BEFORE THE

NORTH DAKOTA PUBLIC SERVICE COMMISSION

In the Matter of Montana-Dakota Utilities

Application for Rate Increase, Case No. PU-22-194

DIRECT TESTIMONY

OF

Marie Fagan, London Economics International LLC

ON BEHALF OF THE

NORTH DAKOTA PUBLIC SERVICE COMMISSION

ADVOCACY STAFF

Date January 30, 2023

Q: Provide your name and professional qualifications.

A: My name is Marie Fagan. I am the Chief Economist at London Economics International, LLC ("LEI"). My business address is 717 Atlantic Avenue, Suite 1A, Boston, MA 02111.

I have over 30 years of experience in research and consulting for the energy sector, spanning international upstream and downstream oil and gas, global coal, North American gas markets, and North American power markets and regulated utilities.

I received a Bachelor of Science Degree in Business Administration from the University of Connecticut in 1984, and a PhD in Economics from the American University in Washington, DC in 1995. I have testified before public utility commissions in a number of states on regulatory matters in electric power, oil, and natural gas. My specific experience includes auditing of electric utility management processes, performance, and financial results; financial analysis of costs, revenues, and returns; and statistical and econometric techniques applied to a variety of energy economics issues including measuring the efficiency of utility use of inputs. My CV is attached as part of Exhibit A

Q: Has anyone else at London Economics International LLC contributed to the preparation of this testimony?

A: Yes. My colleague Barbara Porto, who is a Senior Consultant at LEI, contributed to the discussion of depreciation. My colleague Shashwat Nayak, also a Senior Consultant, contributed to the discussion of return on equity. Their CVs are also attached as part of Exhibit A.

Q: What is the purpose of your testimony?

A: I am submitting this testimony on behalf of the North Dakota Public Service Commission Advocacy Staff (Staff). Staff engaged LEI as the outside independent technical consultant to work with the Commission's advocacy staff

in presenting its case for the North Dakota ratepayers of Montana-Dakota Utilities ("MDU"). As such, I will provide the Commission with an analysis and recommendations concerning MDU's request for a rate increase in its filings in PU-22-194.

Q: Please summarize your testimony.

A: LEI examined MDU's request for a rate increase of $25,372,099 in PU-22-194 (see Figure 1 and Figure 2).

Figure 1. Overview of drivers of requested rate increase (incremental dollar amounts as compared to PU-16-666)

	Amount (in millions)
Increase in Rate Base	$13.8
Lower Sales	2.7
Higher O&M Expenses	10.0
Higher Depreciation	10.0
Property Tax	1.7
Other	1.0
Amortization of L&C and Heskett	7.8
Offset by:	
L&C and Heskett Savings	($21.6)
Net Increase	$25.4

Source: Montana-Dakota Utilities Co. Before the Public Service Commission of North Dakota. Case No. PU-22-194. *Pre-filed Direct Testimony of Nicole A. Kivisto.*

Figure 2. Detailed drivers (incremental dollar amounts as compared to PU-16-666)

Drivers of Rate Increase		Comments
Heskett Unit IV	$5,554,221	Revenue requirement associated with new generation resource
Pension & Post Retirement	1,322,507	Incremental revenue assocaited with pension and post retirement regulatory assets
Other Increase in Rate Base	6,922,226	Rate Base and return associated with other plant additions since Case No. PU-16-666
Lower Sales	2,688,705	Projected sales based on current projections vs that included in Case No. PU-16-666
O&M:		
Labor & Benefits	5,388,832	Annual salary increases and inclusion of additional positions as applicable
Coyote/Big Stone	579,139	Updated since Case No. PU-16-666
Insurance	1,105,929	Increased plant investments to be insured and increased insurance costs on all investments
Software Maintenance	1,232,634	Increase in expensed software maintenance costs due to hosting & cybersecurity enhancements
Other O&M	1,712,432	Updated since Case No. PU-16-666
Depreciation Study	4,576,901	Updated rates based on the 2020 depreciation study supported by Larry E. Kennedy
Other Increase in Depreciation	5,400,151	Largely driven by plant investment
Increase in Property Taxes	1,718,477	Largely driven by plant investment
Other	974,302	
Amorization of L&C and Heskett	7,828,856	As shown in Statement L, page 2
L&C and Heskett Savings	(21,633,213)	The revenue requirement included in Case No PU-16-666, adjusted for TCJA
L&C and Heskett F&PP Savings	NA	The $21.6M associated with L&C and Heskett amortization did not include F&PP. Those savings are reflected in the F&PP expense and result in lower overall revenue.
Total Increase	$25,372,099	

Source: MDU Responses to Staff Set 2, Response No 2.1 Attachment A.xls, tab "Drivers Summary"

Of the proposed $25,372,099 increase, LEI found that MDU's projected test year expenses are overstated by a total of $15,550,869, not including the impact of recommended changes to the pension and post-retirement regulatory asset (see Figure 3). In addition to the specific recommended reductions listed in Figure 3, MDU should be required to perform an analysis of its pension and post-retirements benefits regulatory assets based on more up-to-date discount rates and expected rate of return on assets, as discussed later in this testimony. This is likely to further reduce the revenue requirement. Each of the items in Figure 3 is discussed in detail in this testimony.

Figure 3. LEI's recommended changes to 2023 test year revenue requirements

	Item	Change to expense	Change to rate base
1	Disallow a portion of distribution labor cost share to bring it closer to industry average cost per MWh	$ (90,637)	
2	Disallow 401k expense based on reduction in distribution labor cost	$ (8,792)	
3	Disallow the portion of long-term incentive compensation tied to financial performance	$ (1,391,439)	
4	Disallow short-term incentive compensation tied to financial performance	$ (2,258,988)	
5	Disallow new employee hires/promotions associated with Outage Management System	$ (443,150)	
6	Disallow expenses for institutional advertising	$ (56,112)	
7	Disallow expenses for industry dues	$ (226,557)	
8	Disallow expenses for 10% insurance increase	$ (225,084)	
9	Disallow portion of increase for software maintenance	$ (868,050)	
10	Disallow expense for personal use of vehicles	$ (40,000)	
11	Disallow expense for COVID	$ (1,070,568)	
12	Depreciation rates at PU-16-666 settlement levels	$ (4,741,530)	$ 4,741,530
13	Disallow outage management system		$ (2,146,511)
14	Updated average rate base (average 2023 rate base of $612,177,981 + deprecation disallowance - outage management system)		$614,773,000
15	Impact of reducing proposed ROE from 10.5% to 9.42% on updated rate base	$ (3,319,774)	
16	Impact on income tax (tax rate * difference in ROE)	$ (810,188)	
	Impact on annual revenue requirement of items 1-16	**$ (15,550,869)**	
	Re-calculate pension and post-retirement asset	tbd	tbd

Also, though MDU testified it would be using an inflation rate of 3.37% for 2022 and 2.56% for 2023, a close look at MDU's filings (discussed in more detail below) shows that MDU used those assumed rates in only a few instances. Higher cost escalation rates were assumed for many categories of expense, as discussed in more detail in this testimony.

Q: How did LEI analyze the proposed projections of expenses and changes to rate base?

A: LEI focused on the assumptions that MDU used for its projected test year 2023 expenses and rate base. LEI examined MDU's detailed filings in PU-22-194, including PU-22-194, 016-010_MDU Statements and workpapers A-L, and live

spreadsheets which MDU provided, such as: Response to Staff Set 4 ND 2022 Electric Rate Base – A,B,C,D,H,J.xls, and Response to Staff Set 4 ND 2022 Electric Income Statement - A,E,F,G,I,J.xls. LEI issued data requests ("DRs") to MDU to examine details behind MDU's calculations and projections. LEI compared MDU's assumptions and projections to industry averages, to the outcomes of other rate cases, and to the broader economic environment (including inflation and interest rates).

Q: How is your testimony organized?

A: I have organized my testimony into the following topics:

1: Fulfillment of test year requirements
2: Load growth and sales growth projections
3: Operating and maintenance ("O&M") expenses
4: Pension and post-retirement benefits
5: General Intangible plant in service
6: Transmission capital additions
7: Amortization of Heskett Unit I & Unit II, Lewis & Clark Unit I
8: Depreciation
9: Return on equity
10: Cost of service
11: Summary

Q: Did MDU fulfill all the NDCC §49-05-04.1 requirements related to use of test year?

A: Not fully. MDU provided a comparison of forecast data (2022 and 2023) to historical period data (2021) in response to data request ND PSC 4.2, ND 2022 Electric Class Cost of Service – K.xls; and in filing 016-010 - MDU Statements and workpapers A-L.pdf, Statement A, pp. 3-4; and ND 2022 Electric Rate Base - A,B,C,D,H,J.xls, tab "Rate Base Summary."

However, MDU did not include a comparison of the prior years' forecast or budgeted data to actual data for those periods, stating that "*[w]hile the Company does use a forecasted test period, comparing the information presented in the electric rate case to the test year budgets would not provide a relevant comparison.*"[1] The accuracy of previous budget forecasts is critical in assessing the potential accuracy of the current forecast.

Q: Are MDU's projected load forecast and sales forecast methodologies supported by detailed evidence?

A: No. MDU's discussion of how it developed its load growth and sales forecasts was a scant two pages of testimony.[2] With respect to load growth, MDU forecasted that Integrated System peak load would grow at "just over 1% per year" and that *"seasonal peak demand forecasts are developed on an Integrated System basis and then allocated back to the states."*[3] The testimony did not explain the forecasting methodology or the process of allocation to North Dakota customers.

With respect to sales growth, MDU testimony stated that "*North Dakota's electric sales are forecasted to grow at 1.18% per year for 2021-2026 compared to a historic average growth rate of 0.24% per year from 2015-2020.*"[4] MDU corrected this testimony, indicating that it should read *"North Dakota's electric sales are forecasted to grow at 1.18% per year for 2022-2027 compared to a historic average growth rate of 0.24% per year from 2016-2021."*[5] MDU noted that the sales growth forecast is developed separately for each state for the following customer classes: residential, small commercial

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[1] PU-22-194 MDU response to LEI Set 7 DR 13.1
[2] PU-22-194 Prefiled Testimony of Darcy J. Neigum. Pp. 2-3.
[3] PU-22-194 Prefiled Testimony of Darcy J. Neigum. P. 3.
[4] PU-22-194 Prefiled Testimony of Darcy J. Neigum. P. 3, at lines 2-7.
[5] PU-22-194 MDU response to LEI Set 9 DR 13.7.

and industrial, large commercial and industrial, street lighting, and miscellaneous."[6]

In pre-filed testimony, MDU did not provide data inputs or details of the models it used to create the load and sales forecasts, but simply referred to *"the preliminary 2022-2041 forecast completed in September of 2021."*[7] MDU provided the forecasts for monthly projections of usage per customer and number of customers, and resulting total sales forecasts in response to LEI DR. 13.2 Attachment A.

In response to a data request for the results of all the econometric models for every model used in the sales forecast and every model used in the load forecast referred to in testimony, MDU provided the econometric model results for the load forecasts only.[8] The econometric model for summer peak load (based on 30 annual observations, from 1991-2020) shows that MDU used four independent variables to explain summer peak demand. Two of these, total energy requirements and a time trend, are the main drivers of future growth; the other two drivers in the model controlled for weather. The time trend driver implies that the same average annual trend in peak load growth that over the past 30 years is assumed to hold going forward. MDU did not provide information on the units of measure which were used in the econometric model, so it is not possible to interpret the coefficient estimates in terms of impact on peak demand (i.e., the coefficient estimate on the time trend driver is 3.73—so that for each year, peak demand increases by 3.73, but the units of measure were not provided).

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[6] PU-22-194 Prefiled Testimony of Darcy J. Neigum. P. 2.
[7] Ibid.
[8] PU-22-194 MDU Response to LEI Set 9, DR 13.6.

The econometric model for winter peak load (based on 30 annual observations) incorporated two explanatory variables. The results indicated that the main driver of demand growth over time was total energy requirements (the only other driver in the winter model controlled for average temperature at time of winter peak). No time trend variable was included in the winter peak load model.

MDU did not provide any econometric model results for its sales forecasts. This does not seem to be because it did not use such models to forecast sales. MDU's most recent IRP provides detail of the structural equations (but not the econometric results) used in MDU's sales forecasts for each relevant customer class, and notes "*Econometric equations were tried initially in the development of the forecasted sales for the three primary customer categories by state – residential, SC&I, and General LC&I – while sales forecasts for the street lighting and miscellaneous sectors were developed primarily using linear regression. The final models used for each of the primary customer categories were a combination of econometrics and judgment.*"[9] Without any detailed model results or discussion of the judgement which MDU applied, MDU's methodology for forecasting sales is unclear. And because sales are a key driver for both the summer peak load model and the winter peak load model, this in turn calls into question the validity of the load forecasting models.

Q: Are MDU's labor expense projections for the distribution function in line with industry averages?

A: No. MDU projects distribution labor costs to increase 10% from 2021 (adjusted) to 2022, and another 9% from 2022 to 2023 (for a total of 18% over 2021 levels), bringing costs to $3.63 per megawatt hour ("MWh") (see Figure 4).[10]

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[9] MDU *Integrated Resource Plan Submitted to the North Dakota Public Service Commission*. July 1, 2021. Volume II. P. 16.

[10] Source: 016-010_MDU Statements and workpapers A-L, Statement A, page 3, and Response to Staff Set 4 ND 2022 Electric Income Statement - A,E,F,G,I,J.xls, tab "Labor"

Figure 4. MDU projections of labor expenses for test year 2023

MONTANA-DAKOTA UTILITIES CO.
LABOR EXPENSE
ELECTRIC UTILITY - NORTH DAKOTA
TWELVE MONTHS ENDING DECEMBER 31, 2021
PROJECTED 2022 - 2023

	Per Books 2021	Adjusted Per Books 2021	Projected 2022 1/	Projected 2023 2/	LEI analysis 2023 less 2022	LEI analysis %
Fuel & Purchased Power	$551,071	$0	$0	$0	n/a	n/a
Production	6,322,646	2,790,997	3,012,213	3,131,798	$119,585	4%
Transmission	3,541,964	3,541,964	3,825,501	3,977,053	$151,552	4%
Distribution	6,305,174	6,305,174	6,965,864	7,623,967	$658,103	9%
Customer Accounting	1,390,189	1,390,189	1,553,181	1,614,769	$61,588	4%
Customer Service & Info	162,173	162,173	176,272	183,268	$6,996	4%
Sales	87,233	87,233	94,796	98,558	$3,762	4%
A&G	7,000,429	7,000,429	7,071,813	7,296,518	$224,705	3%
Total Labor Expense	$25,360,879	$21,278,159	$22,699,640	$23,925,931	$1,226,291	5%
Total sales in MWh	2,075,391.86	2,075,391.86	$2,106,778	$2,102,280	($4,498)	0%
Labor exp/MWh	$12.22	$10.25	$10.77	$11.38		
Distribution labor exp per MWh	$3.04	$3.04	$3.31	$3.63	$0.32	10%

Source: 016-010_MDU Statements and workpapers A-L, Statement A, page 3, and Response to Staff Set 4 ND 2022 Electric Income Statement - A,E,F,G,I,J.xls, tab "Labor."

MDU's distribution labor costs of $3.04/MWh for 2021 are already substantially higher than the industry average, and higher than similar investor-owned utilities operating in the region (see Figure 5).

Figure 5. Distribution labor spending in 2020

Company	Total sales of electricity (MWh)	Total distribution labor expenses ($ '000)	Distribution labor expenses/MWh ($/MWh)
Industry average (26 companies)	1,997,608,088	$3,175,764.00	$1.83
Otter Tail Power Company	5,250,002	$11,815.00	$2.25
NorthWestern Corporation	8,834,348	$21,772.00	$2.46
Northern States Power Company	48,832,747	$50,777.00	$1.04

Note: See Figure 22 in this testimony for the list of 26 companies included in the industry group.
Source: FERC Form 1, third-party data provider.

MDU should be prevented from allowing its unit costs to be much higher than industry averages, otherwise it will not have an incentive to keep such costs in line. LEI recommends that the increase in labor cost for distribution be limited to 9% over 2021 levels. This would reduce projected 2023 distribution labor

costs by $90,637. A lower labor expense would also reduce the 401k expense, which is based on 9.7% of straight time labor expense. Reducing the labor expense by $90,637 reduces the 401k expense by $8,792.

Q: Should some charges for vehicle expenses be disallowed?

A: Yes. MDU permits personal use of company vehicles but does not reduce utility expenses based on that personal use.[11] The use is added to the employee's income, and therefore North Dakota customers are also charged the income taxes on the personal use on top of the actual use. MDU recorded personal use in the $30,000-40,000 range not considering income taxes from 2019-2022.[12] MDU reported that *"the amounts reported in DR 8.1 are fringe benefit earnings that are reported on the employee's gross income for tax purposes and the amounts are not paid to the employee by the Company. The expense to the Company is FICA tax expense on the reported earnings. For example, the FICA expense for $35,000 in fringe benefit earnings reported would be $2,677.50.*[13] Therefore, $40,000 should be disallowed.

Q: Should all proposed Incentive Compensation expense, which is substantially higher than in 2021, be allowed?

A: No. Incentive compensation and bonuses are included in labor expense. MDU projects no increase in the Bonuses and Commissions account from 2021 to the 2023 test year, but it projects a substantial increase in Incentive Compensation (see Figure 6, Account 5131). This is owing to MDU's assumption of 11.65% incentive compensation (at potential) which is applied to the sum of Straight time and Vacation time for 2022 and 2023.[14] For 2021, the actual average percentage incentive compensation was 8.1%; for the

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[11] PU-22-194 MDU Responses to Staff DRs 4.1; and 8.1.
[12] PU-22-194 MDU Response LEI Set 6, Staff DR 8.1.
[13] PU-22-194 MDU Responses to Staff/LEI DR Set 9, DR 13.13.
[14] PU-22-914 Direct Testimony of Tara R. Vesey. P. 16, and PU-22-194 Response to Staff Set 4 ND 2022 Electric Income Statement - A,E,F,G,I,J.xls, tab "Projected Labor 2022 & 2023 – WP."

adjusted 2021 year, it is 8.54%. Both are substantially lower than MDU's 11.65% assumption. MDU's proposed target rates for incentive compensation (Statement Workpaper Statement G, Schedule G-1, page 13) are unchanged from the target rates currently in place.[15]

Figure 6. MDU's labor expense projections by category

	Per Books 2021	Adj Per Books 2021	Projected 2022 1/	Projected 2023 2/
5110 Straight Time 2/	$20,657,491	$17,319,899	$18,072,367	$19,131,989
5120 Premium Time 2/	1,296,730	785,138	811,205	843,410
5130 Bonuses & Comm. 3/	1,449,653	1,429,949	1,429,949	1,429,949
5131 Incentive Comp. 4/	1,677,146	1,499,436	2,134,393	2,258,988
5150 Meals 3/	3,121	3,118	3,118	3,118
5193 Vacation 2/	276,738	240,619	248,608	258,477
	$25,360,879	$21,278,159	$22,699,640	$23,925,931

1/ Projected 2022 and 2023 values reflect the removal of labor reported in the Renewable Rider, and labor reported to Heskett Unit I and II, and Lewis & Clark Unit I operations being retired. See Schedule G-1, pages 12-13. The projected balances also include employee additions, see Schedule G-1, pages 12-13.
2/ Reflects a 3.32% for 2022 and 3.97% for 2023 based on the weighted average increases of 3.5% in 2022 and 4.5% in 2023 for non-union and 3.0% for union as shown on Schedule G-1, Pages 12-13.
3/ Adjusted to reflect ongoing stock compensation, miscellaneous bonuses and meals.
4/ Reflects an average incentive level of 11.65% applied to straight time and vacation.

Source: PU-22-194. 016-010_MDU Statements and workpapers A-L, Statement A, page 3, and Response to Staff Set 4 ND 2022 Electric Income Statement - A,E,F,G,I,J.xls, tab "Labor."

Incentive compensation is not universally allowed in utility rate cases.[16] One objection is that incentive compensation based on targets which benefit shareholders (such as earnings and/or stock price) do not reflect ratepayer benefits. For example, the Arkansas Public Service Commission recently disallowed a portion of incentive compensation which was based on financial incentives, noting that the disallowance was consistent with precedent.[17] In

[15] PU-22-194 MDU Response to LEI Set 9, DR 13.10.
[16] Sullivan, Julia E. and Jennifer Good. "Recovery of Executive Compensation Expenses in Utility Rate Cases." *The Electricity Journal*. April 2011, Vol. 24, Issue 3 1040-6190. .
[17] Arkansas Public Service Commission Docket No. 16-052-U. *In The Matter of The Application of Oklahoma Gas and Electric Company for Approval of a General Change in Rates, Charges, and Tariffs.* Order No. 8. May 18, 2017.

Rhode Island, the Commission was not convinced that the cost of incentive compensation was "wholly for the benefit of ratepayers."[18]

Another issue is that if the incentive payments included in the revenue requirement are not paid out in full, then utility shareholders receive the benefit of revenues without incurring the cost, and MDU's proposed 11.65% is higher than has been paid out historically, as noted above.

MDU reported that its projected compensation of $1,429,949 for Account 5130 (Bonuses and Commissions) is mainly related to a long-term incentive program which is tied to financial performance. Approximately $38,510 is related to employee sign on bonuses, relocation allowances, employee recognition, and other miscellaneous charges, which are not tied to financial performance.[19] LEI therefore recommends disallowing the balance of $1,391,439 which is tied to financial performance.

The objectives which drove MDU's short-term incentive compensation for Account 5131 (Incentive Compensation) for 2022 were:[20]

1) Annual O&M expense at or less than an established total annual expense goal;
2) Retaining a customer service ranking within the top 25 companies listed in the annual *JD Power Customer Service Satisfaction Study* of similar utilities; and
3) Employee participation in cyber security training.

Objective 1 benefits shareholders; Objective 3 does not reflect meeting of a goal or target, it is simply a training activity which could be required of

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[18] Sullivan, Julia E. and Jennifer Good. "Recovery of Executive Compensation Expenses in Utility Rate Cases." *The Electricity Journal*. April 2011, Vol. 24, Issue 3 1040-6190.
[19] PU-22-194 MDU Response to LEI Set 9, DR 13.11.
[20] PU-22-194 MDU Response to LEI Set 9, DR 13.11 and DR 13.12. Note: MDU reported that its 2023 incentive plans had not been finalized as of the end of 2022.

employees in the ordinary course of business. Objective 2 is the only driver focused on customer benefit. Objective 2 accounted for 40% of weight of the three drivers in 2022 (see Figure 7).

Figure 7. MDU's short-term incentive compensation drivers

MDU Utilities Group	
O & M Expense Goal	40%
Operational Goal – Customer Service	40%
Cyber Security Goal	20%
Total	100%

Source: PU-22-194 MDU Response to LEI Set 9, DR 13.12, Attachment B. P. 5

MDU also noted that "*Upon attainment of these three goals, the Company provides incentive payments to the employees if a sufficient earnings level is reached. The overall payment is adjusted based on the level of earnings.*"[21] Therefore, even the 40% which is focused on ratepayer benefit is not independent of earnings incentives.

For these reasons, LEI recommends that the $2,258,988 of Incentive Compensation for test year 2023 be disallowed.

Q: Is MDU's 2023 test year advertising all allowable?

A: No. MDU noted that it excluded promotional advertising expenses and expenses not related to North Dakota electric operations from its 2022 and 2023 projections. MDU provided workpapers (Filing 016-010_MDU Statements and workpapers A-L, Statement G, Schedule G-1, pp. 29-34 of 50), with line items for advertising expenses, showing that promotional expenses, and some institutional advertising expenses had been eliminated from the totals. However, other advertising classified as Institutional Expenses was included. This should all be removed. For example, Statement G, Schedule G-1, pp. 33-

[21] PU-22-194 MDU Response to LEI Set 9, DR 13.11.

34 of 50 (Account 5715-Other) shows that a total of $92,083 was included in per books expenses for 2021, of which only $35,971 was for Information and Instructional Advertising. The difference, $56,112, was for Institutional advertising and therefore should be disallowed.

Q: Should industry dues be allowed in rates?

A: No. Industry dues are not a benefit to ratepayers. MDU projected $226,557 for 2023.[22] In most past rate cases the Commission has disallowed industry dues tied to economic development, chamber of commerce and other promotion of the Company, and advertisement-based dues.

Q: What is the impact of inflation assumptions?

A: MDU testified it would be using an inflation rate of 3.37% for 2022 and 2.56% for 2023.[23] A close look at the income statement shows that MDU only uses the 3.37% for 2022 and 2.56% for 2023 in a few instances. The projected income statement shows that the inflation assumptions of 3.37% for 2022 and 2.56% for 2023 apply only to Advertising Expenses, All Other O&M Expenses, Subcontract Labor, and COVID Expenses.[24] Different escalation rates are used for other expense categories. Projected 2022 and 2023 Straight Time, Premium Time, Vacation/Other Non-Productive time, and some Benefits expenses (401k, Workers' Compensation, and Other) are escalated by 3.32% for 2022 and 3.97% for 2023. Projected Materials costs were increased by 10% from 2021 to 2022, and another 5% from 2022 to 2023; Software Maintenance was escalated by 13.08% from 2022 to 2023; and Insurance by 10% from 2022 to 2023. The overall impact is that the cost escalation that MDU built into its projections is higher than the 3.37% and the 2.56% highlighted in testimony.

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[22] PU-22-194. MDU Statements and workpapers A-L, Statement G, Scheduled G-1, P. 8 of 31.
[23] PU-22-194. Prefiled Testimony of Tara R. Vesey. P. 14, at 16.
[24] PU-22-194. MDU Statements and workpapers A-L, Statement A, page 3, and Response to Staff Set 4 ND 2022 Electric Income Statement - A,E,F,G,I,J.xls, multiple tabs.

Q: Are MDU's test year expenses for COVID well supported?

A: No. MDU provided some detail on the items included in COVID charges in MDU Statements and workpapers A-L, Statement G, Schedule G-1, P. 30 of 31 (see Figure 8). The increase from Adjusted 2021 to Projected 2022 is a huge 54% (only a part of which is accounted for by the inflation assumptions) for which MDU did not provide an explanation. The Workpapers for Statement G Schedule G-1 page 50 show COVID costs with tracking annually back to 2016, which could not be consistent with actual history, because 2016 is four years before the pandemic began.

In addition, consistent with the Order in case PU-20-191, if MDU is requesting recovery of costs for COVID, then it must also include tracking of the savings and revenues that were created by COVID, which MDU has not provided. Therefore, the charges of $1,070,568 projected for 2023 should be disallowed.

Figure 8. MDU's actual and proposed COVID expenses

MONTANA-DAKOTA UTILITIES CO.
COVID EXPENSE
ELECTRIC UTILITY - NORTH DAKOTA
TWELVE MONTHS ENDING DECEMBER 31, 2021
PROJECTED 2022 - 2023

	Per Books 2021 1/	Adjusted 2021	Projected 2022 2/	Projected 2023 3/
Production	$65,240	$27,825	$142,831	$146,487
Transmission	16,260	16,260	59,397	60,918
Distribution	33,960	33,960	82,401	84,510
Customer Accounts	72,667	72,667	101,512	104,111
Customer Service	1,029	1,029	2,217	2,274
Sales	406	406	787	807
A&G	525,386	525,386	654,701	671,461
Total	$714,948	$677,533	$1,043,846	$1,070,568

1/ Includes the following costs:
External Auditing
Collection Agency Fees
Commercial Air Service
Corporate Aircraft
Personal Vehicle Use
Meals
Other Reimburseable Expense
Office Supplies
Safety Training Materials & Expense

2/ Reflects the adjusted 2021 total increased by inflation of 3.37 percent.
3/ Adjusted to reflect inflation of 2.56 percent.

Source: MDU Statements and workpapers A-L, Statement G, Schedule G-1. P. 30 of 31.

Q: Are increases to projected insurance expenses explained?

A: No. MDU simply noted that projected 2023 insurance reflects an increase of 10 percent. with an additional $38,542 added to excess liability and $50,652 added to Property - All Risk for Heskett IV.[25] MDU did not explain the 10 percent increase—for example, is it owing to trends in the insurance industry for higher premiums? This 10% increase over 2021 rates amounts to $225,084, which should be disallowed.

Q: Are increases to projected software maintenance explained?

A: Not fully. MDU proposed an increase of 13.08% from estimated 2022 to test year 2023, based on a "5-year average" increase in the cost of software maintenance from 2017 through 2021 (see Figure 9).

Figure 9. MDU high-level history and projections of software maintenance expense

MONTANA-DAKOTA UTILITIES CO.
ELECTRIC UTILITY - NORTH DAKOTA
SOFTWARE MAINTENANCE
TWELVE MONTHS ENDING DECEMBER 31, 2021
PROJECTED 2022-2023
SUMMARY
WORKPAPER

	Projected 2022 Responsibility							Projected 2023 1/
	721	888	926	951	964	994	Total	Total
Production	$107,253	$17,012					$124,265	$140,519
Transmission	122,431	270,456					392,887	444,277
Distribution	23,085	2,428					25,513	28,850
Customer Accounting	0				11,136		11,136	12,593
A&G	528,523	5,743	535,798	29,903	43,872	359,431	1,503,270	1,699,898
Total	$781,292	$295,639	$535,798	$29,903	$55,008	$359,431	$2,057,071	$2,326,137

	Per Books						Projected	
	2015	2016	2017	2018	2019	2020	2021	2022	2023
Software Maintenance	$862,038	$1,073,641	$1,141,417	$1,459,771	$1,442,720	$1,805,783	$1,893,027	$2,057,071	$2,326,137
Percent Increase		24.55%	6.31%	27.89%	-1.17%	25.17%	4.83%	8.67%	13.08%

5 Year Average Percent Increase 13.08%

1/ Projected 2023 reflects a five year average increase of 13.08%.

Source: MDU Statements and workpapers A-L, Statement G, Schedule G-1. P. 44 of 50

[25] PU-22-194. MDU Statements and workpapers A-L, Statement G, Scheduled G-1, P 28 of 31.

However, the details of the software maintenance expenditures, provided in MDU Statements and workpapers A-L, Statement G, Schedule G-1. Pp. 46 and 47 of 50, show total software maintenance expenditures for North Dakota of $1,402,001 for 2022 and $1,458,087 for 2023, an increase of 4%, not 13.08%. This raises three questions: i) Where are the remaining expenditures (which amount to $655,070 for 2022 and $868,050 for 2023)? ii) On what basis does MDU expect these remaining expenditures to increase 32.5% from 2022 to 2023? and iii) Is this increase permanent, or a one-off?

Also, the way in which MDU calculated the 13.08% inflates the escalation rate. MDU simply averaged each year's growth rate. Thus, the very large increases of 27.89% from 2017 to 2018, and 25.17% from 2020 to 2021 (as seen in Figure 9) have a large impact on the average. An alternative rate of growth, measured as the compound annual growth rate ("CAGR"), which depends only on costs in the first and last year of the calculation and the number of years of growth, smooths out the volatile nature of year-by-year growth rates. Using CAGR, from 2016 to 2021 the average annual growth was 12.0%. However, as discussed above, MDU has not provided a foundation for anything greater than a 4% increase in software maintenance expense.

For this reason, LEI recommends allowing only the level of software maintenance cost of $1,458,087 for 2023 in as shown in MDU Statements and workpapers A-L, Statement G, Schedule G-1. Pp. 46 and 47 of 50, not the $2,326,137 shown in Figure 9 above. This amounts to a disallowance of $868,050.

Q: Are MDU's calculation of pension and post-retirement benefits (and associated expenses) reasonable?

A: No. MDU is proposing that the provision for pension and post-retirement benefits (net of the associated deferred taxes), be added to working capital for 2023. This amounts to $11,571,232 (see Figure 10).[26]

Figure 10. MDU's proposed pension and post-retirement capital

MONTANA-DAKOTA UTILITIES CO.
PROVISION FOR PENSIONS AND BENEFITS
ACCUMULATED DEFERRED INCOME TAXES ON PENSIONS
ELECTRIC UTILITY - NORTH DAKOTA
FOR THE TWELVE MONTHS ENDING DECEMBER 31, 2021
PROJECTED 2022-2023

	Total	Provision for Pensions and Benefits	DIT on Pensions and Benefits
Balance at December 31, 2020	$0	$0	$0
Balance at December 31, 2021	0	0	0
Average Balance 2021	$0	$0	$0
Balance at December 31, 2022	11,539,933	15,567,489	(4,027,556)
Average Balance 2022	$5,769,967	$7,783,745	($2,013,778)
Balance at December 31, 2023	11,602,530	15,650,294	(4,047,764)
Average Balance 2023	$11,571,232	$15,608,892	($4,037,660)

Source: Response to Staff Set 4, ND 2022 Electric Rate Base – A,B,C,D,H,J.xls, tab "Working Capital."

MDU did not include pension or post-retirement regulatory assets in its last electric rate case (PU-16-666) but it did include them in its most recent natural gas rate case (PU-20-379).[27]

The value of a pension depends on value of its assets and its liabilities; and all MDU's pension plans have accumulated benefit obligations (liabilities) greater

[26] PU-22-194. Prefiled Testimony of Nicole A. Kivisto, P. 12; and Prefiled Testimony of Tara R. Vesey, P. 27, at 16-17.
[27] PU-22-194. Prefiled Testimony of Tara R. Vesey, P. 31.

than plan assets.[28] It is important to value these liabilities accurately. The American Academy of Actuaries notes that "*[t]here is no market of freely traded pension liabilities*.[29] Therefore, valuation of pension liabilities requires a variety of assumptions. A key assumption required to determine the value of pension liabilities is the discount rate. MDU assumed a fixed discount rate of 2.67% for the liabilities of the collective bargaining plan and a fixed discount rate of 2.60% for the liabilities of the non-bargaining plan, to calculate the present value of the liabilities.[30] MDU did not explain how it arrived at these discount rates. A recent benchmarking study of utility retirement programs found the industry used an average discount rate of 2.6% in 2020 and noted that it was an historic low.[31] The year 2020 was one of low inflation in the United States (1.3%) and correspondingly low discount rates. In 2021 inflation reached 4.5%, and for 2022 will likely average higher year-on-year than in 2021.[32] Therefore it is likely that MDU's discount rate assumptions are too low to be accurate and should be updated.

In addition, MDU's assumed discount rate is not consistent with the risk-free rate that MDU relied upon in its proposed return on equity ("ROE", discussed in detail later in this testimony). The company relied upon a long-term risk-free rate of 3.40%, as represented by a forward US 30-year bond rate. If MDU believes that 3.40% is the correct risk-free rate, its assumption of the 2.6% - 2.67% discount rate for valuing the pension is internally inconsistent. The lower discount rate assumed by MDU for valuing the pension liability will tend to increase the value of the regulatory liability and required contributions, which

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[28] PU-22-194 MDU Response to Advisory DR 3.2, Attachment A. P. 6.
[29] American Academy of Actuaries. *Fundamentals of Current Pension Funding and Accounting for Private Sector Pension Plans.* July 2004. P. 2.
[30] MDU Response to LEI Set 1 DR 10-2.
[31] AON. *Utility Industry Benchmarking Report: Financial Management of Retirement Programs in the Utility Industry.* September 2021 P. 4.
[32] Bureau of Economic Analysis, GDP Price Index

benefits MDU shareholders; the higher discount rate MDU assumed for its proposed ROE increases the ROE, which also benefits MDU shareholders.

MDU assumed a 6% expected return on assets ("EROA") to value the assets in its pension fund. This is somewhat lower than the industry average of 6.8% in 2020.[33] There are many factors which influence the choice of EROA, including "*asset allocation, capital market expectations, and the time period over which the return is expected to be earned.*"[34] Capital market expectations include the expected rate of inflation and the expected interest rate. With tighter monetary policy than in 2020 and higher interest rates, MDU's assumption of a 6% EROA may be too low to be accurate and should be updated. Pension fund analysts have noted that *"Lower assumed returns on assets mean higher expense and may result in a higher cost assessed to rate payers in the near term."*

To summarize, MDU should be required to re-calculate the value of the pension and post-retirement assets using a discount rate and an EROA that reflect the current market. This could reduce the cost to ratepayers, reducing the size of the regulatory asset and its associated costs.

Q: Should the full increase in General Intangible Plant in Service be allowed?

A: No. MDU projected General Intangible Plant in Service to increase by $1,665,593 from 2022 to 2023, an 18.92% increase. This is mostly owing to the installation of an outage management system at a cost of $2,146,511 to North Dakota ratepayers. This system would also require hiring to fill additional positions, and/or promotions, at a cost of $443,150 to North Dakota ratepayers in 2023 (and, presumably, annually thereafter). However, there are no clear

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[33] AON. Utility Industry Benchmarking Report: Financial Management of Retirement Programs in the Utility Industry. September 2021 P. 27.
[34] AON. Utility Industry Benchmarking Report: Financial Management of Retirement Programs in the Utility Industry. September 2021 P. 27.

operational targets (such as specific improvements in SAIDI, SAIFI or CAIDI) that have been referred to in MDU testimony.[35] Without having established the need, or accountability of results through performance targets, it should not be allowed in rates.

Q: What have been MDU's recent capital additions for transmission?

A: MDU recovers its transmission investments either through Transmission Cost Adjustment ("TCA") Rider, or in base rates. Within the current rate case MDU is not proposing any changes to the TCA Rider. MDU is proposing to recover the balance of the transmission related projects placed into service since the last rate case, as well as the projected investment in transmission related projects as projected for test year 2023.

Major transmission projects in 2019 led to surge in transmission spending for MDU (see Figure 11). One large project, at a cost of $130 million to MDU, was responsible for most of the 2019 increase. This was the Big Stone South to Ellendale ("BSSE") project, a joint-venture with Otter Tail Power. It came into service in February 5, 2019.[36] BSSE is a MISO "multi-value" project, for which MISO cost allocation mechanisms allow recovery from all ratepayers who benefit from the line. This means Otter Tail Power Company and Montana-Dakota ratepayers will pay less than one percent of the project costs.[37]

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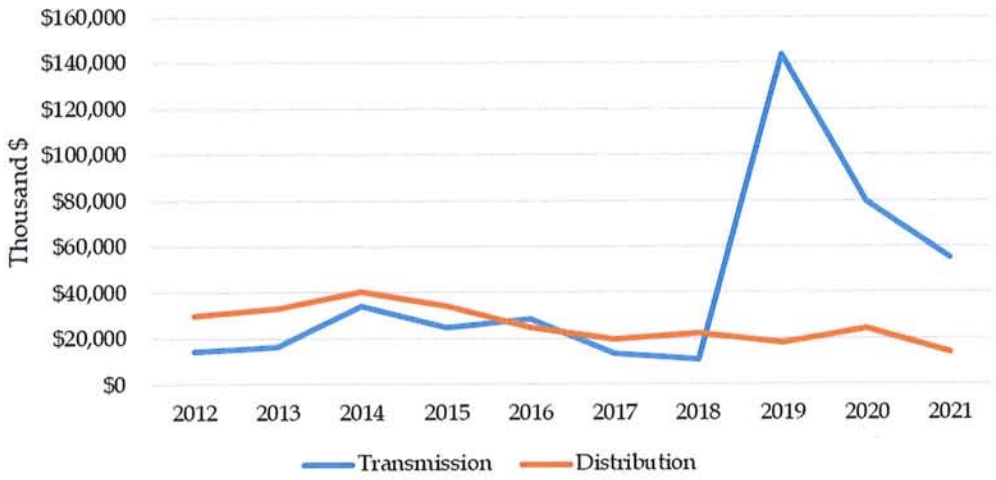
[35] PU-22-914. Prefiled Testimony of Daryl Andersen.
[36]MDU Resources. *2018 Year-End Earnings Results and 2019 Guidance Conference Call.* < https://s29.q4cdn.com/584607104/files/doc_presentation/2019/02/06/Q4-2018-Earnings-Presentation.pdf >; and MDU Integrated Resource Plan 2021. Volume IV. Page 233.
[37]Otter Tail Power Company. < https://www.otpco.com/newsroom/posts/163-mile-big-stone-south-to-ellendale-transmission-line-energized/#:~:text=The%20%24215%20million%20line%20extends,from%20Otter%20Tail%20Power%20Company >

Figure 11. Transmission capital additions by MDU



Source: FERC Form 1 data provided by a third party, and MDU annual reports on Form 10-k.

With most of the cost of BSSE socialized across MISO, transmission cost increases to North Dakota ratepayers were primarily driven by other major transmission projects being placed into service in 2019 and 2020 (see Figure 12).

Based on this capital spending, TCA rates for 2020 nearly doubled. The increase reflected the surge in transmission investment allocated to North Dakota based on the North Dakota demand allocator. It is also attributable to lower transmission revenues being received through MISO and SPP, namely lower facility credits, resulting in higher net revenue requirement. The impact on a residential ratepayer using 894 kWh per month was an estimated increase of $3.35 per month ($40.20 annually) from 2019 to 2020 under the TCA. Since that time, the TCA monthly impact on such a ratepayer declined by $0.03, an annual impact of $0.36 (effective November 1, 2021). It declined an additional annual $10.44 (effective November 1, 2022). These declines were much smaller than the large increase in 2020.

Figure 12. Major MDU transmission projects, 2019 and 2020 (thousand dollars)

Project		2019		2020
Bowdle Substation and Lines	$	5,600		
Leola Substation and Ellendale Ring Bus	$	6,300		
Dickinson Breaker and Transmission Lines	$	5,900	$	2,000
Watford City Substation and Lines	$	9,400	$	5,300
Richland to WAPA Reconductor	$	1,200		
Lightning Protection	$	420		
Mandan Substation Project			$	1,800
Crosby to Zahl Transmission Rebuild			$	1,200
Bismarck Sweet Avenue Substation Addition			$	1,100
Mobile Substation Project			$	3,800
Total	**$**	**28,820**	**$**	**15,200**
Transmission investment allocated to ND	$	19,680	$	12,984

Source: PU-19-285 Application to update Transmission Cost Adjustment (TCA) Rate 59 tariff. July 19, 2019.; PU-20-344 Application to update Transmission Cost Adjustment (TCA) Rate 59 tariff. July 17, 2020

Therefore, though LEI does not take issue with the increase in transmission Plant Additions projected for 2022 and 2023 (shown in MDU's Response to Staff Set 4 ND 2022 Electric Rate Base – A,B,C,D,H,J.xls, tab "Plant Additions 2022" and tab "Plant Additions 2023"), LEI notes that the increase in the rate case is in addition to a surge in transmission investment from 2019 and 2020.

Q: What will be the impact of MDU's proposed changes to amortization of retirement of Heskett Units I and II, and Lewis & Clark Unit I?

A: The cumulative impact of the changes that MDU proposes is an increase in its return on rate base of $10,333,752 and increase its revenue requirement of $20,289,385 for the proposed total amortization period (through 2031). The amortized value of Lewis & Clark Unit I (which retired in 2021) and Heskett Units I and II (which retired in 2022) is currently included in Working Capital, a component of rate base. MDU proposes to move cost recovery to the

Generation Resource Recovery Rider ("GRRR") and change the amortization schedule from four years to ten years for Lewis & Clark Unit I.[38]

MDU provided a detailed breakout which compared returns based on the existing amortization schedule and the proposed schedule (PU-22-194, MDU Response No. LEI 11.4 Attachment A). This breakout showed that total returns to MDU under the existing amortization period, at the current ROE, would be $6,133,761, while the longer amortization period and MDU's proposed 10.5% ROE would increase returns to $16,467,513 (see Figure 13). The increase in returns to MDU is therefore $10,333,752. If the ROE were to remain at 9.65%, the increase in returns would be $9,588,225, showing that most of the increase would be owing to the longer amortization period, not to the higher ROE. LEI also provides a similar calculation based on LEI's recommended ROE of 9.42% (the support for LEI's recommended ROE is discussed in detail later in this testimony).

[38] PU-22-194. Prefiled Testimony of Tara R. Vesey, P. 7 at lines 10-9, and P. 33 at 18-19.

Figure 13. Impact of proposed change in amortization on MDU returns

Based on MDU proposed 10.5% ROE

Return on rate base	Amortization period	ROE	L&C	Heskett	Total for amortization period
Existing return	April 2021 - Mar 2025 for L&C; Mar 2022 - July 2024 for Heskett	9.65% through Dec 2022; 10.5% from Jan 2023	$4,542,997	$1,590,764	$6,133,761
Proposed return	April 2021 - April 2031 for L&C; Mar 2022 - April 2031 for Heskett; (New recovery starting from July 2022)	9.65% through Dec 2022; 10.5% from Jan 2023	$9,473,259	$6,994,254	$16,467,513
Proposed return if ROE not changed	April 2021 - April 2031 for L&C; Mar 2022 - April 2031 for Heskett; (New recovery starting from July 2022)	9.65% for whole period	$9,079,970	$6,642,016	$15,721,986
Increase in total return					$10,333,752
Increase in total return if ROE not changed					$9,588,225

Based on LEI recommended 9.42% ROE

Return on rate base	Amortization period	ROE	L&C	Heskett	Total for amortization period
Existing return	April 2021 - Mar 2025 for L&C; Mar 2022 - July 2024 for Heskett	9.65% through Dec 2022; 9.42% from Jan 2023	$4,403,790	$1,536,311	$5,940,101
Proposed return	April 2021 - April 2031 for L&C; Mar 2022 - April 2031 for Heskett; (New recovery starting from July 2022)	9.65% through Dec 2022; 9.42% from Jan 2023	$8,973,521	$6,546,690	$15,520,211
Proposed return if ROE not changed	April 2021 - April 2031 for L&C; Mar 2022 - April 2031 for Heskett; (New recovery starting from July 2022)	9.42% for whole period	$8,929,273	$6,531,587	$15,460,860
Increase in total return					$9,580,110
Increase in total return if ROE not changed					$9,520,759

Source: PU-22-194. MDU Response No. LEI 11.4 Attachment A.

In terms of the annual revenue requirement, MDU noted that its proposed $7,832,580 annual (not total) amortization is significantly lower than the annual revenue requirement of $21,633,213 which is currently collected in base rates.[39] This annual comparison overlooks the cumulative impact of the change in amortization period. The new yearly revenue requirement of $7,832,580 per year starts in July 2022 and ends in April 2031 (while the revenue requirement for before July 2022 does not change). By the end of April 2031, it will have reached a cumulative total of $84,041,623, based on MDU's analysis (see

[39] PU-22-194 MDU Response No. LEI 11.4 Attachment A.

Figure 14).[40] In contrast, the reduction of $21,633,213 per year is only through July 2024, and reaches a cumulative $63,752,238. The difference in the cumulative totals is $20,289,385. In other words, ratepayers will pay more in total revenue requirements if MDU extends the amortization period.

Figure 14. Impact of proposed change in amortization on MDU cumulative revenue requirement

Total revenue requirement	Amortization period	ROE	L&C	Heskett	Total for amortization period
Existing revenue requirement	April 2021 - Mar 2025 for L&C; Mar 2022 - July 2024 for Heskett	9.65% through Dec 2022; 10.5% from Jan 2023	$32,668,666	$31,083,572	$63,752,238
Proposed revenue requirement	April 2021 - April 2031 for L&C; Mar 2022 - April 2031 for Heskett; (new recovery starting from July 2022)	9.65% through Dec 2022; 10.5% from Jan 2023	$46,471,015	$37,570,608	$84,041,623
Increase in total revenue requirement					$20,289,385

PU-22-194. MDU Response No. LEI 11.4 Attachment A.

In the current filing, MDU does not provide a justification for changing the amortization period. However, the longer amortization period gives an immediate benefit to ratepayers, as there is a net decrease to annual revenue requirements of $13,800,636 (see Figure 15). Without the change to the amortization schedule, MDU's rate proposal would have been $13,800,636 greater than the $25,372,099 that MDU requested—i.e., 54% higher than requested. Therefore, LEI does not recommend disallowance.

[40] Ibid.

Figure 15. Impact of proposed change in amortization on MDU annual revenue requirement

Annual revenue requirements	Amortization period	ROE	L&C	Heskett	Total for amortization period
Existing revenue requirement	April 2021 - Mar 2025 for L&C; Mar 2022 - July 2024 for Heskett	9.65% through Dec 2022; 10.5% from Jan 2023	$8,340,936	$13,292,280	$21,633,216
Proposed revenue requirement	April 2021 - April 2031 for L&C; Mar 2022 - April 2031 for Heskett; (new recovery starting from July 2022)	9.65% through Dec 2022; 10.5% from Jan 2023	$4,080,636	$3,751,944	$7,832,580
Decrease in annual revenue requirement					($13,800,636)

PU-22-194. MDU Response No. LEI 11.4 Attachment A.

Q: Is MDU's proposed increase in depreciation accurate and well-supported?

A: No. MDU is requesting an increase in depreciation of $9,977,052 compared to the dollar amounts in PU-16-666.[41] Of this, $5,400,151 is the result of an increase in new plant investment, some of which is related to the Heskett Unit IV addition. LEI does not take issue with this. The remaining $4,576,901 is based on depreciation rates derived from the 2020 Depreciation Study,[42] compared to the currently approved rates. MDU did not provide enough evidence to justify the increase in depreciation rates in the 2020 Depreciation Study.

LEI examined the "*Calculated Annual Depreciation Rates Applicable to Plant in Service as of December 31, 2020*," prepared by Concentric Energy Advisors and filed in May 2022 in PU-22-194 ("the 2020 Depreciation Study"). As discussed in detail below, some accounts were assigned high depreciation rates, driven largely by MDU's net salvage calculations that boosted negative net salvage values compared to current rates.

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[41] PU-22-194 MDU Response to Staff Set 2, Response No 2.1 Attachment A.xls, tab "Drivers Summary."
[42] PU-22-194. "*Calculated Annual Depreciation Rates Applicable to Plant in Service as of December 31, 2020*," prepared by Concentric Energy Advisors. May 2022.

Most of the $4,576,901 increase is the result of higher composite rates of depreciation in the Steam Production and the Distribution account groups (see Figure 16, highlighted rows). For example, the proposed composite depreciation rate for Distribution is 3.21%, compared to the currently approved rate (allowed in PU-16-666) of 2.32%. At the level of individual accounts, the proposed increase is even more dramatic. For example, the depreciation rate for Account 367.00 (Distribution-Underground Conductor & Devices) is 4.07%, compared to the currently approved rate of 2.14%. The increase in rate is mostly driven by a more negative net salvage rate (negative 50%, compared to the currently approved rate of negative 40% according to the 2020 Depreciation Study). The proposed new depreciation rate for Account 367.00 alone would increase MDU's depreciation expenses by almost $2 million.

Figure 16. Accumulated reserve for depreciation, projected 2023

	Current Composite	Current Depreciation/ Amortization Expense	Proposed Composite 1/	Proposed Depreciation 1/	Composite Change	Change
Steam Production	1.57%	$3,314,685	2.42%	$5,109,259	0.85%	$1,794,574
Other Production	3.08%	3,539,754	3.17%	3,643,189	0.09%	103,435
Heskett Unit IV Gas Turbine	2.33%	1,082,742	2.33%	1,082,742	0.00%	-
Total Production		$7,937,181		$9,835,190		$1,898,009
Transmission	1.69%	$3,976,600	1.67%	$3,929,539	-0.02%	($47,061)
Distribution	2.32%	$7,681,955	3.21%	$10,628,911	0.89%	$2,946,956
General						
Other	6.63%	$611,585	7.00%	$645,715	0.37%	$34,130
Structures & Improvements	0.81%	27,658	1.54%	52,584	0.73%	24,926
Computer Equipment	10.00%	4,723	12.10%	5,714	2.10%	$991
Transportation	5.37%	338,232	8.48%	534,116	3.11%	195,884
Work Equipment	5.39%	486,094	7.89%	711,555	2.50%	$225,461
Total General		$1,468,292		$1,949,684		$422,336
General - Intangible	4/	$1,442,104	4/	$1,442,104		$0
Common						
Other	4.78%	$445,616	4.78%	$445,616	0.00%	$0
Structures & Improvements	0.85%	232,899	0.85%	232,899	0.00%	-
Computer Equipment	20.00%	540,184	20.00%	540,184	0.00%	$0
Vehicles	6.64%	245,993	6.64%	245,993	0.00%	-
Total Common		$1,464,692		$1,464,692		$0
Common - Intangible	4/	$1,720,419	4/	$1,720,419		$0
Acquisition Adjustment	0.00%	$0	0.00%	$0		
Amort. - Power Plant Decommissioning	4/	$647,584	4/	$647,584		$0
Amort. - Wind Decomm.	4/	$0	4/	$0		
Amort. Of Retired Power Plants	4/	$0	4/	$0		
Amort. - Unrecovered Plant	4/	$0	4/	$0		
Amort. - Excess Deferred Taxes	11/	$0	11/	$0		
Total Accumulated Reserve		$26,338,827		$31,618,123		
Book Depreciation Expense		$25,268,508		$30,126,459		
Amort. - of Preferred Stock Redemption	5/	$20,943	5/	$20,943		
Amort. - of Gain/Loss on Buildings	5/	62,095	5/	62,095		
Amort. - Lewis & Clark Unit I and Heskett Units I & II Regulatory Asset	11/	0		0		
Total Depreciation/Amortization Expense		$25,351,546		$30,209,497		$4,857,951

1/ See statement H, Scehdule H-2, page 2

	Depr Study	O&M Change	
Rate Base	($5,897,807)		
Earnings	($443,102)		
Revenue	($544,682)	$263,632	Vehicles & Work Equipment
Rev Req Decrease		($281,050)	
		$4,576,901	

Note: Proposed depreciation rates in the PU-22-194 filing differ slightly from the from the proposed rates in the 2020 Depreciation Study. Source: Interim DR Set 1 in Case No. PU-22-194, Response No. 2.1 Attachment A.xlsx, tab "Depreciation." and Response to Staff Set 4 ND 2022 Electric Income Statement - A,E,F,G,I,J.xls, tab "Projected Reserve."

Depreciation rates similar to those in the 2020 Depreciation Study were recommended in the depreciation study conducted for case PU-16-666, Montana-Dakota Utilities Co. Electric Division Depreciation Study as of December 31, 2014, prepared by AUS Consultants, Case No. PU-16-666

("2014 Depreciation Study") but the rates eventually approved in the settlement agreement for PU-16-666 were lower (see Figure 17).[43]

Figure 17. Summary of composite rates (2014 and 2020 Depreciation Studies and settlement rates)

	Settlement rates	2014 Depreciation Study	2020 Depreciation Study	Change in rate (2020-2014)	Change in rate (2020-settl.)
Steam Plant	1.93%	2.57%	2.45%	-0.12%	0.52%
Other Production Plant	3.76%	4.36%	3.98%	-0.38%	0.22%
Transmission Plant	1.61%	1.94%	1.70%	-0.24%	0.09%
Distribution Plant	2.40%	2.90%	3.25%	0.35%	0.85%
General Plant	5.84%	6.36%	7.34%	0.98%	1.50%
Total Plant in Service	**2.54%**	**2.94%**	**2.95%**	**0.01%**	**0.41%**

Source: LEI003-002, Attachment A_"PU-22-194 PSC DR 6 (LEI Set 2) MDU Response", and LEI003-003, Attachment A_"PU-22-194 PSC DR 6 (LEI Set 2) MDU Response"

The depreciation rates arrived at in the 2020 Depreciation Study

used the remaining life technique, which reflects the following concept:

$$Depreciation\ rates\ (\%) = \frac{(\$\ Depreciation\ accrual\ amount\ )/Remaining\ life}{\$\ Original\ Cost}$$

where: Depreciation accrual amount in dollars = Original cost in dollars – Net salvage value in dollars

Note that the depreciation accrual amount in dollars equals the original cost in dollars less the net salvage value in dollars. Net salvage values can be negative or positive. Negative salvage values increase the calculated depreciation accrual amount in the account, while positive net salvage values decrease it. The higher the depreciation accrual amount, the higher the depreciation rate.

[43] PU-22-194 MDU Response to LEI DR 3.31 Attachment B. Exhibit D.

LEI's analysis shows that MDU's proposed net salvage calculation is the main driver for the high depreciation rates in the Transmission and Distribution accounts. Net salvage rates are calculated as a ratio to the associated retirements:

$$Net\ salvage\ (\%) = \sum \frac{\$\ Net\ salvage}{\$\ Regular\ retirements}$$

where: Net salvage in dollars = Gross salvage in dollars – Cost of removal in dollars
Regular retirements = for the retiring asset, this is the original cost of the asset in the year that asset was first placed in service

Examining the net salvage calculations for Account 367.00 (Distribution-Underground Conductor & Devices), there is a dramatic increase in Removal Costs starting in 2013 that generates extremely negative net salvages values, a negative137.9% in 2013 compared to a negative 24.2% in 2012 (see Figure 18, highlighted row). The same trend of higher reported Removal Costs in more recent years also appears in other accounts (Account 364, Account 365, Account 371, and Account 373).

Figure 18. Selected net salvage calculation from the 2020 Depreciation Study

MDU Electric

ACCOUNT 367.00 - DISTRIBUTION - UNDERGROUND CONDUCTOR & DEVICES
SUMMARY OF BOOK SALVAGE

Year	Regular Retirements	Cost of Removal Amount	Cost of Removal Percent %	Gross Salvage Amount	Gross Salvage Percent %	Net Salvage Amount	Net Salvage Percent %
2006	162,043	50,781	31.3	8,630	5.3	(42,152)	(26.0)
2007	196,914	38,297	19.4	4,344	2.2	(33,953)	(17.2)
2008	638,234	135,231	21.2	23,155	3.6	(112,076)	(17.6)
2009	391,986	76,699	19.6	5,909	1.5	(70,790)	(18.1)
2010	189,625	42,882	22.6	3,665	1.9	(39,217)	(20.7)
2011	523,961	146,727	28.0	7,992	1.5	(138,735)	(26.5)
2012	221,461	67,623	30.5	13,990	6.3	(53,633)	(24.2)
2013	443,661	621,586	140.1	9,758	2.2	(611,828)	(137.9)
2014	455,032	465,097	102.2	0	0.0	(465,097)	(102.2)
2015	547,539	748,021	136.6	1,771	0.3	(746,250)	(136.3)
2016	590,839	636,529	107.7	954	0.2	(635,575)	(107.6)
2017	849,817	1,553,186	182.8	19,700	2.3	(1,533,486)	(180.4)
2018	839,548	856,265	102.0	1,184	0.1	(855,080)	(101.9)
2019	503,891	1,821,219	361.4	1,427	0.3	(1,819,793)	(361.1)
2020	903,169	2,016,539	223.3	5,580	0.6	(2,010,958)	(222.7)
TOTAL	**11,435,813**	**9,767,276**	**85.4**	**326,902**	**2.9**	**(9,440,374)**	**(82.6)**

Currently Approved (40)
Recommended (50) Cost of removal not necessarily synchronized with retirements.

Source: 2020 Depreciation Study.

In addition to the large changes in the historical net salvage value, MDU's proposed salvage rates going forward are not properly explained.

The more negative net salvage percentages proposed in the 2020 Depreciation Study translate into higher depreciation rates compared to the currently approved rates(see Figure 19). The more negative net salvage values are a main driver of the higher depreciation rates proposed by MDU, and therefore the increase in depreciation expense in the current case.

Figure 19. Impact of salvage assumptions to the depreciation rates

Account	Net Salvage Percentage		Change in depreciation rate	
	Proposed by MDU	Currently Approved	Proposed by MDU	Currently Approved
355	-35%	-30%	2.06%	1.96%
362	-15%	-10%	2.05%	1.92%
365	-110%	-100%	3.08%	2.86%
367	-50%	-40%	4.07%	3.73%
373	-45%	-50%	4.27%	4.43%

Note: LEI calculated the change in depreciation rate using the calculation provided on response to DR LEI003-036. The approved net salvage percentage are based on what is listed as "Currently Approved" percentages in Section 7 of the 2020 Depreciation Study.

Sources: Sections 7 and 8 of the 2020 Depreciation Study and LEI003-036

As a point of reference, LEI examined the proposed depreciation rates for Otter Tail Power Company in its 2022 technical update of depreciation rates (Docket No. E017/D-22-Attachment 1). LEI found the Otter Tail depreciation rates to be more aligned with MDU's currently approved rates which originated from the settlement of PU-16-666(see Figure 20).

Figure 20. Sample depreciation rates (Otter Tail 2022)

	Otter Tail (2022 technical update)	MDU settlement rates	MDU 2020 Depreciation Study
Steam Plant	2.78%	1.93%	2.45%
Other Production Plant	3.04%	3.76%	3.98%
Transmission Plant	1.62%	1.61%	1.70%
Distribution Plant	2.36%	2.40%	3.25%
General Plant	5.15%	5.84%	7.34%
Total Plant in Service	**2.56%**	**2.54%**	**2.95%**

Sources: Otter Tail Power Company. 2022 Technical Update. Docket No. E017/D-22-Attachment 1

In summary, MDU did not provide a compelling argument to increase depreciation rates. LEI recommends the continued use of the currently approved rates, and disallowance of the proposed $4,741,530.

Q: Are MDU's proposed ROE and resulting cost of capital reasonable?

A: No. The ROE proposed by MDU in the current rate case is 10.5% with a capital structure of 50.81% common equity for 2023. LEI's analysis, discussed in detail below, demonstrates that, with a capital structure of 50.81% common equity, an ROE of 9.42% is reasonable for MDU. The main reason for the difference in LEI's recommended ROE and MDU's proposed ROE is the unjustifiably high market risk premium assumed by MDU, discussed in detail below. Based on LEI's analysis, MDU's proposed ROE of 10.50% is not justifiable. LEI's recommended ROE and capital structure results in a WACC of 6.97%.

Q: How did LEI arrive at its recommended ROE?

A: For a regulated utility, the ROE allowed by the regulator must not be so high that the utility earns significant surplus profits beyond what it would have earned in a competitive environment with a similar risk profile, nor should it be so low that the utility sees no adequate value in continuing to operate the regulated business.

A key driver of the appropriate level of allowed ROE is the level of un-diversifiable risk faced by the utility. This type of risk is explicitly accounted for in widely used approaches to determining appropriate ROE for regulated utilities. One of these approaches, Capital Asset Pricing Model ("CAPM"), which LEI relied upon to determine whether MDU's proposed ROE is reasonable. CAPM is the most widely used methodology to estimate return on equity by companies which use best practices.[44]

The Discounted Cash Flow ("DCF") methodology is sometimes used for determining a reasonable ROE but has the weakness that it is based upon

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[44] Bruner, Robert & Eades, Kenneth & Harris, Robert & Higgins, Robert. (1998). *Best Practices in Estimating the Cost of Capital: Survey and Synthesis.* Financial Practice and Education. 8.

estimates of the future growth of cash flows. These can be unreliable for long-term (3 years or more) forecasts. Studies have shown that a naïve random walk (in which a given year's projected earnings are simply equal to the previous year's earnings plus random white noise) provides as accurate a forecast of long term future earnings as analysts' forecasts.[45] Earnings forecasts do not only lack accuracy, they tend to over-value the cost of equity because, has been shown by a variety of research, analysts' forecast are consistently overly optimistic.[46] Therefore, relying on the DCF formula to determine ROE produces an upwardly-biased estimate of the ROE required by investors.

The CAPM, utilized by LEI, arrives at an estimate of ROE based on three variables: i) the risk-free rate, ii) Beta (β), a measure of the systematic risk of an asset compared to the market as a whole, where a Beta greater than 1 means the asset is more volatile than the market, and a Beta less than 1 means it is less volatile, and iii) the market risk premium:

ROE = risk-free rate + Beta * (market risk premium)

Q: What is the risk-free rate recommended by LEI?

A: CAPM requires a measurement of the risk-free rate of return. A risk-free rate implies a return available on an investment that is guaranteed and is uncorrelated with risky investments in a market.[47] For an investment to be considered risk-free, there needs to be near-zero default risk and a near-zero reinvestment risk.[47] It is relatively straightforward to select a proxy for an

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[45] Michael Lacina, B. Brian Lee and Zhao Xu, *Advances in Business and Management Forecasting*, at 77–101 (Kenneth D. Lawrence, Ronald K. Klimberg eds., Emerald Grp. Publ'g Ltd. 2011).

[46] R.D. Harris, "The Accuracy, Bias, and Efficiency of Analysts' Long Run Earnings Growth Forecasts." *Journal of Business Fin. & Accounting*, 725–55 (June/July 1999); P. DeChow, A. Hutton, and R. Sloan. "The Relation Between Analysts' Forecasts of Long-Term Earnings Growth and Stock Price Performance Following Equity Offerings." *Contemporary Accounting Research* (2000); K. Chan, L., Karceski, J., & Lakonishok, J., "The Level and Persistence of Growth Rates." *Journal of Finance.* 643–84 (2003).

[47] Aswath Damodaran. Stern School of Business, New York University. *What is the risk-free rate? A Search for the Basic Building Block*. December 2008.

investment that is virtually default-free: government bonds issued by the US are widely considered to be the best proxies for default-free investments. This is reinforced by the credit ratings from major credit rating agencies (Moody's: Aaa, S&P ratings: AA+, and Fitch ratings: AAA) for such bonds.

CAPM refers to the returns required by the equity owners of a firm; and equity has no maturity date. Therefore, the appropriate US government bond term is as long as possible—i.e., a 30-year bond will serve as the best proxy for risk-free rate.

LEI estimated the risk-free rate by referring to Consensus forecasts of US government bond yields based on the October 2022 survey (see Figure 21).[48,49] The Consensus forecasts are published for 10-year bonds but not 30-year bonds. To translate the forecast for a 10-year bond (3.30%) into a 30-year bond, LEI calculated the historical average spread (1977-2022) between 10-year and 30-year government bond yield.[50] This amounted to 0.39%.

Therefore, the appropriate risk-free rate to use for calculating ROE for MDU is 3.69% (i.e., 3.30% + 0.39%). At 3.69%, LEI's estimate of risk-free rate is higher than MDU's estimates, which range from 2.37% to 3.40%.

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[48] Consensus Forecasts. Surveys of International Economic Forecasts. October 10, 2022.

[49] LEI utilized the annual forecasts till 2027 as it expects the ROE approved by the Commission in the current rate case proceeding to be applicable till 2027.

[50] Federal Reserve Bank of St. Louis. Federal Reserve Economic Data.

Figure 21. Consensus forecasts of US 10-year government bond yield

Year	US 10-Year Government Bond Yield (Consensus Forecasts)
2023	3.50%
2024	3.30%
2025	3.30%
2026	3.20%
2027	3.20%
Average	**3.30%**

Sources: Federal Reserve Bank of St. Louis; Consensus Forecasts, October 10, 2022. The October 2022 survey is the most recent survey (as of January 12, 2023) with long-term forecasts.

Q: What level of Beta does LEI recommend?

A: CAPM requires a measurement of Beta for the asset (or company) in question. Since the MDU utility business is not a publicly traded entity, this requires establishing an appropriate peer group of companies, and determining the Beta for the peer group. The companies that make up a peer group should face similar business and financial risks as does MDU. The peer group should be large enough to minimize unsystematic, firm-specific risks. The screening criteria used to create the peer group must therefore be carefully chosen so that they are not so narrow in scope that they significantly reduce the sample size, and not so broad in scope that they lead to selection of unrepresentative companies. LEI's screening criteria for choosing peer companies were:

- Publicly traded in a designated US stock exchange consistently since at least 2017;
- Operations in regulated generation and distribution of electricity;
- At least 70% of average revenue for the last 3 years (2019 to 2021) was from regulated electricity and natural gas businesses;
- At least 40% of average revenue for the last 3 years (2019 to 2021) was from regulated electricity in the US; and

- Investment grade credit rating of "Adequate/BBB-" or higher based on S&P Global Ratings.

Based on the criteria, LEI's peer group includes 26 companies. For a publicly traded company, Beta is typically estimated by regressing the stock returns for the firm against the market returns.[51] These were calculated for a 3-year period by Standard & Poor's (see Figure 22). For LEI's peer group, the Betas averaged 0.79.

[51] The reference market exchange is the exchange in which the firm is traded.

Figure 22. S&P Betas from LEI's peer group

Company Name	3-yr beta
ALLETE, Inc.	0.88
Alliant Energy Corporation	0.67
Ameren Corporation	0.73
American Electric Power Company, Inc.	0.63
Black Hills Corporation	0.90
CMS Energy Corporation	0.64
Dominion Energy, Inc.	0.73
DTE Energy Company	0.85
Duke Energy Corporation	0.71
Edison International	0.84
Entergy Corporation	0.83
FirstEnergy Corp.	0.81
IDACORP, Inc.	0.73
NextEra Energy, Inc.	0.86
NorthWestern Corporation	0.86
OGE Energy Corp.	0.77
Otter Tail Corporation	1.02
PG&E Corporation	1.07
Pinnacle West Capital Corporation	0.77
PNM Resources, Inc.	0.74
Portland General Electric Company	0.81
Sempra	0.83
The Southern Company	0.78
Unitil Corporation	0.78
WEC Energy Group, Inc.	0.63
Xcel Energy Inc.	0.70
Average	**0.79**

MDU's estimated Betas range from 0.74 to 0.89; LEI's recommended Beta is within this range.

Q: What is a reasonable way to represent the market risk premium ("MRP")?

A: The MRP measures what investors on average demand as extra return for investing in a risky portfolio relative to a risk-free asset. The historical spread

between the risk-free rate and market returns is widely used to estimate the MRP. A range of historical MRPs which includes a mix of high, low, and neutral interest rate environments helps to capture the uncertainties in predicting future MRPs. The long-term historical average MRP for the US from 1926 through 2020 is 7.25%.[52]

MDU's MRP estimate of 12.68% is much too high compared to the 7.25% long-term measure; and the assumption of 12.68% is the main driver of the higher 10.5% ROE that MDU is proposing. An MRP of 12.68% implies an annual market return of about 16% (assuming a risk-free rate of 3.69%). This annual market return is far higher than what is expected by investors. Investor expectations (based on S&P 500 futures) indicate an extremely low annual average market return of 3.2% from 2023-2027 (the five-year period of the current rate case).[53] It is also far higher than supported by academic research, which indicates a range of 5%-8%.[54] To support the 12.68%, MDU compares it to the total realized US equity market return.[55] The comparison should instead be to only the additional return to equities—the MRP—over risk-free rate. The reason for MDU's over-estimation of the MRP is its reliance on earnings forecasts.[56] Earnings forecasts, as discussed previously, tend to be inaccurate and biased towards over-estimating earnings.

MDU referred to empirical CAPM ("ECAPM"), a concept which is based on empirical research which shows that CAPM tends to underestimate the cost of capital for companies (like regulated utilities) whose Betas are less than one. To account for this, ECAPM techniques are sometimes used to raise the

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[52] Based on data sourced from Duff & Phelps Cost of Capital Navigator.
[53] CME Group. E-mini S&P 500 Futures – Settlements. Accessed on January 17, 2023.
[54] Richard A. Brealey, Stewart C. Myers, and Paul Allen, Principles of Corporate Finance, Irwin McGraw-Hill (8th ed. 2006).
[55] PU-22-194. Prefiled Testimony of Ann E. Bulkley. P. 46.
[56] PU-22-194. Prefiled Testimony of Ann E. Bulkley. P. 45.

predicted returns associated with Betas less than one and reduce the predicted returns for Betas greater than one. The ECAPM formula utilized by MDU arbitrarily assigned a weight of 75% to the Beta*MRP term and a weight of 25% to an additional term, the MRP, as shown below:

$$ROE = RFP + (0.75*Beta*MRP) + .25*MRP$$

The ECAPM formulation increases the market ROE if Beta is less than one. The selection of weights is crucial to the resulting ROE, but MDU did not provide empirical evidence to support its assumption of the 0.75 and 0.25 weights.

Q: What ROE does LEI recommend?

A: As shown below in Figure 23, based on LEI's assessment of the three components of the CAPM model, the LEI recommends an ROE of 9.42%.

Figure 23. LEI calculation of recommended ROE

Recommended ROE						
Risk-free rate	+	(Beta	*	MRP)	=	ROE
3.69%	+	0.79	*	7.25%	=	9.42%

Q: Is MDU's request for an ROE adder for flotation cost reasonable?

A: No, for several reasons. First, Commissions do not universally allow such costs. In a Southern California Edison case in 2019, the California Public Utilities Commission noted, *"We concluded in D.92-11-047…any reconsideration of a flotation adjustment in a future proceeding would require a showing of theoretical, practical, utility and market specific data, and a showing that a flotation cost adjustment does not shift the burden of the transaction costs from investors to ratepayers. The utilities proposing a flotation adjustment have: (1) not identified any of their actual flotation costs; (2) not identified any new common equity issuances in the test year; and (3) not demonstrated that their utility stocks are trading at, or below, their book value. […] we reject consideration of a flotation adjustment in this proceeding.*

Consistent with prior Commission policy, SDG&E and SoCalGas's inclusion of flotation adjustments is inappropriate. The Commission will not grant the inclusion of flotation costs in setting the ROE for the applicants."[57] MDU seems to be planning for new stock issuances for the test year (based on its request to increase the share of equity in its capital structure from 49.35% for 2021 to 50.81% for the 2023 test year).[58] But, MDU has not identified any actual flotation costs. Its stock has not been trading below book value, either. It has been trading at about $30 per share for January 2023, with a book value of $18-$19 per share.[59]

Second, as noted in a recent case in Indiana, flotation costs are not actual out-of-pocket costs. *"The Company has not experienced any out-of-pocket costs for flotation. Underwriters are not compensated in this fashion. Instead, underwriters are compensated through an "underwriting spread." An underwriting spread is the difference between the price at which the underwriter purchases the shares from the firm, and the price at which the underwriter sells the shares to investors."*[60]

Third, also noted in the Indiana case, the equity market already accounts for flotation costs. *"When an underwriter markets a firm's securities to investors, the investors are well aware of the underwriter's fees. In other words, the investors know that a portion of the price they are paying for the shares does not go directly to the company, but instead goes to compensate the underwriter for its services. In fact, federal law requires that the underwriter's compensation*

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[57] California Public Utility Commission. Application 19-04-014. *Application of Southern California Edison Company (U338E) for Authority to Establish Its Authorized Cost of Capital for Utility Operations for 2020 and to Partially Reset the Annual Cost of Capital Adjustment Mechanism.* Decision 19-12-056. December 20, 2019.
[58] PU-22-194. MDU Statements and workpapers A-L. Statement E. P.1.
[59] https://markets.businessinsider.com/stocks/mdu-stock
[60] Indiana Utility Regulatory Commission. Cause No. 45235. *Indiana Office of Utility Consumer Counselor Public's Exhibit No. 11 (Part I) Testimony of OUCC Witness David J. Garrett.* August 20, 2019.

be disclosed on the front page of the prospectus. Thus, investors have already considered and accounted for flotation costs when making their decision to purchase shares at the quoted price. As a result, there is no need for the Company's shareholders to receive additional compensation to account for costs they have already considered and agreed to."[61]

Finally, increasing the cost of capital for every year to cover a one-off expense will over-charge ratepayers. To prevent over-collection, even if ratepayers were found to be responsible for a portion of flotation costs under some circumstances, MDU can request cost recovery as an expense. It should not be added to ROE. Expensing the cost recognizes the one-time nature of the expenses.[62]

Q: MDU argues that it faces specific business and financial risks that are not captured by analysis of peer companies, is this valid?

A: No. According to the analysis by S&P Global Ratings, the business risk faced by MDU is classified as "Excellent" i.e., the lowest possible business risk in their analysis. The S&P Global Ratings analysis cites very low industry risk and a strong competitive position. Although S&P classifies MDU's financial risk as "Significant," the peer companies considered by LEI face similar financial risk (as credit rating of "Adequate/BBB-" or higher is one of the criteria LEI applied when choosing the peer companies). LEI therefore believes that MDU does not face additional risks when compared to its peer companies, and therefore LEI's estimate of Beta is accurate and does not require an arbitrary adder.

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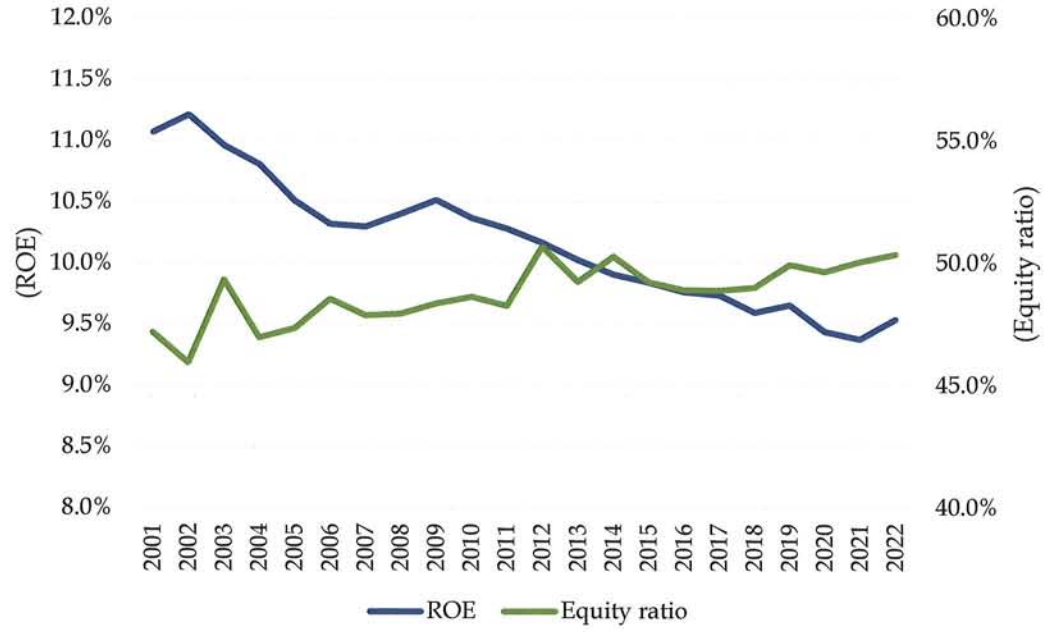
[61] Ibid.
[62] Ibid.

Q: What is the historical trend for ROEs and equity ratio in capital structures allowed to electric utilities in the United States?

A: In the United States, allowed ROEs in electric rate cases gradually declined from 2001 through 2021 (with a slight uptick in 2022), from an average of 11.1% to 9.5% (see Figure 24). At the same time, the share of equity in the capital structure (the equity ratio) has remained relatively steady, averaging 49% over the same period.

Figure 24. Allowed ROE and equity ratio for regulated electric utilities in the United States



Source: S&P Global Market Intelligence

Q: Should MDU's equity ratio be allowed to increase to 50.81%?

A: Possibly. MDU equity's ratio was 49.35% in 2021; MDU proposes an equity ratio of 50.81% for the 2023 test year. The proposed equity ratio is mostly in line with the equity ratios allowed to regulated US electric utilities in 2022 and lower than the equity ratio of 51.403% allowed in the PU-16-666 electric rate

increase proceeding.[63] However, it is higher than the average of 50.4% allowed to US electric utilities in 2022 (see Figure 24).

Higher equity ratios can have material impacts on utility rates, as equity is more expensive to finance than debt. Every 100-basis point increase in equity ratio leads to an increase in MDU's annual revenue requirement of about $300,000.[64] MDU must make meaningful efforts to keep its equity ratio below 50%. There are no indications from the rating agencies that MDU's BBB+ credit rating is at risk.

Considering the above analysis, the ROE of 10.50% sought by MDU is not justifiable; LEI recommends 9.42%. Based on a 9.42% ROE, MDU's pre-tax weighted average cost of capital ("WACC") would be 6.97% (see Figure 25).

Figure 25. MDU WACC based on MDU and LEI ROEs

WACC (pre-tax) - 2023			
Type of Capital	Ratio	MDU proposed	LEI recommended
Long-term debt	44.59%	4.50%	4.50%
Short-term debt	4.60%	3.68%	3.68%
Common Equity	50.81%	10.50%	9.42%
WACC (pre tax)		7.51%	6.97%

The impact of the 9.42% ROE reduces the revenue requirement for the 2023 test year by about $3 million (see Figure 26).

Figure 26. Reduction in revenue requirement based on LEI ROEs

Impact on test year revenue requirement				
Average Rate Base	$	612,177,981		
		MDU proposed		LEI recommended
WACC (pre tax) (%)		7.51%		6.97%
WACC (pre tax) ($)	$	45,989,119	$	42,640,758
Savings compared to 10.5% ROE			$	3,348,361

[63] Based on S&P global intelligence, the average common equity ratio authorized for US electric utilities is 51.08%.
[64] LEI's calculations, assuming the currently allowed ROE of 9.65% and MDU's projections of average rate base, cost of debt and capital structure for 2023.

Q: Did LEI review MDU's proposed cost of service?

A: Yes, LEI conducted a high-level review of the Prefiled Testimony of Ronald Amen, and Statement K, and compared them with MDU's cost of service documents filed in PU-16-666.

Q: Did any issues stand out?

A: Yes, two issues stood out. First, MDU did not provide jurisdictional allocation factors for 2023 in its filing. MDU provided jurisdictional allocation factors in response to Staff Set 1, "ND Electric Rate Base – Interim A, B,C,D,H,J.xls, tab "Factor," but only for 2020-2022; and provided a more detailed breakout of these factors in response to Staff DR 15.3, but only for 2020. LEI did not find a discussion of the way in which MDU arrived at jurisdictional allocation factors for 2023 in MDU testimony in PU-22-194 or anywhere in Statement K.

Second, comparing the loss factors MDU used in PU-22-194 to those proposed in PU-16-666, MDU's proposed average distribution losses in the current case are quite a bit higher, at 2.179%; as opposed to 1.54% for PU-16-666 (see Figure 27).The biggest increases are in the categories "Distribution Primary Lines" and "Distribution Service Lines." MDU did not provide a loss factor study, so it is not possible to determine how they arrived at the values (and the values are hard-coded in the file ND 2022 Electric Class Cost of Service – K, tab "E&D Allocation"). Without an explanation of how average losses increased so much on their distribution primary and service lines, LEI recommends retaining the distribution line losses from the PU-16-666 filing.

Figure 27. MDU loss factors compared across rate cases

Loss Factors PU-22-194	
	Average Losses
Production and Transmission	5.388%
Substation Transformers Losses	0.342%
Distribution Primary Lines	0.902%
Distribution Transformers	0.762%
Service Lines	0.173%
Total Distribution Losses	2.179%
5-Year Average Total Losses	7.567%
Loss Factors PU-16-666	
	Average Losses
Production and Transmission	5.72%
Substation Transformers Losses	0.33%
Distribution Primary Lines	0.19%
Distribution Transformers	0.71%
Service Lines	0.31%
Total Distribution Losses	1.54%
5-Year Average Total Losses	7.26%

Source: PU-22-194, Statement K P. 19 of 51; PU-16-666, PU-16-666, Workpapers Supporting Statement M. P. M-27.

Q: Please summarize LEI's recommendations and their impact on the rate increase requested by MDU

A: LEI's recommendations are summarized in Figure 28 (the same as Figure 3, repeated here for the reader's convenience). LEI's recommendations amount to a reduction in test year revenue requirements of $15,550,869. This does not include the impact of recommended changes to the discount rate and EROA used to calculate the regulatory asset for pension and post-retirement benefits.

Figure 28. LEI's recommended changes to 2023 test year revenue requirements

	Item	Change to expense	Change to rate base
1	Disallow a portion of distribution labor cost share to bring it closer to industry average cost per MWh	$ (90,637)	
2	Disallow 401k expense based on reduction in distribution labor cost	$ (8,792)	
3	Disallow the portion of long-term incentive compensation tied to financial performance	$ (1,391,439)	
4	Disallow short-term incentive compensation tied to financial performance	$ (2,258,988)	
5	Disallow new employee hires/promotions associated with Outage Management System	$ (443,150)	
6	Disallow expenses for institutional advertising	$ (56,112)	
7	Disallow expenses for industry dues	$ (226,557)	
8	Disallow expenses for 10% insurance increase	$ (225,084)	
9	Disallow portion of increase for software maintenance	$ (868,050)	
10	Disallow expense for personal use of vehicles	$ (40,000)	
11	Disallow expense for COVID	$ (1,070,568)	
12	Depreciation rates at PU-16-666 settlement levels	$ (4,741,530)	$ 4,741,530
13	Disallow outage management system		$ (2,146,511)
14	Updated average rate base (average 2023 rate base of $612,177,981 + deprecation disallowance - outage management system)		$614,773,000
15	Impact of reducing proposed ROE from 10.5% to 9.42% on updated rate base	$ (3,319,774)	
16	Impact on income tax (tax rate * difference in ROE)	$ (810,188)	
	Impact on annual revenue requirement of items 1-16	**$ (15,550,869)**	
	Re-calculate pension and post-retirement asset	tbd	tbd

Q: Does this conclude your testimony?

A: Yes, it does.

London Economics International LLC

Exhibit A - CVs

Marie N. Fagan, PhD

Chief Economist, London Economics International, LLC

LONDON ECONOMICS

KEY QUALIFICATIONS:

Marie Fagan is the Chief Economist at London Economics International, LLC, based in Boston, Massachusetts. With over 30 years of experience in research and consulting for the energy sector, Marie's career has spanned international upstream and downstream oil and gas, global coal, North American gas markets, and North American power markets. She has advised industry clients, financial clients, regulators, and public interest organizations. She serves as an expert witness in oil, gas, and electric power litigation and regulatory matters. Marie is experienced in the use of scenario analysis, an approach which helps clients identify potential turning points and arrive at decisions that are robust given the uncertainties inherent in any future set of market conditions.

At LEI, Marie leads LEI's utility management performance audit engagements and has been involved in performance-based ratemaking cases. She has experience as a project manager for complex, multi-year engagements, including a two-year project for the Maine Public Utilities Commission, and a two-year audit project for the Mississippi Public Service Commission. She has deep experience in econometric analysis.

Projects have included serving as independent expert witness for the Maine Public Utilities Commission, in the evaluation of the costs and benefits of new natural gas pipelines into New England, and independent expert witness for the Minnesota Department of Commerce in the matter of the CN application of Enbridge Energy for the Enbridge Line 3 oil pipeline expansion.

From 1996-2014, she was with Cambridge Energy Research Associates ("CERA," now part of IHS Markit). She served as an Associate, then Associate Director for CERA's Global Oil research practice, as Director for the North American Gas research practice; she founded the CERAView Institutional Investor Service and co-founded CERA's Global Steam Coal service; she served as Senior Director for CERA's North American Electric Power service and of IHS CERA's Upstream Strategy service. Before joining CERA, Marie served as an economist with the United States Energy Information Administration ("EIA"), conducting analysis and modeling supporting the Annual Energy Outlook ("AEO"), and conducting analysis of energy company financial performance.

Marie is the author of original research with publications in academic and industry journals. She holds a PhD in Economics from the American University in Washington, DC. She is a member of the Energy Bar Association, the American Economic Association, International Association for Energy Economics, and the Boston Economic Club. She is former Vice President of Business for the US Association for Energy Economics ("USAEE") and is a former member of the USAEE Strategic Planning Committee. She serves as a referee for the *Energy Journal,* the flagship academic publication of the International Association for Energy Economics.

EDUCATION:

Institution	American University, Washington DC
Date:	1995
Degree(s) or Diploma(s) obtained:	PhD in Economics. Dissertation: "Measuring Cost and Efficiency in US Crude Oil Resource Development, 1977-1990: A Frontier Translog Cost Function Approach"

Institution	University of Connecticut
Date:	1984
Degree(s) or Diploma(s) obtained:	Bachelor of Science, Business Administration (Finance)

EMPLOYMENT RECORD:

Date:	2014-present
Location:	Boston, MA
Company:	**London Economics International LLC ("LEI")**
Position:	Chief Economist (2020-present) Managing Consultant and Lead Economist (2016-2019) Managing Consultant (2014-2015)

Date:	2003-2014
Location:	Cambridge, MA
Company:	**IHS Markit (formerly Cambridge Energy Research Associates ("CERA"))**

Position:	Senior director, Upstream Strategy Advisory service (2012-2014). • Responsible for the re-vamp of research services and development of new research services focused on the needs of oil and gas exploration and production companies. Defined product architecture, defined deliverables, and generated research, as well as managed the delivery of research. Responsible for marketing plans and focus, conducting presentations to Board of Directors meetings and other C-suite client groups. Keynote speaker at IHS CERA events such as CERAWeek and other industry events and conferences Senior director, North American Gas, Power, and Renewables group (2007-2011). • Responsible for thought leadership, development, and delivery of research for IHS CERA's North American Electric Power Advisory Service and North American Gas and Power Scenarios Service. Led client engagements, as well as wrote and published research. Provided oversight and direction of the launch of a new research service, the IHS CERA Global Steam Coal Advisory Service Director/Senior director, CERAView Institutional Investor Service (2004-2007) • Created, launched, and directed IHS CERA's first research service encompassing the oil, gas, and power sectors to serve a targeted client community. Developed a new IHS CERA research publication, *Investors' Energy Monthly*, and served as publication's executive editor. In this role, won the IHS Circle of Excellence Award in 2005 Director, North American Gas Advisory service (2003-2004) • Responsible for rapid re-construction and turnaround of one of CERA's largest research advisory services. Contributed to and helped define the research agenda and was responsible for the editorial content and publication of major research and analytical reports related to gas infrastructure and markets in North America. Advised senior executive clients, including leading discussions of sensitive client-related issues.

Date:	2001-2002
Location:	Boston, MA
Company:	**International Human Resources Development Corporation ("IHRDC")**
Position:	Director, International Gas Program • Developed and implemented management training programs for middle and senior energy company managers, designed interactive presentations and teaching materials, and served as instructor. Taught principles of project development and financial analysis of energy company operations.

Date:	1996-2001
Location:	Cambridge, MA
Company:	**CERA**
Position:	Associate director, Global Oil advisory service (1999-2001) • Authored original research reports, responsible for client presentations and the management, execution, and delivery of consulting projects. Associate, Global Oil advisory service (1996-1998) • Developed and maintained IHS CERA's expertise in exploration and production costs, technology, and financial factors affecting the upstream oil and gas industry.

Date:	1994-1996
Location:	Washington, DC
Company:	**US Department of Energy, Energy Information Administration**
Position:	Economist • Conducted financial analysis of upstream and integrated oil and gas companies; evaluated and implemented conceptual approaches to analysis of energy markets and market incentives and wrote and published original research reports.

Date:	1989-1994
Location:	Vienna, Virginia
Company:	**Decision Analysis Corporation of Virginia (DAC)**
Position:	Research associate/Associate • Performed economic and econometric analysis, modeling, and forecasting to support the Energy Information Administration energy end-use models. Designed the National Energy Modeling System's Commercial Building Energy Demand Model; conducted financial analysis of energy companies.

Date:	1988
Location:	Washington DC
Company:	**US Department of Energy, Office of Policy, Planning and Analysis**
Position:	Intern • Researched waste-to-energy potential in the United States; constructed a database, developed econometric models, analyzed results, and produced written reports.

PROJECT EXPERIENCE:

Date:	July 2022 - present
Location:	Maine
Organization:	Maine Public Utilities Commission
Description:	**Investment incentives for electric distribution utility** Marie served as independent expert for the Maine PUC in its investigation of Central Maine Power Company ("CMP") management issues and related ratemaking and performance incentive mechanisms. Ultimately, the Commission's goal was to determine whether the rate plan to be proposed by CMP in a concurrent docket would be more suitable than the current cost-of-service rate plan under which CMP operates, given the parent company's incentives to invest in CMP. Marie led the project, which included a literature review of utility investment incentives and of multi-national entities' ("MNE") incentives to invest in subsidiaries. The project also included detailed case studies of performance-based ratemaking regimes in other US jurisdictions, and the role and effectiveness of performance incentives in the regimes. [Docket No. 2022-00038, and Docket No. 2022-00152].

Date:	May 2022 – October 2022
Location:	ERCOT
Organization:	Private client (law firm)
Description:	**Analysis of fair market prices for natural gas** LEI provided economic analysis and independent expert advice related to natural gas market activities in Texas during and around February 2021 in conjunction with Brazos Electric Power Cooperative, Inc. bankruptcy case in Texas. LEI provided an expert testimony report [Cause No. 21-03863]. Marie served as the project manager, natural gas expert, and a key witness.

Date:	April 2022
Location:	ERCOT/PJM/SPP
Organization:	Confidential client
Description:	**Regulatory and commercialization pathways for a renewable developer platform** LEI was engaged by a multinational energy company to support its due diligence of an acquisition of a 3000 MW+ portfolio of solar and wind development assets across PJM, ERCOT, and SPP. LEI performed a review of the state regulations and RTO markets for each asset, to evaluate the opportunities and risks around the commercialization paths for each asset. Marie led the analysis related to the ERCOT and SPP regions.

Date:	February 2022 - present
Location:	Louisiana
Organization:	Louisiana Public Service Commission
Description:	**Review of integrated resource planning ("IRP") process for three Louisiana utilities** LEI was engaged by Louisiana Public Service Commission, Docket No. I-36175 (Cleco Power), Docket No. I-36181 (Entergy Louisiana), and Docket No. I-36242 (SWEPCO), to assist to serve as the outside technical independent consultant in the process related to the IRP process for the three utilities. LEI reviewed and examined filings and pre-filed

	testimony; drafted, reviewed, and responded to discovery, and prepared direct and cross-answering testimony. LEI appeared at technical conferences and hearings and assisted with trial preparations. Marie directed the three engagements and served as independent expert witness.

Date:	March 2022
Location:	Texas/ERCOT
Organization:	UT Austin Bureau of Economic Geology
Description:	**Expert contributor to study of gas distribution industry for Texas Railroad Commission** Following Storm Uri of February 2021, the Texas Railroad Commission was asked by the State of Texas to deliver an investigation of the value of underground storage for local gas distribution companies ("LDCs"), especially for coping with extreme weather conditions. The Bureau of Economic Geology at the University of Texas at Austin led the project. Marie provided insight into essential elements of the LDC gas supply procurement process, as well as best practices for winter supply security.

Date:	March 2022
Location:	Maine
Organization:	New England Aqua Ventus/Pine Tree Offshore Wind
Description:	**Economic impact of development of offshore wind in Maine** LEI was engaged by New England Aqua Ventus/Pine Tree Offshore Wind to evaluate the potential economic benefits to Maine of two scenarios for offshore wind project construction and operations based on floating offshore structures: NEAV's 144-MW Research Array, and a commercial-scale buildout of 5,000 MW over a number of years. LEI utilized the IMPLAN economic model to estimate the economic impacts. Marie directed and led the project.

Date:	September 2021 - March 2022
Location:	ERCOT
Organization:	Private client
Description:	**February 2021 winter storm impacts on ERCOT natural gas production and prices** LEI developed and examined data for natural gas production at the basin level in Texas, flows on intra-state and inter-state pipelines, prices at supply and market hubs, and use of gas by electric power plants and other customers in the state. Marie served as senior advisor to the project team.

Date:	July 2021 - present
Location:	Louisiana
Organization:	Louisiana Public Service Commission
Description:	**Audit of fuel costs of Cleco Power associated with the February 2021 Winter Storm Event** LEI was engaged by Louisiana Public Service Commission, Docket No. X-35990, to perform an audit of the Fuel Adjustment Clause ("FAC") filings of Cleco Power related to costs incurred during the February 2021 Winter Storm Event. Marie supervised and directed the audit. In addition to the scope of services typically provided in an FAC audit, LEI also examined actions and decisions of Cleco Power leading up to and during the Winter Storm Event.

Date:	May 2021 – March 2022
Location:	Louisiana
Organization:	Louisiana Public Service Commission
Description:	**Evaluation of utility green pricing option** LEI was engaged by Louisiana Public Service Commission, Docket No. U-35916, to serve as the technical consultant evaluating Entergy Louisiana LLC's application for authorization to implement a green pricing option, to be paid for by a Green Pricing Option ("GPO") or Large Volume Green Pricing Option ("LVGPO") rider, and related rate relief. LEI reviewed and examined filings and pre-filed testimony, assisted in drafting, reviewing, and responding to discovery, prepared testimony, and conducted other activities related to the matter.

Date:	April 2021 – June 2021
Location:	ERCOT
Organization:	Private client
Description:	**February 2021 winter storm impacts on ERCOT energy prices** For a law firm representing an ERCOT market participant, LEI conducted an analysis of the impact on hourly real time energy prices in ERCOT for the week of February 14, 2021. Marie served as co-author of report, filed in PUCT Project 51812, Item No. 207. https://interchange.puc.texas.gov/search/documents/?controlNumber=51812&itemNumber=207

Date:	July 2021 – December 2021
Location:	Ohio
Organization:	Public Utilities Commission of Ohio
Description:	**Audit of Legacy Generation Resource ("LGR") Riders of Duke Energy, AEP Ohio, and AES Ohio** LEI was engaged by the Public Utility Commission of Ohio, to perform audits of the LGR Riders for three major Ohio electric distribution utilities. The LGR Riders are the mechanisms for passing to customers the costs of a power purchase contract with the Ohio Valley Electric Corporation ("OVEC"). Aspects of the audit included assessing the reasonableness and prudency of the disposition of energy and capacity in the PJM market of the energy provide by two coal plants owned by OVEC, as well as plant performance, compliance with environmental requirements, and the prudency of fuel purchases. LEI also audited charges and true ups related to the companies' filings. Marie supervised and directed the audits.

Date:	February 2021 - February 2022
Location:	New Jersey
Organization:	New Jersey Board of Public Utilities
Description:	**Natural gas capacity and non-pipeline alternatives** LEI was engaged by the New Jersey Board of Public Utilities to examine current and future natural gas transmission capacity to serve demand from New Jersey's local gas distribution utilities (Docket No. GO19070846). The purpose of the engagement was to

	determine if capacity on pipelines and from non-pipeline sources would be sufficient to meet demand from firm customers through 2030. LEI examined the capacity and contracting status of pipelines serving New Jersey. LEI examined design day demand projections from the LDCs and estimated impacts of New Jersey's energy efficiency targets in the context of its Energy Master Plan and de-carbonization goals. LEI also looked at the role of third-party suppliers. LEI provided recommendations for addressing capacity issues. LEI also developed a playbook for identifying possible alternatives, including non-pipeline alternatives and new tariff mechanisms, for avoiding and/or responding to potential disruptions. Marie led the project.

Date:	August 2020 - August 2021
Location:	Louisiana
Organization:	Louisiana Public Service Commission
Description:	**Audit of fuel adjustment clause of Entergy Louisiana** LEI was engaged by Louisiana Public Service Commission, Docket No. X-35523, to perform an audit of the Fuel Adjustment Clause filings of Entergy Louisiana. Marie supervised and directed the audit. The audit involved detailed examination of monthly true-ups of incurred costs with billed costs; the appropriate of interest rates as applied to over-recovered or under-recovered costs; examination of the impact of deferred costs; reconciliation of expenses recorded in FERC Form 1 account categories ("as booked") with expenses included in monthly fuel adjustment clause filings; the prudency and reasonableness of costs incurred for oil, gas, coal, and nuclear fuel and transportation, and an assessment operating performance of utility generating assets.

Date:	July 2020 - present
Location:	Louisiana
Organization:	Louisiana Public Service Commission
Description:	**Audit of fuel adjustment clause of Cleco Power** LEI was engaged by Louisiana Public Service Commission, Docket No. X-35522, to perform an audit of the Fuel Adjustment Clause filings of Cleco Power. Marie supervised and directed the audit. The audit involved detailed examination of monthly true-ups of incurred costs with billed costs; the appropriate of interest rates as applied to over-recovered or under-recovered costs; examination of the impact of deferred costs; reconciliation of expenses recorded in FERC Form 1 account categories ("as booked") with expenses included in monthly fuel adjustment clause filings; the prudency and reasonableness of costs incurred for oil, gas, coal, and lignite; and transportation; and an assessment operating performance of utility generating assets.

Date:	June 2020 - October 2020
Location:	Ohio
Organization:	Public Utilities Commission of Ohio
Description:	**Audit of PSR of Duke Energy** LEI was engaged by the Public Utility Commission of Ohio, to perform an audit of the Price Stabilization Rider ("PSR") of Duke Energy Ohio related to Duke's purchase of energy from the Ohio Valley Electric Corporation ("OVEC") (PUCO Case No. 20-167-EL-RDR). Aspects of the audit included assessing the reasonableness and prudency of the disposition of energy and capacity in the PJM market of the energy provide by two coal

	plants, as well as plant performance, compliance with environmental requirements, and the prudency of fuel purchases. LEI also audited charges and true ups related to the company's quarterly PSR filings. Marie supervised and directed the audit.

Date:	May 2020 - September 2020
Location:	Ohio
Organization:	Public Utilities Commission of Ohio
Description:	**Audit of PPA Rider of AEP Ohio** LEI was engaged by the Public Utility Commission of Ohio, to perform an audit of the PPA Rider of AEP Ohio related to AEP's purchase of energy from the Ohio Valley Electric Corporation ("OVEC") (PUCO Case No. 18-1004-EL-RDR). Aspects of the audit included assessing the reasonableness and prudency of the disposition of energy and capacity in the PJM market of the energy provide by two coal plants, as well as plant performance, compliance with environmental requirements, and the prudency of fuel purchases. LEI also audited charges and true ups related to the company's quarterly PPA filings. Marie supervised and directed the audit.

Date:	April 2020 - May 2020
Location:	North Dakota
Organization:	Public interest law firm
Description:	**Impacts of the potential shutdown of the Dakota Access pipeline ("DAPL")** LEI was engaged by a law firm representing the plaintiff tribes to provide a Declaration in the matter of US District Court Case No. 1:16-cv-1534-JEB. Marie directed and led the research and prepared the Declaration as well as an in-depth report. The report covered issues including the long-term and near-term drivers of oil production in North Dakota, the drivers of global oil demand, the costs to transport oil by rail versus pipeline, and analysis of rail transport trends in the United States. She provided independent analysis as well as critiques of Declarations filed by other witnesses. Her declaration is available at: https://earthjustice.org/sites/default/files/files/3154-525_declarations-in-support-of-standing-rock.pdf

Date:	February 2020 - February 2022
Location:	Louisiana
Organization:	Louisiana Public Service Commission
Description:	**Rulemaking to study renewable energy tariff, aka "green tariff" options** Marie's team supported the Louisiana Public Service Commission in Docket No. R-35423. LEI provided framing questions for stakeholder feedback on green tariff options, evaluated stakeholder responses, provided in-depth case studies of green tariffs in other US jurisdictions, and provided other consultatory services for the Commission.

Date:	January 2020 - June 2020
Location:	Massachusetts
Company:	Massachusetts Office of the Attorney General
Description:	**Application for firm transportation on a gas pipeline** The MA Attorney General's Office of Ratepayer Advocacy ("AGO") engaged LEI to examine the application of National Grid d/b/a Boston Gas for approval to execute a

	contract with Algonquin, for firm transportation ("FT") on the Atlantic Bridge Project (DPU 19-132). Marie led the project which included examining National Grid's projections of gas demand and its assumed resources to meet demand; examining the Assigned Precedent agreement for the FT as well as other documents; and providing a critique of the assumptions driving National Grid's cost-benefit analysis. Marie reviewed briefs, developed interrogatory requests, and evaluated the responses to such requests.

Date:	November 2019
Location:	Japan
Organization:	Private equity investor
Description:	**Long-term outlook for Japan electricity sector** LEI was engaged to prepare a brief, fact-based report that would help support a view of wholesale electricity prices in Japan after 2040. Marie authored the report, which covered i) the structure of Japanese electric power industry, and ii) the status of de-regulation and environmental policy. Based on this, Marie developed two reasonable scenarios for wholesale prices based on two different paths for energy supply to 2040 and beyond.

Date:	October 2019 – November 2019
Location:	ERCOT
Organization:	European investor-owned utility
Description:	**Investment environment for transmission in ERCOT** LEI was engaged by a European utility to examine the investment environment for transmission in ERCOT. Marie's team provided a detailed report covering agents and institutions, the regulatory and legal framework, remuneration of investment, and transmission planning.

Date:	July 2019 - August 2019
Location:	Alberta, British Columbia
Organization:	Counsel for natural gas producer
Description:	**Analysis of Western Canadian natural gas costs and production** LEI was retained by counsel to provide support in the matter of NOVA Gas Transmission Limited ("NGTL")'s application to the National Energy Board ("NEB"). LEI reviewed evidence and prepared testimony. Marie led analysis of the natural gas and natural gas liquids ("NGLs") market in Alberta and British Columbia, and the impact of a pipeline surcharge on producers of natural gas.

Date:	May 2019 – August 2020
Location:	Massachusetts
Organization:	Investor-owned gas distribution utility
Description:	**Econometric benchmarking analysis of gas utility performance for PBR** LEI was hired to be the advisor of a gas utility company in Massachusetts for their performance-based distribution ratemaking plan. Eversource hired LEI in relation to its NStar Gas distribution company, to support NStar Gas's rate filing for performance-based ratemaking. Marie led an econometric benchmarking analysis of utility performance and served as a testifying witness. The econometric analysis used a transcendental logarithmic

	cost function (a tried-and-tested methodology for providing empirical evidence in utility benchmarking cases) to help set expectations for further efficiency improvement and an appropriate stretch factor. The benchmarking report was used by counsel to develop the company's strategy for the rate filing. Marie prepared direct written testimony, delivered oral testimony, developed interrogatory requests, responded to interrogatories by opposing counsel, and prepared rebuttal testimony. DPU Docket No. 19-120.

Date:	June 2019- December 2019
Location:	Ontario
Organization:	Generating company
Description:	**Benchmarking generation utility performance** LEI was engaged to support a hydropower generating company in relation to its second-generation hydroelectric payment amounts price-cap application before the regulator. The project involved performing independent benchmarking analysis of OPG's regulated hydroelectric facilities. This project involved selecting an appropriate peer group, selection of appropriate metrics to be benchmarked, and model development. Marie created an econometric model to develop recommendations as to the appropriate stretch factor to apply. LEI also aided the company in public consultations and the regulatory process.

Date:	October 2018 – April 2018
Location:	United States, ISO-NE
Company:	Massachusetts Office of the Attorney General
Description:	**Winter fuel reliability/electric power market design** The MA Attorney General's Office of Ratepayer Advocacy ("AGO") engaged LEI to examine ISO-New England's proposals to address potential winter fuel security issues facing the electric power sector. Marie led the project, including developing an independent definition of the problem to be solved; developing solutions, identifying potential allies in the NEPOOL stakeholder community; analyzing other stakeholders' proposals; and working with the AGO in the stakeholder process. LEI developed an alternative proposal, a forward auction for stored energy reserves based on the financial concept of an American call option with a two-dimensional bid (the option premium and strike price).

Date:	February 2018 – December 2018
Location:	Global
Company:	Columbia University School of International and Public Affairs, Center on Global Energy Policy
Description:	**Econometric analysis of crude oil price and income elasticities of demand** LEI was engaged by the Columbia University, Center for Global Energy Policy ("CGEP") to conduct econometric analysis of global oil demand. Marie directed and managed the project, the foundation of which was a detailed econometric analysis of price and income elasticities of oil demand. Marie employed a variety of specifications of econometric models (including static and dynamic models, and symmetric and asymmetric models) and estimated separate models for crude oil, gasoline, and diesel demand. She used country-level data covering 40 years (1977-2016), aggregated into panel (pooled cross-

	section and time series) data sets for OECD, non-OECD, and oil-producing countries. Marie examined and reported the results of econometric tests covering time-series properties of the data (tests for integration and cointegration), performance of the log linear model specification as compared to an intrinsically non-linear specification, and the pool-ability of cross-sectional data.

Date:	September 2018-December 2018
Location:	United States, ISO-NE
Company:	Maine Public Utilities Commission
Description:	**Avoided energy supply costs** LEI was engaged to perform a critical review of the methodology and assumptions which underpinned other consultants' analysis of avoided energy supply costs ("AESC"). Marie led the gas market forecast, and the critical review of the other consultants' gas price forecast. She also led a careful examination of the economic theory and econometric techniques used by the other consultants to estimate demand-induced price reduction effects ("DRIPE"). Owing to miss-specified models and/or unwarranted assumptions (such as a perfectly inelastic demand curve for natural gas in the long term) the other consultants' DRIPE estimates were generally too high. [Docket No. 2018-00321]

Date:	June 2018-December 2018
Location:	United States, PJM
Company:	Public Utilities Commission of Ohio
Description:	**Management performance and financial audit of large utility** LEI was engaged to perform a management performance and financial audit of AEP Ohio's Alternative Energy Rider ("AER"). Marie led the project which required examining the terms of power purchase agreements ("PPAs") for wind and solar power, the cost of renewable energy credits ("RECs"); energy and capacity market prices; inventory strategies, and the accuracy of AEP Ohio's load forecasts. Marie recruited a local Ohio accounting firm to perform the financial portion of the audit; she provided guidance (as the firm had not previously audited a utility) and oversight of their work as well as the work of the LEI in-house team. [Docket No. 18-80-EL-RDR]

Date:	March 2018 - September 2018
Location:	United States, MISO, Michigan
Company:	NGO
Description:	**The role of Enbridge Line 5 in NGLs and crude oil transport in Michigan** For a non-governmental organization ("NGO") Marie produced three white papers examining the current and future role of Enbridge Line 5 in Michigan related to three issues: propane supply in Michigan, transportation for crude oil producers in Michigan, and supply of crude oil to Michigan-area refineries. Marie's analysis of the propane market included a comparative static econometric analysis of the supply and demand from propane in Michigan, explained in non-technical language. The white papers were used by the client in discussions with the Governor of Michigan and other stakeholders

Date:	July 2017-June 2018
Location:	United States, MISO, Minnesota
Company:	Minnesota Department of Commerce
Description:	**Role of Enbridge Line 3 in heavy and light crude oil supplies** Marie served as independent market expert assisting the Minnesota Department of Commerce in evaluating the application of Enbridge Energy for a Certificate of Need for its Line 3 oil pipeline expansion project (Docket No. PL-9/CN-14-916, OAH Docket No. 65-2500-32764). Marie's analysis covered global and local trends in refined product demand and crude oil supply, refinery utilization rates and utilization of high-conversion refinery capacity in Petroleum Administration for Defense District ("PADD") 2 and in the local Minnesota region. Her analysis required detailed examination of the assumptions and methodology of an oil pipeline linear programming-based model, in order to assess another witness's testimony which relied on the model. Marie provided written testimony; responded to interrogatory requests, provided written surrebuttal, and oral testimony.

Date:	June 2017-December 2018
Location:	United States, MISO, Mississippi
Company:	Mississippi Public Service Commission
Description:	**Management audit of large vertically integrated utility** Marie led a management audit of the fuel (gas, coal, and nuclear) and energy procurement activities of Entergy Mississippi. Marie's team assessed fuel and energy contract terms, and reviewed the prudency of coal and nuclear fuel procurement and inventory practices. Marie's team also assessed management, organization, controls, strategies, and outcomes for the company's hourly MISO offers. The team investigated the operations of a nuclear power plant, and the financial implications of the utility's power purchase agreement for nuclear power. Marie appeared before the Commission to present and defend findings.

Date:	November 2018 - February 2019
Location:	WECC
Company:	PacifiCorp
Description:	**Independent evaluator ("IE") for energy procurement** LEI was retained as an IE by PacifiCorp for its system-wide 2017 Solar RFP. Marie led the project, which included a review of PacifiCorp's Solar RFP, the facilitation and monitoring of communications between PacifiCorp and bidders, performing independent initial shortlist evaluation and scoring, and the filing of status reports and the final IE closing report.

Date:	April, May 2017
Location:	United States and Canada
Company:	Private client
Description:	**Review of investable energy sectors** For a private equity client, Marie led an extensive project reviewing a wide range of investable energy sectors in the United States and Canada. The sectors included: electricity generation (natural gas, wind, solar, hydro), AMI, distributed resources,

	demand response, retail energy, gas LDCs, gas storage, gas pipeline transportation, LNG-related infrastructure, vertically integrated utilities, electric distribution utilities, and water utilities. LEI assessed the investment potential of each sector for the next five years and proposed a methodology to screen and identify investment opportunities and execute on these opportunities.

Date:	March 2017
Location:	Alberta, Canada
Company:	Private client
Description:	**Analysis of capacity markets** LEI was engaged to provide global perspectives on the detailed mechanisms that make up capacity markets, so that eventual capacity market design in Alberta will be workable and efficient, with minimal unintended consequences. Marie led research and delivered a detailed report on market power mitigation mechanisms and their potential impacts on capacity market performance.

Date:	February 2017
Location:	North America
Company:	Provider of services to vehicle fleet industry
Description:	**Outlook for electrification of transportation** Marie developed scenario outlooks for electric vehicle ("EV") market penetration in the United States; examined the role of electric utilities (and their emerging EV-related business models) as potential partners versus competitors to the downstream transportation industry; identified activities and strategic positioning of upstream and downstream industry participants; led discussion of implications of "electrification of transportation" for fleet service companies, convenience stores, and other downstream industry participants. Presented material to company's partner advisory board.

Date:	December 2016
Location:	Alberta, Canada
Company:	Private client
Description:	**Analysis of capacity markets** To support Board-level understanding of the implications of potential capacity market designs in Alberta, Marie prepared a detailed review and comparison of capacity markets across international and North American jurisdictions. Report concluded "the devil is in the details" of capacity market design. Market design details with potentially large impacts on the client were resource eligibility definitions, price setting mechanism, demand curve design, performance requirements, and market power mitigation rules.

Date:	September 2016
Location:	Northeast United States
Company:	Private client
Description:	**Examination of solar business models** For a client performing due diligence related to a potential investment in business-to-business behind-the-meter solar in the Northeast United States, Marie led a project

	examining US federal and state incentives for solar adoption, and assessing business models used for targeting commercial, institutional, and industrial sectors. For each business model, LEI assessed the competitive environment—who is operating in the sector, what is their go-to-market strategy, and in general how these models have been performing. Marie's team also provided a 10-year outlook for solar renewable energy credits ("SRECs") for certain jurisdictions. Finally, LEI developed key questions the client should ask as part of its evaluation of potential transactions in the behind-the-meter solar sector.

Date:	October 2016-November 2016
Location:	California, Kansas
Company:	Law firm
Description:	**Support for counsel in renewable natural gas matter** Marie prepared an expert report in support of litigation in Case 15CV-04225 in the District Court of Johnson County, Kansas. LEI was retained by counsel to examine the value of the green attributes of landfill gas ("LFG") produced by a project in Kansas City and sold under long-term contract to the Sacramento Municipal Utility District ("SMUD"). Marie's report demonstrated several flaws in the methodology relied upon by the opposing counsel's expert witness. Marie proposed an alternative, more accurate methodology for valuing the green attributes of LFG, based on market fundamentals driven by the California RPS requirements.

Date:	August 2016-October 2016
Location:	Maine
Company:	Maine Public Utilities Commission
Description:	**Macroeconomic impact of biomass generation** Marie led an engagement to estimate the macroeconomic impact of biomass generation within the state of Maine (Maine PUC Docket No. 2016-00084). This included direct, indirect, and induced impacts on: permanent direct jobs, payments to municipalities, payments for fuel harvested in the State, payments for in-state resource access, in-state purchases of goods and services, and construction-related jobs and purchases. Marie used the macroeconomic model known as IMPLAN to capture the economic impacts on industries including logging, sawmills, and other forestry-related industries and well as on state and local taxes.

Date:	May 2016
Location:	ERCOT/Texas
Company:	Private client
Description:	**Examination of ancillary services** Marie conducted a case study assessing the current ancillary services ("CAS") market in ERCOT, outlining the structure of ERCOT's proposed Future Ancillary Services Nodal Protocol Revision Request ("FAS-NPRR"), and examining the implications of ERCOT's experience so far for the Alberta electricity market. Findings included the following: While it was widely expected that the addition of large amounts of wind (and other non-synchronous generation) on the ERCOT system would significantly increase the need for ancillary services, by 2015, ERCOT's procurement of CAS products had not increased compared with 2011. However, the need for synchronous inertial response ("SIR") which

	is not part of CAS did increase somewhat over the time period, though ERCOT did not include SIR in its FAS-NPRR.

Date:	April 2016-May 2016
Location:	ERCOT/Texas
Company:	Renewable power investor
Description:	**Due diligence in ERCOT** LEI was hired to perform due diligence for an investor interested in wind assets in ERCOT. Marie examined the political, legislative, and economic drivers of ERCOT's Competitive Renewable Energy Zones ("CREZ") and provided an assessment of state-level support for further expansion of CREZ transmission lines. She also provided assessment of and outlook for ERCOT's and the Public Utility Commission of Texas's views of the "system cost" of wind (the potential increased need for ancillary services and firm capacity on the system).

Date:	June 2014-April 2016
Location:	Maine
Company:	Maine Public Utilities Commission
Description:	**Project manager and testifying expert** Marie served as project manager, independent market expert, and expert witness for the Maine Public Utilities Commission, in the evaluation of the costs and benefits of alternatives for expansion of natural gas supply into Maine pursuant to the Maine Energy Cost Reduction Act (MPUC Docket #2014-00071). Marie reviewed and evaluated proposals for firm natural gas transportation service by pipeline developers. These evaluations included LEI's review of commercial terms include in the pipeline Precedent Agreements that underpin capacity expansion projects; review of contract provisions for Firm Transportation Agreements and Negotiated Rate Agreements; and evaluation of the status of the FERC and state-level permitting process for each pipeline proposal. Marie provided expertise in upstream natural gas (exploration and production), midstream natural gas (interstate pipelines) and global energy markets including oil and LNG markets, to provide a solid grounding for LEI's long-term outlook for New England natural gas prices. Marie directed the natural gas network modeling (using GPCM, an industry-standard network model of the North American natural gas system) and power simulation modeling (using LEI's proprietary POOLMod model) to arrive at a quantitative cost-benefit analysis of proposals. She authored reports provided to the Commission; responded to discovery from other parties; prepared discovery questions and cross-examined witnesses; reviewed testimony by other parties and provided assessments of the issues presented; and she served as an expert witness in the proceedings.

Date:	November 2015-December 2015
Location:	US Northeast
Company:	Renewable power developer
Description:	**Due diligence for assets in ISO-NE (Maine)** LEI was hired by a wind developer to provide a quantitative assessment, based on an economic dispatch model, of congestion/curtailment risk for a wind asset in Maine. LEI used its proprietary dispatch model, PoolMod, to provide an outlook from 2016 through 2020 of hourly LMPs, as well as the components of LMP (energy, losses, and congestion).

	We incorporated information from the interconnection impact study to examine system limits for the plants in question. LEI also provided an assessment of risk of outages based on NERC outage data for NPCC. Marie led the project

Date:	October 2015-November 2015
Location:	ERCOT/ Texas
Company:	Private equity company
Description:	**Due diligence for assets in ERCOT** LEI was hired to forecast the potential energy revenues of two wind farms in Texas, using its proprietary dispatch model, PoolMod. Marie led the project, and also examined the implications of the PPA related to the two wind farms.

Date:	July 2015
Location:	North America/United Kingdom
Company:	UK Department of Energy and Climate Change
Description:	**Examination of design of auctions** Marie participated in a review of auction design for the UK DECC. The UK market regulator was interested in whether US power markets evaluate generation bids based on criteria other than the price bid, specifically, if the length of contract had a role in the auctions. LEI reviewed capacity market rules for PJM, ISO-New England and the New York ISO. Marie examined whether and for how long a "lock-in" option for the first year capacity price is offered to new generation assets bidding into the auctions. She also reviewed international spectrum auctions, North American gas transmission open season rules, and international auctions for toll roads to examine whether and how duration or length of contract is incorporated into bidding.

Date:	May 2015
Location:	Connecticut; Virginia
Company:	Private equity company
Description:	**Review of gas transportation contracts** Marie evaluated contracts for firm gas transportation capacity for gas-fired plants in Virginia and Connecticut.

Date:	April 2015
Location:	Connecticut; New Jersey
Company:	Private equity company
Description:	**Outlook for natural gas prices** LEI was retained to forecast delivered gas prices in New England (Connecticut) and PJM (New Jersey) and locational marginal prices as well as retail electricity prices in Connecticut. Marie led the gas market analysis.

Date:	August 2014 - January 2015
Location:	North America
Company:	Private client

Description:	**Monthly energy market reports** LEI was engaged to support an energy company's Regulatory Group in its administering of the company's compliance program. The purpose of the engagement was to ensure that client's transactional and business groups were made aware of market rules and regulatory risks. This involved creating and delivering a monthly report covering developments by regional market and traded products which included: energy, capacity, long-term transmission service, FTR auctions, ancillary services, diesel oil, PRB coal, natural gas commodity, transmission, and storage, RECS, and CO_2. Marie served as project manager and executive editor of the monthly report and monthly conference call, and provided the research and insight on US gas, oil, and coal markets, and FERC activities.

Date:	October 2014
Location:	New England
Company:	Private equity company
Description:	**Assessment of ancillary service market** To support potential acquisition of hydropower assets, Marie provided analysis of ISO-New England's Locational Forward Reserves Market ("LFRM").

Date:	April-June 2014
Location:	US Midwest
Company:	Private equity company
Description:	**Due diligence for asset in PJM** For due diligence related to a district cooling system in the Midwest, Marie reviewed contracts and developed a model for projecting revenues and gross margins for the asset. Marie provided insight by identifying the potential for lower customer contract prices at renewal (in contrast to the seller's assumptions) and other areas of revenue risk.

Date:	June 2014
Location:	North America
Company:	Law firm
Description:	**Examination of FERC policies and practices** LEI was engaged by a law firm on behalf of a Canadian energy company to provide market advisory for an investigation related to the timing of outage scheduling under PPAs. Marie provided research and expertise covering FERC practices related to monitoring, enforcement, and definition and prosecution of alleged market manipulation.

Date:	April-May 2014
Location:	Nova Scotia
Company:	Government of Nova Scotia
Description:	**Organization of energy system** Marie provided a detailed overview of the Nova Scotia gas and power sectors, including governing institutions, the legal and regulatory framework, recent developments and challenges, and SWOT analysis.

SPEAKING ENGAGEMENTS:

Selected recent webinars and conferences

Energy Bar Association Mid-year Meeting and Conference 2021 (virtual). Session chair: *Securitization of utility costs: Panacea or poison pill?* October 13, 2021.

International Association for Energy Economics ("IAEE") 2021 Conference (virtual). Presentation title: *Liberalization, de-carbonization, and nuclear recovery in Japan: Outlook for long-term energy prices.* June 7, 2021.

Expert participant (virtual) in University of California Davis, Institute of Transportation Studies: *Future Scenarios of Passenger Mobility in the US: Year 2030,* October 2020.

Energy Bar Association Mid-year Meeting and Conference 2020 (virtual). Presentation title: *Performance-based ratemaking for local gas distribution companies: Lessons learned from a recent rate case.* October 13, 2020.

Boston Bar Association, 2020 Virtual Energy Conference. Session title: *Performance-based Ratemaking.* Presentation title: *Performance-based ratemaking: Understanding the basics, and the role of performance incentives.* July 15, 2020. http://energyconference.bbablogs.org/

Morgan Stanley Webcast Series | *Regulatory Outlook for Key Pipeline Projects with Experts Bloomberg and London Economics International.* Presentation title: *Impacts of a potential shutdown of Enbridge Line 5.* July 10, 2020.

US Association for Energy Economics, Webinar. Presentation title: *Taking a look ahead: The long-term impacts of a crisis on oil demand.* June 29, 2020. https://www.usaee.org/webinars/webinar-kleinberg.aspx

US Energy Association, Webinar. Presentation title: *Taking a look ahead: The long-term impacts of a crisis on oil demand.* May 27, 2020. https://usea.org/event/taking-look-ahead-long-term-impacts-oil-demand-after-crisis

USAEE/IAEE 37th Annual North American Conference. Denver, CO. Session chairman/moderator, concurrent session title: *Regulation.* November 6, 2019.

ASSA/IAEE. Atlanta, GA. Session title: *Single and bi-directional economic dependencies in energy systems.* Presentation title: *Business and innovation cycles in the US Upstream: Surviving the ups and downs.* January 2019.

MIT/SPE/YPE. Cambridge, MA. Session chairman/moderator, session title: *Meeting the changing demand for US natural gas: Do markets alone suffice or are regulatory changes necessary?* April 26, 2018.

ERCOT Market Summit. Austin, TX. Session chairman/moderator, session title: *Perspectives on ERCOT Market Reforms.* February 28, 2018.

ASSA/IAEE. Philadelphia, PA. Session title: *Energy Economics, Regime Changes, and Sustainability* Discussant for paper "What's killing nuclear power in US electricity markets?" January 6, 2018.

PUBLICATIONS:

Technical/Academic

Kleinberg, Robert and Fagan, Marie, "Business Cycles and Innovation Cycles in the U.S. Upstream Oil & Gas Industry." (December 1, 2019). USAEE Working Paper No. 19-423. Available at SSRN: https://ssrn.com/abstract=3508466 or http://dx.doi.org/10.2139/ssrn.3508466

"The Disappearing Middle Class: Economies of Scale in Exploration and Development," presented at the International Association for Energy Economics, 26th annual conference, Aberdeen, June 2002.

"The Key Role of Technology in Reducing Offshore Finding and Development Costs," *Fundamentals of the Global Offshore Industry,* The Petroleum Economist Ltd., London, September 2001.

"The US Oil and Gas Supply Situation: How Did We Get Here?" guest lecture, Clark University, Worcester, MA, October 2000.

"The Technology Revolution and Upstream Costs," *The Leading Edge* (Journal of the Society of Exploration Geophysicists), June 2000.

Review of *Exploration, Development, and Production – Texas Oil and Gas 1970-1995,* for the *Journal of Economic Literature,* 1999.

"Resource Depletion and Technical Change: Effects on US Crude Oil Finding Costs from 1977 to 1994," *The Energy Journal,* 1997.

"Inter-jurisdictional Competition, Resource Rents, Tax Exporting, and Oil and Gas Severance Taxes," *The Journal of Energy Finance and Development,* 1997, with Kevin Forbes.

"Fiscal Illusion and Fiscal Sclerosis: The Case of Oil and Gas Severance Taxes," presented at the US Association for Energy Economics/International Association for Energy Economics conference, Boston, MA October 1996.

"Prices, Depletion, and Technical Change 1977-1990: The Declining Cost of Crude Oil," presented at the Allied Social Science Association Annual Meeting, American Economic Association/International Association for Energy Economics session, San Francisco, CA, January 1996.

"Technical Change and Scale Economies in US Onshore Oil and Gas Exploration 1977-1990," presented at the Southern Economic Association meeting, New Orleans, LA, November 1993.

US Department of Energy

State Energy Severance Taxes, DOE/EIA-TR/0599, Washington, DC, 1995.

Oil and Gas Development in the United States in the Early 1990s: An Expanded Role for Independent Producers, DOE/EIA-0600, Washington, DC, 1995, with Jon Rasmussen.

"Trash to Energy: A Burning Issue," *1988 Selected Papers and Presentations by DOE's Policy Integration Staff,* US Department of Energy, Office of Policy, Planning and Analysis, Office of Policy Integration, Washington, DC, December 1988, with Peggy Podolak.

IHS/CERA Publications

Global Prospects for Shale Gas: Assessing Above-ground Risks and Enablers IHS CERA Private Report 2013
The Impact of Technology on US Offshore Finding and Development Costs IHS CERA Private Report 2013
The Next E&P Hotspots: What are the Leading Indicators? IHS CERA Decision Brief 2012
Taking the Shale Gale International: Lessons from North America IHS CERA Decision Brief 2012
Prospects for Shale Gas in Europe: Insights from CERAWeek IHS CERA Insight 2012
Envisioning a Long-term Future for Coal IHS CERA Insight 2011
North American Power Industry Landscape 2011 IHS CERA Decision Brief 2011
Common Ground? CERAWeek Perspectives on US Electric Power Transmission IHS CERA Insight 2010
North American Power Industry Landscape 2010 IHS CERA Decision Brief 2010
Mexico's Road to Renewable Power: The Cost of a Range of Targets and Options IHS CERA Decision Brief 2009
Competitive Bidding: A Key Tool for Capital Formation in the US Power Sector IHS CERA Decision Brief 2009
Financing the Global Power Business: Insights from CERAWeek IHS CERA Insight 2009
Concentrating Solar Power: US Demand Heats Up IHS CERA Decision Brief 2008
US CO2 Policy Quandary: Near-term Reductions Imply a High Carbon Price IHS CERA Private Report 2008
The US Energy Act of 2007: Addressing the Demand Side of Electric Power IHS CERA Insight 2008
Investors' Energy Monthly December 2004 - November 2007
Some Sail, Some Fail: Utility M&A after PUHCA IHS CERA Decision Brief 2006
Another Decade of Rising Upstream Costs? IHS CERA Decision Brief 2006
Merchant Power's Recovery: Four Dimensions of Value IHS CERA Private Report 2006
PUHCA Repeal and Utility M&A: One Big Obstacle Down, Many Remain IHS CERA Decision Brief 2005
North American Gas Monthly Briefing January 2003 - June 2004
Costs are Up for North American Natural Gas IHS CERA Decision Brief 2004
Bottom Line: A New Long-term Floor for North American Gas Prices IHS CERA Private Report 2004
Upstream Gas Costs and North American E&P Strategy: Avoiding the Edge IHS CERA Decision Brief 2004
Can We Drill Our Way Out of the (Natural Gas) Supply Shortage? IHS CERA Decision Brief 2003
Cost-effective Deepwater Development: Seeing the Forest from the "Trees" IHS CERA Private Report 2001
Optimization and the Role of R&D IHS CERA Decision Brief 2001
Upstream Spending Plans: Inflation in the Pipeline IHS CERA Alert 2001
Upstream Technology on the Horizon IHS CERA Decision Brief 2000
Upstream Costs--Why the Gap will widen IHS CERA Decision Brief 1999
The Impact of Falling Oil Prices on Upstream Operations IHS CERA Decision Brief 1998
The Technology Revolution and Upstream Costs IHS CERA Private Report 1998
Managing the Rig Shortage IHS CERA Decision Brief 1997

News Media

"Economists wonder: Did COVID-19 accelerate timeline for peak oil demand?" (excerpts from USEA webinar *Taking a look ahead: The long-term impacts of a crisis on oil demand,* May 27, 2020). S&P Global Market Intelligence. June 8, 2020.
https://platform.mi.spglobal/SNL.Services.Export.Service/v2/Export/Retrieve?filename=Html_2bdf6b05-697e-4a2b-8768-579bf532b596.html.

"Upstream oil costs on the rise" (excerpts from *Another Decade of Rising Upstream Costs?* IHS CERA Decision Brief 2006), *The Wall Street Journal Morning Brief,* June 28, 2006.

"Unnatural Gas Prices," live television interview for CNN-FN, December 23, 2003.

IHS/CERA CERAWeek Roles

Chairman, Coal Plenary *Envisioning a Long-term Role for Coal,* March 10, 2011
Chairman, Strategy Session *Financing the Power Future,* March 10, 2011
Chairman, Expert Dialog *North American Gas and Power Scenarios Wildcards,* March 9, 2011
Chairman, Strategy Session *Financing a North American Power Sector in Transition,* March 12, 2010
Panelist, CERA Insights *Global Power Outlook,* March 12, 2010
Chairman, Strategy Session *US Electric Power Transmission: the Battle of the Jurisdictions,* March 11, 2010
Chairman, Critical Issue Forum, *Financing the Power Sector in a Turbulent Economy,* February 12, 2009
Chairman, Critical Issue Forum *Power Sector Investment: Global Capital, Local Strategies* February 15, 2008
Panelist, Leadership Circle *Global Power Outlook* February 14, 2008
Chairman, Critical Issue Forum *Rising Costs and the Outlook for North American Gas,* February 14, 2007
Host and Commentator, *Reception for Institutional Investors* February 13, 2007
Panelist, Critical Issue Forum *Oil Sector Finance: The Cliff behind the Clouds?* February 13, 2007
Host and Commentator, *Reception for Institutional Investors* February 7, 2006
Chairman, Critical Issue Forum *Financing the Oil Future: A Three-Trillion Dollar Dilemma* February 7, 2006
Host and Commentator, *Reception for Institutional Investors* February 15, 2005
Chairman, Critical Issue Forum *North American Natural Gas: E&P in a Mature Region* February 11, 2004
Chairman, Expert Briefing *North American Gas E&P Strategy: Getting off the Treadmill?* February 12, 2003
Panelist, Expert Briefing *Bracing for a Wild Ride: North American Gas Market Outlook* February 11, 2003

Barbara Porto

Senior Consultant, London Economics International, LLC

LONDON ECONOMICS

YEARS WITH FIRM/ENTITY: 8

NATIONALITY: BRAZILIAN

KEY QUALIFICATIONS:

Barbara is a Consultant at London Economics International LLC ("LEI"), where she supports the firm's technical engagements with regulators, utilities and private equity firms on issues regarding market design, project evaluations, wholesale price analysis, and utility management/performance auditing. Barbara is LEI's lead expert and modeler for the California ISO's energy and capacity markets, responsible for analyzing changes in market rules and system dynamics. Barbara also serves as a key modeler for LEI's gas pricing model.

Barbara has experience in coordination and execution of utility management/performance auditing and has been involved in all LEI's utility management performance audit engagements since joining the company.

Prior to LEI, Barbara was an Analyst at ENEVA, the largest private thermal power generation company in Brazil, where she was responsible for market intelligence reports and procurement strategic planning.

EDUCATION:

Institution	Hult International Business School
Date:	August 2014
Degree(s) or Diploma(s) obtained:	MBA - Master of Business Administration

Institution	COPPEAD/UFRJ (Brazil)
Date:	December 2010
Degree(s) or Diploma(s) obtained:	Finance Certificate

Institution	Universidade Estácio de Sá (Brazil)
Date:	June 2010
Degree(s) or Diploma(s) obtained:	Bachelor of International Relations

EMPLOYMENT RECORD:

Date:	January 2015 - Present
Location:	Boston, MA

Company:	London Economics International LLC
Position:	Consultant

Date:	July 2008 - August 2013
Location:	Rio de Janeiro, Brazil
Company:	ENEVA (subsidiary of E.ON AG)
Position:	Analyst (July 2010 - August 2013) Intern (July 2008 - June 2010)

RECENT PROJECT EXPERIENCE:

Date:	January 2019 to present
Location:	California
Company:	LEI's Continuous Modeling Initiative (CMI)
Description:	As lead California market modeler, Barbara tracks and evaluates the impact of on-going structural and regulatory changes in the electricity market to produce detailed price forecast and associated analyses on an ongoing semi-annual basis using LEI's in-house price forecast software, POOLMod.

Date:	October 2022 - ongoing
Location:	North Dakota
Company:	North Dakota Public Sevice Commission
Description:	**Montana-Dakota Utilities rate case** LEI was engaged by the North Dakota Public Service Commission as the outside independent technical consultant supporting the Commission's ratepayer advocacy staff in a rate case involving Montana-Dakota Utilities. LEI examined key components of the rate case, which included the depreciation study, tax rates, environmental upgrades, transmission investment, the ROE/common equity ratio, amortization for early retirement of coal plants, and impacts on residential rates versus impacts on other classes of service. LEI prepared data requests, and provided written and oral testimony. Barbara worked on the sections of the audit related to depreciation and environmental upgrades.

Date:	August - December 2022
Location:	Mississippi
Company:	Mississippi Public Service Commission
Description:	**Management audit of Entergy Mississippi** LEI was engaged to conduct the annual fuel procurement and management audit of Entergy Mississippi. The LEI team assessed a complex array of issues including the Company's organization and staffing, risk management and company controls, coal procurement and inventory management, coal transportation, natural gas procurement and trading, plant operations and generation portfolio management, energy procurement and trading, and costs associated with the Grand Gulf nuclear plant. LEI prepared a comprehensive report detailing its analysis, findings, and recommendations,

	and appeared before the Mississippi Public Service Commission to present its findings and recommendations. Barbara worked on the procurement and inventory management sections of the audit related to natural gas and coal.

Date:	June 2022
Location:	California
Company:	Confidential client
Description:	**Ancillary service revenue streams for long-duration storage in California** LEI was engaged by a developer to evaluate potential revenue stream of its battery storage technology that is capable in providing very long-duration storage. Specifically, LEI is helping the client understand the value of regulation, spinning reserve, frequency regulation, voltage support and other revenue streams that its battery can earn in the California market under current market structure and under future potential market designs.

Date:	July 2020 – April 2022
Location:	Louisiana
Company:	Louisiana Public Service Commission
Description:	**Management audit of fuel adjustment clause for Cleco Power** LEI was engaged by Louisiana Public Service Commission ("LPSC"), Docket No. X-35522, to perform an audit of the Fuel Adjustment Clause filings of Cleco Power. Barbara assisted with developing and analyzing data requests to evaluate if fuel costs were prudent and in compliance with LPSC orders.

Date:	July – December 2021
Location:	Ohio
Company:	Public Utility Commission of Ohio
Description:	**Audit of Legacy Generation Resource Rider for Ohio Valley Energy Company** LEI was engaged by the Public Utility Commission of Ohio to perform an audit of the prudency and performance of the generation purchase riders of Duke Energy Ohio, AEP Ohio, and AES Ohio for the output of two coal plants operated by Ohio Valley Energy Company ("OVEC"). Barbara was responsible for examining OVEC's participation in the PJM market and the fuel and variable cost expenditures to determined whether they were prudently incurred.

Date:	July – December 2019; July – December 2020; June – December 2021
Location:	USA
Company:	Mississippi Public Service Commission
Description:	**Management audit of fuel and electricity procurement** LEI was engaged for a two-year term (and then extended for an additional year) to conduct the annual management audits of the oil, gas, coal, nuclear fuel, and energy procurement activities of Mississippi Power Company. The LEI team assessed a complex array of issues including fuel and energy contract terms and the prudency of fuel procurement and inventory practices. LEI appeared before the Commission to

	present and defend findings. Barbara worked on the procurement and inventory management sections of the audit related to natural gas and coal.

Date:	August 2020 – September 2021
Location:	Louisiana
Company:	Louisiana Public Service Commission
Description:	**Management audit of fuel adjustment clause for Entergy** LEI was engaged by Louisiana Public Service Commission ("LPSC"), Docket No. X-35523, to perform an audit of the Fuel Adjustment Clause filings of Entergy Louisiana, LLC. Barbara assisted with developing and analyzing data requests to evaluate if fuel costs were prudent and in compliance with LPSC orders.

Date:	February – April 2021
Location:	ISO-NE and California
Company:	Confidential client
Description:	**Due diligence on a potential wind portfolio acquisition** LEI was engaged by an infrastructure investment fund to provide consulting and advisory services in support of due diligence efforts on a potential wind portfolio acquisition in ISO-NE and California. The scope of the project included reviewing data room materials, critically reviewing a market report prepared by the sell-side consultant, preparing independent long-term 20-year energy and capacity price forecast for the target assets under two different scenarios, one reflecting a base case scenario with nation-wide carbon tax implemented by 2028, and another reflecting decarbonization goal achieved through non-carbon tax policies. Barbara was responsible for the California portion of the project, conducting extensive and detailed review of the materials provided, additional research on various topics, and performing the California modeling activities.

Date:	August – December 2020
Location:	USA
Company:	Confidential client
Description:	**Financial Transmission Rights ("FTRs") and Auction Revenue Rights ("ARRs") Market Review** LEI has been engaged by a Regional Transmission Operator ("RTO") to conduct a holistic assessment of its FTR markets and ARRs to determine whether the current ARR/FTR processes constitute appropriate mechanism to ensure that load receives the optimal value of the transmission system for which it is paying through its transmission access charges. Barbara was responsible for analyzing the FTR/ARR metrics and target allocation process, as well as comparing it to similar mechanisms in other jurisdictions.

Date:	January – March 2020
Location:	Massachusetts
Company:	Massachusetts Office of the Attorney General
Description:	**Application for firm transportation on a gas pipeline** The MA Attorney General's Office of Ratepayer Advocacy ("AGO") engaged LEI to examine the application of National Grid d/b/a Boston Gas for approval to execute a

	contract with Algonquin, for firm transportation ("FT") on the Atlantic Bridge Project (DPU 19-132). The project included examining National Grid's projections of gas demand and its assumed resources to meet demand; examining the Assigned Precedent agreement for the FT as well as other documents; and providing a critique of the assumptions driving National Grid's cost-benefit analysis. Barbara assisted with reviewing briefs, developing interrogatory requests, and evaluating the responses to such requests.

Date:	January - March 2020
Location:	USA - Midwest
Company:	Distribution cooperative
Description:	LEI was retained by a Midwest cooperative seeking to cease purchasing supply from the incumbent and rather opt for an alternate supply provider. As part of the engagement, LEI prepared a critique of the stranded cost estimate provided by the incumbent provider and calculated its own estimate of the stranded cost payment based on FERC's policy guidelines in Order 888. LEI's calculation of market value for the released energy and capacity from the incumbent t provided was based on its own forecast of energy and capacity prices in the MISO markets. LEI's report was filed with FERC as part of the litigation procedures. Barbara was responsible for the capacity market analysis, reviewing thousands of capacity transactions in the MISO region.

Date:	April - December 2019
Location:	Canada
Company:	Ontario Power Generation ("OPG")
Description:	LEI was engaged to support Ontario Power Generation in relation to its second-generation hydroelectric payment amounts price-cap application before the Ontario Energy Board ("OEB"). The project involved performing an updated TFP study reflecting the OEB's 2017 Decision on the first-generation price-cap index. Other key tasks were the preparation of analysis and written evidence assessing whether the inflation factor and treatment of the Capacity Refurbishment Variance Account remain appropriate. Barbara worked on the inflation factor, physical TFP, coauthored the report and assisted on information-gathering.

Date:	November - December 2019
Location:	USA
Company:	Confidential client
Description:	For a transmission developer in the in Northeast, LEI modeled various portfolios of renewable generation assets (including wind, solar, and hydro resources) together with various quantities and technologies of storage resource to analyze, and optimize, the capacity factor and delivered price for energy on the proposed HVDC transmission line. LEI also modeled customer load at the withdrawal end of the line together with additional storage to analyze the benefits of these storage resources to provide load-following service. Barbara assisted with research on the costs and technical specifications of various storage technologies.

Date:	October - November 2019

Location:	USA
Company:	Range EES
Description:	LEI was engaged by Range EES to analyze the local economic development benefits associated with the construction and operations of a Compressed Air Energy Storage ("CAES") project at the site of the soon-to-be-retired Intermountain Power Project plant in Millard County, Utah (the "Project") using the REMI PI+ model. Barbara assisted the REMI modeler with research, conducting model runs and in the composition of the final report.

Date:	March - April 2015; October 2015; May 2019
Location:	Colombia
Company:	Confidential client
Description:	LEI was hired by an electric operator for the purposes of valuing a portfolio of generating assets in Colombia. LEI's scope of work consists of a comprehensive review of the Colombia energy market (including fuel and power market drivers), describe in detail the functioning of both wholesale power market and firm energy market (capacity market), develop forecasts of spot prices in order to derive expected revenues for the portfolio. Colombia being a hydro dominated system, as part of its modeling exercise, LEI ran a Monte Carlo simulation to develop a series of probabilities associated with generation profiles of Colombia's hydro resources to reflect the impact of weather conditions and water inflows on hydropower plants' output. LEI summarized its research and modeling results in a final report that was presented to lenders and other interested parties. In May 2019, LEI was hired to update the market fundamentals and energy prices outlook in order to evaluate the impact of evolving market conditions on a portfolio of assets acquired by the client in 2015. Barbara created the fuels forecast, assisted with research tasks for the modeling activities, and coauthored the report.

Date:	January - February 2019
Location:	Singapore
Company:	Singapore National Climate Change Secretariat ("NCCS")
Description:	As part of a consortium, LEI was hired by the NCCS to undertake a study on effective carbon prices faced by energy-intensive manufacturing sub-sectors in jurisdictions across Asia, Middle East, Europe, and North America. Specifically, LEI was tasked with studying carbon policies in China, Middle East, Taiwan, USA, and Canada. The deliverables, consisting of a report and a dashboard tool, allowed the NCCS to compare effective carbon prices across competitor jurisdictions in these key manufacturing sectors and thus inform current and future policy decisions regarding the level of Singapore's carbon price and wider climate change policy. Barbara was responsible for the Panama study.

Date:	January 2018 - January 2019
Location:	USA
Company:	Public Utility Commission of Ohio
Description:	LEI was engaged in 2018 by the Public Utility Commission of Ohio to perform a management/performance audit of the Alternative Energy Rider of the Ohio Power Company (AEP Ohio). LEI examined processes involved in procuring RECs and SRECs.

	LEI compared and benchmarked AEP Ohio RECs and SRECs costs and other operational results against data from public sources. LEI created a working model of the true-up process and provided quantitative results comparing the impact of quarterly versus semi-annual true-up periods on the utility and on ratepayers. Barbara performed analysis on RECs benchmarking, inventory, and compliance, as well as the cost of compliance and the approach used by AEP Ohio to calculate the cost of RPS compliance.

Date:	July - December 2018
Location:	New England, USA
Company:	Confidential client
Description:	LEI was retained to assist in the review of the avoided energy supply costs as reported in the Avoided Energy Supply Cost ("AESC") 2015 - Update of December 16, 2016 and provide independently developed forecasts of energy supply costs and/or wholesale electricity and natural gas prices in New England. As part of the required services, the LEI undertook a review of the AESC and provided expert analysis of the AESC assumptions, methodology and results. LEI also advised the Commission and its staff with respect to the application of the AESC in the context of evaluating the cost effectiveness of energy efficiency measures. In addition, LEI provided independently developed energy supply costs and/or wholesale electricity and natural gas prices for the region that reflect current market conditions and outlooks. Barbara was responsible for the natural gas and other fuels price outlook review and performing natural gas forecast.

Date:	June - December 2017; July - November 2018
Location:	USA
Company:	Confidential client
Description:	LEI was engaged by a public service commission to audit management activities of a major vertically-integrated utility in the MISO region. LEI assessed the utility's practices for economical purchase and use of fuel and electric energy, assessed relevant fuel and energy contract terms, investigated the operations of the utility's coal and nuclear generation units, and reviewed the prudency of coal inventory levels and inventory control procedures. Barbara worked on the procurement and inventory management sections of the audit related to natural gas, oil, and coal.

Date:	July - August 2018
Location:	New York, USA
Company:	Confidential client
Description:	For an international client, LEI prepared a memo reviewing the performance of a generation asset in the NYISO wholesale markets. The memo included a review of the plant's competitive advantages and disadvantages from the point of view of its technology, operational characteristics, fuel procurement options, location with respect to transmission constraints. LEI's analysis also included a view on likely short and medium market conditions, together with potential market developments, that could affect the plant's revenues. Barbara was responsible for the fuels and plant performance sections of the report.

Date:	March - August 2018

Location:	USA
Company:	Confidential client
Description:	For a non-governmental organization ("NGO") LEI examined the current and future role of Enbridge Line 5 on oil consumers and producers in the State of Michigan. LEI's analysis covered a) the extent to which refineries which serve Michigan consumers require Enbridge Line 5 to provide crude oil; b) the extent to which consumers of propane in Michigan's Upper Peninsula rely on Enbridge Line 5; and c) the extent to which producers of crude oil in Michigan's Lower Peninsula rely on Enbridge Line 5. Barbara assisted with research tasks and coauthored the report.

Date:	May - July 2018
Location:	Maine, USA
Company:	Confidential client
Description:	LEI was retained to assess the financial viability of select biomass power plants in the next few years and confirm the plant's assertion that a discount on certain transmission costs was required in order to avoid plant closures. Barbara led the engagement, creating an estimated pro forma income statement to assess whether the select biomass plants are expecting to make positive (or negative) gross profit margin in the next few years, 2018-2021. The financial model presented a range of market revenues that the power plants can earn from the sale of energy, capacity, and RECs in ISO-NE's control area, relative to an estimate of going forward operating costs for two power plants. The model included five scenarios.

Date:	January - July 2018
Location:	USA
Company:	Maine PUC
Description:	LEI was retained by the Maine PUC to review and critique the analysis filed by Central Maine Power ("CMP") regarding the benefits to Maine resulting from the New England Clean Energy Connect ("NECEC"), which is a 1,200 MW HVDC Transmission Line from the Quebec-Maine border to Lewiston. The analysis includes work related to the regional energy markets, including the effect of the NECEC on a) wholesale energy, capacity, and ancillary service costs for Maine ratepayers b) impact on price volatility during natural gas price spike events; and c) greenhouse gas (GHG) reduction benefits. In addition, the analysis will also include work related to economic benefits to Maine from the NECEC including a) job creation, both direct and indirect; b) employment impacts from electricity price reductions and associated cost savings; c) economic development benefits and d) municipal tax revenues. Barbara was responsible for the natural gas price outlook review and performing natural gas forecast.

Date:	February - April 2018
Location:	USA
Company:	Columbia University Center for Global Energy Policy
Description:	LEI was engaged by the Columbia University School of International and Public Administration's Center on Global Energy Policy ("CGEP") to conduct econometric analysis of global oil (crude oil and key refined products) demand and its income and

	price drivers. Barbara conducted a portion of the econometric analysis using STATA and coauthored the report.

Date:	November 2017 - March 2018
Location:	USA
Company:	PacifiCorp
Description:	LEI was retained as an independent evaluator ("IE") by PacifiCorp for its system-wide 2017 Solar RFP. LEI reviewed PacifiCorp's Solar RFP, facilitated and monitored communications between PacifiCorp and bidders, performed a review of the initial shortlist evaluation and scoring, and filed status reports and the IE closing report. Barbara coauthored the status and IE report, and managed the information-gathering and summarizing process, which involved information from over 100 bids, and multiple documents from each bidder.

Date:	August 2017
Location:	Canada
Company:	Confidential client
Description:	For a large utility, LEI performed a detailed bottom-up analysis of the range of costs for building a utility-scale solar farm in a Canadian province. LEI researched potential costs for multiple solar module technologies, interconnection options, and land types. The cost analysis customized the hardware, labor, and other costs into the province's business landscape so as to create an accurate representation of the costs for building a solar generation resource. Barbara assisted on the research, composition of the cost model and final report.

Date:	May 2017 - August 2017
Location:	USA
Company:	Confidential client
Description:	LEI was retained to provide a research paper highlighting the opportunity to evolve system planning practices to a more resilient transmission system in the longer term, one that promotes efficient electricity production and consumption decisions and efficient infrastructure investment. Barbara assisted on the research tasks.

Date:	May 2017
Location:	USA
Company:	Confidential client
Description:	For a private equity client, LEI reviewed all investable energy sectors in the US and Canada (except oil and gas exploration and production). The sectors included: electricity generation (natural gas, wind, solar, hydro), AMI, distributed Resources, demand response, retail and gentailers, gas LDCs, gas storage, gas pipeline transportation, LNG-related infrastructure, vertically-integrated utilities, electric distribution, and water utilities. LEI assessed the investment potential of each sector for the next five years and proposed a methodology to screen and identify investment opportunities and execute on these opportunities. Barbara was responsible for the electric generation sector and the Alaska regional study.

Date:	April 2017
Location:	USA
Company:	Confidential client
Description:	For a private developer, LEI reviewed the eligibility of small (less than 25 MW) run-of-river hydroelectric electric generation facilities to provide ancillary services in the ISO-NE, MISO, NYISO, and PJM jurisdictions. Barbara assisted with research tasks.

Date:	December 2015 - April 2017
Location:	Canada
Company:	Ontario Power Generation ("OPG")
Description:	LEI prepared a report for OPG entitled "Empirical Analysis of Total Factor Productivity Trends in the North American Hydroelectric Generation Industry." The purpose of this report was to share findings from LEI's total factor productivity ("TFP") study, which estimated TFP trends for a select group of peers from the North American hydroelectric generation industry. Data for this study covered an eleven-year period from 2002-2012. This study was further updated for newly available data (encompassing operating costs and other statistics for calendar years 2013 and 2014). LEI also supported OPG through 2017 in recommending an appropriate X factor and I factor to use in a I-X regime for hydroelectric generation. Barbara coauthored the report and assisted on information-gathering.

Date:	December 2016
Location:	USA
Company:	Confidential client
Description:	In 2014, LEI assessed the impact of the construction of the 1000 MW Pacifico HVDC transmission interline between Southern Peru and Northern Chile. LEI also provided due diligence support and market analysis for the Peruvian and Chilean electricity markets to the team of investors backing the project. In 2016, the model was updated to the current market condition. Barbara assisted with research tasks.

Date:	July - December 2016
Location:	USA
Company:	Confidential client
Description:	LEI was retained by a transmission developer to serve as Independent Examiner for a proposed merchant transmission project open solicitation process. The project entailed designing the solicitation process, meeting with potential shippers on the line to garner early interest, drafting announcements and press releases, conducting information sessions, updating the solicitation website, evaluating and ranking bids, assisting both bilateral negotiations with shippers, and submitting a report to FERC as part of the developers' Section 205 filing. Barbara coauthored the IE report and managed the information-gathering.

Date:	June 2016
Location:	USA

Company:	Confidential client
Description:	LEI was retained by a transmission utility to provide an overview of resources in the Chicago area and the Commonwealth Edison ("ComEd") zone and analyze the congestion of several nodes within the Chicago area and shorelines sites of Lake Michigan. Barbara assisted with research tasks.

Date:	June 2016
Location:	Brazil
Company:	Confidential client
Description:	For a Canadian electricity transmission company, Barbara conducted theoretical and empirical analysis of the Brazilian Electricity Market Credit Crisis highlighting interesting lessons for the Alberta market. Topics explored include: credit/financing issues, system reliability, government interventions, power market risks, resources diversity.

Date:	April - May 2016
Location:	Multiple
Company:	TransAlta
Description:	LEI was retained to provide ongoing research, analytical and advisory support to TransAlta as the Alberta government implements its climate change policy, which will shut down coal plants early, ramp up renewable generation, and put in place a province wide carbon tax. Part of the engagement was to perform a case study-oriented comparative review of ancillary services in North America and abroad. Barbara was responsible for the Ireland case study.

Date:	March 2016
Location:	Canada
Company:	Alberta Balancing Pool
Description:	LEI was retained by the Alberta Balancing Pool to provide wholesale energy price forecasts and market revenue projections over the period 2017-2020 for various generating facilities operating in the Alberta. LEI ran multiple sensitivities accounting for changes in ownership and dispatch rights, facility decommission and carbon policy changes. LEI relied on its proprietary dispatch simulation model, POOLMod applying Conjecture theoretical approach. Barbara assisted with research tasks.

Date:	October - November 2015
Location:	Multiple
Company:	Confidential client
Description:	LEI was retained as part of a consortium to support an energy product manufacturing firm assess the market for solar thermal technologies, with a focus on an economic assessment of solar thermal technology, assessing the value contribution of the different components of the value chain creating a molten thermal solar plant. In addition, the client asked LEI to provide support to developing business strategies for this market. LEI's conducted the analysis in 3 out of 5 high priority markets - Saudi Arabia, Morocco, and Chile. More specifically we assessed the economics for solar thermal in each market,

	commented on the general perception of the technology and provided a comprehensive brief on the rules governing the market access. Barbara was responsible for the Chilean market.

Date:	June - October 2015
Location:	USA
Company:	Confidential client
Description:	LEI was retained by the largest electric utility company in Malaysia, to conduct a capacity building workshop on performance-based regulation ("PBR") and technical visits to utilities and regulators worldwide that are operating under PBR-like regimes. Barbara presented to TNB's traveling contingent on PBR Requirements standards across different jurisdictions and on fundamental of Tariff Design.

Date:	June 2015
Location:	USA
Company:	Confidential client
Description:	LEI was retained to categorize the different plants in PJM into self-supply, merchant or under PPA. Barbara assisted with research tasks.

Date:	May - June 2015
Location:	USA
Company:	Confidential client
Description:	LEI was engaged by a private equity company to provide a briefing paper that compares "The Opportunities of the Buy versus Build Investment Decision." The paper contains quantitative and qualitative research and analysis, based on market data on purchase prices from recent transactions (focused on New York, New England, and PJM), versus the cost of new build assets. Barbara assisted with research tasks.

Date:	April 2015
Location:	Colombia
Company:	Confidential client
Description:	LEI was hired by a financial investor to provide an understanding of the dynamics underpinning hydro-dominated power markets as opposed to thermal systems. As part of this project, LEI reviewed in detail the dynamics and key drivers of energy markets in a sample of Latin America countries including Colombia, Panama, Brazil and Chile. Colombia was the point of focus of the report, in this respect LEI compared and contrast several aspects of the Colombian markets to other jurisdictions and created a scoring card to evaluate Colombia against similar jurisdictions. Barbara assisted with research tasks and coauthored the report.

Date:	January - February 2015
Location:	USA, Canada and Mexico
Company:	Confidential client

Description:	LEI was retained by the client to conduct a mini-workshop to discuss the market opportunities and risks on five proposed transmission projects in the US and Mexico. Barbara was involved in the analysis of the Mexican projects.

Shashwat Nayak

Senior Consultant, London Economics International, LLC

LONDON ECONOMICS

YEARS WITH FIRM/ENTITY: <1

NATIONALITY: INDIAN

KEY QUALIFICATIONS:

Shashwat joined London Economics International ("LEI") in 2022 as a Senior Consultant with a strong finance background and experience working in the electricity sector. During his time at LEI, Shashwat has worked on multiple assignments with respect to cost of capital and capital structure for regulated utilities.

Prior to joining LEI, Shashwat worked as a Management Consultant in the 'Energy Utilities and Resources' practice of PwC India. He has hands-on experience in policy, regulatory and financial aspects of the electricity and other infrastructure sectors. He has assisted multiple regulators (at the federal and state level in India), utilities (power generation, power transmission, power distribution, water collection, water treatment etc. in India and the Middle East), think tanks and other private sector entities in financial advisory (including determination of ROE), bid advisory, risk management, electricity sector reforms, developing Multi Year Tariff (MYT) Regulations, drafting/ reviewing utility business plans and capital expenditure plans, tariff/rate determination, policy advocacy, determination of accurate cost of electricity supply, etc.

EDUCATION:

Institution	Xavier Institute of Management, Bhubaneswar (India)
Date:	March 2018
Degree(s) or Diploma(s) obtained:	MBA in Business Management (with a major in 'Finance')

Institution	B. M. S. College of Engineering, Bengaluru (India)
Date:	June 2013
Degree(s) or Diploma(s) obtained:	Bachelor of Engineering (Information Science & Engineering)

EMPLOYMENT RECORD:

Date:	August 2022 - Present
Location:	Toronto, ON (Canada)
Company:	London Economics International LLC ("LEI")
Position:	Senior Consultant

Date:	May 2018 - June 2022
Location:	Gurgaon, India
Company:	PricewaterhouseCoopers Pvt. Ltd. ("PwC India")
Position:	Manager (April 2022 - June 2022) Senior Consultant (October 2020 - March 2022) Consultant (May 2018 - September 2020)

Date:	August 2013 - August 2015
Location:	Bengaluru, India
Company:	Tata Consultancy Services Ltd.
Position:	Systems Engineer

RECENT PROJECT EXPERIENCE (LEI):

Date:	June 2022 - ongoing
Location:	Charlottetown, PE (Canada)
Company:	Carr, Stevenson & MacKay (legal counsel to Prince Edward Island Regulatory and Appeals Commission)
Description:	LEI was engaged to provide independent, expert evidence (both written and oral) to Prince Edward Island Regulatory and Appeals Commission ("IRAC") regarding a just and reasonable ROE for Maritime Electric Company, Limited ("MECL")

Date:	October 2022 - ongoing
Location:	North Dakota
Company:	North Dakota Public Service Commission
Description:	**Montana-Dakota Utilities rate case** LEI was engaged by the North Dakota Public Service Commission as the outside independent technical consultant supporting the Commission's ratepayer advocacy staff in a rate case involving Montana-Dakota Utilities. LEI examined key components of the rate case, which included the depreciation study, tax rates, environmental upgrades, transmission investment, the ROE/common equity ratio, amortization for early retirement of coal plants, and impacts on residential rates versus impacts on other classes of service. LEI prepared data requests and provided written and oral testimony. Barbara worked on the sections of the audit related to depreciation and environmental upgrades.

Date:	July 2019 - Ongoing
Location:	Toronto, ON (Canada)
Company:	Ontario Energy Board
Description:	LEI has been retained by the OEB to provide quarterly updates on the macroeconomic conditions of the utility sector in Ontario. Every quarter, LEI provides analysis of

	whether the cost of capital policy and/or methodologies for calculating and updating the parameters may warrant review due to structural changes in the sector. LEI also provides variance analysis/trend analysis of interest rates, inflation factors and cost of capital parameters, including the Return on Equity and deemed long-term and short-term debt rates based on movements of relevant economic indicators. These are presented in the form of quarterly reports.

Date:	January 2023 - Ongoing
Location:	Toronto, ON (Canada)
Company:	Ontario Energy Board
Description:	LEI was engaged by the OEB staff as a cost of capital / capital structure expert to review Enbridge Gas' application for 2024 rebasing and 2025-2028 price cap plan. LEI's responsibilities includes analyzing the evidence and assisting OEB staff in preparing interrogatories, independent expert evidence, and participating in the technical conference following the review of interrogatory responses.

Date:	October 2022 - Ongoing
Location:	Alberta (Canada)
Company:	a distribution facility owner ("DFO") operating in Alberta
Description:	**Preparation of expert testimony related to performance-based ratemaking ("PBR"):** LEI was engaged by a distribution facility owner ("DFO") to provide expert evidence and assist in its participation in the Alberta Utilities Commission ("AUC") proceeding to establish parameters for the third PBR term in the province (AUC Proceeding 27388). LEI provided recommendations related to the timing of PBR rate adjustments, merits of the price cap versus revenue-per-customer cap approaches, I factor, X factor, capital funding provisions, earnings sharing mechanisms, and quantifying and tracking efficiencies. LEI based its recommendations on industry best practices as well as analysis of Alberta-specific data.

SAMPLE PROJECT EXPERIENCE (PWC INDIA):

- ***Assistance to Central Electricity Regulatory Commission (CERC):*** Assistance to CERC (federal electricity regulator in India) in review & scrutiny of 50+ tariff applications filed by utilities (generation & transmission), revision of revenue requirement of prior periods based on audited accounts, projecting the revenue requirement for the upcoming period and accordingly finalizing the regulatory tariffs for the utilities based on these projections

- ***Assistance to Indian regulatory authorities such as Joint Electricity Regulatory Commission (JERC) & Punjab State Electricity Regulatory Commission (PSERC):*** Formulation of Multi Year Tariff (MYT) Regulations for periods FY 2019-2022 (JERC) and FY 2020-2023 (PSERC) respectively. Assistance in review and analysis of Business Plan and Capital Investment Plan (CIP), submitted by distribution companies in the state of Goa and 6 Union Territories (UTs) in case of JERC, and State-owned transmission and distribution utilities of the state of Punjab (PSTCL & PSPCL) in case of PSERC. The engagements involved forecasting energy sales, connected load & consumer base, preparation of power purchase plan and

evaluation/approval of CIP of the utilities. Review and approval of tariff applications filed by the Generation, Transmission and Distribution utilities.

- ***Assistance to utilities in regulatory submissions:*** Supported a Middle East based client in regulatory submissions by developing financial models for calculating tariffs/rates for power (generation/transmission/distribution) & water sector (desalination/collection/distribution /wastewater treatment etc.) utilities. Assessing the financial impact of various decisions of regulatory bodies and judicial authorities (including the Supreme Court of India) on an Indian distribution utility and providing suitable recommendations based on the assessment. Assisting various utilities such as Power Transmission Company of Uttarakhand (PTCUL) & Himachal Pradesh State Electricity Board (HPSEB) in in preparation of application/ petition for determination of tariff for multiple years, preparation of financial model based on applicable regulations, support during technical validation of the application, support during public consultation, analysis of Order by the state regulatory commission and recommendations on further course of action based on the Order. Assistance to a federal government owned central transmission utility and a federal government owned hydropower generation company, in policy advocacy & impact assessment of CERC tariff Regulations applicable for the period from FY 2019-24.

- ***Advice on electricity sector reforms:*** Assisted an international financial institution in developing structural reform options in the Indian electricity distribution sector by introducing choice/competition in the retail supply of electricity. Supported a prominent think tank funded by USAID in conducting a study on regulatory interventions for grid discipline and grid reliability for 8 countries in the South Asian Region. Assisted a prominent Indian think tank in developing a financial model for computing cost of supply of electricity to various class of consumers and building a framework to assess affordability of electricity tariffs.

- ***Assistance in bid submission:*** Assisted a European multinational utility in the bidding process for privatization of an Indian electricity distribution utility, including regulatory & commercial due diligence and preparing financial projections for the target utility.

- ***Assistance in formulating a market entry strategy:*** Assisted a European multinational utility in developing a market entry strategy for electricity trading in Indian wholesale energy markets.

STATE OF NORTH DAKOTA

PUBLIC SERVICE COMMISSION

Montana-Dakota Utilities Co.
2022 Electric Rate Increase
Application

Case No. PU-22-194

VERIFICATION

STATE OF MA)
) ss.
COUNTY OF Middlesex)

Marie Fagan, being first duly sworn on oath, deposes and states that she has read the testimony and exhibits submitted in the above captioned matter under her name, that they were prepared by her or under her direction, that she knows the contents thereof, and that the same are true and correct to the best of her knowledge and belief.

Marie Fagan

Subscribed and sworn to before me this 30th day of January, 2023.

HILLERY DORNER
MY COMMISSION EXPIRES ON
12-04-2026
COMMONWEALTH OF MASSACHUSETTS
NOTARY PUBLIC

Notary Public
My Commission Expires: 12/4/26

STATE OF NORTH DAKOTA

PUBLIC SERVICE COMMISSION

Montana-Dakota Utilities Co.
2022 Electric Rate Increase
Application

Case No. PU-22-194

AFFIDAVIT OF SERVICE

STATE OF NORTH DAKOTA)
)ss
COUNTY OF BURLEIGH)

Anna Heinen states under oath as follows:

1. I swear and affirm upon penalty of perjury that the statements made in this affidavit are true and correct.

2. I am of legal age and on the 31st day of January, 2023, I served a true and correct copy of the following documents:

- **DIRECT TESTIMONY OF MARIE FAGAN, LONDON ECONOMICS INTERNATIONAL LLC;**
- **EXHIBIT A; and**
- **VERIFICATION;**

upon the following:

VIA EMAIL & U.S. MAIL

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Anna Heinen

Subscribed and sworn before me this 31st day of January, 2023.

APRIL HEINZ
Notary Public
State of North Dakota
My Commission Expires Dec 26, 2026

Notary Public
Burleigh County, North Dakota