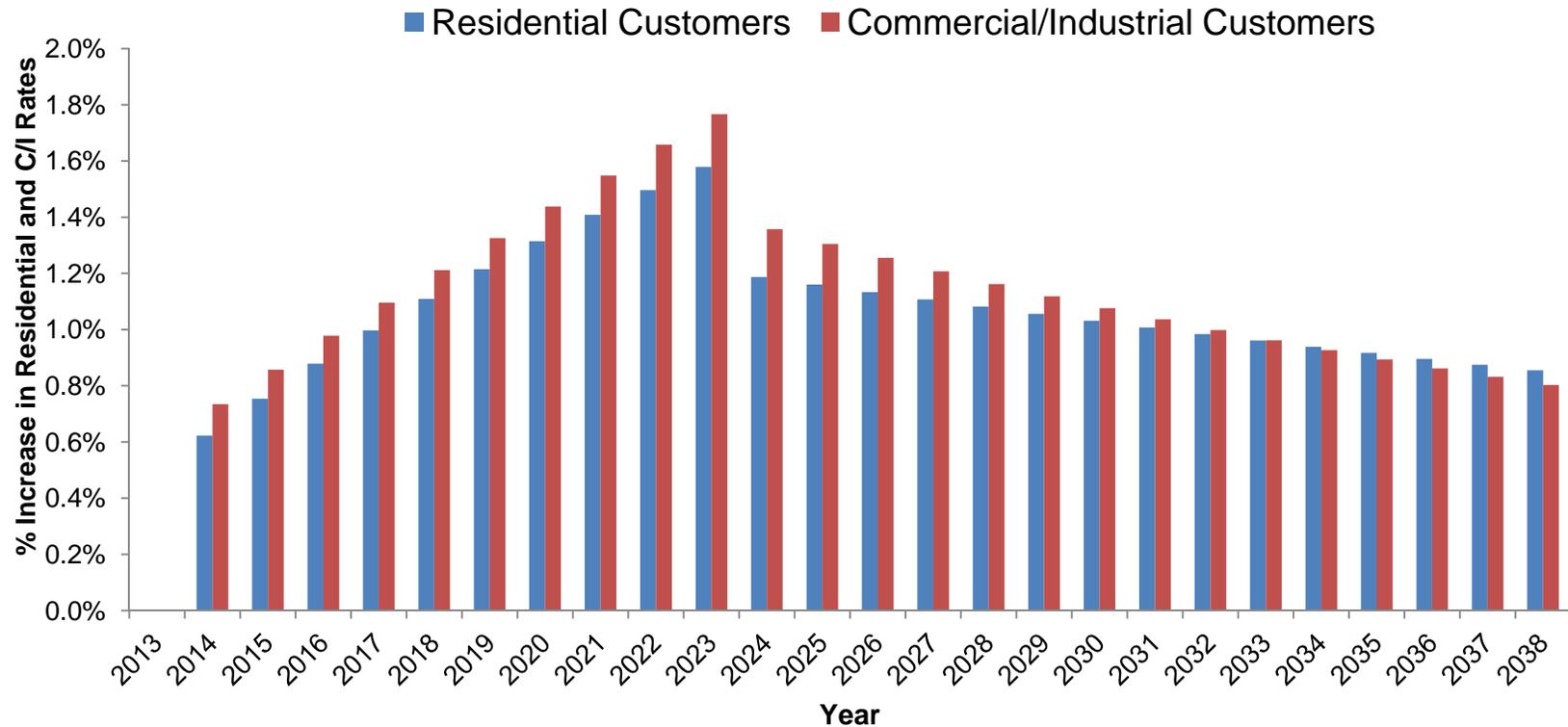
Note: Compared to operating an EE program without any business model features

Average Change in Energy Bills

Note: Compared to operating an EE program without any business model features.
SFVR = straight fixed variable rate for lost revenue recovery

Findings: Impact on Utility Earnings
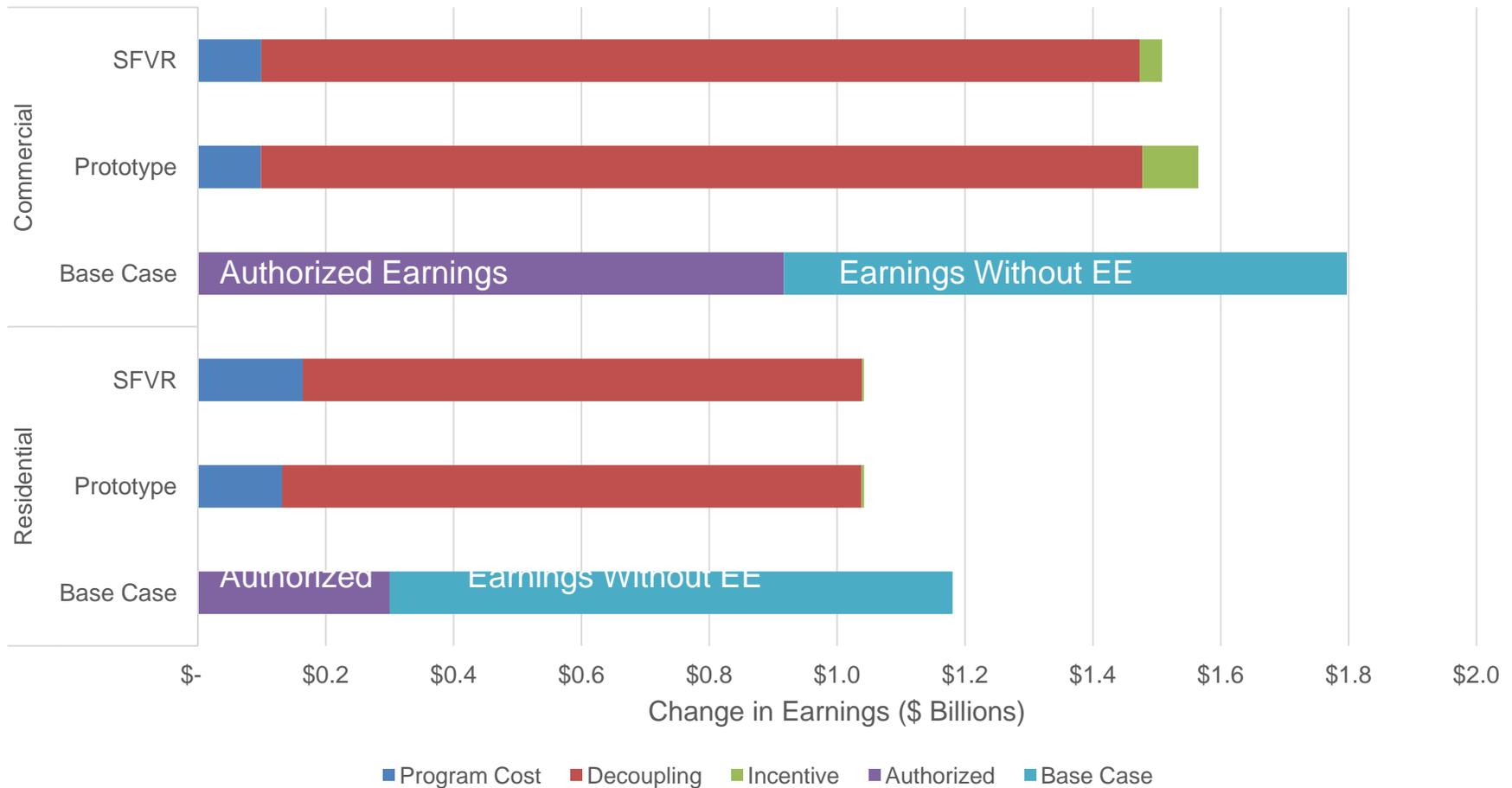
Note: Compared to operating an EE program without any business model features.
SFVR = straight fixed variable rate for lost revenue recovery

The "DRIPE" Effect – Demand Reduction Induced Price Effect

- EE programs reduce rates by eliminating a greater proportion of more expensive on-peak than off-peak fuel expenditures.

- Deferring "new builds," environmental retrofits, and T&D upgrades would be additional benefits, but these are not specified for the stereotypical utility.

- Even if the utility recovers program costs and is paid incentives, there can be downward pressure on rates because of the "DRIPE" effect.

- But with this combination, the utility is still left short of the earnings and ROE it would receive without the EE programs.

Conclusions

- Utility earnings are reduced by EE programs, but they can be restored by alternative business models.

- With these alternative models, EE programs:
  - cause modest increases in electricity rates,
  - reduce average bills for all customers,
  - significantly cut the electricity bills of participants.

- Depending on the choice of business model, non-participant utility bills may also decline.

- Selecting the right business model is important to the future of EE programs.

- Tying reward to performance is an important principle for regulatory design.

Conclusions

- The "utility of the future" discussion has largely focused on the rush to DG

- Yet EE exerts similar stresses to utility economics and is likely to "scale up" significantly

- With DER expanding and climate policy likely, we need to define strategies so that the utility industry and consumers can continue to prosper as the grid evolves

For More Information

Dr. Marilyn A. Brown
Brook Byers Professor
Georgia Institute of Technology
School of Public Policy
Atlanta, GA 30332-0345
Marilyn.Brown@pubpolicy.gatech.edu
Climate and Energy Policy Lab:
http://www.cepl.gatech.edu

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GT Understanding of CBA Tests

○ **Ratepayer Impact Measure (RIM)**

  ✕ Benefits: Avoided Supply Costs (Production and T&D)

  ✕ Costs: Lost Revenues Caused by Reduced Sales, Program Administration Costs, Program Incentives to Participants

○ **Total Resource Cost Test (TRC)**

  ✕ Benefits: Avoided Supply Costs (Production and T&D)

  ✕ Costs: Program Administration Costs, Participant Measure Costs

○ **Program Administrator Cost Test (PAC)**

  ✕ Benefits: Avoided Supply Costs (Production and T&D)

  ✕ Costs: Program Administration Costs, Program Incentives to Participants

○ **Participant Cost Test (PCT)**

  ✕ Benefits: Bill Savings, Program Incentives to Participants

  ✕ Costs: Participant Measure Costs