Review of Liberty's Rate Design, Revenue Decoupling and Common Practices in Natural Gas

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I. Introduction

Liberty Utilities (Gas New Brunswick) LP ("Liberty") is a regulated utility providing natural gas services to over 12,400 customers in New Brunswick, with 855 km of pipeline serving 14 communities in the province. Liberty engaged the authors to review its proposed rate design for natural gas customers across different customer classes. In addition, Liberty also requested a review of Revenue Decoupling Mechanisms ("RDM") followed in North American jurisdictions. Liberty pursued this engagement in response to two factors:

- Combating attrition of customers to alternative fuel competition and electrification.
- Proposal of an RDM to encourage innovative rate design while accounting for fluctuations in utility revenues due to weather phenomena.

Our report is organized as follows: Section II provides an overview of ratemaking principles, namely, Cost of Service ("COS") and Rate Design; Section III describes increasing competition that Liberty faced over the period between 2015 – 2021 from alternative fuels; Section IV details Liberty's proposed rate design and rates for its natural gas customers; Section V briefly describes an RDM; Section VI surveys typical RDM practices followed in Canada and the US in the natural gas regulatory landscape and Section VII discusses Liberty's RDM.

II. Ratemaking Principles

COS studies are one of the primary tools employed in setting rates for regulated utilities providing natural gas services. The underlying principle of cost-of-service regulation is that the prices charged to customers for services reflect the utility's cost to provide those services. This principle applies to both overall rates as well as those charged to individual customer classes.

A COS study begins with a revenue requirement analysis – the total revenue that a utility is given the opportunity to collect from all customers that receive service from the utility. A "test year" is set, usually the twelve months that will serve as the entire study period. The twelve months can be the forward-looking twelve months or can be the most recent twelve months.

Once the test year's revenue requirement is determined, costs are functionalized[1], classified[2] and allocated[3]. Allocation factors specific to each class serve as the basis for allocating costs. The cost burden which a rate class imposes relative to the utility's total costs determines these

[1] Functionalization for natural gas utilities typically involves the identification of costs that belong to the following functional units: Production, Storage, Transmission, Distribution and General.

[2] Classification criteria for cost allocation typically include demand, energy/commodity and customer related costs.

[3] Once a company's costs are functionalized and classified, they are allocated among the different customer classes based on pre-determined allocation factors for each type of cost.

factors. For example, the annual peak demand for a particular customer class drives a significant portion of its distribution pipeline costs. In this case, its proportionate contribution to the overall system peak demand observed during the test year typically determines the allocation factor for the class. The revenue requirement is apportioned among each class based on the final allocation factors. This process is repeated over all functional units. The resulting fully allocated revenue requirement is the amount that is to be collected from the respective customer classes through the rates charged to them.

Thus, the fundamental purpose of a COS study is to appropriately allocate a company's historical or projected test-year costs among its various customer classes with the goal of complete recovery of the revenue requirement. A common costing approach widely used to accomplish this, is Embedded Cost of Service ("ECOS" also known as a Fully Allocated Costs). ECOS is the methodology used by Liberty in its general rate cases and uses Liberty's actual investment and expenses to determine each customer classes' cost.

Rate design refers to the process by which a company's revenue requirement is recovered from customers through rates and considers the costs that the customer class imposes on the system. For a given customer class, a rate is simply the ratio of the allocated revenue requirement to some measure of total usage. However, efficient rate design would reflect the cost drivers to provide service to a given customer, *i.e.*, rates would be cost-based. In his seminal work on cost-based rate design, Professor James Bonbright provided the guiding principles for efficient rate design,[4] and included the different trade-offs one faces when designing rates, including yielding total revenue requirements, stability in revenue and rates, improving economic efficiency and fairness in the allocation of costs among customers.

Rate design often involves multiple components to a rate. Typically, the rate includes a fixed charge (*i.e.*, a service or customer charge) that is constant for a given billing period and a usage-based component that reflects a customer's actual consumption during the billing period. Rates for different customer classes, however, do not always reflect the costs imposed by the respective class on the system. For example, costs that are classified as demand related costs in the COS study would ideally be recovered through a demand-based rate while costs classified as usage-related would be recovered through a purely volumetric rate. This would reflect cost-causation and efficient rate design. In some cases, rates set for commercial or industrial customers have demand charges and thus reflect cost causation. Rates set for residential customers, however, typically seek to recover most costs through a single volumetric rate,

[4] James C. Bonbright, Principles of Public Utility Rates (1961).

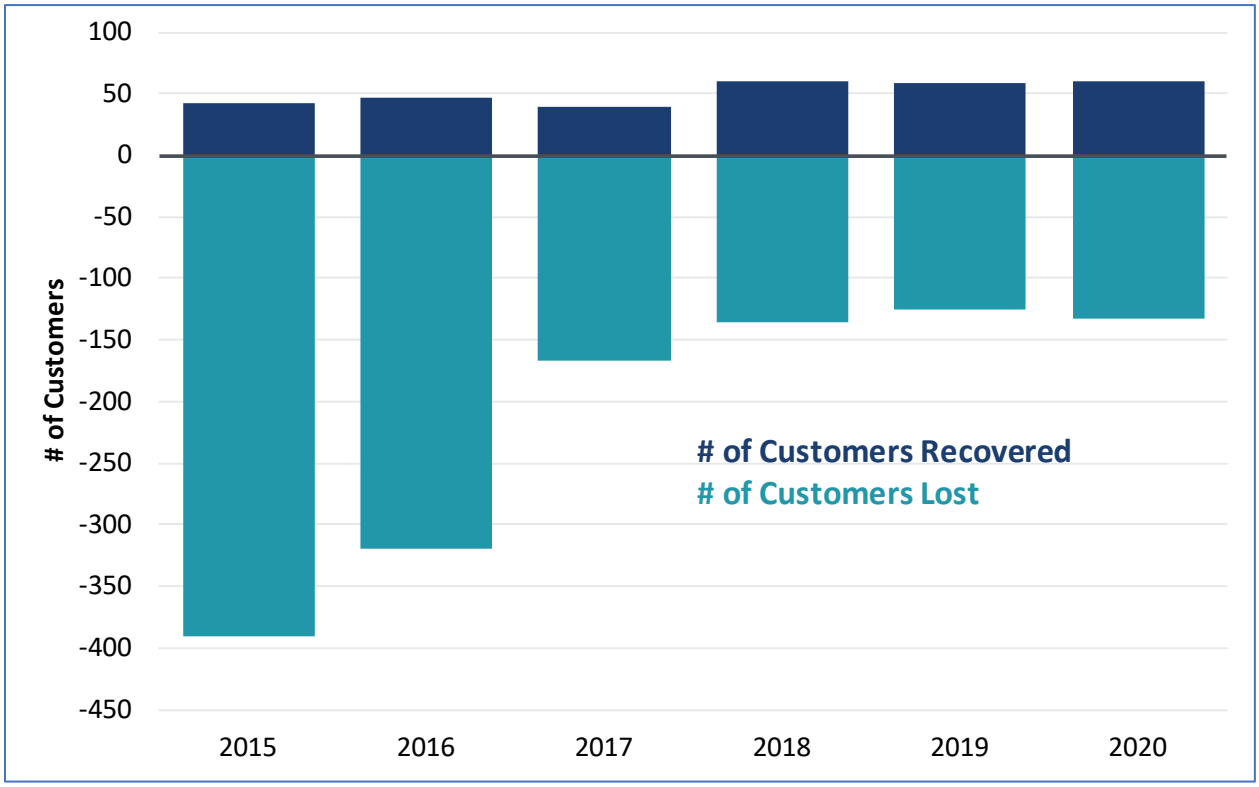
which values each unit of consumption equally, with fixed charges that do not fully recover the fixed costs of providing the service.

III. Challenge from Alternative Fuels

In recent years, Liberty has faced increasing competition from alternative fuels—primarily but not exclusively propane—which has resulted in a steady loss of customers between 2015 and 2021.

Figure 1 shows the total number of customers lost on an annual basis against those that Liberty has won back. The chart tracks the total number of customers that either were or are under service from Liberty across six customer classes.[5] Note that this figure represents losses due, among others, to business closures and competing fuels including propane, oil, electricity, and other unknown fuels.

Figure 1: Annual Customer Attrition, 2015-2020

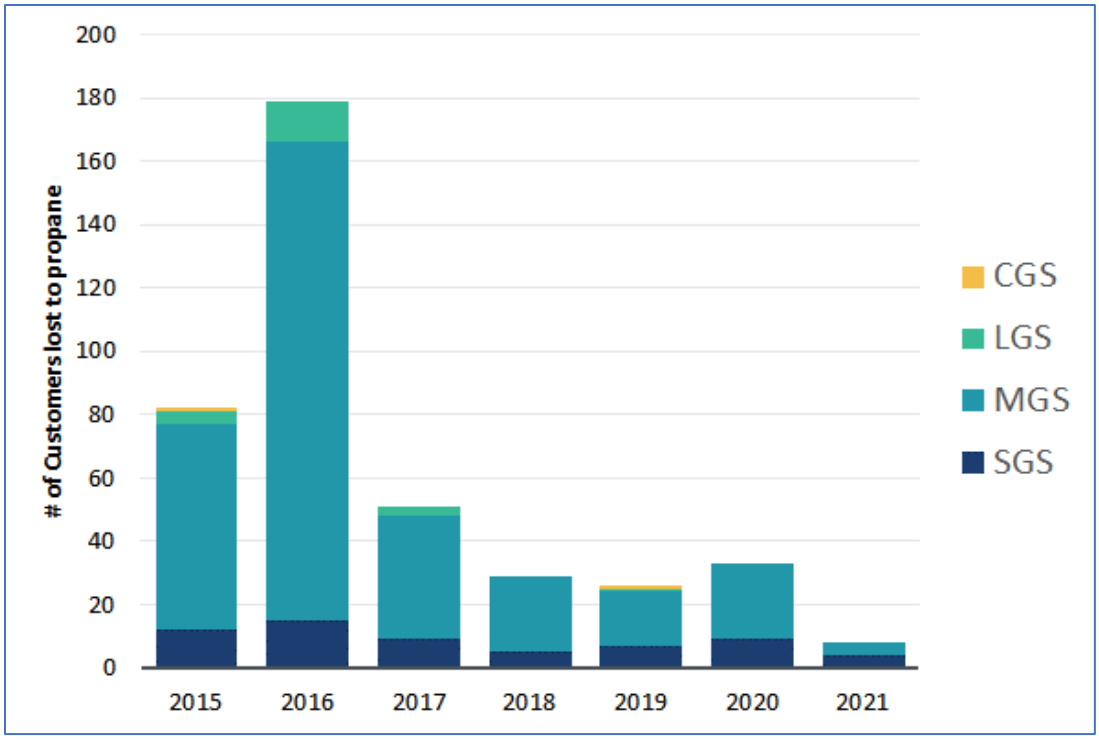


Source: Liberty Utilities

[5] Liberty's six customer classes are as follows: Small General Service ("SGS"), Mid-General Service ("MGS"), Large General Service ("LGS"), Contract General Service ("CGS"), Industrial Contract General Service ("ICGS"), Off-Peak Service ("OPS").

Figure 2 below presents a similar picture but depicts customers lost solely due to competition from Propane. Since 2015, Liberty lost close to 400 customers to competition from propane. While the total number of customers lost to propane has trended downward in recent years when compared to the peak of 2016, the threat of competition from propane still exists as does from other alternative fuels and from electrification. The total number of Liberty customers receiving service in New Brunswick is approximately 12,400. As is evident from Figure 2, the MGS rate class is one where Liberty has faced stiffest competition. Between 2015 and 2021, MGS, on average, accounted for approximately 70% all customers lost to propane on an annual basis.

Figure 2: Annual Customer Attrition due to Propane, 2015-2020



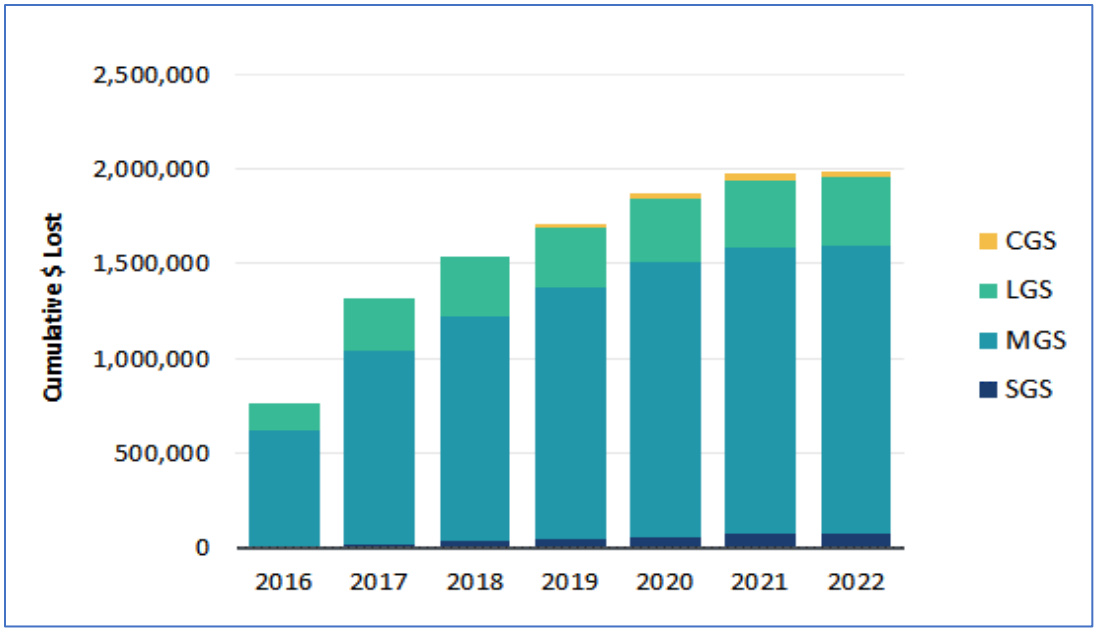
Source: Liberty Utilities

Relatedly, this has resulted in loss of revenue for Liberty. Figure 3 below presents the cumulative revenues that Liberty has lost due to customers switching to propane for their energy needs. It includes the effect of a customer leaving each year as well as the revenues that would have been collected from them had they stayed with Liberty. In aggregate, as of 2022, Liberty has lost approximately CAN$2 million across all customers classes, with the MGS class accounting for a significant portion of those losses.

Liberty has identified a couple of contributing factors to propane's emergence as a strong competitor. First, unlike natural gas, propane is not as regulated a commodity. This provides propane suppliers with more flexibility than regulated utilities in terms of price setting. Propane suppliers match the price of natural gas and compete on offering low prices.

Furthermore, propane companies do not have an obligation to serve all customers. They have identified and targeted the more desirable existing Liberty MGS customers. With respect to the other customer classes, they do not appear to have technical solutions required to serve larger customers while the SGS customers are not ideal due to the low sales volume. Liberty hopes that with revised rates for the MGS rate class, they will be more competitive.

Figure 3: Cumulative Revenue Losses due to Competition from Propane, 2016-2022



Source: Liberty Utilities

IV. Liberty's Proposed Rate Design & Rates

Figure 4 below summarizes Liberty's current rate design and rates for its SGS and MGS classes, as well as the proposed rate changes. Liberty is proposing to maintain its current rate design for both the SGS and MGS class. With respect to rates, for the SGS class Liberty is proposing to maintain the customer charge at $21.50. For the block 1 usage rates, Liberty is proposing a 4.16% increase, from $10.4163 per GJ to $10.8493 per GJ. Given that the customer charge does not change, the overall increase in rates for the SGS class is 3.12%.

With respect to the MGS class, Liberty is proposing to also maintain the customer charge at current rates for its MGS (small) $21.50 and MGS (large) $50.00. For the per-GJ usage block rates, Liberty is proposing a 4.62% decrease in the first block and a 4.00% decrease in the second block. Given that the customer charges do not change, the overall decrease in rates for the MGS class is 4.17%.

Figure 4: Current and Proposed Rates, SGS and MGS

	SGS		**MGS**			
	Customer Charge	Block 1	Customer Charge		Block 1	Block 2
			Small	Lg.		
Current	$21.50	$10.4163	$21.50	$50.00	$11.4320	$8.2372
Proposed	$21.50	$10.8493	$21.50	$50.00	$10.9033	$7.9077
% Change	0	4.16	0	0	-4.62	-4.00
Class % Change	**3.12%**		**-4.17**			

Source: Liberty Utilities

Notes: Customer charge is monthly, Block charges are $/GJs, Class % change based on revenue changes assuming no elasticity effects.

Figure 5 below summarizes Liberty's current rate design and rates for its LGS class, as well as the proposed rate changes. Liberty is proposing to maintain its current rate design for the LGS class. With respect to rates, Liberty is proposing to maintain the customer charge for both the LGS (small) $275 and LGS (large) $375. The LGS class has one block and Liberty is proposing a 4.61% decrease. The LGS also has summer and winter seasonal rates, and Liberty is proposing no change to the summer seasonal rate and a 4.00% decrease to the winter seasonal rate. The overall decrease in rates for the LGS class is 3.76%.

Figure 5: Current and Proposed Rates, LGS

	Customer Charge		Block 1	Summer	Winter
	Small	Lg.			
Current	$275.00	$375.00	$8.4138	$2.5037	$6.7524
Proposed	$275.00	$375.00	$8.0257	$2.5037	$6.4823
% Change	0	0	-4.61	0	-4.00
Class % Change	**-3.76**				

Source: Liberty Utilities

Notes: Customer charge is monthly, Block charges are $/GJs, Class % change based on revenue changes assuming no elasticity effects.

In addition to the SGS, MGS and LGS classes, Liberty has three additional classes of customers. There is a contract general service class (CGS), which has demand, summer, and winter charges.

There is an industrial contract general service class (ICGS) which has customer, demand, summer, and winter charges. The last is an off-peak service class (OPS) with a customer charge and one block charge. Liberty is not proposing any rate design changes to these three customer classes.

Figure 6 below summarizes Liberty's current rate design and rates for the CGS and ICCS classes. With respect to rates, for the CGS class, Liberty is proposing to maintain the demand and summer charges at current levels and to decrease the winter charge by 8.04%. Overall, the CGS class will experience a 6.20% decrease under Liberty's proposed rates. For the ICGS class, Liberty is proposing to maintain the customer, demand, and summer charges at current levels and to decrease the winter charge by 17.90%. Overall, the ICGS class will experience a 7.07% decrease under Liberty's proposed rates. Finally, Liberty is proposing to maintain the customer charge at $50.00 for the OPS class and to decrease the block charge by 2.89%. Overall, the OPS class will experience a reduction of 2.85% under Liberty's proposed rates.

Figure 6: Current and Proposed Rates, CGS and ICGS

	Contract General			Industrial Contract General			
	Demand	Summer	Winter	Customer	Demand	Summer	Winter
Current	$19.00	$1.9066	$6.1047	$3,300	$25.56	$0.9375	$1.7859
Proposed	$19.00	$1.9066	$5.6136	$3,300	$25.56	$0.9375	$1.4633
% Change	0	0	-8.04	0	0	0	-17.90
Class % Change	-6.20			-7.07			

In summary, Liberty proposes to maintain its current rate design and make no modifications to them for all its classes of customers. In terms of rates, all customer classes except for SGS will experience a rate decrease under Liberty's proposal, ranging from a high (in absolute terms) of -7.07% for the ICGS class, to a low of -2.85% for the OPS class. The SGS class, will experience an overall rate increase of 3.12%.

Liberty's rate proposal is consistent with sound economics and good rate practice for a couple of reasons. Figure 7 below summarizes the revenue to cost ratio of each of Liberty's customer classes. Specifically, the statistic in the figure is the revenues using the current rates and volumes (customer and GJ) from the period divided by the costs from Liberty's COS study. It measures the degree to which current class revenues (and rates) are recovering the classes' cost of service. As can be seen in the figure, the SGS class has been significantly below 1.00 for the years in the figure, meaning that the SGS class revenues are not sufficient to recover the

costs that the SGS class imposes on the system. Liberty's proposed modest rate increase for the SGS class is consistent with the COS study and moves the SGS rates closer to cost. Liberty's modest rate increase proposal is economically reasonable and follows the Bonbright principles discussed above regarding rate stability and preventing customer rate shock. In addition, the rate changes made to the other customer classes, brings them all closer to cost, as reflected in the revenue to cost ratio. This is a movement in the correct direction and is consistent with ensuring rates are fair to the different customer classes. For example, the rate change for the SGS class increases the revenue to cost ratio to 0.61 and moves the customer class closer to the class' underlying costs and making the rates fairer. For the MGS class, the rate change brings the class practically on par with costs. While for the remaining classes, Liberty is reducing rates to reduce the amount of support the rates provide to the other classes and making the rates fairer.

Figure 7: Revenue to Cost Ratio by Customer Class

	2021	2022	2023
SGS	0.55	0.49	0.61
MGS	0.89	0.88	1.02
LGS	1.70	1.76	1.45
CGS	1.43	1.32	1.11
ICGS	1.42	1.46	1.18

Source: Liberty Utilities

V. Revenue Decoupling

In Section II, we provided an overview of the process by which a natural gas utility sets its revenue requirement through a cost-of-service study. As described, these studies usually involve a compilation of costs, and subsequently the setting of rates, by using total sales from a given test year. These sales can be from a year in the past or the future. Given that the use of natural gas services by a customer can fluctuate significantly based on weather conditions, it may be the case that actual sales for a given year are markedly different from those used to come up with a revenue requirement and the design of rates. In such a case, the actual revenues collected by the utility will be different than the requirements set during the company's rate case, resulting in either a shortfall or over collection of revenue. Revenue decoupling is a regulatory mechanism that disentangles the relationship between a utility's revenues and the inherent uncertainty in total sales. It ensures that a utility recovers its revenue requirement regardless of the total level of sales by setting up a "true-up" mechanism that periodically compares the revenue requirement for a given period against the actual revenues collected for the same period. If the utility over collects, a credit is issued to

customers to reflect the difference in revenues while under collection will result in an added charge on customer bills to make up for lost revenue.

Revenue decoupling may take various forms based on the jurisdiction under consideration but can be seen to provide financial stability to natural gas utilities, rate stability to customers and may also reduce contention between utilities and regulators during periodic rate cases. As it stands, traditional ratemaking for smaller customer classes attempts to recover largely fixed utility costs through volumetric rates that depend on how much customers consume. Therefore, a company's fixed cost recovery is contingent on the level of sales – the more the company can manage to sell, the closer it can get to recover its costs. Relatedly, it can create a disincentive for the company to drive energy conservation measures. Revenue decoupling can help mitigate this – by reducing the incentive to continually drive sales, it can provide the utilities the opportunity to be more innovative in their rate design and pursue province/jurisdiction mandated conservation goals without feeling the pinch of reduced sales volume. These features of revenue decoupling – providing financial stability to utilities, easing regulatory disputes during the ratemaking process, and driving innovation on the utility's part that can be passed through to ratepayers – are all hailed as benefits that the mechanism has to offer.

Given Liberty's application to set up a decoupling mechanism in the upcoming rate case, we provide an overview of current revenue decoupling practices in Canada and select US states in the following section.

VI. Revenue Decoupling Practices in the U.S. and Canada

In this section, we provide case studies of current revenue decoupling practices in North American jurisdictions. Specifically, we focus on the following jurisdictions:

1. **British Columbia** has a natural gas utility with an established revenue decoupling mechanism.
2. **California** is a pioneer in revenue decoupling mechanisms, as it was the first US state to establish a regulatory framework for a natural gas utility in the US.
3. **Massachusetts** required all electric and natural gas utilities to implement a revenue decoupling mechanism following a 2008 ruling and thus has a well-documented history of RDM mechanisms.
4. **New York,** like Massachusetts, also required all electric and natural gas utilities to set up decoupling mechanisms as part of utility rate cases.

A. British Columbia

The current revenue decoupling mechanism implemented in British Columbia is called a "Revenue Stabilization Adjustment Mechanism" ("RSAM") and was initially borne out of BC Gas' (now Fortis BC) request to set up a revenue adjustment mechanism to mitigate the impact of abnormal weather conditions on the utility's revenues with a mechanism known as the "Weather Stabilization Adjustment Mechanism". The utility withdrew this request but was ordered by the British Columbia Utilities Commission ("BCUC or Commission") to propose a full decoupling mechanism in time for the hearing on the company's next revenue requirement.[6]

BC Gas' initial RSAM proposal targeted variances in revenues from residential and commercial customer classes only during the winter months. Per this proposal, the company would place in a deferral account any variance in winter revenues that were above or below the company's forecast by more than a five percent dead band. The company argued that the creation of the deadband would ensure that undue shocks to customer rates would be minimized. In response to the Commission's request to come up with a full-decoupling mechanism, the company argued that the proposed RSAM was preferable to a full-decoupling mechanism. In its decision, the Commission accepted BC Gas' RSAM proposal but rejected the creation of a deadband. Instead, it recommended that the company amortize any differential revenues in the deferral account over a multi-year period to minimize rate volatility.[7]

To this date, FortisBC has continued to use the RSAM to account for differences in actual and forecasted revenues. The RSAM is included as a rate Rider in customer bills. In a recent rate case,[8] the company provided the calculation for the RSAM rider, as shown below in Figure 8. First, the total difference in revenues is calculated after accounting for interest and then amortized over a two-year period. The amortized amount is then divided by the total actual sales volume for the relevant rate classes for the forecasted year. In this case, that difference comes out to be negative, which would result in a negative rate rider, or in other words, result in a credit on customer bills.

[6] *See* Order No. G-33-93.

[7] *See* Order No. G-59-94.

[8] *See* Order No. G-78-21.

Figure 8: Fortis BC Calculation of RSAM Rider 5 for 2021

RSAM + RSAM Interest, Projected December 31, 2020 Balance (1*)	(239.1)
Amortization Period (years)	2
2021 Amortization post-tax ($000)	(119.6)
Tax Rate	27%
2021 Amortization pre-tax ($000)	(164.0)

RSAM (Rider 5) Calculation

Rate Class	RSAM Amortization ($000)	2021 Volume (TJ)	Rider ($/GJ)
Rate 1		235.3	(0.333)
Rate 2		166.8	(0.333)
Rate 3		90.2	(0.333)
	(164)	492.4	(0.333)

Notes: (1*) The projected December 31, 2020 balance is based on preliminary actuals.

Source: Order No. G-78-21

B. California

California was the first US state to introduce a revenue decoupling mechanism for natural gas utilities in 1978.[9] This was borne out of an investigation into gas utilities experiencing large fluctuations in revenues due to weather impacts and fuel switching. The first iteration of decoupling was a Supply Adjustment Mechanism ("SAM"), which compensated utilities for differences in revenues due to sales fluctuations. Differences between authorized revenues and actual revenues were tracked in balancing accounts and differences were either refunded or recovered from customers on a bi-annual basis through adjustments to rates.

As mentioned above, California utilities track authorized revenue requirements and actual billed revenues through balancing accounts. As an example, San Diego Gas & Electric Company maintains the Cost Fixed Cost Account ("CFCA") for revenue decoupling. Through this account, the company tracks, on a monthly basis, the authorized base margin revenue requirements (which includes the authorized revenue requirement for gas storage) against the actual billed core transportation base margin revenue. The CFCA applies to all core customers and is recovered through the core transportation tariff. For a given month, the CFCA also includes interest amounts at a rate that is one-twelfth of the interest rate on three-month Commercial Paper for the previous month.

[9] United States Department of Energy, "Natural Gas Revenue Decoupling Regulation: Impacts on Industry", July 2010.

C. Massachusetts

In 2008, the Massachusetts legislature passed Bill No. 2768, "An Act Relative to Green Communities" in order to encourage and improve investment in energy efficiency measures and move away from dependence on fossil-fuels for energy needs. Subsequently, in 2008, the Massachusetts Department of Public Utilities ("MDPU") directed all electric and gas utilities in the state to propose a full revenue decoupling mechanism in the next rate case. The MDPU argued that this move would remove financial barriers that might keep the state's distribution utilities from engaging in demand reducing efforts. This would also remove the companies' ability to retain excess revenues earned from additional sales growth in between rate proceedings.

NSTAR Gas Co. implements a revenue decoupling adjustment mechanism that it publishes with the Massachusetts Department of Public Utilities ("MDPU") on a periodic basis. Following the MDPU's 2008 ruling, the company employs a full decoupling mechanism to adjust natural gas distribution rates. In the most recent Revenue Decoupling Adjustment Clause,[10] NSTAR lays out the specifics of the decoupling mechanism for all their customer classes.

The revenue decoupling adjustment happens on a bi-annual basis, for the peak[11] and off-peak[12] period. The adjustment is calculated by comparing, for each customer class group, the difference between actual revenue per customer and the base revenue per customer, the latter of which refers to the allowable revenue to be recovered based on the set revenue requirement. The difference is multiplied by the total number of actual customers in each customer class group to come up with the total Revenue Adjustment Amount ("RDA") that is to be recovered through an adjustment to the rates. The total amount is apportioned among the different customer class groups using a pre-determined Distribution Revenue Allocator ("RDA") from the company's most recent rate filing. These Allocators vary for the peak and off-peak periods. The clause also set a Revenue Decoupling Cap ("RDC"), per which the total adjustment amount may not exceed 3% of the total revenues from firm sales and transportation. If the RDA exceeds the RDC, the adjustment amount will be set equal to the RDC and the excess amount will be deferred for adjustment in the next period. Once the RDA and DRA are determined, the product of the two is divided by the total forecasted throughput volume to come up with the Revenue Decoupling Adjustment Factor ("RDAF") to be added to customer bills. It is to be noted, however, that the RDAF for a peak period will only be applied to bills for the next peak

[10] *See* M.D.P.U. No. 409H.

[11] NSTAR defines the peak period as November 1 through April 30.

[12] NSTAR defines the off-peak period as May 1 through October 31.

period, and likewise for the off-peak period. The company is required to file all information related to the RDA ninety days prior to the effective dates for the peak and off-peak periods, respectively.

D. New York

In a bid to support the State's energy policies at the time, to promote the use of renewable sources of energy and encourage energy efficiency, the New York Public Service Commission ("NYPSC") produced an order[13] that directed all electric and natural gas utilities to propose and implement a true-up mechanism to compare forecasted and actual revenues. The order was passed to address potential disincentives for utilities to purse conservation initiatives from a rate perspective.

While all natural gas utilities in New York have a decoupling mechanism in place, these may take different forms in practice. As an example, we consider the revenue decoupling mechanism ("RDM") as implemented by New York State Electric & Gas Corporation. Per the RDM,[14] the companies establish Delivery Service Revenue ("DSR") Targets[15] based on the approved revenue requirement established in the most recent rate case. For the purpose of the RDM, two RDM classes are established – one residential class and one consolidated non-residential class. Delivery Revenues are also established, which are the sum of all billed base delivery revenues from all customers.[16] The actual delivery revenues will also account for a weather normalization adjustment clause. At the end of the year, the cumulative actual delivery revenues (after including weather normalization adjustments) are compared to the aggregate monthly DSRs. Any required adjustments based on the difference between the two series will be made during the 12-month period in the succeeding year. If at any time during the rate year, the difference between the cumulative delivery revenues and DSRs amount to 1.50% or more, the company may file an interim RDM. Such interim RDMs are limited to no more than one per rate year.

The company is required to file an RDM statement with the effective rate adjustments with the New York Public Service Commission no less than 30 days prior to the effective date of the adjustment. In the event of an interim RDM, the company must file an RDM statement no less than 10 days prior to the effective date.

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[13] *See* NYPSC Case 03-E-0640 and Case 06-G-0746.

[14] RDM General Information issues in compliance with Order in Case No. 19-G-0379.

[15] These are monthly weather-normalized revenue targets.

[16] Includes both the fixed customer charges as well as per therm delivery rates.

VII. Liberty's Proposed Decoupling Mechanism

As part of the 2023 rate application, Liberty is proposing to introduce an RDM, aimed at sharing the benefits of mitigating large revenue fluctuations with customers and the utility. This mechanism aims to reduce revenue volatility due to weather or other phenomena, thereby reducing risk for the company and consumers. As part of this decoupling mechanism, Liberty proposes:

1. A full-decoupling mechanism on an average revenue per customer basis
2. Applicable only to the distribution revenue
3. Applicable to all customer classes, except for LICS and OPS
4. Includes an interest rate equivalent to Liberty's average short-term interest rate for the month, plus 0.65%, and shall utilize the actual number of days in the month and the applicable fiscal year
5. Rate rider calculated for each class (volumetric) and adjusted annually
6. Limited impact of rate rider on annual distribution revenue (+/-5%), with amounts over/under this threshold retained in account balances

As part of its RDM for the SGS rate class, Liberty is proposing to include a monthly real-time Weather Normalization Adjustment ("WNA") to the SGS rate class during the heating season only (October through May). This will take the form of a monthly customer-by-customer bill adjustment that accounts for variations in actual versus normal weather conditions. This may have a downward effect on customer's bills in extreme weather when conditions deviate markedly from what is considered normal weather.

Based on our review of revenue decoupling mechanisms in other North American jurisdictions, the key traits of Liberty's proposal appear to be in line with those typically implemented. The full decoupling mechanism is like those adopted by the British Columbia and Massachusetts utilities sampled in the previous section. The application of the decoupling mechanism to only the distribution portion of the revenue is consistent with all sampled utilities, as commodity costs are a straight pass-through to customers, *i.e.*, the utility does not earn any profits on gas supply costs. Rate class eligibility is also consistent with the sampled utilities as it applies across the major customers classes. The inclusion of interest in the calculation of rate adjustment also aligns with the British Columbia and California utilities while the limit placed on the level of rate adjustments is consistent with the Massachusetts and New York utilities. In aggregate, Liberty's proposal for the revenue decoupling mechanism is grounded in regulatory precedent.

VIII. CV of Dr. Agustin J. Ros

Dr. Agustin J. Ros has over 25 years of expertise in regulatory and antitrust economics in network industries—airlines, electricity, natural gas, postal, telecommunications, transport and water—and in statistical and econometric analysis. He is Adjunct Professor at the International Business School at Brandeis University where he teaches a course on global regulatory and antitrust economics and is an advisor to the Board of the Boston International Arbitration Council.

He has filed expert reports and testimony before U.S. Federal District Courts, the Federal Communications Commission, the Federal Energy Regulatory Commission, the Canadian Competition Commission, the Canadian Radio and Telecommunications Commission, before many U.S. and Canadian public utility commissions and before the International Chamber of Commerce. In Mexico, Dr. Ros has filed expert reports before the Competition Commission, the Secretariat of Communications and Transport, the Secretariat of Energy, the Energy Regulatory Commission, the Federal Telecommunication Regulator, and the National Regulatory Gas Commission. In addition, he has filed expert reports before regulatory or competition agencies in Australia, Bahamas, Barbados, Brazil, Colombia, El Salvador, Guatemala, Honduras, Indonesia, Italy, New Zealand, Peru, Singapore, Spain, and Trinidad and Tobago.

In regulatory economics he has filed reports involving all aspects of tariff setting, including demand analysis and forecasts, marginal and embedded costing, rate of return and weighted average cost of capital, just and reasonable rates, market-based rates, performance-based ratemaking. In antitrust economics, he has filed reports involving market allocation agreements, assessment of market power and mergers, market definition, cross-subsidies and predatory pricing, economic damages and econometric and statistical analysis.

Dr. Ros has worked as an economist at the Illinois Commerce Commission, the Federal Communications Commission, and the Mexican Competition Commission. At the ICC he was Executive Assistant to the Chairman advising the Chairman on all economic and policy matters before the Commission and was selected to participate in the Federal-State partnership in Telecommunications at the FCC in 1996 where he worked on the economic rules implementing the local competition provisions of the Telecommunications Act of 1996. In 2008-2010 he worked for the OECD and the Mexican Competition Commission co-leading a team of competition experts assessing competition in a number of key sectors of the Mexican economy including, aviation, banking, inter-city bus transport, energy, pharmaceutical, supermarkets,

and telecommunications. The team made a series of policy recommendations to increase competition some of which were enacted into law.

Dr. Ros has published widely in peer-reviewed academic journals such as *Energy Economics*, *Energy Journal*, *Journal of Regulatory Economics*, *Review of Industrial Organization*, *Review of Network Economics*, *Telecommunications Policy,* and *Info*.

AREAS OF EXPERTISE

- Costing, Demand and Tariffs in Regulated Industries
- Antitrust and Competition Policy
- Regulated Industry Policy and Restructuring
- Damages Calculation
- Statistical and Econometric Analysis

EDUCATION

Ph.D. Economics, University of Illinois-Urbana Champaign 1994

M.S. Economics, University of Illinois-Urbana Champaign 1991

B.A. Economics, Rutgers University-Newark 1989

TEACHING POSITIONS

Adjunct Professor, Brandeis University, International Business School 2016 - present

Guest Lecturer, University of Anahuac, Mexico City 2010

Adjunct Instructor, Northeastern University 2000

EMPLOYMENT

Senior Managing Director, Ankura Consulting 2023 - present

Principal, The Brattle Group 2017 - 2023

Economist, OECD and Mexican Competition Commission 2008 - 2010

Senior Managing Director, NERA Economic Consulting 1996 - 2017

Economist, Federal Communications Commission 1996

Economist, Illinois Commerce Commission 1994 - 1996

EXPERT REPORTS, TESTIMONIES AND AFFIDAVITS

1. Rebuttal Report on behalf of Plaintiff before the United States District Court Southern District of Florida Fort Pierce Division, Case No. 21-14354-CIV-CANNON in the matter of Plaintiff, Town of Indian Shores *v.* Defendant, City of Vero Beach regarding antitrust assessment of territorial market allocation agreement, October 7, 2022.

2. Expert Report on behalf of Plaintiff before the United States District Court Southern District of Florida Fort Pierce Division, Case No. 21-14354-CIV-CANNON in the matter of Plaintiff, Town of Indian Shores v. Defendant, City of Vero Beach regarding antitrust assessment of territorial market allocation agreement, September 6, 2022.

3. Prepared Answering Testimony on behalf of Tri-State Generation and Transmission Association, Inc., before the Federal Energy Regulatory Commission in Dockets Nos. ER20-2441-002, ER20-2442-002, EL20-68-002, ER21-426-001, ER21-682-002, ER21-768-002 (Consolidated) on just and reasonable rates and undue discrimination, July 15, 2022.

4. Rebuttal Expert Report on behalf of Defendants before the United States District Court Southern District of Florida Ft. Lauderdale Division, in the matter of Plaintiffs Café Gelato & Panini LLC d/b/a Café Gelato Panini, on behalf of itself and all others similarly situated, v. Defendants Simon Property Group INC., Simon Property Group, L.P., M.S. Management Associates, and the Town Center at Town Center at Boca Raton Trust, June 3, 2022.

5. Expert Report on behalf of Defendants before the United States District Court Southern District of Florida Ft. Lauderdale Division, in the matter of Plaintiffs Café Gelato & Panini LLC d/b/a Café Gelato Panini, on behalf of itself and all others similarly situated, v. Defendants Simon Property Group INC., Simon Property Group, L.P., M.S. Management Associates, and the Town Center at Town Center at Boca Raton Trust, May 17, 2022.

6. Expert report before the Régie de l'énergie on behalf of Hydro-Québec TransÉnergie, Response to PEG's Commentary on HQT's MRI Evidence, with Sai Shetty, November 29, 2021.

7. Expert report before the Régie de l'énergie on behalf of Hydro-Québec TransÉnergie, Total Factor Productivity and the X-factor for Hydro-Québec TransÉnergie, with Walter Graf, Sai Shetty and Maria Castaner, February 19, 2021.

8. Expert report on behalf of North Carolina Municipal Power Agency Number 1, Piedmont Municipal Power Agency, and North Carolina Electric Membership Corporation on electricity cost allocation of nuclear fleet costs in arbitration proceeding against Duke Energy Carolinas, November 13, 2020.

9. Expert report before the Canadian Radio and Telecommunications Commission, on behalf of Bragg Communications Inc. (c.o.b. Eastlink), Cogeco Communications Inc., Rogers Communications Canada Inc., Shaw Cablesystems G.P., and Videotron Ltd., Assessment of an Expert Report by the Brattle Group Regarding Telecom Order CRTC 2019-288, with Renée M. Duplantis, Dimitri Dimitropoulos and Ian Cass, March 13, 2020.

10. Testimony before the State of New Hampshire Public Utilities Commission, Docket No. DE 19-057, on behalf of the Staff of the New Hampshire Public Utility Commission on electricity marginal cost of service studies, December 20, 2019.

11. Rebuttal Testimony before the Virginia Corporation Commission, Case No. PUR-2019-00104, on behalf of the Virginia Electric Power Company on cost allocation of utility scale solar projects, December 19, 2019.

12. Testimony before the State of New Hampshire Public Utilities Commission, Docket No. DE 19-064, on behalf of the Staff of the New Hampshire Public Utility Commission on electricity marginal cost of service studies, December 6, 2019.

13. Expert report on behalf of the Newfoundland and Labrador Board of Commissioners of Public Utilities: Review of Existing and Proposed Network Additions Policies for Newfoundland and Labrador Hydro, with Philip Hanser and Peal Donohoo-Vallet, November 19, 2019.

14. Expert report on behalf of Bragg Communications Inc. (c.o.b. Eastlink), Cogeco Communications Inc., Rogers Communications Canada Inc., Shaw Cablesystems G.P., and Videotron Ltd., Analysis of CRTC's Final Rates for Aggregated Wholesale High-Speed Access Services: Impact on Broadband Network Investment and Innovation, with Renée M. Duplantis, Dimitri Dimitropoulos and Ian Cass, November 13, 2019.

15. Testimony before the Virginia Corporation Commission, Case No. PUR-2019-00104, on behalf of the Virginia Electric Power Company on cost allocation of utility scale solar projects, July 1, 2019.

16. Expert report on behalf of the Newfoundland and Labrador Board of Commissioners of Public Utilities: Embedded and Marginal Cost of Service Review, with Philip Hanser, T. Bruce Tschusida, Pearl Donohoo-Vallet, and Lynn Zang, May 3, 2019.

17. Expert report on behalf of Shaw Communications before the Canadian Legislative Review Panel of the Broadcasting and Telecommunications: Analysis of BDU Contributions, ISP Taxes and Regulations in the Canadian Broadcasting and Telecommunications Industries: Economic Efficiency, Investment and Innovation, with Coleman Bazelon and Renée Duplantis, January 11, 2019.

18. Expert opinion on behalf of CFE International LLC before the U.S. Citizenship and Immigration Services and Department of Homeland Security: An Overview of the Mexican Energy Markets and Reforms, October 25, 2018.

19. Expert report on behalf of Shaw Communications before the Canadian Competition Bureau: An Analysis of Broadband Services in Canada, Competition, Regulation and Investment with Coleman Bazelon and Renée Duplantis, August 30, 2018.

20. Affidavit on behalf of CFE International LLC before the Federal Energy Regulatory Commission: market-based rate authority application on vertical and horizontal market power issues in U.S. electricity markets, with Judy Chang, June 13, 2018.

21. Expert report on behalf of the Australian Competition and Consumer Commission (ACCC), before the ACCC: International experiences in retail electricity markets, with Toby Brown, Neil Lessem, Serena Hesmondhalgh, James D. Reitzes and Haruna Fujita, June 2018

22. Expert report on behalf of Transportadora de Gas Natural de la Huasteca, S. de R.I. de C.V. before the Mexican Energy Regulatory Commission: expert opinion on issues related to the appropriate allowed rate of return for the TGNH pipeline, with Paul Carpenter and Bente Villadsen, May 23, 2018.

23. Expert report on behalf of Infraestructura Marina del Golfo, before the Mexican Energy Regulatory Commission: expert opinion on issues related to the appropriate allowed rate of return for the IMG pipeline, with Paul Carpenter and Bente Villadsen, May 23, 2018.

24. Expert report on behalf of GCI Communications before the Federal Communications Commission: rate of return, cost of service and cross-subsidy analysis of GCI's Satellite-Based Services, with William Zarakas and Nicolas E. Powers, May 2018.

25. Expert report on behalf of GCI Communications before the Federal Communications Commission, In the Matter of Connect America Fund and Universal Service Reform, WC Docket No. 10-90 and WT Docket No. 10-208A: analysis of the FCC's Rural Health Care Program Funding and Recipients, with William Zarakas, David Kwok, and M. Elaine Cunha, September 2017.

26. Expert report on behalf of Teléfonos de Mexico before the Mexican Telecommunications Authority: measurement of total factor productivity for Teléfonos de Mexico, July, 2014.

27. Expert report on behalf of Citibank, before the Honduran Competition Commission: expert report on the competitive effects of the FICHOSA – Citibank merger, April, 2014.

28. Expert report on behalf of America Móvil before the Mexican Competition Commission: correcting the OECD's erroneous assessment of competition in the Mexican telecommunications sector, May 2013. With Professor Jerry A. Hausman.

29. Expert report on behalf of Leyde and LACTHOSA before the Honduran Competition Commission: expert report on the competitive effects of a joint venture between Leyde and LACTHOSA in the Honduran dairy sector, April 2013.

30. Expert report on behalf of Lowe's Mexico before the Mexican Competition Commission: economic analysis on market definition, market power and monopolistic practices in the market for home improvement products sold through superstores, October 2012.

31. Expert report on behalf of Comcel before the Regulatory Commission of Communications in Colombia: expert report on economic analysis of Resolution CRC 3139 2011 regarding on-net and off-net pricing and termination rates, November 9, 2011.

32. Expert report on behalf of ESSOSA and Puma before the El Salvador Competition Commission: expert report on the competition implications of assets sales in El Salvador, (with Ramsey Shehadeh) October 5, 2011.

33. Expert report on behalf of ESSOSA and Puma before the Honduran Commission for the Defense and Promotion of Competition: expert report on the competition implications of assets sales in Honduras, (with Ramsey Shehadeh) July 19, 2011.

34. Testimony before the state of Illinois on behalf of Northern Illinois Gas Company, Docket No. 11-0046, surrebuttal testimony regarding market definition, market power and public interest considerations, filed April 22, 2011.

35. Testimony before the Alberta Public Utility Commission, Proceeding 566 Electricity Rate Regulation Initiative, update, reply and PBR review study, filed February 22, 2011.

36. Testimony before the Alberta Public Utility Commission, Proceeding 566 Electricity Rate Regulation Initiative, total factor productivity study, filed December 30, 2010.

37. Testimony before the state of Illinois on behalf of Northern Illinois Gas Company, Docket No. 09-0310, rebuttal testimony regarding market definition, market power and public interest considerations, filed August 6, 2010.

38. Expert report before the Commission for the Supervision of Business Competition of the Republic of Indonesia on behalf of Singapore Telecommunications Limited and Singapore Telecom Mobile, "Competitive Assessment of the Indonesian Mobile Sector," (with William E. Taylor, Nigel Attenborough and Christian Dippon), filed October 15, 2007, rebuttal report filed January 11, 2008.

39. Expert report before the Ministry of Economic Affairs and Development on behalf of Cable and Wireless Barbados, "An Economic Assessment of Mandating Indirect Access in Barbados," (with Michael Khyefets and Loren Adler), November 14, 2007.

40. Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSITPEL) on behalf of Telefonica de Peru, expert report on economic efficiency considerations with respect to termination rates and the impact of capacity-based charges, (with Jose Maria Rodriguez), filed October 17, 2007.

41. Expert report before the Canadian Radio and Telecommunications Commission (Telecom Public Notice CRTC 2006-14) on behalf of Bell Aliant Regional Communications, "Telecommunications Competition in the US: An Assessment of Wholesale Regulation Policy," (with William E. Taylor), filed March 15, 2007.

42. Expert report before the New York Public Service Commission (Case 06-C-0897) on behalf of Verizon New York, "Report on Competition for Retail Business Services," (with William E. Taylor and Harold Ware), filed report August 31, 2006. Supplemental Report filed October 2, 2006.

43. Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, response to Digicel's economic analysis of Interconnections costs and rates, filed May 12, 2006 (with Timothy Tardiff).

44. Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, expert report on interconnections costs in Trinidad and Tobago, filed May 4, 2006 (with Timothy Tardiff).

45. Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, expert report on Benchmark Mobile Termination Rates, Evaluation of the .Econ Report, filed February 10, 2006 (with Timothy Tardiff).

46. Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSITPEL) on behalf of Telefonica de Peru, expert report on OSIPTEL's imputation methodology, filed February 7, 2006 (with Jose Maria Rodriguez and Eduardo Prieto Kessler).

47. Expert report before the Comisión Federal de Telecomunicaciones de México, on behalf of Telcel, S.A., expert report measuring the cost Telcel incurs when providing interconnection services to operators, filed 22 June 2005.

48. Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSIPTEL) on behalf of Telefonica de Peru, final report regarding the estimation of Telefonica de Peru's total factor productivity for application in the 2004-2007 price cap regime (with José María Rodríguez Ovejero and Juan Hernández García), 21 June 2004.

49. Expert report before the Bahamas Public Utilities Commission, on behalf of the Bahamas Telecommunications Company, "Public Consultation on the Universal Service Obligation in The Bahamas," Comments filed 24 March 2004; Reply Comments filed 10 June 2004.

50. Expert report before the Canadian Radio-television and Telecommunications Commission on behalf of Aliant Telecom Inc., Bell Canada, MTS Communications Inc., Saskatchewan Telecommunications and Télébec, société en commandite, Public Notice 2003-10, "A Review of Rules and Regulations Governing Bundled Telecommunications Services." filed 12 March 2004, updated report filed 26 March 2004.

51. Expert report before the Bahamas Public Utilities Commission, on behalf of the Bahamas Telecommunications Company, "Public Consultation on Price Control of Bahamas Telecommunications Company," 19 September 2003.

52. Expert report before the Comisión Federal de Telecomunicaciones de México, on behalf of the Commission, "Telmex's 2003-2006 Price Cap Tariff Proposal," expert report in arbitration regarding the renewal of the price cap plan for Telmex (with William Taylor, Georgina Martinez, and Aniruddha Banerjee), 13 December 2002.

53. Expert report before the Honorable Arbitration Tribunal of Fairness in Guatemala, Case No. CENAC-A-01-2002, final report in arbitration regarding call termination costs in fixed and wireless networks (with José María Rodríguez Ovejero, Laurent Bensancon, and Juan Hernández García), September 2002.

54. Expert report before the Federal Communications Commission on behalf of BellSouth Corporation Docket Nos. 01-338, 96-98, 98-47 Reply Declaration (with William Taylor, Aniruddha Banerjee, and Charles Zarkadas) regarding unbundling obligations of local exchange carriers. Filed 17 July 2002.

55. Expert report before the Federal Communications Commission on behalf of Verizon Communications, Docket Nos. 01-339, 01-337, 02-33, Statement of 43 Economists on the Proper Regulatory Treatment of Broadband Internet Access Service, 3 May 2002.

56. Expert report before the New Zealand Commerce Commission on behalf of Telecom New Zealand, "Review of CostQuests' Associates Benchmarking Survey" (with William Taylor, Greg Houston, Tom Hird, Jaime D'Almeida, and Carol Osborne), May 2002.

57. Testimony before the State of Illinois on behalf of Verizon North Inc. and Verizon South Inc., Docket No. 98-0195, surrebuttal testimony regarding investigation into certain payphone issues as directed in Docket 97-0225, 16 July 2001.

58. Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSIPTEL) on behalf of Telefonica de Peru, final report regarding the estimation of Telefonica de Peru's total factor productivity for application in the 2001-2003 price cap regime (with Timothy Tardiff, José María Rodríguez Ovejero, and Juan Hernández García), 22 June 2001.

59. Testimony before the State of Illinois on behalf of Verizon North Inc. and Verizon South Inc., Docket No. 98-0195, rebuttal testimony regarding investigation into certain payphone issues as directed in Docket 97-0225, 20 April 2001.

60. Expert report before the New Zealand Commerce Commission, on behalf of Telecom New Zealand, "Costs of Telecommunications Competition Policies," final report exploring the indirect economic costs of changing competition policy to a more regulatory approach (with Harold Ware, Timothy Tardiff, and Nigel Attenborough), May 2000.

61. Testimony before the State of Illinois on behalf of GTE North Incorporated and GTE South Incorporated, Docket No. 98-0195, direct testimony regarding investigation into certain payphone issues as directed in Docket No. 97-0225, 21 December 1999.

62. Expert report before the Federal Communications Commission on behalf of US West, An Economic and Policy Analysis of Efficient Inter-Carrier Compensation Mechanisms for ISP-Bound Traffic, 12 November 1999.

63. Expert report before the Pennsylvania Public Utility Commission on behalf of Bell Atlantic Pennsylvania, Promised Fulfilled: Bell Atlantic-Pennsylvania's Infrastructure Development (with William Taylor, Charles Zarkadas, and Jaime D'Almeida), 15 January 1999.

64. Testimony before the State of Illinois on behalf of Illinois Gas Transmission Company, Docket No 98-0510, rebuttal testimony regarding certification of Illinois Gas Transmission Company as a Common Carrier by Pipeline and approval of rates and accounting, and for cancellation of the Certificate of Illini Carrier, LP, 11 January 1999.

65. Expert report before the Spanish Regulatory Commission on behalf of Telefónica, final report "Assessment of the methodology used by Telefónica in the calculation of the prices included in the interconnection reference offer and comparison with BT's interconnection prices" (with Nigel Attenborough, David Robinson, Yogesh Sharma, and José María Rodríguez Ovejero), October 1998.

66. Expert report before the Italian Regulatory Commission on behalf of Telecom Italia, final report "Volume Discounts: A Report for Telecom Italia" (with Nigel Attenborough, Andrea Coscelli, and Andrea Lofaro), October 1998.

67. Expert report before the Federal Communications Commission on behalf of Bell Atlantic, Docket Nos. 96-262, 94-1, 91-213, 96-263, "An Analysis of the Effects of Exchange Access Reform on Demand Stimulation" (with Charles Zarkadas), 27 April 1997.

RECENT CONSULTING ENGAGEMENTS

Consulting work on behalf of a major electricity and natural gas provider in Latin America: Due diligence review and analysis of a liquified natural gas contract.

Consulting work on behalf of the Colombian regulator of energy and gas (CREG): Recommendations for a Tariff and Capacity Model for Natural Gas Transportation in Colombia, November 30, 2021 with Dan Harris, Carlos Lapuerta and Pedro Marin.

Consulting work on behalf of the Colombian regulator of energy and gas (CREG): Report entitled "Review of International Experience Regarding the Regulation and Remuneration of Natural Gas Transportation and Recommendations for Colombia," November 12, 2021 with Carlos Lapuerta and Pedro Marin.

Consulting work on behalf of the Colombian regulator of energy and gas (CREG): Report entitled "Market Diagnostic of the Colombian Natural Gas Transportation Market," October 16, 2021 with Carlos Lapuerta and Pedro Marin.

Consulting work on behalf of CPS Energy and the Rate Advisory Committee involving electricity and gas cost of service, rate design, energy efficiency and energy burden analysis, ongoing.

Consulting work on behalf of a private-equity firm interested in purchasing solar distributed generation assets: Regulatory policy considerations, main determinants of demand and forecasts involving distributed solar energy, 2020.

Consulting work on behalf of Consumers Energy, class cost of service for residential NEM customers, January 2020.

Consulting work on behalf of a large Mid-western electricity provider in the U.S.: Analysis of the costs to serve secondary and primary NEM and standby customers, 2019.

Consulting work on behalf of a municipal electricity provider in the U.S.: Rate Design Principles and Rate Review for electricity and water services, 2019.

Consulting report on behalf of large South American oil and gas company: Evaluation of proposal in relation to the regulation of wholesale petroleum prices, (Evaluación de las propuestas en relación con la regulación de los precios de reconocimiento), with Pedro Marin, November 13, 2019.

Consulting work on behalf of a major electricity distribution company in the U.S.: cost study and competitive pricing principles of advanced metering services, 2018-2019.

Consulting work on behalf of a Canadian electricity provider: benchmarking analysis of generation utilities in transmission and regulatory practices with respective to generation procurement practices, distributed energy resources and customer-specific pricing practices, 2018.

Consulting work on behalf of a U.S. generation and transmission electricity cooperative: embedded and marginal cost of service studies to support rate reform initiative, 2018.

Consulting work on behalf of a major electricity distribution provider in the U.S.: develop a locational distribution marginal cost-based cost of service study to support the value of distributed energy resource proceedings, 2017 - 2018.

Consulting report on behalf of major foreign electricity and gas distribution company: Rules and regulations applicable to the competitive U.S. retail electricity providers in the U.S. and Canada: A regulatory assessment, November 2017.

Consulting report on behalf of major foreign electricity and gas distribution company: Rules and regulations applicable to the competitive U.S. retail natural gas providers in the U.S. and Canada: A regulatory assessment, November 2017.

Consulting work on behalf of the Cities of Garland, Mesquite, Plano, and Richardson appealing the decision by North Texas Municipal Water District affecting wholesale water rates, Texas PUC Docket No. 46662 and SOAH Docket No. 473-17-4964.WS: economic analysis of whether wholesale water rate charged by the District adversely affects the public interest and rate design issues., 2017 – 2018.

Consulting work on behalf of a major electricity distribution company in the U.S.: cost study and competitive pricing principles of advanced metering services, 2015 - 2016.

Consulting report for the Mexican National Center for the Control of Natural Gas: Electricity demand forecast for the National Mexican Electricity System for the period 2017-2030. December 2016. With Veronica Irastorza and Elvira Creel.

Consulting report for the Mexican Secretariat of Communications and Transport: "Econometric demand study of fixed and mobile broadband and telephony services and Pay-TV services using discrete choice analysis." January 2016. With Kenneth Train and Douglas Umaña.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: recommended number of CFE gencos. September 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: Recommended optimal portfolio mix for the CFE gencos. September 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: Identification of relevant markets within the Mexican wholesale electricity markets. August 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy: Vesting contract criteria and methodology report. July 2015. With Hamish Fraser, Gene Meehan and Kurt Strunk.

RECENT PRESENTATIONS

Presentation before Rutgers University Center for Research in Regulated Industries Western Conference: “Residential Rooftop Solar Demand and the Impact of NEM Compensation and Electricity Prices,” June 23, 2022.

Presentation before Rutgers University Center for Research in Regulated Industries Western Conference: “PBR: What, Why and What Have You Done for Me Lately?” June 22, 2022.

Presentation before Rutgers University Center for Research in Regulated Industries Eastern Conference: “Residential Rooftop Solar Demand and the Impact of NEM Compensation and Electricity Prices,” June 2, 2022.

Webinar Presentation, Cross-Border Energy Update: Recent Government Policy Changes and the Future of Power Projects in Mexico, June 10, 2020.

Presentation before the National Association of Regulatory Utility Commissioners (NARUC): Cost of Service Allocation in a New Era, February 9, 2020.

Presentation before Rutgers University’s Center for Research in Regulated Industries, Advanced Workshop: “Empirical Assessment of the Demand for Residential Solar Distributed Generation and the Impact of Electricity Rate Design Reform, January 17, 2020.

Presentation before the Harvard Electricity Policy Group: Rate Design and Low Income Consumers June 12, 2019.

Presentation before Rutgers University Center for Research in Regulated Industries Eastern Conference: “Does Electricity Competition Work for Residential Customers?” May 30, 2019.

Presentation before Rutgers University’s Center for Research in Regulated Industries, Advanced Workshop: “Residential Electricity Competition at a Crossroads,” February 15, 2019.

Presentation before the EEI Electric Rates Advanced Course, “Introduction to Embedded Cost of Service,” with Phil Q Hanser, July 2018.

Presentation before the EEI Electric Rates Advanced Course, “Introduction to Marginal Cost of Service,” with Phil Q Hanser, July 2018.

Presentation before the Public Collaborative for the Puerto Rico Electricity System, “Introduction to Utility Regulation,” with Karl McDermott, July 19, 2018.

Presentations before the Public Collaborative for the Puerto Rico Electricity System, “Introduction to Electricity System Planning,” with Karl McDermott, July 19, 2018.

Presentation before the Public Collaborative for the Puerto Rico Electricity System, “Ownership Structure, Contracting Process and Wholesale Markets,” with Karl McDermott, July 19, 2018.

Presentation before Rutgers University Center for Research in Regulated Industries Eastern Conference: "Marginal cost of service: electricity distribution locational marginal costs, with Phillip Q Hanser and T. Bruce Tsuchida, June 8, 2018.

Presentation before the World Forum on Energy Regulation, Cancun Mexico: "Rate design helping facilitate change in electricity markets," March 2018.

Presentation before Rutgers University's Center for Research in Regulated Industries, Advanced Workshop: "Utility of the future and cost of service: challenges and opportunities," January 2018.

Presentation before Rutgers University's Center for Research in Regulated Industries, 36th Annual Eastern Conference: "The evolving electricity distribution network – technological, competitive and regulatory implications." May 2017.

Presentation before Rutgers University's Center for Research in Regulated Industries, Advanced Workshop: "Costing and pricing of electricity smart grid service offerings and competitive implications." January 2017.

Presentation before Rutgers University's Center for Research in Regulated Industries, 35th Annual Eastern Conference: "Determinants of total factor productivity in the U.S. electricity sector and the effects of performance-based regulation." May 2016.

Presentation before Rutgers University's Center for Research in Regulated Industries, Advanced Workshop: "merger theory and practice in the U.S. electricity sector." January 2016.

PUBLICATIONS

1. "Residential Rooftop Solar Demand and the Impact of NEM Compensation and Electricity Prices," (with Sai Shetty), *Energy Economics* 118: 1-15 (2023).

2. "Does electricity competition work for residential consumers? Evidence from demand models for default and competitive electricity services." *The Journal of Regulatory Economics* 58:1-32 (2020).

3. "Economic framework for compensating distributed energy resources: Theory and practice." (with Romkaew Broehm and Philip Hanser), *The Electricity Journal* 31(8): 14-22 (2018).

4. "The future of the electric grid and its regulation: Some considerations," *The Electricity Journal* 31(2): 18-25 (2018).

5. "An Econometric Assessment of Electricity Demand in the United States using Utility-Specific Panel Data and the Impact of Retail Competition on Prices." *The Energy Journal* 38(4): 73-99 (2017).

6. “An Econometric Assessment of Telecommunications Prices and Consumer Surplus in Mexico using Panel Data.” (with Jerry A. Hausman), *Journal of Regulatory Economics*, vol. 43:284-304 (2013).

7. “Corrección de la Evaluación Errónea de la OCDE Acerca de la Competencia en el Sector de las telecomunicaciones en México.” (con Jerry Hausman), *El Trimestre Economico* (2013).

8. “The Impact of Asymmetric Mobile Regulation in Colombia.” (with Douglas Umana), *Info*, vol. 15 No. 3:54-65 (2013).

9. “Correcting the OECD’s Erroneous Assessment of Telecommunications Competition in Mexico.” (with Jerry A. Hausman), *CPI Antitrust Chronicle* June 2012.

10. “North American Performance-Base Regulation for the 21st Century.” (with Jeff D. Makholm and Stephen Collins), *Electricity Journal* vol. 25, Issue 4, May 2012.

11. “The Determinants of Pricing in the Mexican Domestic Airline Sector: The Impact of Competition and Airport Congestion.” *Review of Industrial Organization* vol. 38:1 (2011), pp 43-60.

12. “Anticipating Merger Guidelines from Mexico’s Commission on Competition.” (with Elizabeth M. Bailey), *International Antitrust Bulletin* vol. 4, (2010).

13. “X-factor Updating and Total Factor Productivity Growth: The Case of Peruvian Telecommunications, 1996-2003.” (with Jeffrey I. Bernstein, Juan Hernandez and Jose Maria Rodriguez), *Journal of Regulatory Economics*, vol. 30:3 (2006), pp 316-342.

14. “Crecimiento de la demanda por servicios de comunicación móviles. Mitos y realidades (International Mobile Demand Growth: Myths and Reality)” (with Aniruddha Banerjee), *AHCIET Móvil* (September 2005).

15. “Concepto de costes básicos para la modelización entelecomunicaciones (Basic Economic Cost Concepts for Telecommunications Cost Modeling), Perspectivas en Telecomunicaciones (Perspectives in Telecommunications) (July 2005).

16. “Drivers of Demand Growth for Mobile Telecommunications Services: Evidence from International Panel Data.” (with Aniruddha Banerjee), in Global Economy and Digital Society, Elsevier (2004).

17. “Patterns in Global Fixed and Mobile Telecommunications Development: A Cluster Analysis.” (with Aniruddha Banerjee), *Telecommunications Policy*, vol. 28 (2004), pp. 107-132.

18. “The Impact of the Regulatory Process and Price Cap Regulation in Latin American Telecommunications Markets.” *Review of Network Economics*, vol. 2 (2003), pp. 270-286.

19. "Does Employee Ownership Motivate Workers? Worker Effort, Shirking and Horizontal Monitoring in ESOP." The Determinants of the Incidence and the Effects of Participatory Organizations, Advances in the Economic Analysis of Participatory and Labor Management, edited by Takao Kato and Jeffrey Pliskin, Elsevier Science, vol. 7 (2003).

20. "The Internet: Market Characteristics and Regulatory Conundrums." (with Aniruddha Banerjee), Forecasting the Internet: Understanding the Explosive Growth of Data Communications, edited by David G. Loomis and Lester D. Taylor, Kluwer Academic Publishers (2002), pp. 187-216.

21. Profits for All? The Costs and Benefits of Employee Ownership, Nova Science Publishers, (2001).

22. "Are Residential Local Exchange Prices Too Low? Drivers to Competition in the Local Exchange Market and the Impact of Inefficient Prices." (with Karl McDermott), in Expanding Competition in Regulated Industries, edited by Michael Crew, Kluwer Academic Publishers (2000), pp. 149-168.

23. "Telecommunications Privatization and Tariff Rebalancing: Evidence from Latin America." (with Aniruddha Banerjee), *Telecommunications Policy*, vol. 24 (2000), 233-252.

24. "Utility Regulation in Latin America." (with Leonardo Giacchino, Cesar Herrera, Siôn Jones, Phillip Maggs, and Kristina Sepetys), Privatisation International, edited by Mark Baker, vol. 2 (2000).

25. "Essential Facilities, Economic Efficiency, and a Mandate to Share: A Policy Primer." (with Karl McDermott, Kenneth Gordon, and William Taylor), Edison Electric Institute (January 2000).

26. "Does Ownership or Competition Matter? The Effects of Telecommunications Reform on Network Expansion and Efficiency." *Journal of Regulatory Economics*, vol.15 (1999), pp. 65-92.

27. "Telecommunication Restructuring in Brazil: Issues and Options (A Report Based on the Proceedings of the U.S./Brazil Aspen Global Forum)." International Center for Public Administration and Policy Institute for Policy Research and Implementation, Graduate School of Public Affairs, University of Colorado at Denver (December 1997).

28. "When, Where and How? Implementing Effective Telecommunications Competition & Regulatory Policy." *Journal of Project Finance* (Winter 1997).

29. "Telecommunications in Brazil: Restructuring and Privatization" (et. al.), A Report Based on the Proceedings of the Brazil/U.S. Aspen Global Forum, International Center for Public

Administration and Policy Institute for Policy Research and Implementation, Graduate School of Public Affairs, University of Colorado at Denver, August (1997).

30. “Another Look at What’s Driving Utility Stock Prices.” (with John L. Damagalski and Philip R. O’Connor), *Public Utilities Fortnightly* (January 1997).

31. "Regulatory Change and the Dismantling of the Bottleneck." Tenth NARUC Biennial Regulatory Information Proceedings (October 1996).

32. "Stranded Costs: Is the Market Paying Attention? A Look at Market-to-Book Ratios." (with John L. Damagalski and Philip R. O'Connor), *Public Utilities Fortnightly* (May 1996).

33. "The Gas Storage Market: What Does it Tell Us?" (with Ruth Kretschmer), *Public Utilities Fortnightly* (April 1996).

34. "Incentive Ratemaking in Illinois: The Transition to Competitive Markets" (with Terry S. Harvill), *Public Utilities Fortnightly* (July 1995).