Regulation of Modernizing Power Distributors: Lessons From Performance-Based Regulation Research

Mark Newton Lowry, PhD

Pacific Economics Group Research, LLC

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Introduction

This presentation discusses the regulatory context for distribution (Dx) system modernization

Traditional cost of service regulation (COSR) is stressed when distributors accelerate grid modernization

This has sparked experimentation with new approaches to regulation which include performance based regulation (PBR) and distribution system planning

Berkeley Lab has recently commissioned two papers on PBR

This presentation considers implications for distribution regulation and planning

Cost of Service Regulation

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COSR Basics

- Base rates adjusted in rate cases that can be irregularly timed
- Tracker/rider treatment of fuel and purchased power expenses
- Usage (e.g., volumetric and demand) charges traditionally collect many “fixed” costs

Sensitivity to Business Conditions

- Utility performance and regulatory cost vary with external business conditions
- When conditions *favor* utilities, rate cases are infrequent so regulatory cost is low and performance incentives are strong
- When conditions are *chronically unfavorable*, rate cases are frequent so that regulatory cost is high, performance incentives are weakened, and operating flexibility is restricted
- Performance can deteriorate just when good performance is crucial

Drivers of Electric Utility Financial Attrition

Multiyear Averages	Electricity Average Use			GDPPI Inflation[2]	Summary Attrition Index
	Residential[1]	Commercial[1]	Average [A]	[C]	[C-A]
1927-1930	7.06%	6.67%	6.86%	NA	NA
1931-1940	5.45%	2.00%	3.73%	-1.59%	-5.31%
1941-1950	6.48%	5.08%	5.78%	5.26%	-0.52%
1951-1960	7.53%	6.29%	6.91%	2.42%	-4.49%
1961-1967	5.37%	10.48%	7.93%	1.77%	-6.15%
1968-1972	6.38%	6.43%	6.41%	4.66%	-1.75%
1973-1982	1.34%	1.61%	1.47%	7.24%	5.77%
1983-1986	0.90%	2.26%	1.58%	3.13%	1.55%
1987-1990	1.39%	2.29%	1.84%	3.33%	1.49%
1991-2000	1.15%	1.68%	1.41%	2.03%	0.62%
2001-2007	0.73%	0.64%	0.68%	2.47%	1.79%
2008-2015	-0.47%	-0.20%	-0.34%	1.53%	1.87%

[1] U.S. Department of Energy, Energy Information Administration, Form EIA-861, "Annual Electric Utility Report," and Form EIA-826, "Monthly Electric Utility Sales and Revenues Report with State Distributions," and EIA-0035, "Monthly Energy Review."

[2] Bureau of Economic Analysis, Table 1.4.4. "Price Indexes for Gross Domestic Product, Gross Domestic Purchases, and Final Sales to Domestic Purchasers," Revised April 28, 2017.

>>> Key business conditions today are much less favorable than in COSR's "golden age" when it became a tradition

Drivers of Electric Utility Financial Attrition (cont'd)

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Capex Requirements

Many utilities today seek sustained high distribution capex

- Replace aging facilities
- Improve reliability and resiliency
- Install "smart grid" facilities

This capex doesn't automatically trigger new revenue

Attrition impact generally greater for utility distribution companies (UDCs) than for vertically integrated electric utilities (VIEUs)

UDCs are more likely to need several years of brisk rate escalation to quickly modernize grids

COSR Today

Utilities engaged in accelerated grid modernization are likely to request frequent rate cases under COSR today

Under this system . . .

- Little profit from capex containment
- Rate base growth is main path to earnings growth
- Weak incentive to embrace demand side management (DSM) and distributed generation and storage (DGS)

>>> Weak performance incentives while competition mounts

COSR Today (cont'd)

Review of Dx capex surges can be challenging

- Rapid technological change
- Shifting demand for distributor services due to DSM and DGS

>>> weak incentives + prudence concerns
= benefit from distribution system planning

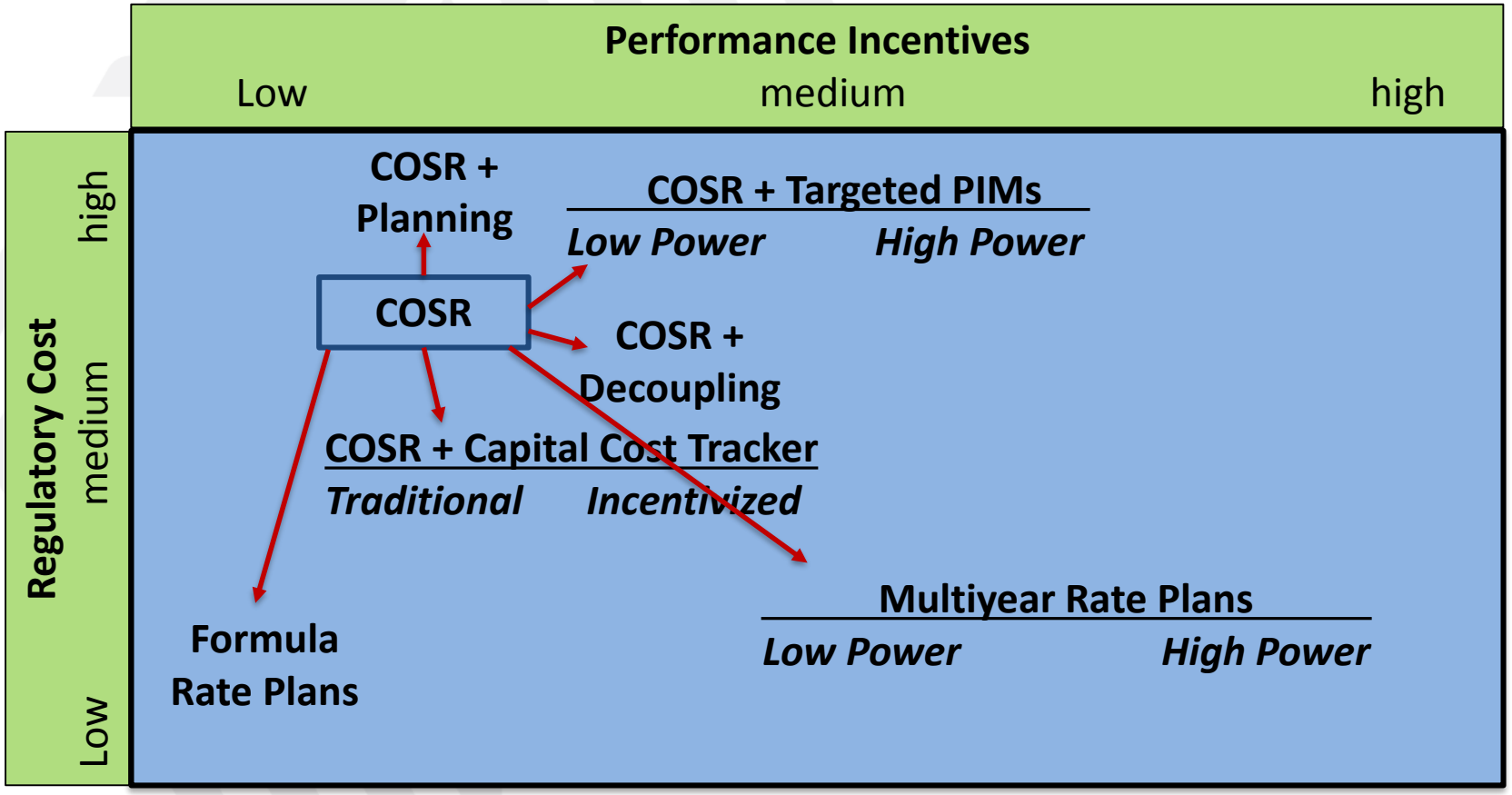
Grid modernization proceedings especially likely for UDCs

Frequent rate cases divert regulatory resources from other worthwhile activities
(e.g., distribution system planning, generic rate design proceedings)

Alternative Regulation (Altreg)

COSR challenges have spurred adoption of alternative forms of regulation

These have various attributes

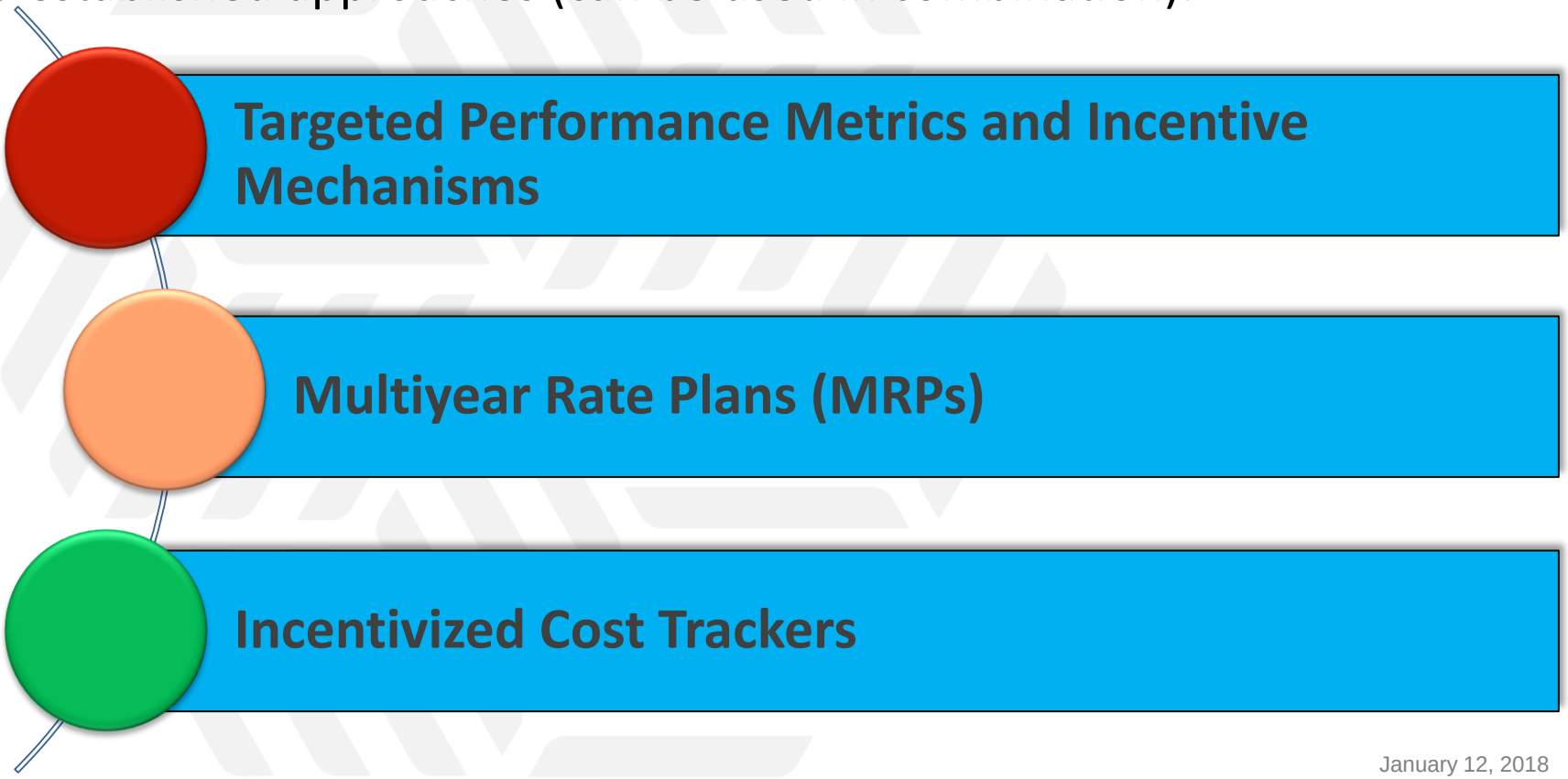


Some options address regulatory cost but not performance issues

Performance-Based Regulation

PBR: Regulation designed to improve utility performance with stronger incentives

3 established approaches (can be used in combination):



Performance Metrics

Performance metrics quantify utility activities in key performance areas

Several potential uses

- Monitoring Only
- Monitoring with Target
- Performance Incentive Mechanisms (PIMs)

PIMs strengthen incentives in targeted areas by linking revenue to performance

Performance metric systems can have different approaches for different metrics

"Scorecards" summarize utility performance for public

What do PIMs Target?

PIMs have traditionally targeted service quality and energy conservation

Need for *new* performance metrics and incentive mechanisms focus of recent "utility of the future" proceedings

Peak load management

- *System* load peak
- Non-wire alternatives to *local* grid investments

Functioning and utilization of smart-grid facilities

Quality of service to DGS customers

MRP practitioners (e.g., Britain, New York, Ontario) are also PIM innovators

Ontario Scorecard Metrics

Performance Outcomes	Performance Categories	Measures
Customer Focus Services are provided in a manner that responds to identified customer preferences.	Service Quality	New Residential/Small Business Services Connected on Time
		Scheduled Appointments Met On Time
		Telephone Calls Answered On Time
	Customer Satisfaction	First Contact Resolution
		Billing Accuracy
		Customer Satisfaction Survey Results
Operational Effectiveness Continuous improvement in productivity and cost performance is achieved; and distributors deliver on system reliability and quality objectives.	Safety	Level of Public awareness [measure to be determined]
		Level of Compliance with Ontario Regulation 22/04
		Serious Electrical Incident Index: Number of General Public Incidents
		Serious Electrical Incident Index: Rate per 10, 100, 1000 km of line
	System Reliability	Average Number of Hours that Power to a Customer is Interrupted
		Average Number of Times that Power to a Customer is Interrupted
	Asset Management	Distribution System Plan Implementation Progress
	Cost Control	Efficiency Assessment
		Total Cost per Customer [1]
		Total Cost per Km of Line [1]

Notes:
1. These figures were generated by the Board based on the total cost benchmarking analysis conducted by Pacific Economics Group Research, LLC and based on the distributor's annual reported information.
2. The Conservation & Demand Management net annual peak demand savings include any persisting peak demand savings from the previous years.

Ontario Scorecard Categories (cont'd)

Performance Outcomes	Performance Categories	Measures	
Public Policy Responsiveness Distributors deliver on obligations mandated by government (e.g., in legislation and in regulatory requirements imposed further to Ministerial directives to the Board).	Conservation & Demand Management	Net Annual Peak Demand Savings (Percent of target achieved)	
		Net Cumulative Energy Savings (Percent of target achieved)	
	Connection of Renewable Generation	Renewable Generation Connection Impact Assessments Completed On Time	
		New Micro-embedded Generation Facilities Connected On Time	
Financial Performance Financial viability is maintained; and savings from operational effectiveness are sustainable.	Financial Ratios	Liquidity: Current Ratio (Current Assets/Current Liabilities)	
		Leverage: Total Debt (includes short-term and long-term debt) to Equity Ratio	
		Profitability: Regulatory Return on Equity	Deemed (included in rates)
			Achieved

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PIM Pros and Cons

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PIM Pro:

- Metrics focus utilities on performance dimensions that matter to regulators and customers
- PIMs can strengthen utility performance incentives
- PIMs can target specific areas of concern (e.g., areas of weak incentives)
- Sweeping change in regulatory system not required

PIM Con:

- Difficult to measure performance and design incentive mechanisms
- Design and operation of PIMs can invite controversy & strategic behavior
- Incremental regulatory cost can be non-negligible
- Utilities may focus on targeted performance areas and ignore less measurable areas

Multiyear Rate Plans

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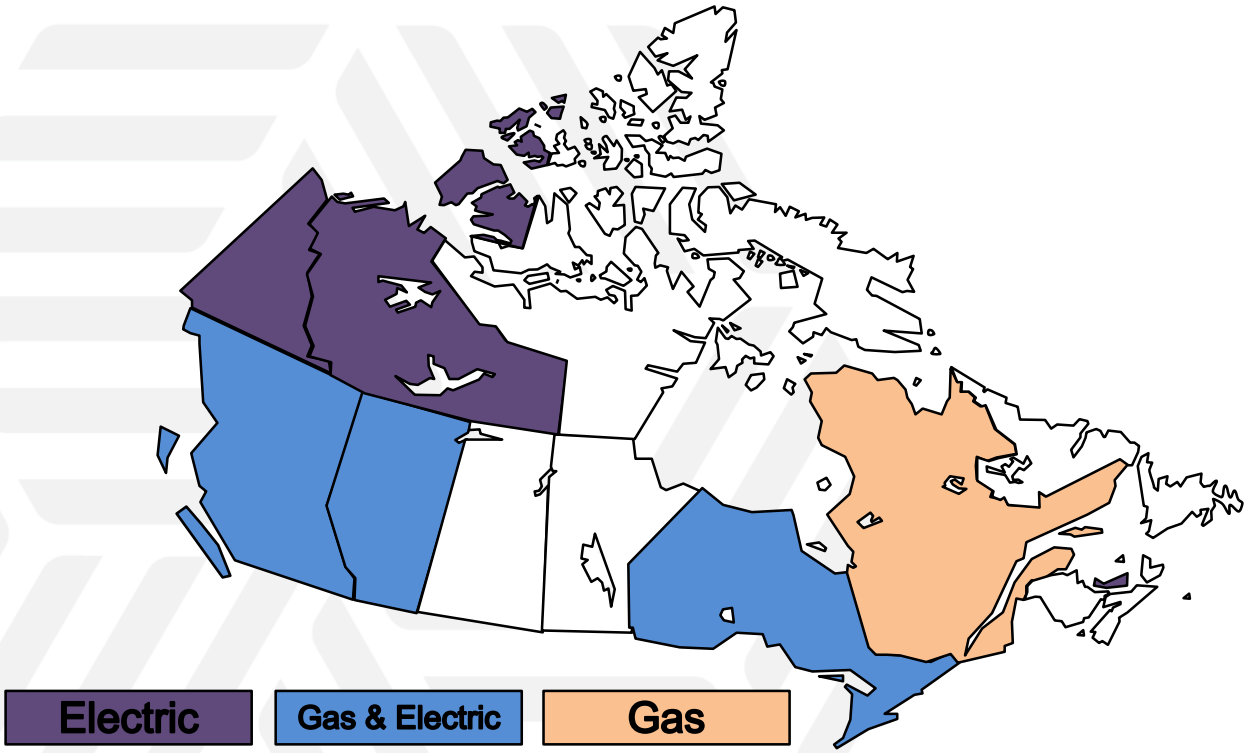
Key Components

- Reduced rate case frequency (e.g., 3-10 year rate case cycle)
- Attrition relief mechanism (ARM) provides automatic relief for cost pressures *based on forecasts and/or an index --- not a cost tracker or "formula rate"*
- Trackers for some costs (e.g., fuel, purchased power, and retirement)
- PIMs link earnings to reliability and customer service quality

Optional Components

- Revenue decoupling
- Earnings sharing and "off ramp" mechanisms
- Marketing flexibility (e.g., optional rates and services)
- Additional PIMs (e.g., demand-side management)
- Integrated resource planning and distribution system planning

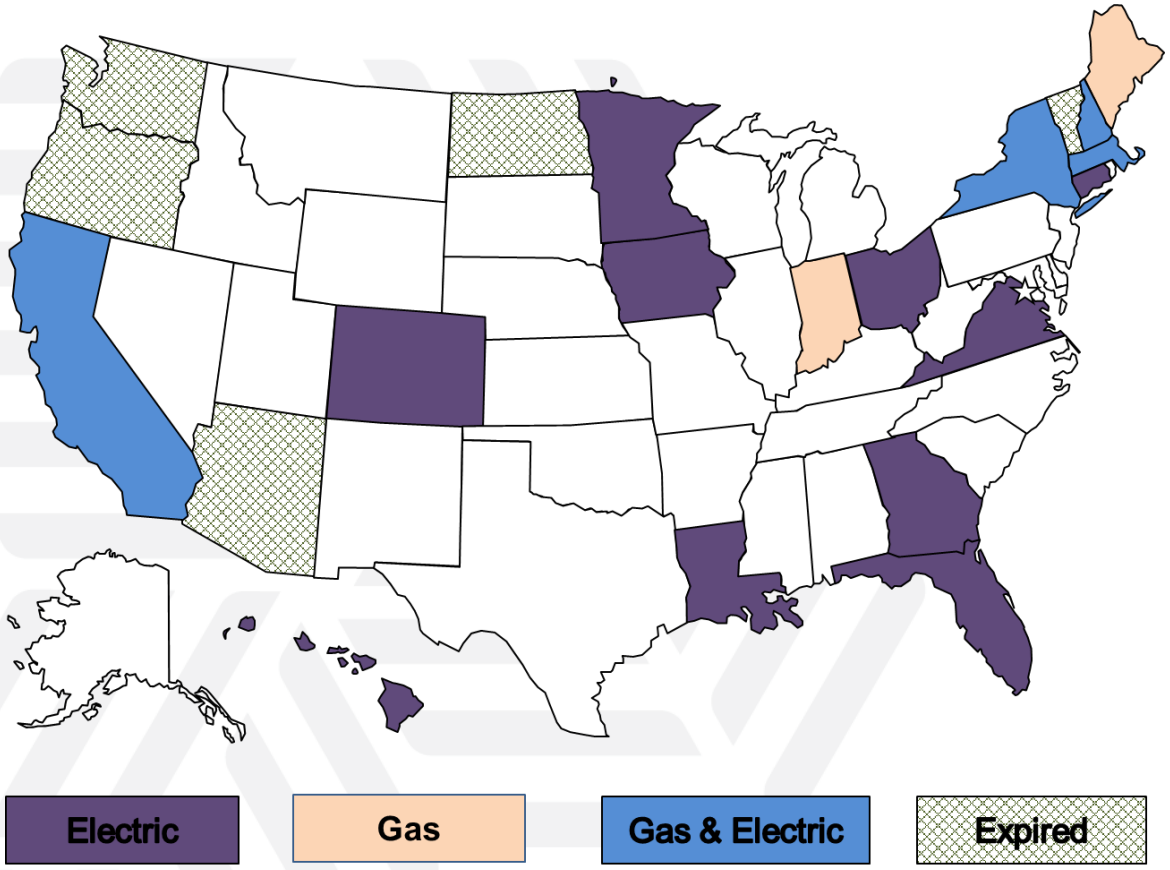
MRP Precedents: Canada



MRPs mandatory for distributors in many Canadian provinces and countries overseas (e.g., Australia and RIIO in Great Britain)

Impetus has frequently come from policymakers

MRP Precedents: United States



MRPs now a common form of Altreg in U.S.

Use of MRPs growing most rapidly for vertically integrated electric utilities (VIEUs)

MRP Pros and Cons

Pro

Stronger performance incentives

Streamlined regulation

- Fewer, less overlapping rate cases free resources for other uses (e.g., Dx system planning)

Focus on performance (e.g., productivity goals and benchmarking)

Con

Change in regulatory system can be large

Parties can struggle to agree on key plan provisions (e.g., ARM)

Opportunities for strategic behavior

ARM Design

ARM design key issue in MRP proceedings

Several well-established approaches

- Forecasting (e.g., Minnesota)
- Indexing (e.g., Ontario)

  e.g., *growth Revenue = growth Input Prices – X + growth Customers*

  X Factor = Industry Productivity Trend + Stretch Factor

  Customers get productivity growth commitment

  Stretch factors sometimes based on statistical benchmarking
- Hybrid (e.g., California)

  e.g., indexing for O&M costs

  forecasting for capital

ARM Design (cont'd)

Productivity index measures utility efficiency in using inputs (e.g., labor, materials and capital) to achieve operating scale

Productivity grows when real (inflation-adjusted) cost grows more slowly than scale

Berkeley Lab paper reports productivity trends of U.S. power distributors; here are 1996-2016 results.*

	Average Annual Growth Rate (1996-2016)		
	Capital	O&M	Multi-factor
West North Central	0.41%	1.02%	0.62%
East North Central	-0.22%	0.38%	-0.18%
South Central	0.22%	0.62%	0.24%
Full U.S. Sample	0.29%	0.59%	0.34%

* Results for individual utilities in Additional Slides

Ontario Energy Board Uses Benchmarking to Set Stretch Factors for Power Distributors

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VARIABLE KEY

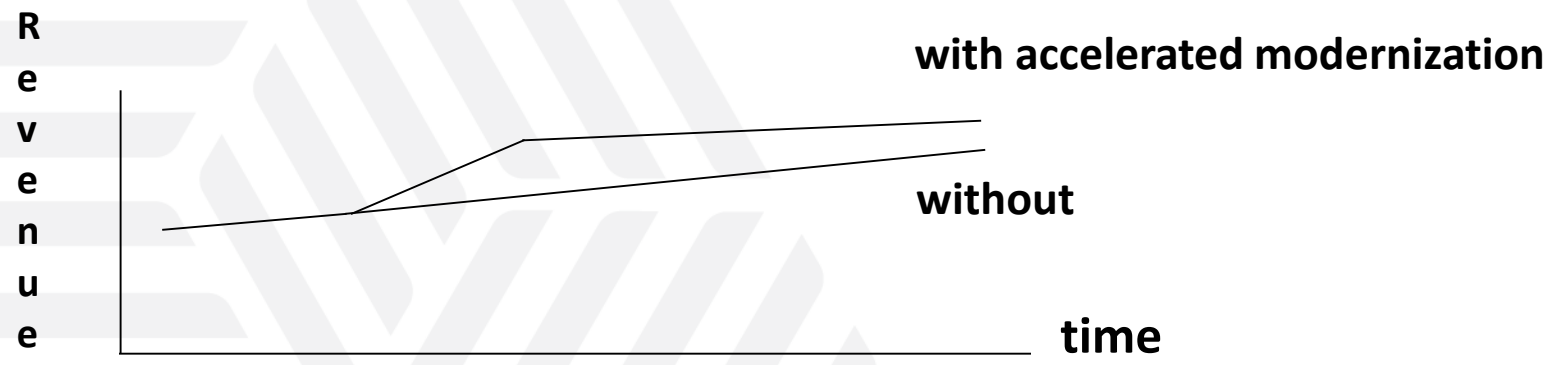
Input Price:	WK = Capital Price Index
Outputs:	N = Number of Customers
	C = System Capacity Peak Demand
	D = Retail Deliveries
Other Business Conditions:	L = Average Line Length (km)
	NG = % of 2012 Customers added in the last 10 years
	Trend = Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC
WK*	0.6271	85.5530
N*	0.4444	8.0730
C*	0.1612	3.2140
D*	0.1047	3.4010
L*	0.2853	13.9090
NG*	0.0165	2.4110
Trend*	0.0171	12.5700
Constant*	12.815	683.362
System Rbar-Squared	0.983	
Sample Period	2002-2012	
Number of Observations	802	

***Variable is significant at 95% confidence level**

Benchmarking also used to appraise proposed revenue requirements in rate cases

ARM Design (cont'd)



Agreeing on ARMs for *rapidly modernizing* UDCs is difficult

This has slowed growth of MRPs for American UDCs

Some regulators (e.g., Alberta, Ontario, Britain) have grappled with challenge

ARMs are often easier to design for VIEUs

PBR and System Planning

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PBR and planning are complements

Planning can inform design of multiyear rate plan ARMs

Enhances understanding of needed cost growth

Distribution system plans required in some MRP systems

MRPs streamline regulation, free resources for planning

Metrics are a key planning tool

Productivity and benchmarking research used to design MRPs can also inform planning

- Index O&M expenses (e.g., Australia)
- Establish long run productivity goals
- Identify cost inefficiencies
- Australian, British & Ontario regulators use statistical cost research to appraise cost forecasts

Carrots and sticks work together to encourage better performance

Conclusions

Accelerated Dx system modernization weakens performance incentives and raises regulatory cost under COSR

Capital cost trackers and formula rates reduce regulatory cost but not prudence concerns

PBR and distribution system planning are increasingly used to address these challenges

Problems more pronounced for UDCs, so their regulators are leading innovators

PBR and planning are complements, using carrots and sticks to encourage better performance

Additional Slides

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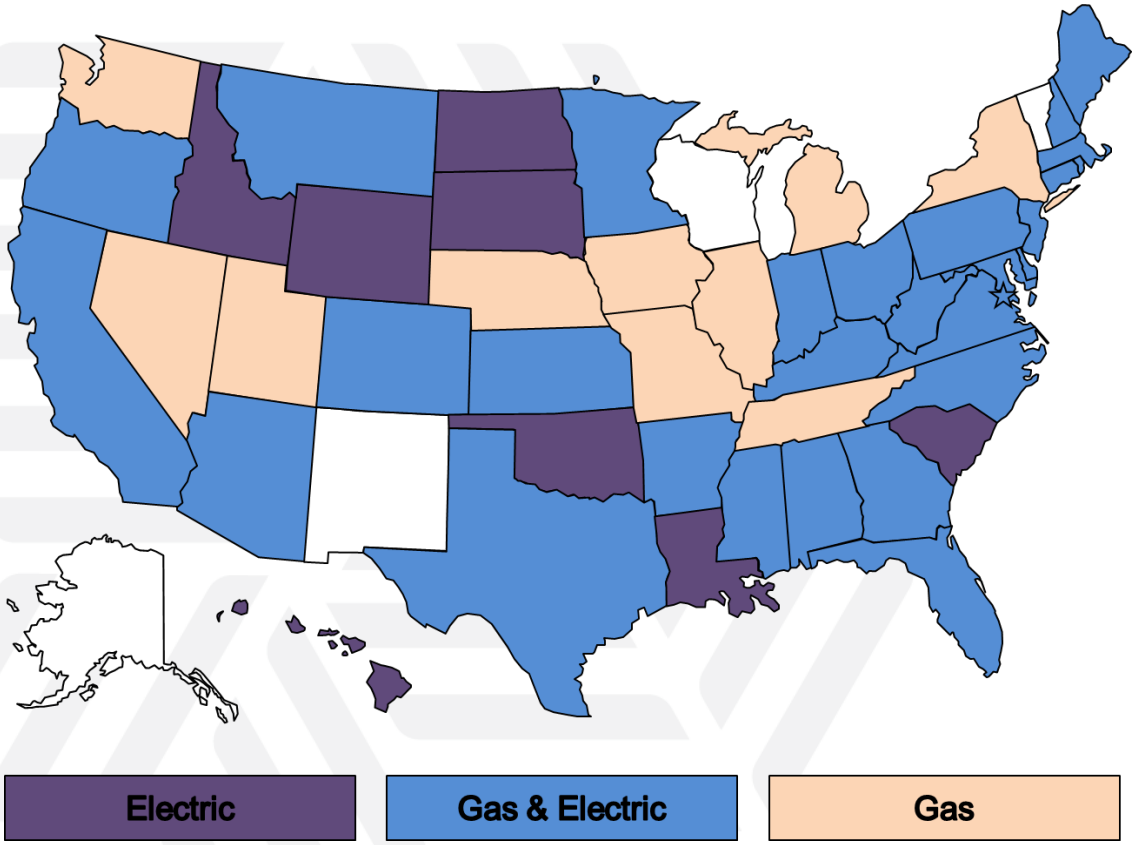
Capital Cost Tracker Precedents

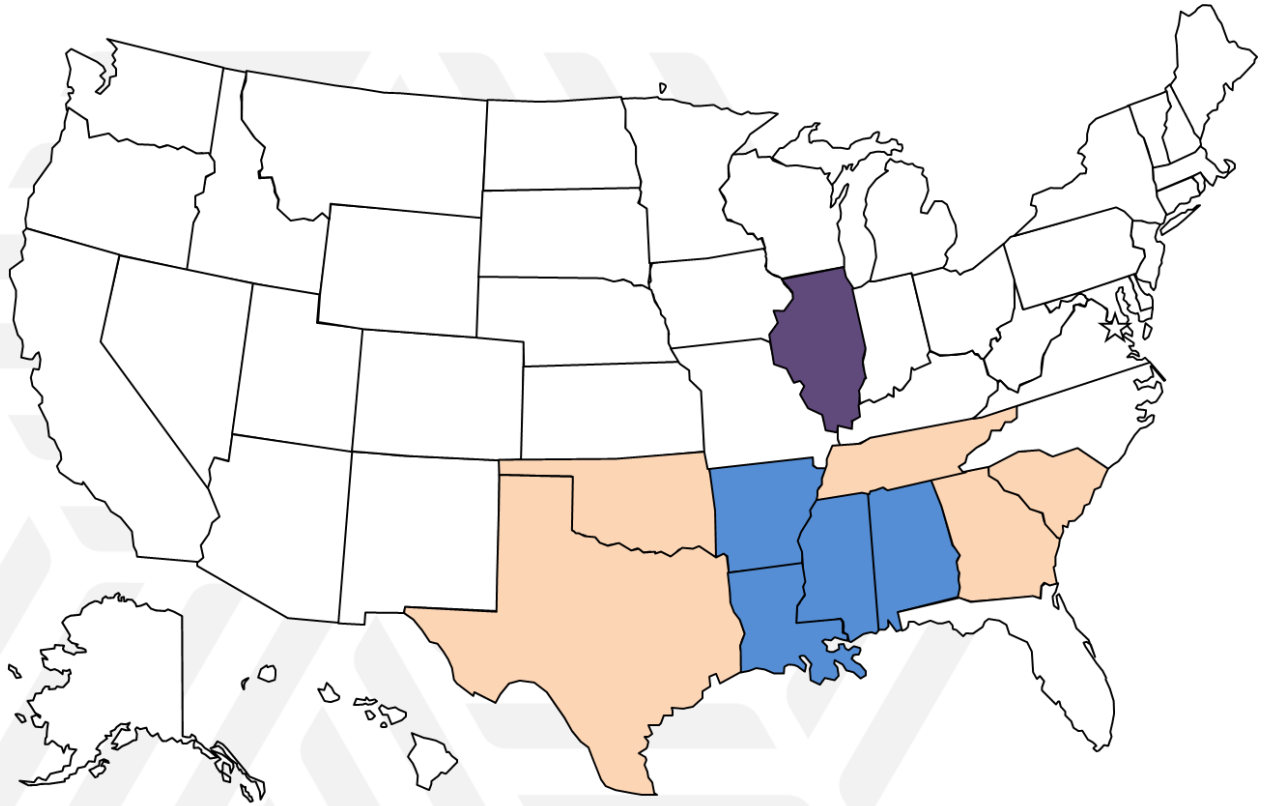


Cost trackers are a common way to finance capex surges

Trackers in a few states track substantially *all* distribution capex

Source: Pacific Economics Group Research, LLC

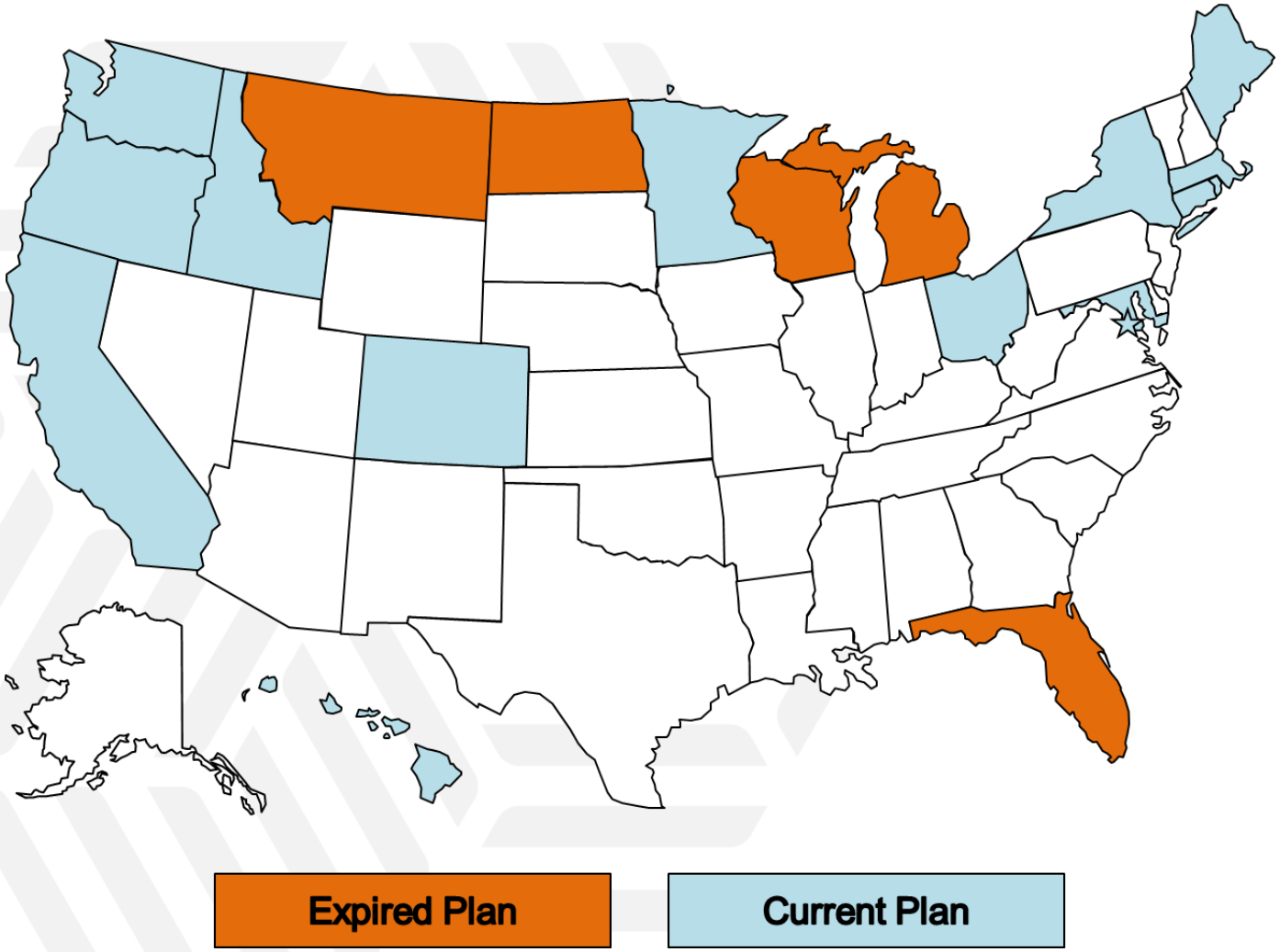
Retail Formula Rate Plan Precedents



Formula rates fund grid modernization in IL

Source: Pacific Economics Group Research, LLC

Electric Revenue Decoupling Precedents



Source: Pacific Economics Group Research, LLC

Marketing Flexibility

MRPs can afford utilities more marketing flexibility by reducing rate case frequency and opportunities for cross-subsidization

e.g., "Streamlined regulation" of optional tariffs and services

- Special contracts
- Green power packages (utility scale and distributed)
- Energy transformation services (e.g., EV charging, heat pump leasing)
- Reliability-differentiated services
- Other smart-grid-enabled services

MRPs have been popular in utility industries facing competition, technical change, and complex, changing demand

Productivity Trends of Midwest and South Central Power Distributors (2007-2016)

West North Central	TFP	O&M PFP	Capital PFP
ALLETE (Minnesota Power)	0.68%	0.20%	1.02%
Cleco Power	1.44%	4.03%	-0.39%
Empire District Electric	-1.25%	-1.89%	-0.41%
Kansas City Power & Light	0.89%	1.65%	0.42%
Kansas Gas and Electric	0.86%	0.58%	0.99%
MDU Resources	0.29%	1.08%	-1.09%
Northern States Power (MN)	1.78%	2.37%	1.43%
Northwestern Public Service (SD)	0.63%	0.66%	0.89%
Otter Tail Power	0.62%	0.27%	0.96%
Superior Water, Light and Power	-0.43%	-1.28%	-0.12%
Union Electric	1.28%	3.24%	0.28%
Westar Energy (KPL)	0.18%	0.11%	0.71%
Wisconsin Electric Power	0.34%	0.74%	0.79%
Wisconsin Power and Light	0.45%	1.70%	-0.71%
Wisconsin Public Service	1.50%	1.86%	1.44%

Source: Pacific Economics Group Research, LLC

Productivity Trends of Midwest and South Central Power Distributors (2007-2016) (cont'd)

	TFP	O&M PFP	Capital PFP
East North Central			
Ameren Illinois	0.02%	-0.26%	0.21%
Cleveland Electric Illuminating	0.25%	2.25%	-0.59%
Dayton Power and Light	-0.83%	-0.63%	-0.76%
Duke Energy Indiana	0.70%	1.42%	0.75%
Duke Energy Ohio	0.28%	2.06%	-0.34%
Indiana Michigan Power	0.42%	1.96%	-0.85%
Indianapolis Power & Light	0.95%	0.19%	1.41%
Ohio Edison	1.51%	4.26%	0.24%
Ohio Power	-2.94%	-5.54%	-0.90%
Southern Indiana Gas and Electric	-3.31%	-4.78%	-1.51%
Toledo Edison	0.99%	3.30%	-0.12%
South Central			
Duke Energy Kentucky	0.21%	0.12%	0.90%
Entergy Mississippi	1.14%	2.41%	-0.21%
Entergy New Orleans	4.85%	5.83%	5.62%
Kentucky Power	-2.22%	-3.08%	-1.10%
Kentucky Utilities	-1.19%	-1.67%	-0.32%
Kingsport Power	0.50%	2.08%	-0.24%
Louisville Gas and Electric	-1.42%	-2.24%	-0.58%
Mississippi Power	-0.48%	0.12%	-1.31%
El Paso Electric	0.78%	2.02%	-0.79%
US Average	**0.34%**	**0.59%**	**0.29%**

Source: Pacific Economics Group Research, LLC

Case Study: Central Maine Power

Impetus for MRPs in Maine came from Commission
3 successive plans (here is the last)

Attrition Relief Mechanism:
growth Rates = growth GDPPI – X (X=1%)

Capital Cost Tracker: Automated metering infrastructure

Earning Sharing: Asymmetric sharing of surplus earnings

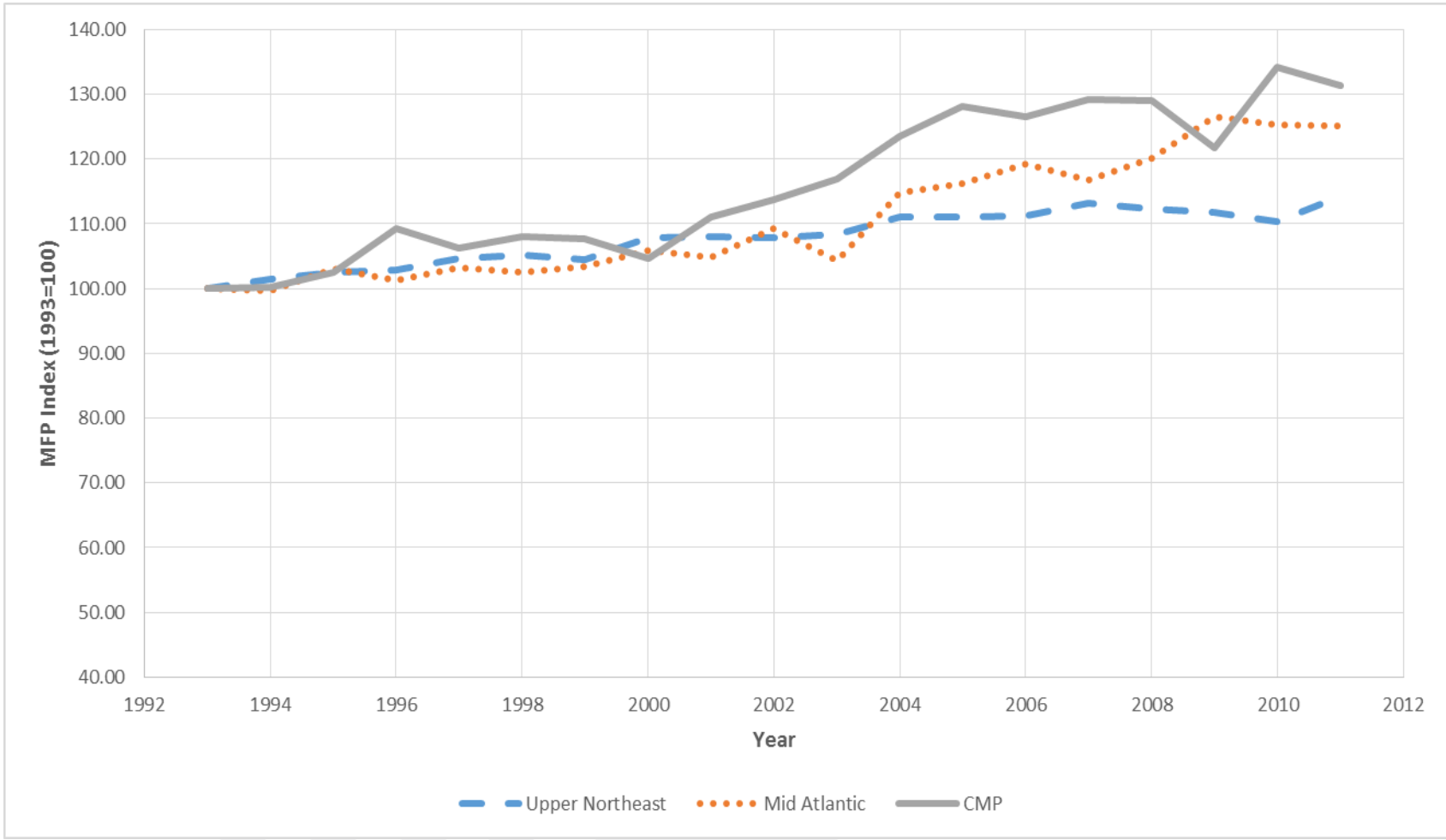
Plan term: 5 years (2009-2013)

Service Quality: Multi-indicator penalty mechanism

Marketing Flexibility: Light-handed regulation of optional rate schedules and rate discounts

Reference: Maine Public Utilities Commission, "ARP 2008 Settlement," June 2008

Distribution Productivity Trends of CMP and Two Northeast Regions



Source: Pacific Economics Group Research, LLC

Suggestions for Further Reading

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Suggestions for Further Reading (cont'd)

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Ontario Energy Board (2016), *Handbook for Utility Rate Applications.*

Mark Newton Lowry

President, Pacific Economics Group Research LLC (PEG)

- Active in PBR since 1990s
- Specialties: multi-year rate plans, productivity and benchmarking research, revenue decoupling and other Altreg mechanisms
- Recent clients: Alberta Utilities Consumer Advocate, Association Quebecoise des Consommateurs d'Electricite Industriels, Berkeley Lab, Commercial Energy Consumers of British Columbia, Edison Electric Institute, Green Mountain Power, Ontario Energy Board, Xcel Energy
- Former Penn State University energy economics professor
- PhD Applied Economics, University of Wisconsin
- Ohio native, Madison (WI) resident

Speaker Contact Information

Mark Newton Lowry, PhD

President

Pacific Economics Group Research (PEG) LLC

www.pacificeconomicsgroup.com

44 East Mifflin St., Suite 601, Madison, WI 53703

608-257-1522 ext. 23

mnlowry@pacificeconomicsgroup.com