

# Proposal – Economic viability study of Entergy Louisiana LLC

Prepared for the Louisiana Public Service Commission by London Economics International LLC

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*London Economics International LLC (“LEI”) is pleased to submit this proposal to the Louisiana Public Service Commission (“LPSC”, or “Commission”) to perform analysis and assist the LPSC Staff in review of the viability study of the legacy power plants of Entergy Louisiana LLC (“ELL”). LEI is a leading energy consulting firm with over two decades of experience in the North American and international energy sectors. LEI has recent experience working with LPSC and has extensive experience with power generation assets and the valuation of power sector infrastructure. LEI is thus uniquely qualified to review the analysis of the viability of ELL legacy assets and determination of the units to be retired following the commencement of operations of Washington Parish Energy Center.*

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# 1 Introduction to London Economics International

London Economics International LLC is a US-owned and US-managed global economic, financial, and strategic advisory professional services firm specializing in energy and infrastructure. The firm combines detailed understanding of specific network and commodity industries, such as electricity generation and distribution, with a suite of proprietary quantitative models to produce reliable and comprehensible results.

The firm also has in-depth expertise in economic and financial issues related to the electricity, gas, and water sectors, such as asset valuation, procurement, regulatory economics, and market design, assessment and analysis. The firm has its roots in advising on the initial round of privatization of electricity, gas, and water companies in the United Kingdom. Since then, LEI has advised private sector clients, market institutions, and governments on privatization, asset valuation, deregulation, tariff design, market power, strategy, and strategy development in virtually all deregulated markets worldwide, including Canada, the United States, Europe, Asia, Latin America, Africa, and the Middle East. Figure 1 provides examples of selected LEI clients throughout the world.

LEI maintains primary offices in Toronto, Boston, and Chicago.

**Figure 1. Selected LEI clients throughout the world**



The following attributes make LEI uniquely qualified to assist LPSC:

- LEI has a **breadth of expertise related to** examining the economic viability of generation assets, including both **conventional** and **renewable facilities** with storage capabilities;
- LEI has **many decades of experience** and has advised on many billion dollars' worth of valuations and financing, including the **initial rounds of privatization** in the UK, US, and Canada following market liberalization;
- LEI has assisted on a wide variety of work related to **re-contracting initiatives and post-contract analysis** of generation assets. This includes re-contracting work related to generation assets across the US;
- LEI has performed detailed **analysis of operations, books, and records of investor-owned utilities**, in the context of management performance audits;
- LEI has experience with **electricity sector policy and regulatory matters in Louisiana**;
- LEI **regularly serves as a financial advisor** to participants in the power sector across the US and internationally, and provides advice on issues ranging from cost of capital, target capital structures, and asset valuations;
- LEI has in-depth knowledge of **the US and global electricity markets**. This enables us to provide expertise regarding changes in market dynamics and implications to regulatory frameworks;
- LEI is **focused on the electricity sector**. Our experience along all aspects of the value chain of the electric power sector enables us to understand the interplay among the various components of the electricity market structure;
- LEI has a **suite of proprietary modeling tools** developed internally for the electricity sector. Our tools are regularly relied upon by our clients to perform various market analyses or as inputs to financial and economic modeling; and
- LEI has developed a **suite of pro-forma financial models** which are easily populated to reflect the specific dynamics of a given investment/project.

## 2 Understanding of the engagement

Entergy Louisiana LLC (“ELL”) owns a generation portfolio which includes a total of 16 power plants based on natural gas-fired, coal-fired, and nuclear power production technologies, with a combined installed capacity of 8,900 MW (as of 2019 Integrated Resource Plan). ELL has recently added more gas-fired capacity at St. Charles, with more capacity scheduled to come online in the next two years at Lake Charles and Washington Parish sites. These three additions amount to 2,210 MW.

LEI understands that LPSC is seeking an independent consultant to support Staff by

- 1) reviewing and evaluating ELL’s August 17, 2020 report on the economic viability of ELL’s legacy power plants; and
- 2) reviewing whether the addition of Washington Parish Energy Center (“WPEC”) would allow for de-activation of any legacy gas unit without creating reliability issues.

### 2.1 Entergy Louisiana LLC

Entergy Louisiana LLC is a subsidiary of Entergy Corporation, along with Entergy Arkansas LLC, Entergy Mississippi LLC, Entergy New Orleans LLC, and Entergy Texas Inc. ELL operates in Louisiana and is one of five investor-owned utilities in the state.<sup>1</sup> ELL provides electric service to about 1 million customers.<sup>2</sup>

ELL’s generation portfolio includes 9,826 MW (existing 8,900 MW + J Wayne Leonard Power Station 926 MW). There are 3,115 MW capacity of natural gas-fired steam power plants – these are the four power plants that are categorized as legacy gas plants.

**Figure 2. ELL generation portfolio**

	COD	Resource details	Capacity (MW)
Existing resources		Coal	392
		Nuclear	1,981
		CCGT	2,634
		CT	445
		Legacy gas	3,115
		Load modifying resources	333
	<b>Total</b>		<b>8,900</b>
New additions since 2019 Integrated Resource Plan	2019	J Wayne Leonard Power Station	926
	2020	Lake Charles Power Station	924
	2021	Washington Parish Energy Center	363
		<b>Total</b>	

<sup>1</sup> There are also about a dozen electric cooperatives <<https://www.entergy-louisiana.com/about-us/>>

<sup>2</sup> ELL also serves 94,000 natural gas customers in Baton Rouge <<https://www.entergy-louisiana.com/about-us/>>

These legacy gas units (six in total) are currently over 40 years old and are expected to retire, according to the ELL 2019 IRP, within the next 20 years along with some of the coal-fired units – a total of 5,800 MW. The currently planned retirements are shown in Figure 3.

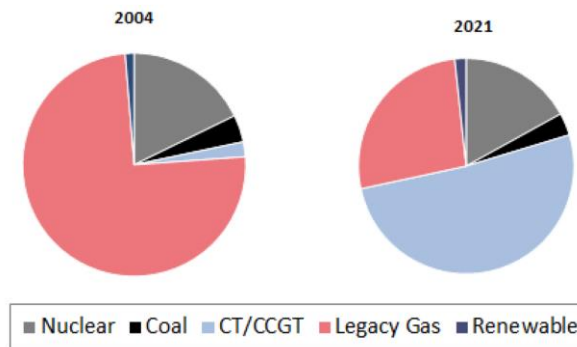
**Figure 3. Planned retirements**

Resource details	Technology	Capacity (MW)	Retirement assumption
Little Gypsy - Unit 2	natural gas-fired steam	401	2026
White Bluff - Unit 1	coal-fired steam	13	2027
White Bluff - Unit 2	coal-fired steam	12	2028
Little Gypsy - Unit 3	natural gas-fired steam	508	2029
Independence - Unit 1	coal-fired steam	7	2030

Source: Entergy Louisiana 2019 Integrated Resource Plan

The timing and selection of the units to retire depend on the load growth and the replacement capacity to address local reliability needs of ELL. In the past 2 decades the composition of the generation portfolio of ELL continues to evolve to have natural gas-fired combined cycle combustion turbines accounting for more than 50% by 2021 (see Figure 4).

**Figure 4. Evolving generation portfolio of ELL**



Source: Entergy Louisiana 2019 Integrated Resource Plan

Additionally, ELL has committed to purchasing the output of 1,000 MW of combined cycle gas turbine (“CCGT”) capacity and 50 MW of solar photovoltaic capacity via power purchase agreements (“PPAs”).

## 2.2 ELL’s legacy generation economic study

ELL joined the Midcontinent Independent System Operator (“MISO”) in 2013, and it is part of the Load Resource Zone 9 of the MISO footprint. ELL continues to be responsible for reliability within its service territory, as such ELL produces IRPs designed to balance risk and reliability with minimization of the cost of service to the customers.

ELL was required by the Commission to complete a study to determine the economic viability of the legacy power plants. This requirement was formalized in the LPSC's Directive at the February 21, 2018 Open Session, which specified that such study and the final reports of the Commission Staff be completed no later than six months after the commencement of generation at Lake Charles Power Station.

ELL completed the study, and filed it on August 17, 2020, in Docket No. X-35643.

The methodology ELL used was to determine the most economic and reliable combination of resources to meet the demand of ELL's customers. Such approach was implemented utilizing coordinated study of the ELL's system from the perspectives of planning analysis, power generation and transmission planning.

ELL's main conclusion was that certain legacy units can be deactivated and replaced earlier than previously planned, when WPEC is activated in 2021. Specifically, the chosen scenario will allow ELL to modernize its fleet and deactivate legacy units ahead of the assumed 60-year life, while maintaining the reliability performance and at a lower cost than keeping the legacy units running.

### **2.3 Key issues in assessing economic viability of generation assets**

LEI proposes to conduct the evaluation and analysis of the ELL's economic viability study examining the assumptions, validity of the methodology and robustness of the conclusions. Generally, when evaluating economic performance of a portfolio of generation assets (of which the legacy units are a part), the analysis should focus on the ability of the portfolio to meet the objectives (i.e. meet demand in a reliable fashion) while controlling economic costs. The following are some of the key issues and concepts relevant when conducting this kind of analysis. While these methods are not necessarily applicable when analyzing this particular portfolio's performance (both operational and financial), nevertheless, it is important to keep these concepts in mind when evaluating both portfolio and individual assets.

The valuation of an asset requires considering the subject asset under several angles:

- what it is worth as an income producing asset (the discounted value of future cash flows, or the *income* approach);
- the value of the asset if sold in the marketplace (the *market* approach); and
- how much it would cost to replace the asset with one of similar capabilities and performance attributes (the *cost* approach).

The income approach requires a detailed understanding of the drivers of future net cash flows and determination of an appropriate discount rate. In the case of legacy gas power plants, this could include a projection of the revenues earned from participation in MISO-operated markets (e.g. energy, capacity, and ancillary services).

The market approach is based on an assessment of suitable comparable sales, reflecting the observed valuations of similar assets in a sale. LEI maintains a database of transactions for that purpose, allowing for the identification of comparable transactions.

The cost approach is based on the cost of reproducing or replacing the assets, with adjustments for age-related reductions in functionality (depreciation). LEI maintains a database of investment costs for new generation infrastructure, including hydroelectric generation, and has gained experience from working on hydroelectric-related projects across the US.

Over a long-term time horizon, and provided that an informed estimate of future cash flows can be made, the income approach can be the most appropriate. However, the market approach can provide useful insight to augment and confirm the valuation process if reasonably similar comparables (assets similar to the asset being valued which have changed hands at publicly available arms-length prices) can be found. While the cost approach relies on a series of assumptions regarding comparable plant construction costs, it serves to reinforce the other two valuation methods by demonstrating that the existing asset is not likely to be rendered obsolete.

### **2.3.1 Income approach**

Relying on the income approach for valuing the legacy gas assets requires developing estimates of future revenues, which are then compared to annual expenses in order to perform a Discounted Cash Flow (“DCF”) analysis over the 20-year horizon. Data requirements to perform this analysis include:

- Expected market prices for energy, capacity, and ancillary services prices ;
- annual costs (opex and capex);
- annual hours of operation (capacity factor);
- terminal value; and
- discount rate.

Since there can be uncertainty around several of the parameters listed, the valuation will result in a range of fair market values. This range can be further refined by performing sensitivity analyses in which some key outlook or parameter could be changed.

#### **Expected market prices**

LEI maintains an up-to-date dispatch simulation model of MISO’s energy markets, designed to replicate the outcomes on an hourly basis. The data utilized by LEI model, POOLMod, is populated with data available from MISO, EIA, FERC and commercial data sources.

#### **Annual costs**

In order to calculate projected annual cash flows for the assets, LEI will additionally need information about fixed and variable Operations and Maintenance (“O&M”) costs, sustaining capital spending (and financing parameters), income/property taxes, and any other applicable costs and fees (such as environmental compliance).



## Annual hours of operation

A power plant can only earn revenues if it is operating. The annual hours of operation relative to the capacity of the plant is referred to as the capacity factor. An efficient plant will generally be dispatched more hours than an inefficient plant (have a higher capacity factor) and thus have more market revenues.

## Terminal value

The terminal value can be defined as the residual value of the asset at the end of the terminal year. LEI often estimates a terminal value based on a generic assumption of continuation of the average value of the levelized estimated free cash flows over the last few years of the horizon. LEI would estimate the remaining life of the plant based on the age of its major components versus the average useful life of these components.

## Discount rate

Determining an appropriate discount rate is an important element of the income approach to valuation. The discount rate reflects the time value of money, based on the principle that future cash flows are less valuable today than those that occur in the present or near future. The discount rate is generally based on the investor's Weighted Average Cost of Capital ("WACC"). A representative WACC based on an analysis of industry standards including debt to equity ratios, cost of debt, and cost of equity.

A common approach to determine the cost of equity is the Capital Asset Pricing Model ("CAPM"). It combines a long-run assessment of the risk of the firm or asset in question with estimates of the prevailing risk-free rate and the rate of return of the market as a whole to project a cost of equity.

The CAPM model is characterized by the following formula:

$$R_E = R_f + [\beta \times (R_M)]$$

*R<sub>E</sub> is the return on equity, the expected return on an asset, given the other factors.*

*R<sub>f</sub> is the risk-free interest rate.*

*Beta is the measure of the non-diversifiable risk or systematic risk in the model; mathematically the covariance of the asset and market returns, divided by the standard deviation of the market returns.*

*R<sub>M</sub> is the market risk premium, the increment by which asset market returns have exceeded the risk-free rate.*

LEI would derive a value for each of the parameters of the CAPM formula based on industry comparables and the project risk, in concert with the rest of analysis.

### **2.3.2 Market approach**

In order to compare and confirm the results from the income approach valuation, LEI would compare the legacy gas power assets to similar assets sold in comparable jurisdictions, assuming such sales data are available.

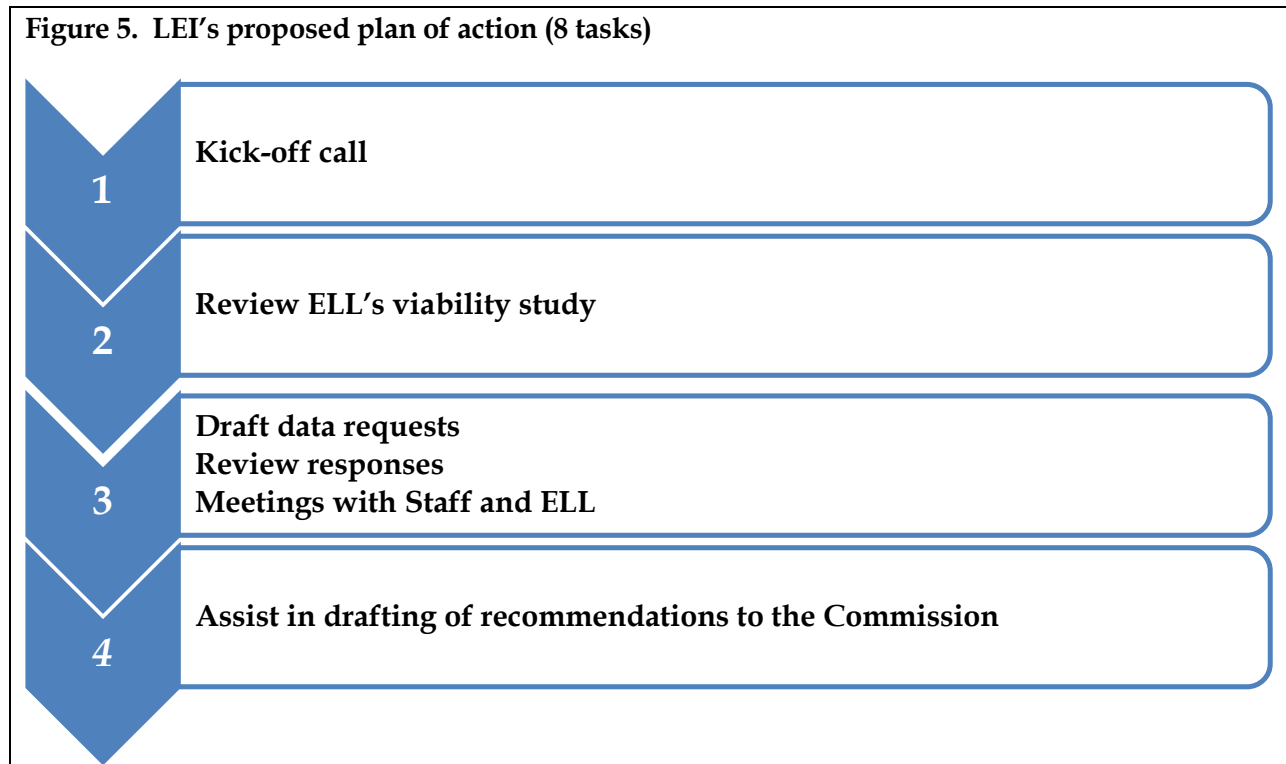
### **2.3.3 Cost approach**

Finally, a valuation of the legacy gas power assets can be performed based on the cost approach. The cost approach involves an estimation of reproduction or replacement cost of an asset less accrued depreciation. However, if the technology of the plant to be evaluated is out of date, this method may not be desirable.

LEI will then take into account the accrued depreciation, based on an estimate of the useful life of the assets as compared to their current age, to complete the cost-based approach to valuation.

### 3 Proposed plan of action

LEI will review the ELL August 17, 2020 study (confidential version) and supporting documentation filed by ELL. Also, as requested by Staff, LEI will conduct and review data requests, assist in the preparation and review of exhibits as well as the recommendations to the Commission, and participate in all relevant meetings and discussions with ELL. In doing so, LEI plans to pursue the proposed plan of action summarized in Figure 5 below. In alignment with what LPSC noted in the RFP for this engagement, LEI understands that the LPSC and its staff will have the right to determine how these tasks will be carried out.



LEI's key findings will be summarized in the form of a report to the LPSC. Moreover, in the course of this engagement, LEI senior staff will confer with the LPSC staff in the form of periodic telephone and video calls and by e-mail.

## 4 Proposed deliverables and budget

Based on all tasks in the proposed scope of work, the anticipated deliverables, and LEI's professional fee, LEI estimates a professional fee budget of US\$39,555.00. Figure 6 provides a breakdown of LEI's professional fee by task.

**Figure 6. Breakdown of estimated budget per task**

Tasks	Budget
1 Kick-off call	\$ 925
2 Review ELL's viability study	\$ 10,325
3 Draft data requests / Review responses / Meetings with Staff and ELL	\$ 13,680
4 Assist in drafting of recommendations to the Commission	\$ 14,625
<b>Total</b>	<b>\$ 39,555</b>

Any additional work requested in writing by LPSC outside of the scope of work will be invoiced on a Time and Material ("T&M") basis, based on the professional fee schedule presented below.

**Figure 7. LEI's hourly professional fee rates**

Staff	Project role	Company position	Hourly rate	Daily rate
Marie Fagan	Project Director	Chief Economist	\$ 495	\$ 3,960
Himanshu Bhardwaj	Project Researcher	Research Associate	\$ 215	\$ 1,720

Additional customary expenses will be invoiced at cost, including but not limited to travel related to the engagement, necessary data acquisition, printing, courier and other pre-approved expenses. LEI does not expect to incur travel costs, as the new scope of work does not include testimony. However, if travel is required, LEI provides an estimate of travel costs in Figure 8 below. LEI will comply with all expense caps as outlined in the State of Louisiana Division of Administration Travel Policies and Procedures Memorandum. Accordingly, the total professional fees including the expense budget will be approximately US\$43,430.00.

**Figure 8. Travel costs**

Travel	# trips	# people	# nights	Total
Meetings with LPSC	2	1	1	\$1,550
Stakeholder meetings	3	1	2	\$2,325
<b>Total estimated costs</b>				<b>\$3,875</b>

## 5 Sample of relevant knowledge and experience

LEI's experience matches the qualifications required by LPSC. Below, we briefly elaborate on our knowledge of the electric sector, experience with generation asset valuations, and capabilities in regulatory proceeding expert testimonies.

### 5.1 Previous engagements in Louisiana

LEI has recent and relevant experience advising the LPSC.

- **Audit of Cleco Fuel Adjustment Clause:** LEI is currently serving as the outside independent technical consultant in the matter of Docket No. X-35522, "Audit of Fuel Adjustment Clause Filings for Cleco Power LLC for the period beginning January 1, 2018 through December 31, 2019 (2018-2019).
- **Audit of Entergy Fuel Adjustment Clause:** LEI is currently serving as the outside independent technical consultant in the matter of Docket No. X-35523, "Audit of Fuel Adjustment Clause Filings for Entergy Louisiana, LLC for the period beginning January 1, 2016 through December 31, 2019 (2016-2019).
- **Consultant for renewable energy tariff:** LEI is currently serving as the outside independent technical consultant in the matter of Docket No. R-35423, "Rulemaking to Study Renewable Energy Tariff Option with a Focus on Bringing Renewable Energy to Louisiana."

### 5.2 Engagements related to functional areas of regulated investor-owned utilities, and accounting standards and practices

LEI has broad experience in examining functional areas of utility activity, in the context of management performance audits, as well as the application of utility accounting practices in the context of financial audits.

- **Management performance audit of two major utilities in Mississippi:** LEI was engaged by the Mississippi Public Service Commission for a two- year engagement to audit the management performance of Entergy Mississippi. As part of the management audit, LEI also prepared a fuel inventory audit, where LEI assessed the utility's practices for economic purchase and use of fuel and electric energy, evaluated relevant fuel, and energy contract terms, investigated the operations of the utility's coal and nuclear generation units, and reviewed the prudence of coal inventory levels and inventory control procedures. This audit involved assessing the performance and operations of coal, gas and nuclear plants. Following this engagement, the Commission hired LEI for another two years to perform a similar audit of the Mississippi Power Company.
- **Audit of AEP Ohio OVEC PPA:** LEI was engaged by the Public Utilities 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 Company ("OVEC"). Aspects of the audit included assessing the reasonableness and prudence 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 prudence of fuel purchases. LEI also audited charges and true ups related to the company's quarterly PPA filings.

- ***Audit of Price Stabilization Rider of Duke Energy Ohio:*** LEI was engaged by the Public Utilities Commission of Ohio to perform an audit of the PSR of Duke Energy Ohio. Aspects of the audit included assessing the reasonableness and prudence 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 prudence of fuel purchases. LEI also audited charges and true ups related to the company's quarterly PSR filings.
- ***Audit of management performance and financial aspects of AEP Ohio's AER:*** LEI was engaged by the Public Utilities Commission of Ohio to perform a management performance and financial audit of AEP Ohio's Alternative Energy Rider ("AER"). The project required examining the terms of 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. LEI recruited a local Ohio accounting firm to perform portions of the audit and provided guidance (as the firm had not previously audited a utility) and oversight of their work.

### 5.3 Engagements related to ratemaking and rate base adjustments

LEI principals and consultants have extensive experience advising on matters related to ratemaking and rate base adjustments in a variety of regulatory regimes.

- ***Cost of Capital Parameters Review:*** LEI was retained by the Ontario Energy Board ("OEB") to provide updates on the macroeconomic conditions of the utility sector in Ontario. As part of its advice, LEI provided an annual presentation to the OEB and senior management to discuss key issues driving changes in the utility sector. LEI provided recommendations on 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 was also asked to provide, on a case-by-case basis, analysis on where changes going forward to the approved capital structures may warrant consideration based on expected changes in risk for wires, generation and natural gas distributors in Ontario. LEI also provided variance analysis/trend analysis of 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 were presented in a quarterly report that included a number of these elements and were presented to OEB staff
- ***regulation of generation in Ontario:*** for Ontario Energy Board, LEI authored paper described the ways in which legacy assets of Ontario Power Generation could be regulated, including incentive regulation and a set of regulatory contracts. Deliverables included providing technical advisory during public workshop
- ***AESO transmission cost causation study:*** LEI developed a transmission cost causation study for the Alberta Electric System Operator ("AESO"). The study was used for the determination of the AESO's Demand Transmission Service Rate DTS, and filed with AESO's 2014 tariff application to the Alberta Utilities Commission ("AUC"). The study covered four main topics:

(i) Functionalization of Capital Costs; (ii) Functionalization of Operating & Maintenance ("O&M") costs; (iii) Classification of Bulk and Regional System Costs; and (iv) Implementation Considerations.

- ***review of AESO Tariff Application:*** LEI was retained to review the AESO's 2018 Tariff Application with specific focus on the allocation of transmission costs using a 12CP allocator as well as to confirm the accurate application of the AESO's cost of service methodology in its filed cost of service model
- ***preparation of rate application and development of filing guidelines:*** LEI was engaged by Tenaga Nasional Berhad ("TNB") to work as the project manager of its Incentive Based Regulation ("IBR") submission for the 2nd regulatory term. LEI provided advice on the policy and government framework for the implementation of IBR, providing strategic advice to IBR Council and TNB management regarding the IBR submission, managing and monitoring the submission process, coordinating with business entities and attending IBR Council meetings, progress meetings, and challenge workshops. Moreover, LEI reviewed the current Regulatory Implementation Guidelines ("RIGs") set by the Energy Commission and proposed enhancements to the RIGs. LEI is also currently involved in negotiations with the Energy Commission regarding proposed changes to the RIGs. LEI is also updating and providing enhancements to TNB's Revenue Requirement Model ("RRM") which sets the IBR tariff for each business entity. Furthermore, LEI assisted in the writing of the IBR submission report to the Energy Commission.
- ***provided expert testimony in support of FortisAlberta Inc. ("FAI") in its filing for a performance-based ratemaking ("PBR") plan with the Alberta Utilities Commission ("AUC"):*** The testimony provided detailed data analysis (including inflation and TFP trends), underpinning PBR economic theory, and reviews of best practices in various North American and International jurisdictions. The testimony offers back up elements for each of the various components of the PBR plan that is being proposed by FAI.
- ***supported client's transmission FBR reopener application:*** in particular, the client wanted LEI to provide an independent opinion on their argument (i) to amend the G factor calculation to eliminate the G-factor lag effective January 1, 2011 and (ii) to reduce EPC's current X factor of 1.2% to 0.0%. LEI provided support throughout the whole litigation proceeding by responding to information requests which involved additional research and analysis, including synthesis of publications on recent technological advances in electricity transmission sector, and updating the Ontario LDCs TFP model to ten years
- ***provided independent assessment of Alberta's Comprehensive Market Design:*** LEI provided a critical review of the new capacity and energy market design being proposed by the Alberta Electricity System Operator ("AESO") in a written report submitted, on behalf of a market participant, to the Alberta Utilities Commission ("AUC"). LEI identified criteria for evaluation of the new market design, compared the AESO's proposal against other well-established organized wholesale electricity markets, and then categorized associated rules based on an objective evaluation of both positive and negative features. [AUC Proceeding No. 23757]
- ***testimony in support of transmission operating rules and curtailment protocols for interties into Alberta:*** LEI Principal, Julia Frayer, provided testimony in support of transmission operating rules and curtailment protocols for interties into Alberta, as proposed by the

Alberta Electricity System Operator (“AESO”), in order to support a fair, efficient and openly competitive power market. The testimony was made in front of the Alberta Utilities Commission (“AUC”), on behalf of Morgan Stanley Capital Group (“MSCG”), a customer of the Montana-Alberta Transmission Line. The analysis considered commercial as well as operating protocols in deregulated power markets and considers how market rules incentivize new entry and produce dynamic efficiency gains related to more intense competition. The AUC issued a favorable decision to MSCG in early 2013. [AUC Proceeding No. 1633]

- ***prepared testimony and testified in support of TransAlta in relation to a settlement for contravention of FERC Regulation related to timing of exports from 2010:*** The settlement was crafted by the Market Surveillance Administrator and filed with the Alberta Utilities Commission (“AUC”) for approval in December 2011. LEI assessed the economic and policy considerations of the settlement and its appropriateness in context of enforcement and sufficiency of penalty payment. [AUC Proceeding No. 1553]
- ***provided support to FortisAlberta Inc. (“FAI”), a Canadian electricity utility, in its filing for its capital tracker application with the regulator:*** LEI reviewed the submissions of the interveners and advised FAI on how to address the issues raised by these interveners.
- ***rate impact analysis and study of costs and benefits of municipalization:*** LEI was retained by the Maine Public Utility Commission to fulfill a legislative mandate to study proposed legislation that would involve municipalization of the state’s transmission and distribution networks. LEI submits its expert report for the Legislature on February 15, 2020 and testified before the Joint Standing Committee on Energy, Utilities and Technology on February 26, 2020. [MPUC Docket 2019-00280]
- ***expert witness in a performance-based ratemaking case for a gas LDC:*** LEI was retained in early 2019 to conduct Total Factor Productivity and Benchmarking analyses for the US gas distribution industry, and provide expert technical advice to a gas utility company in Massachusetts; LEI’s analysis and expert testimony was submitted in anticipation of a performance-based distribution ratemaking application in late 2019. [DPU Docket 19-120]
- ***efficacy of distributed generation as a non-transmission solution to local transmission reliability problems:*** LEI prepared direct testimony and rebuttal testimony related to the technical efficacy and cost-effectiveness of various non-transmission alternatives and specifically distribution level solar and battery storage solution to a known reliability problem in a load pocket within Massachusetts. [Massachusetts, docket EFSB 17-02/D.P.U. 17-82/17-83]
- ***testified on behalf of the NEPOOL in a jump ball filing at FERC regarding the Performance Incentive scheme proposed by ISO-NE:*** in written testimony submitted to FERC, LEI Principal, Julia Frayer, identified shortcomings in ISO-NE’s proposed performance incentive scheme for its forward capacity market. [Docket No. ER14-1050 at FERC]
- ***performed economic advisory in a matter relating to market design strategy for a large Canadian generator:*** LEI performed a case study-oriented comparative review of energy-only and energy and capacity markets in North America and abroad, with lessons learned from other jurisdictions. LEI’s work plan called for the simulation modeling of three forms of market design: an energy-only market, an energy and capacity market akin to Grid of the US



RTO markets, and a hybrid market with long term contracts and a spot market for capacity. The third phase involved the creation of a customized tool for future analysis, based on the simulation modeling results.

- ***devised an innovative approach for evaluating the economics, environmental, and siting costs and benefits of transmission (and generation investment) for the California Independent System Operator:*** building upon the traditional economic framework for cost-benefit analysis, the LEI team devised an approach to quantitatively value the expected net benefits from various infrastructure projects, taking into account market uncertainties as well as the classic deregulated market coordination problem of planning for transmission given uncertain generation investment and vice versa. A scoring technique for environmental permitting and siting issues was also developed, in order to quantify the potential impact of the proposed project on the local environment and economy, as well as to measure the impact of such factors on the project timetable and eventual net benefits to society. Real option techniques were also considered in this engagement to assess the potential value of uncertainty and the benefits for delaying various investment strategies. The methodology was also expanded to handle the potential to evaluate numerous competing projects, in recognition of the fact that transmission and generation investments (and other potential investments) could be both complements and substitutes.
- ***Analysis of productivity trends in the gas LDC sector:*** LEI analyzed productivity trends in the US over the last fifteen years; LEI also studied the effect of indicators that drive relative efficiency differences across LDCs. LEI's analysis supported regulatory strategy and decision-making on rates.
- ***drafted a white paper reviewing New York PSC's recommendation to set a price cap on competitive retailers:*** LEI reviewed and refuted the evidence submitted by the regulatory staff in support of their recommendation to institute a price cap on the competitive electricity providers in New York's retail market on the basis of market power assertions.

## 5.4 Engagements in MISO

Recent engagements across other parts of MISO are outlined below.

- ***Due diligence for a potential asset acquisition in MISO:*** LEI was engaged to assist in due diligence of a potential asset acquisition in MISO, involving gas-fired generation assets. LEI reviewed the contracts and financial analysis, with a specific focus on the assumed market value of capacity in the long term, and locational marginal prices for energy.
- ***Asset evaluation:*** LEI was engaged by an investment firm in association with asset valuation, due diligence support, and market analysis. Work involved reviewing documents in a virtual data room, and analysis related to drivers of gross margin for the asset: macroeconomics, weather fluctuations, fuel and electricity cost projections, and an overview of gas and electricity market in the region where the asset was located.
- ***Revenue opportunity for gas-fired cogeneration units in MISO:*** The purpose of the assignment was to inform the client of potential risks associated with the plants upon the termination of their power purchase agreements. Under this engagement, LEI simulated

MISO's energy and capacity markets and derived forecast of wholesale energy prices and capacity prices relevant to the units' geographic location.

- ***Economic analysis for a proposed transmission project in MISO:*** LEI conducted a modeling exercise to determine the potential revenues for a proposed transmission project wheeling power from western MISO to eastern MISO (and eventually PJM). LEI evaluated both the revenue opportunities to the investors as well as social benefits to the MISO system and evaluated the incremental value of the business strategy of selling the energy (and capacity) out of East MISO to third parties in PJM.
- ***Costs/benefits analysis of Entergy joining an RTO:*** LEI was hired by the Public Utility Commission of Texas ("PUCT") to provide a cost-benefit analysis about the announced decision by Entergy to join MISO. LEI provided quantitative and qualitative analyses of specific costs/benefits attributable to Entergy Texas Inc. ("ETI") and its customers following membership in MISO or SPP.
- ***Review of ETI's impact analysis of termination of PPA on consumers:*** LEI was hired by the PUCT to conduct a due diligence review of the analyses performed by ETI on the impact of the termination of specific PPAs while a member of MISO. LEI's scope of work included a review of ETI's inputs & results, methodology, and interpretation of MISO market rules.
- ***Due diligence and valuation update of a district cooling asset in the Midwest:*** LEI was engaged by an investment firm in association with due diligence of a district cooling system in the Midwest. After one year, the client needed an update of the valuation of assets for purposes of spinning the assets off into a portfolio company. LEI used our capability for electric and capacity price modeling using our proprietary POOLMod tool to update the forecasts relevant to these assets, which included a district cooling plant and a combined steam and electricity plant.
- ***Estimating coal plants' energy and capacity revenues in MISO:*** LEI performed the valuation of two power plants located in the Midwest region of the US to determine their potential value upon expiration of ongoing PPA. The plants revenues were calculated based on the 25-year forecasts of electricity prices in their respective zones. Given the long-term horizon of the modeling exercise, we also simulated an organized capacity market based on the Resource Adequacy requirements of MISO to estimate potential capacity revenues for the plants.

## 5.5 Sample experience in assessing viability and valuation of generation assets

LEI has been engaged in a wide variety of projects related to calculating the viability and value of generation, transmission, and distribution assets; as well as portfolios of assets and entire companies. The following is a non-exhaustive sample of LEI's valuation-related engagements.

- ***Extensive modeling exercise to support hydro plant divestiture:*** LEI was retained by a US power conglomerate to provide a model of the Ontario market in support of the divestiture of Ontario hydro units. LEI analyzed the performance of targeted plants and performed sensitivities given nuclear recovery and different hydrological scenarios. The modeling incorporated both production cost and strategic behavior-based methods. LEI also

supplemented its analysis with a report on the potential for the assets to earn revenues in the ancillary services market.

- ***Renewables revenues analysis for small hydro in BC:*** LEI reviewed programs to promote renewables across the Pacific Northwest, including US states and Canadian provinces. Based on this analysis and analysis of voluntary compliance programs, LEI developed a valuation of potential revenues to several small hydro facilities in British Columbia from REC sales.
- ***Forecasting market revenues of a hydro plant:*** For a financial client, LEI was responsible for forecasting market revenues for a small hydro generation portfolio in Western New York. The work involved a twenty-six-year forecast of energy and capacity prices in Zone A under a base case assumption as well as analyzing sensitivities applying different gas price assumptions and different supply assumptions.
- ***Due diligence, market issues research and price forecast analysis for a hydro plant acquisition in New York state.*** For a private equity power sector investor, LEI assisted in conducting due diligence in the bidding process with respect to an acquisition of a +32 MW hydro plant in the New York market by a group of private investors. LEI conducted economic appraisals, coordination of preliminary technical due diligences, worked closely with strategic advisors of the private equity investor, and conducted oversight of financial modeling. The analysis included long-term fuel and electricity prices, major maintenance and coordination of engineering analysis, financial modelling, analysis of operating agreements and review of relevant reports.
- ***Hydropower generation related research and financial and strategic analysis.*** As part of a retainer agreement with a growing private equity firm focused on the roll-up of small hydro properties, LEI performed a variety of supporting activities, including examination of forward markets, review of PPAs, assessment of renewable energy policies, and strategic analysis.
- ***Evaluation of the cost-effectiveness of clean energy projects in the context of a large hydroelectric facility:*** LEI analyzed the methodology and underlying assumptions of the generation resource costing approach used by a large Canadian utility against accepted financial principles and observable market trends. LEI's proposed methodology was utilized by the industry to determine a new set of levelized costs for the same resources considered previously by the utility. Further, LEI's proposed methodology was used to produce a generation portfolio which satisfied the forecast load requirements of the utilities service area while achieving the lowest cost of supply.
- ***Real options analysis of arbitrage value of a hydro generation project in Atlantic Canada.*** LEI assisted the client in assessing the volatility premium associated with a long-term energy contract. The client joined co-developing a hydroelectric generation project and associated transmission links in Atlantic Canada in exchange for 20% of the hydroelectric generation project's output for 35 years. LEI assisted the client to understand the benefits of the flexible, renewable hydro electric energy using a real-options based approach to consider the total arbitrage value and intrinsic value of the energy, based on consideration of contract terms and the client's views of market forwards.

- ***Due diligence for a hydro plant acquisition in Massachusetts.*** LEI was hired by a New England based renewable energy company to lead the acquisition of a small MW hydroelectric project in Massachusetts. LEI helped to close the transaction.
- ***Energy storage review for a small hydro developer:*** LEI was retained to evaluate the cost economics of installing energy storage technologies at existing hydro power plants in Massachusetts and New York. The analysis was conducted in three phases – phase 1 consisted of literature reviews and primary information collection (from manufacturers and service providers) on the available types of energy storage technologies and associated fixed and variable costs. Phase 2 consisted of an economic cost-benefit analysis of the least cost storage technologies to understand the viability of the investment. Phase 3 consisted of developing comprehensive criteria for selecting the energy storage manufacturer/service provider and presenting implementation recommendations.
- ***Assisted with large scale hydro development:*** LEI assisted an Alberta generator on strategy related to new large scale hydro development, including justification as inflation hedge for potential pension fund investors, integration into competitive market while maintaining ability to finance, and other strategic and regulatory support.
- ***Global Investment Consultancy, Austria:*** LEI was retained by a global investment consultancy to prepare a report on the potential premium for power from small hydro facilities in Austria based on renewables ticket market outcomes worldwide and on the characteristics of the Austrian electricity market. LEI also assessed the potential price of wholesale electricity based on long run marginal costs and survey of existing European forwards markets.
- ***NYISO, NE-ISO REC Market Analysis:*** LEI was engaged by a large Canadian hydro generator to evaluate the potential renewable premium associated with its hydro assets in North America. LEI developed an economic model to project legacy Renewable Energy Certificate (“REC”) prices in New York and New England. LEI also provided alternative methodologies such as projecting the premium based on forecasted carbon allowance prices and analyzing potential sales to large corporations on a voluntary basis.
- ***Review analysis of a company's market prices used to forecast hydro plant revenues.*** LEI analyzed the reasonableness of an electric company's market prices for energy and Renewable Energy Credits (“RECs”) for purposes of forecasting revenues from the client's hydroelectric facility.
- ***Prepared 30-year price forecast for hydroelectric valuation:*** LEI was retained to do a 30-year energy price forecast for Western New York, capacity price forecast for the Rest of the State, and revenue forecasts for a hydroelectric generation facility.
- ***Real options analysis for hydro plants in New England.*** LEI was retained by a Canadian industrial conglomerate to perform a series of real option analyses on Lakeview, Lennox, and Mississagi hydro stations, Great Northern Paper, and a collection of stations in New England.

- ***Real options-based valuation of a generation unit:*** LEI was retained by Alberta's electricity transmission regulator to conduct a real options-based valuation of the Clover Bar unit so as to provide a realistic, market-based foundation for determining the reservation price of the Clover Bar unit contracts. LEI's analysis suggested that the value of Clover Bar is intimately related to the flexibility of the plant.
- ***Valuation of hydro generation portfolio:*** LEI supported a Canadian industrial conglomerate in its winning bid for a package of hydro stations in an engagement that included bid support for multiple asset acquisitions, strategic advisory services, and financial modeling. Tasks included revenue estimation, due diligence support, and estimates of the value of ancillary services. LEI's analysis covered valuations for oil and gas fired peaker and an aging coal station.
- ***Valuation of hydro generation portfolio:*** LEI was commissioned by a potential investor to provide analysis and valuation of hydro assets being divested in New England and complete a ten-year price forecast for the New England power market. As part of the engagement, LEI modeled the costs associated with certain PPA contracts as well as associated standard service obligations and evaluated the optionality, or "extrinsic value," of a collection of flexible power plants within the portfolio.
- ***Valuation of a Power Purchase Agreement:*** LEI acted as an expert on behalf of the counsel for the appellant in a power contract dispute. LEI provided a valuation of the power purchase agreement ("PPA") for a coal-fired power generation facility within the historical context of when the PPA was first acquired. LEI reviewed the terms of the contract, the broader economic environment, and the power market fundamentals at that point in time. LEI utilized three separate valuation techniques, discounted cash flow analysis, replacement cost, and comparable transactions. LEI provided two written deliverables: 1) a memorandum reviewing and critiquing previous expert witness reports and 2) an expert report highlighting LEI's analysis and conclusions regarding the value of the contract. The matter is still being pursued, and it is expected that LEI's report will be submitted into evidence and LEI experts will provide deposition and, if necessary, courtroom testimony.
- ***Valuation of a distribution company:*** LEI was retained by a potential US acquirer of an Ontario municipal utility to advise on all aspects of distribution company valuation, including implications of PBR in Ontario, potential for revenues from unregulated businesses, other revenue and profit drivers, and on financial and corporate structure.
- ***Workshop on power sector asset valuation:*** LEI arranged for the Development Bank of Japan a workshop on power sector asset valuation to demonstrate the analytic techniques required to value assets in the context of deregulation in Japan, and created a model to show the impact of privatization on key power sector assets. In order to provide some practical application of the methodology employed, LEI used examples of assets similar to those held by J-Power (Electric Power Development Corporation). Where appropriate, case studies from other countries were included.
- ***Valuation of overseas generation and distribution assets:*** LEI provided a preliminary valuation of various overseas generation and distribution assets located in the Caribbean and

the Philippines. LEI prepared for each international entity owned by the specified company: 1) plant by plant summary pro-forma financial models of plant cash flow; 2) where available, public financial statements and projections prepared by the subsidiary; 3) regulatory documents related to the assets or subsidiaries; 4) summary terms and conditions of the major power purchase agreements relating to subsidiary power plants; 5) copies of major power purchase agreements; 6) narrative description of major issues regarding each asset and/or entity. LEI also prepared a narrative report, including the items above and the following summary data: valuation summary for each subsidiary, composed of asset-by-asset valuations for discounted cash flow methods; description of the valuation methods and assumptions; cash flow summary for each subsidiary; and summary of potential buyers/IPO process and any activity to date

- ***Proposed transmission line valuation:*** LEI conducted for a Canadian industrial conglomerate an indicative valuation of a proposed new transmission line. LEI forecasted the revenues associated with the project and combined this revenue forecast with the estimated costs of the project to arrive at an estimate of the net present value of the project and return on investment.
- ***Columbia generation portfolio analysis:*** LEI was hired by an electric operator for the purposes of valuing a portfolio of generating assets in Colombia. LEI's scope of work consisted of a comprehensive review of the Colombia energy market (including fuel and power market drivers), describing in details the functioning of both wholesale power market and firm energy market (capacity market), and developing 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.
- ***Re-contracting environment for power plants:*** On behalf of a private equity fund, LEI conducted an assessment of the re-contracting environment for gas plants in Ontario and Saskatchewan over the next 15 years. The engagement focuses on reviewing the historic contracting of gas/thermal assets, the relevant political and regulatory context and outlook with respect to carbon targets and emissions performance standards, the need for gas plants as part of the supply mix, locational value in alleviating congestion and valuation of energy, capacity, ancillary service and export revenue streams
- ***Evaluation of investment in new generation asset:*** LEI was asked by the client to assist with the evaluation of an investment in a new gas-fired power project in Alberta (the "Project"). LEI created a Baseline forecast for the Alberta market to allow the client to evaluate the energy & capacity market dynamics in the Province, which was paired with detailed reporting for the financial and operational details for the client's project. In addition, LEI also created two sensitivities to assess the upside and downside case associated with the Baseline.
- ***Evaluation of a major US utility:*** LEI supported a UK power generator's due diligence effort associated with an acquisition attempt for a major Southeastern US utility, including valuation, regulatory risks, and political analysis. LEI's analysis included an assessment of

the regulations that the company operated under as a regulated utility and a review of the rate base. The team also evaluated the political climate and operating strategy of the company, its outstanding trading book, existing power purchase agreements, and supply obligations. The engagement included indicative valuation of each of the company's business lines, and extensive interaction with deal team members. LEI also analyzed the potential for the Kentucky Public Service Commission to allow LG&E to utilize alternative ratemaking methods in its tariff, as well as utility ratebase settlements in neighboring states.

- **Market advisor for the purchase of generation assets:** LEI served as lead market advisor for a utility in its successful bid for New York coal-fired assets. LEI developed electricity and capacity forecasts for the New York power market, a long-term outlook on the functionality of market rules, and an evaluation of the generation portfolio. LEI assisted in the assessment of various fuel management strategies and relative value of joint venture/power purchase agreements. LEI participated throughout the financing process, walking members of the financial community through the detailed analysis during ratings agency presentations and the roadshow to investors and analysts.
- **Asset valuation and due diligence support:** LEI was engaged by an investment firm in association with asset valuation, due diligence support and market analysis. Work involved reviewing documents in a virtual data room, and analysis related to drivers of gross margin for the asset: macroeconomics, weather fluctuations, fuel and electricity cost projections, and overview of gas and electricity market in the region where the asset was located.

## 5.6 Testimony experience

LEI has a proven track record advising regulatory bodies on wide range of topics and presenting its expertise as expert witnesses on behalf of the commission staff and intervenors. The following are a sample of recent engagements involving regulatory matters and preparation of public testimony.

- **Served as testifying expert for the Maine Public Utilities Commission:** LEI performed analysis and provided testimony 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 #2015-00071). LEI reviewed and evaluated proposals for firm natural gas transportation service by pipeline developers and 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. LEI 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 served as an expert witness in the proceedings.
- **Served as independent testifying expert on the role of Enbridge Line 3 in heavy and light crude oil supplies:** LEI 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). LEI assessed another witness's testimony which relied on a detailed linear-

programming model of the North American oil pipeline system. LEI provided written testimony; responded to interrogatory requests, provided written surrebuttal, and provided oral testimony

- ***Served as an independent monitor on behalf of the Utah Public Service Commission:*** LEI was part of a consortium serving as the independent monitor on behalf of the Utah Public Service Commission (“UT PSC”) for a PacifiCorp renewable solicitation process. This process included: review of the solicitation process, documents, and modeling methodologies; monitoring, auditing, and validation of bid evaluation process; bid evaluation; and contract negotiation. Final report and testimony were filed with the UT PSC [Public Utility Commission of Oregon, Docket No. UM1368].
- ***Acted as the fairness monitor for Ontario Power Authority’s (“OPA”) evaluation of “launch period” feed-in tariff (“FIT”) applications:*** The team aided in the design of the evaluation framework and provided on-going support during the evaluation process. LEI prepared a final report that outlined LEI’s opinion as to the fairness of the overall process.
- ***Served as an independent monitor for Entergy New Orleans:*** LEI was engaged to act as the independent monitor for Entergy New Orleans’ solicitation of a Third Party Administrator to implement and deliver conservation and demand management programs on behalf of the utility. LEI oversaw the bid receipt, as well as the review and selection process. LEI provided a final report outlining the fairness of the overall process.
- ***Served as auction monitor for Connecticut Department of Public Utility Control (“CT DPUC”) Transitional Standard Offer:*** LEI was hired by DPUC to oversee the Transitional Standard Offer (“TSO”) auction by Connecticut Light and Power (“CL&P”) for its load (more than 5,000 MW peak demand) in 2005 and 2006. The scope of the project included approving the RFP and communication protocol, participating in all bidder calls and negotiations, analyzing the New England market and developing scenarios for likely bids, and verifying CL&P’s decision-making process for selecting winning bids. LEI also provided testimony to the DPUC based on its assessment of the auction process and its accordance with DPUC principles of competition.
- ***Expert testimony before FERC related to Shell Energy’s sale of capacity commitments :*** In 2009-2010, LEI team provided expert testimony before FERC related to Shell Energy’s sale of capacity commitments from facilities in New York to New England in an alleged market manipulation case. LEI team examined market rules, operating procedures, and pricing arrangements in New England and New York at the time of the investigation, and examined the participation of Shell in the capacity markets and compliance offers in the energy markets, commenting on the economic rationale behind the client’s must offer strategies in the energy market for capacity compliance. [EL09-48-000]
- ***Confidential FERC investigation in 2009-2010 of market manipulation in New England:*** LEI team assisted the client with certain matters pertaining to a FERC investigation. Specifically, the scope of this retention included economic and market analysis in support of a market participant in ISO New England’s day ahead load response program (“DALRP”). The LEI team also provided affidavits and deposed in connection with FERC investigation of behind-



the-fence industrial generator and participation in a wholesale power market in New England. The LEI team helped the client to respond to assertions of market manipulation and estimate market benefit provided through its participation in the demand response program.

- ***Standard Market Design in ERCOT:*** LEI examined issues related to the FERC's Standard Market Design and its implications for ERCOT and TXU. We assisted in the preparation of comments for submission to FERC. In the course of producing these comments, we evaluated specific proposals and benchmarked them against best practices worldwide. (2002)
- ***ISO-NE tariff design:*** LEI submitted testimony on behalf of ISO New England to the FERC to help defend ISO New England's self-funding tariff. LEI first defined the basic underlying economic principles for specifying the tariff, and then undertook to show how the tariff should be applied to various system users. The engagement involved an intensive financial modeling effort and frequent interaction with stakeholders. (2000) [ER01-316-000]
- ***Triennial market power analysis (southeast region):*** in support of a client's application to renew market-based rate authorization under the provision of FERC, LEI performed Pivotal Suppliers Analysis and Market Share Analysis for the Entergy balancing authority area. (2011) [ER97-4281 et al.]
- ***Triennial market power analysis (northeast region):*** in support of a client's application to renew market-based rate authorization under the provision of FERC, LEI performed Pivotal Suppliers Analysis and Market Share Analysis for the Northeast region, including New England, New York, PJM as well as the Connecticut, NYC and PJM East submarkets. (2011) [ER97-4281 et al.]
- ***Triennial market power analysis (northeast region):*** in support of a client's application to renew market-based rate authorization under the provision of FERC, LEI performed Pivotal Suppliers Analysis and Market Share Analysis for the Northeast region, including New England, New York, and PJM. (2011) [ER10-2895 et al.]
- ***Buyer market power analysis and vertical market power analysis:*** in support of a client's opposition of a proposed electric transmission and distribution utility merger in the Northeast US, LEI analyzed the potential competitive market effects on a vertical scale and considered the extent of buyer market power for the purchase of standard service (full requirements) products. LEI supported the client at FERC [EC11-35-000].<sup>3</sup> (2010-2011)
- ***Merger-related market power analysis:*** LEI evaluated the PJM market and considered the competitive effects of the proposed merger of FirstEnergy and Allegheny, in light of current and evolving market conditions for PJM West area. LEI's analysis contributed to the negotiated, confidential settlement between certain parties. (2010) [EC10-68-000]
- ***Updated market power analysis:*** prepared for a US utility's triennial review of market-based rate authorizations for certain subsidiaries in the northeast region. LEI analyzed the company's market power in PJM and ISO-NE. (2010) [ER98-4159 et al.]

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<sup>3</sup> LEI's white paper was not filed with FERC but was relied upon by the client when they filed protest.

- **Section 203 and 205 analysis in support of NRG's acquisition of certain Dynegy assets in CAISO and ISO-NE:** LEI was engaged to provide testimony in support of a proposed acquisition. LEI performed a Delivered Price Test ("DPT") for CAISO and ISO-NE energy markets as well as a standalone Herfindahl-Hirschman Index ("HHI") analysis for the capacity markets. In addition, LEI discussed the impact of the acquisition of the ancillary services markets. (2010) [EC10-88-000]
- **Section 203 and 205 analysis in support of an asset acquisition in the Entergy control area:** LEI was engaged to provide testimony in support of a proposed acquisition in Entergy's control area. LEI conducted a change in HHI analysis as well as an analysis of the acquirer's net load position for a Section 203 filing. LEI also conducted the Section 205 analysis and showed that with the acquisition, the client still passes the pivotal supplier and market share screens. (2010) [EC10-86-000]
- **Updated market power analysis:** prepared for a US IPP's triennial review of market-based rate authorizations for certain subsidiaries in the southwest region. LEI analyzed the company's market power in CAISO. (2010) [ER99-115 et al.]
- **Critique of market power allegations in California during the Energy Crisis:** LEI is serving as advisor to a Canadian-based electricity supplier related to allegations of market power abuse during the California crisis period; LEI has been examining and critiquing the underlying analysis for the related cases at FERC now on remand from the US Court of Appeals, as well as the new complaint filed by the California parties. (2010) [EL01-10-000 et al.]
- **Preparation of analysis for generation market power under FERC's indicative screens for market-based rate authorization:** in support of the acquisition of a 21 MW photovoltaic solar facility, LEI performed an updated market power analysis for acquirer's affiliates in the California ISO which have been granted market-based rate authorization, and prepared the related Section 203 filing. (2010) [ER10-204-000]

## 6 Project team

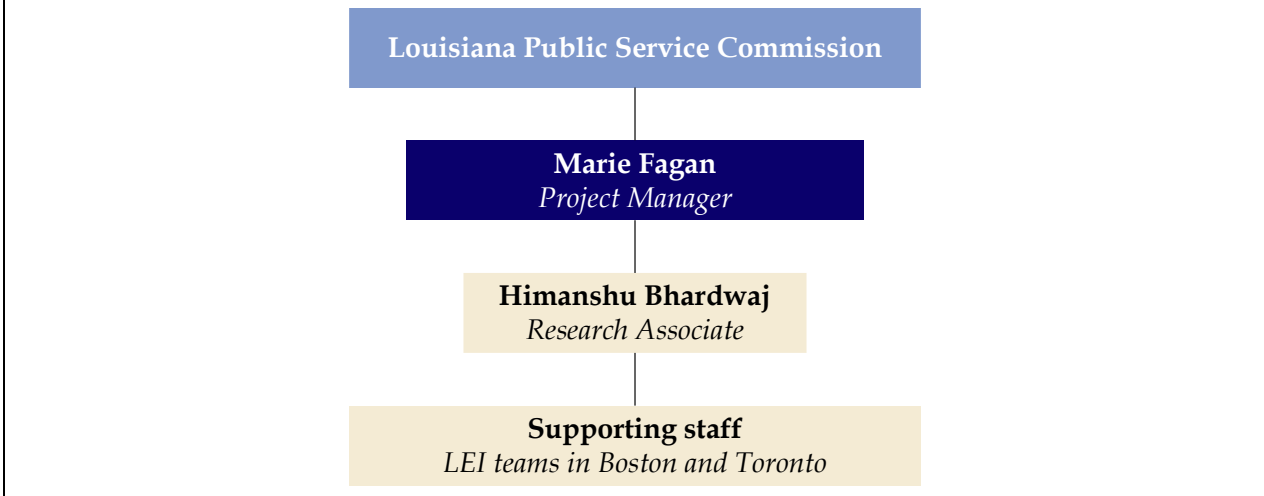
Based on the requirements of the engagement, LEI has gathered a select team of talented and dedicated professionals with the required qualifications to assist LPSC in the review of ELL Viability Study of Legacy Gas Assets. The team possesses considerable independent assessment expertise, understanding of ratemaking and utility accounting, analytical and technical capabilities, and strong understanding of power markets, including in MISO.

There will be two key personnel assigned to this project. Additional staff members and resources will be available for this project on an as-needed basis. Key staff members assigned are as follows:

- *Marie Fagan, Chief Economist*
- *Himanshu Bhardwaj, Research Associate*

*Marie Fagan* will be charged with the overall responsibility for this project and will act as Project Manager should LEI be selected as the technical consultant for LPSC. *Himanshu Bhardwaj* will focus on research tasks as a core team member. In addition, LEI staff in Toronto and Boston will provide additional support as needed.

**Figure 9. Proposed LEI team organization chart**



### 6.1 Brief bios of key staff assigned to the project

**Marie N. Fagan, PhD** is Chief Economist at LEI. With over 25 years of experience in research and consulting for the energy sector, Dr. Fagan’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 C-suite industry clients, buy-side and sell-side financial clients, as well as legislators and regulators, including LPSC; she has also served as an expert witness throughout jurisdictions in North America. At LEI, Dr. Fagan’s expertise across electricity markets and fuels provides integrated perspectives and supports sound strategic advice for clients. Dr. Fagan directs LEI’s research of the Electric Reliability Council of Texas (“ERCOT”) electric power market and has extensive experience working with clients in the MISO, PJM, NYISO, and ISO-NE.

Dr. Fagan draws on her long-time experience advising clients based on an integrated understanding of market rules and practices. Recent projects have included engagements where Marie provided expertise in the areas of energy system and market planning/analysis; renewable and conventional energy generation; solicitations; project economics and financing. Dr Fagan has participated in formula-based ratemaking dockets and led multi-year audits of vertically integrated utilities. Accordingly, Dr. Fagan's experience encompasses the support areas in which LPSC is seeking assistance.

**Himanshu Bhardwaj** is a Research Associate at LEI where he supports the firm's technical engagements with regulators, utilities and private equity firms on issues regarding market design, project evaluations, and wholesale price analysis. Himanshu recently joined LEI after completing graduate studies at Columbia University, NY. Himanshu very broad strategy consulting experience spanning multiple industries and countries, including advising government entities and investors on broad range of financial modeling and analysis topics.

Full CVs of the key team members are available in Section 7.

## 7 CVs of key experts

Marie N. Fagan, PhD



### *Chief Economist*

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#### **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.

At LEI, Marie's expertise across electricity markets and fuels provides integrated perspectives and supports sound strategic advice for clients. She has experience as a project manager for complex, multi-year engagements, including a two-year project for the Maine Public Utilities Commission in 2014-2016, and a two-year project for the Mississippi Public Service Commission in 2017-2019. She has deep experience in econometric analysis.

Marie leads LEI's engagements related to oil and natural gas market analysis. She directs gas pipeline modeling efforts based on a sophisticated network model, supporting outlooks for natural gas prices and basis, and analysis of flows on North American interstate pipelines. She provides in-depth expert testimony on issues such as basis differentials, pipeline capacity and utilization in key regions, and LNG import and export supply and demand. Projects have included serving as independent market expert for the Maine Public Utilities Commission, in the evaluation of the costs and benefits of new natural gas pipelines into New England, and independent market expert 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, New England Women in Energy and Environment, and the Boston Economic

Club. She is Vice President of Business for the US Association for Energy Economics. 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:	<b>London Economics International LLC ("LEI")</b>
Position:	Chief Economist (2020-present) Managing Consultant and Lead Economist (2016-2019) Managing Consultant (2014-2015)

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

Position:	<p>Senior director, Upstream Strategy Advisory service (2012-2014).</p> <ul style="list-style-type: none"> <li>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</li> </ul> <p>Senior director, North American Gas, Power, and Renewables group (2007-2011).</p> <ul style="list-style-type: none"> <li>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</li> </ul> <p>Director/Senior director, CERAVIEW Institutional Investor Service (2004-2007)</p> <ul style="list-style-type: none"> <li>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, <i>Investors' Energy Monthly</i>, and served as publication's executive editor. In this role, won the IHS Circle of Excellence Award in 2005</li> </ul> <p>Director, North American Gas Advisory service (2003-2004)</p> <ul style="list-style-type: none"> <li>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.</li> </ul>
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Date:	2001-2002
Location:	Boston, MA
Company:	<b>International Human Resources Development Corporation ("IHRDC")</b>
Position:	<p>Director, International Gas Program</p> <ul style="list-style-type: none"> <li>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.</li> </ul>

Date:	1996-2001
Location:	Cambridge, MA
Company:	<b>CERA</b>
Position:	<p>Associate director, Global Oil advisory service (1999-2001)</p> <ul style="list-style-type: none"> <li>• Authored original research reports, responsible for client presentations and the management, execution, and delivery of consulting projects.</li> </ul> <p>Associate, Global Oil advisory service (1996-1998)</p> <ul style="list-style-type: none"> <li>• Developed and maintained IHS CERA's expertise in exploration and production costs, technology, and financial factors affecting the upstream oil and gas industry.</li> </ul>

Date:	1994-1996
Location:	Washington, DC
Company:	<b>US Department of Energy, Energy Information Administration</b>
Position:	<p>Economist</p> <ul style="list-style-type: none"> <li>• 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.</li> </ul>

Date:	1989-1994
Location:	Vienna, Virginia
Company:	Decision Analysis Corporation of Virginia (DAC)
Position:	<p>Research associate/ Associate</p> <ul style="list-style-type: none"> <li>• 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 Energy Demand Model; conducted financial analysis of energy companies.</li> </ul>

Date:	1988
Location:	Washington DC
Company:	US Department of Energy, Office of Policy, Planning and Analysis
Position:	<p>Intern</p> <ul style="list-style-type: none"> <li>• Researched waste-to-energy potential in the United States; constructed a database, developed econometric models, analyzed results and produced written reports.</li> </ul>



## RECENT PROJECT EXPERIENCE:

<i>Date:</i>	August 2020 - present
<i>Location:</i>	Louisiana
<i>Organization:</i>	Louisiana Public Service Commission
<i>Description:</i>	<b>Audit of fuel adjustment clause for Entergy Louisiana</b> 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.

<i>Date:</i>	July 2020 - present
<i>Location:</i>	Louisiana
<i>Organization:</i>	Louisiana Public Service Commission
<i>Description:</i>	<b>Audit of fuel adjustment clause for Cleco Power</b> 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.

<i>Date:</i>	June 2020 - present
<i>Location:</i>	Ohio
<i>Organization:</i>	Public Utilities Commission of Ohio
<i>Description:</i>	<b>Audit of PSR of Duke Energy</b> LEI was engaged by the Public Utilities Commission of Ohio, to perform an audit of the Price Stabilization Rider ("PSR") of Duke Energy. Aspects of the audit included assessing the reasonableness and prudence 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 prudence of fuel purchases. LEI also audited charges and true ups related to the company's quarterly PSR filings. Marie supervised and directed the audit.

<i>Date:</i>	May 2020 - present
<i>Location:</i>	Ohio
<i>Organization:</i>	Public Utilities Commission of Ohio
<i>Description:</i>	<b>Audit of AEP Ohio OVEC PPA</b> LEI was engaged by the Public Utilities Commission of Ohio, to perform an audit of the PPA Rider of AEP Ohio in it purchase of energy from the Ohio Valley Electric Company ("OVEC"). Aspects of the audit included assessing the reasonableness and prudence 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 prudence of fuel purchases. LEI also audited charges and true ups related to the company's quarterly PPA filings. Marie supervised and directed the audit.

<i>Date:</i>	April 2020 - May 2020
<i>Location:</i>	North Dakota
<i>Organization:</i>	Law firm

<i>Description:</i>	<b>Impacts of the potential shutdown of the Dakota Access pipeline (“DAPL”)</b> 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: <a href="https://earthjustice.org/sites/default/files/files/3154-525_declarations-in-support-of-standing-rock.pdf">https://earthjustice.org/sites/default/files/files/3154-525_declarations-in-support-of-standing-rock.pdf</a>
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<i>Date:</i>	February 2020 - present
<i>Location:</i>	Louisiana
<i>Organization:</i>	Louisiana Public Service Commission
<i>Description:</i>	<b>Rulemaking to study renewable energy tariff, aka “green tariff” options</b> 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 consultative services for the Commission.

<i>Date:</i>	January 2020 – June 2020
<i>Location:</i>	Massachusetts
<i>Company:</i>	Massachusetts Office of the Attorney General
<i>Description:</i>	<b>Application for firm transportation on a gas pipeline</b> 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.

<i>Date:</i>	November 2019
<i>Location:</i>	Japan
<i>Organization:</i>	Private equity investor
<i>Description:</i>	<b>Long-term outlook for Japan electricity sector</b> 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.

<i>Date:</i>	October 2019 – November 2019
<i>Location:</i>	ERCOT

<i>Organization:</i>	European investor-owned utility
<i>Description:</i>	<b>Investment environment for transmission in ERCOT</b> 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.

<i>Date:</i>	July 2019 - August 2019
<i>Location:</i>	Alberta, British Columbia
<i>Organization:</i>	Counsel for natural gas producer
<i>Description:</i>	<b>Analysis of Western Canadian natural gas costs and production</b> 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.

<i>Date:</i>	May 2019 - August 2020
<i>Location:</i>	Massachusetts
<i>Organization:</i>	Investor-owned gas distribution utility
<i>Description:</i>	<b>Econometric benchmarking analysis of gas utility performance</b> LEI was engaged by an investor-owned local gas distribution company to support its 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 appropriate stretch factor. The benchmarking report was used by counsel to develop the company's strategy for the rate filing. Marie served as a testifying witness.

<i>Date:</i>	June 2019- December 2019
<i>Location:</i>	Ontario
<i>Organization:</i>	Generating company
<i>Description:</i>	<b>Benchmarking generation utility performance</b> 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.

<i>Date:</i>	October 2018 - April 2018
<i>Location:</i>	United States, ISO-NE
<i>Company:</i>	Massachusetts Office of the Attorney General

<i>Description:</i>	<b>Winter fuel reliability/electric power market design</b> 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).
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<i>Date:</i>	February 2018 - December 2018
<i>Location:</i>	Global
<i>Company:</i>	Columbia University School of International and Public Affairs, Center on Global Energy Policy
<i>Description:</i>	<b>Econometric analysis of crude oil price and income elasticities of demand</b> 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. LEI's results were provided in a comprehensive report titled "Oil demand: Up the down staircase," which underwent academic review outside of CGEP. The report will be published by CGEP.

<i>Date:</i>	September 2018-December 2018
<i>Location:</i>	United States, ISO-NE
<i>Company:</i>	Maine Public Utilities Commission
<i>Description:</i>	<b>Avoided energy supply costs</b> 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.

<i>Date:</i>	June 2018-December 2018
<i>Location:</i>	United States, PJM

<i>Company:</i>	Public Utilities Commission of Ohio
<i>Description:</i>	<b>Management performance and financial audit of large utility</b> 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.

<i>Date:</i>	March 2018 - September 2018
<i>Location:</i>	United States, MISO, Michigan
<i>Company:</i>	NGO
<i>Description:</i>	<b>The role of Enbridge Line 5 in NGLs and crude oil transport in Michigan</b> 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

<i>Date:</i>	July 2017-June 2018
<i>Location:</i>	United States, MISO, Minnesota
<i>Company:</i>	Minnesota Department of Commerce
<i>Description:</i>	<b>Role of Enbridge Line 3 in heavy and light crude oil supplies</b> 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.

<i>Date:</i>	June 2017-December 2018
<i>Location:</i>	United States, MISO, Mississippi
<i>Company:</i>	Mississippi Public Service Commission
<i>Description:</i>	<b>Management audit of large vertically integrated utility</b> 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 prudence 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.
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<i>Date:</i>	November 2018 - February 2018
<i>Location:</i>	WECC
<i>Company:</i>	PacifiCorp
<i>Description:</i>	<b>Independent evaluator ("IE") for energy procurement</b> 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 a review of the initial shortlist evaluation and scoring, and the filing of status reports and the final IE closing report.

<i>Date:</i>	April, May 2017
<i>Location:</i>	United States and Canada
<i>Company:</i>	Private client
<i>Description:</i>	<b>Review of investable energy sectors</b> 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.

<i>Date:</i>	March 2017
<i>Location:</i>	Alberta, Canada
<i>Company:</i>	Private client
<i>Description:</i>	<b>Analysis of capacity markets</b> 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.

<i>Date:</i>	February 2017
<i>Location:</i>	North America
<i>Company:</i>	Provider of services to vehicle fleet industry
<i>Description:</i>	<b>Outlook for electrification of transportation</b> 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.
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<i>Date:</i>	December 2016
<i>Location:</i>	Alberta, Canada
<i>Company:</i>	Private client
<i>Description:</i>	<b>Analysis of capacity markets</b> 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.

<i>Date:</i>	September 2016
<i>Location:</i>	Northeast United States
<i>Company:</i>	Private client
<i>Description:</i>	<b>Examination of solar business models</b> 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.

<i>Date:</i>	October 2016-November 2016
<i>Location:</i>	California, Kansas
<i>Company:</i>	Law firm
<i>Description:</i>	<b>Support for counsel in contested matter</b> 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 opposing counsel's expert's methodology. Marie proposed an alternative, more accurate methodology for valuing the green attributes of LFG, based on market fundamentals driven by the California RPS requirements.

<i>Date:</i>	August 2016-October 2016
<i>Location:</i>	Maine

<i>Company:</i>	Maine Public Utilities Commission
<i>Description:</i>	<b>Macroeconomic impact of biomass generation</b> 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.

<i>Date:</i>	May 2016
<i>Location:</i>	ERCOT/Texas
<i>Company:</i>	Private client
<i>Description:</i>	<b>Examination of ancillary services</b> 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.

<i>Date:</i>	April 2016-May 2016
<i>Location:</i>	ERCOT/Texas
<i>Company:</i>	Renewable power investor
<i>Description:</i>	<b>Due diligence in ERCOT</b> 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).

<i>Date:</i>	June 2014-April 2016
<i>Location:</i>	Maine
<i>Company:</i>	Maine Public Utilities Commission
<i>Description:</i>	<b>Project manager and testifying expert</b> 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 #2015-00071). 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



	<p>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.</p>
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<i>Date:</i>	November 2015-December 2015
<i>Location:</i>	US Northeast
<i>Company:</i>	Renewable power developer
<i>Description:</i>	<p><b>Due diligence for assets in ISO-NE (Maine)</b>  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</p>

<i>Date:</i>	October 2015-November 2015
<i>Location:</i>	ERCOT/ Texas
<i>Company:</i>	Private equity company
<i>Description:</i>	<p><b>Due diligence for assets in ERCOT</b>  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.</p>

<i>Date:</i>	July 2015
<i>Location:</i>	North America/United Kingdom
<i>Company:</i>	UK Department of Energy and Climate Change
<i>Description:</i>	<p><b>Examination of design of auctions</b>  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.</p>

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

<i>Date:</i>	April 2015
<i>Location:</i>	Connecticut; New Jersey
<i>Company:</i>	Private equity company
<i>Description:</i>	<b>Outlook for natural gas prices</b> 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.

<i>Date:</i>	August 2014 - January 2015
<i>Location:</i>	North America
<i>Company:</i>	Private client
<i>Description:</i>	<b>Monthly energy market reports</b> 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 <sub>2</sub> . 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.

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

<i>Date:</i>	April-June 2014
<i>Location:</i>	US Midwest
<i>Company:</i>	Private equity company
<i>Description:</i>	<b>Due diligence for asset in PJM</b> 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.

<i>Date:</i>	June 2014
<i>Location:</i>	North America
<i>Company:</i>	Law firm
<i>Description:</i>	<b>Examination of FERC policies and practices</b> 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.

<i>Date:</i>	April-May 2014
<i>Location:</i>	Nova Scotia
<i>Company:</i>	Government of Nova Scotia
<i>Description:</i>	<b>Organization of energy system</b> 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 AND CONTRIBUTIONS:**

### **Selected recent webinars and conferences**

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 Fall Conference (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**

Fagan, Marie. "Up the Down Staircase: What History Teaches Us about Oil Demand after a Crisis" (May 4, 2020). USAEE Working Paper No. 20-440. Available at SSRN: <https://ssrn.com/abstract=3592443>

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](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





**From:** 2010  
**Employer:** Deloitte & Touche (Deloitte Consulting & Monitor Deloitte)  
Senior Associate, Strategy

**From:** 2008  
**Employer:** Frost & Sullivan  
Consultant, Strategy

**From:** 2005  
**Employer:** Standard & Poor's  
Senior Associate, Fixed Income and M&A

## **RECENT PROJECT EXPERIENCE:**

The projects briefly described below are typical of the work Himanshu Bhardwaj has performed.

### **Energy related studies**

- *Drafted 8 MOUs resulting in over US\$250MN in investment through an improved market access and investor relations strategy, economic impact assessment, and privatization for a major downstream (oil & gas) industrial city.* Himanshu led the investor participation strategy for a leading national oil company's downstream activity in an industrial city in Middle East.
- *Advised a leading public sector utilities company on tariff mechanism review for commercial and residential sector.* The study involved various scenario assessments across demand - supply gaps in peak loads and non-peak loads seasons. Further, digitization of meters and billing processes was included as a part of the strategy implementation.
- *Yielded a multimillion-dollar cost optimization strategy for a major oil company by drafting a 10-year business plan.* Himanshu co-managed the study during the 2014-2015 oil crisis, by optimizing multiple variable cost drivers (such as opex, margins, taxes, and forex), translating into a 1.25% overall cost savings.
- *Supported a leading oil and gas exploration company in increasing revenues 10x by drafting a successful growth strategy.* Identified offshore exploration projects in Asia Pacific alongside supply chain and logistics requirements and introduction with various refineries and downstream players along the value chain.

### **Various public sector & infrastructure studies**

- *Identified revenue growth opportunities of appx. 500% for a leading civil aviation authority by reorganizing through a privatization strategy after decades of sustainable losses.*

- *Orchestrated and presented a multi-billion private sector participation plan to a government healthcare authority, covering national healthcare infrastructure and healthcare insurance, impacting over 30 million citizens.*
- *Implemented a digital strategy for a leading telecommunication and infocom authority with an estimated economic impact of US\$100MN through a 'data monetization' opportunity covering ownership, privacy, and open data.*
- *Devised and launched a local content strategy and economic impact assessment for a major commerce and trade authority through opportunities worth US\$2BN by calculated expansions of their infrastructure, energy, and transportation sectors.*
- *Developed a multibillion-dollar portfolio strategy for a leading sovereign wealth fund covering a comprehensive social portfolio, including education, hospitals, social infrastructure, and low-to-mid-income housing assets.*
- *Remodeled the business plan of a tourism authority through private sector investment in tourism assets (national parks, attractions), positively impacting over 2 million citizens in the province and generating over US\$50MN in fiscal revenues.*
- *Overhauled the non-core postal delivery operations of a national postal agency through a US\$100MN privatization strategy that included establishing fulfillment center and banking operations, and transforming last mile delivery.*
- *Earned US\$500K in success fees on a PPP deal by delivering a privatization strategy for a Shanghai port authority.*
- *Achieved a 5% reduction in costs through reorganization and transformation of the healthcare regulator in Singapore.*
- *Partnered with a leading telecom regulator on a 3G rollout strategy and auction plan impacting over 200 million citizens.*