

ENBRIDGE ENERGY, LIMITED PARTNERSHIP

MINNESOTA PUBLIC UTILITIES COMMISSION

MPUC DOCKET NO. PL-9/CN-14-916  
OAH DOCKET NO. 11-2500-32764

DIRECT TESTIMONY OF RICHARD W. LICHTY, Ph.D.

January 31, 2017

1 **I. INTRODUCTION AND QUALIFICATIONS**

2

3 **Q. Please state your name.**

4 A. My name is Richard W. Lichty, Ph.D.

5

6 **Q. On whose behalf are you filing testimony?**

7 A. I am testifying on behalf of Enbridge Energy, Limited Partnership (“Enbridge”).

8

9 **Q. What is your area of expertise and qualifications?**

10 A. I am a Professor Emeritus from the University of Minnesota Duluth. I have been teaching  
11 economics since 1965. I have several peer reviewed articles, and I am the co-author of  
12 Urban Regional Economics: Concepts, Tools, Applications, a University Press textbook  
13 published by Iowa State University Press. I served as Acting Director of the Minnesota  
14 State Council on Economic Education, and as Director of the UMD Bureau of Business and  
15 Economic Research. Additional details regarding my experience and qualifications are  
16 attached as **Schedule 1**.

17

18 **II. ECONOMIC ANALYSIS**

19

20 **Q. What is the purpose of your testimony?**

21 A. The purpose of my testimony is to introduce the report titled “Report on the Economic  
22 Impacts Analysis for the Line 3 Replacement Project” dated January 31, 2017, attached as  
23 **Schedule 2** (the “Analysis”). Enbridge requested the Analysis to review the economic  
24 benefits that will accrue to the State of Minnesota through construction of the Line 3  
25 Replacement Project (“Project”). The Analysis provides a prediction of economic benefits  
26 from construction of the Project using an economic analysis tool known as an input-output  
27 model.

28

29 The Analysis is limited to the impacts of construction of the Project. The Analysis does not  
30 describe benefits within the petroleum marketplace. I worked with Julie Carey of Navigant  
31 Consulting in preparation of the Analysis. Additional detail concerning Ms. Carey’s  
32 qualifications is provided in **Schedule 3**.

33

34 **Q. What economic modeling tool did you use to create the Analysis?**

35 A. For the Analysis, an input-output modeling system known as IMPLAN was used to formulate  
36 predictions of the direct, indirect, and induced effects of constructing the Project. Input-  
37 output modeling is widely used to predict the effects of a series of complicated economic  
38 transactions.

39

40 **Q. What is your conclusion?**

41 A. As explained in more detail in my Analysis, I conclude that construction of the Project will  
42 have significant economic benefits to the Minnesota economy. The estimated Project  
43 construction cost for the portion located in Minnesota is approximately \$2.1 billion. This  
44 private investment in Minnesota is anticipated to be responsible for an estimated 13,604  
45 jobs,<sup>1</sup> \$864,721,326 in labor income, and total economic output of \$2,253,696,670. This is a  
46 very significant benefit for the State of Minnesota.

47

48 **Q. Does this conclude your direct testimony?**

49 A. Yes, it does.

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<sup>1</sup> Jobs are reported in terms of "FTE." FTE Employment refers to Full Time Equivalent Employment. FTE reflects part-time and full-time annual average jobs converted to full-time equivalent jobs. Employment is measured in terms of full-time equivalent jobs. If an employer hires a full-time employee to work 40 hours per week and a part-time employee to work 20 hours per week, the full-time worker and half-time worker combined would be counted as 1½ full-time equivalent jobs.

Richard W. Lichty, Ph.D.  
Professor Emeritus  
University of Minnesota Duluth

Telephone: Home: (218) 525-3449

Address:  
7522 Barrs Lake Road  
Duluth, MN 55803

I. Educational Background

Kansas State University Graduate Major Supporting Field	Ph.D. Degree Economics Sociology	1971
Kansas State University Graduate Major Minor Field	M.A. Degree Economics Sociology	1966

II. Professional Experience

Adjunct Professor Teaching Principles of Microeconomics & Macroeconomics– UMD and Lake Superior College	2010-2016
Research Director, UMD Bureau of Business and Economics Research	1993-2003
Morse-Alumni Distinguished Teaching Professor of Business and Economics University of Minnesota-Duluth	1996-Retirement 2007

III. Scholarly Research and Publications

A. Monographs

1. Expert testimony report, Enbridge proposed “Sandpiper” pipeline construction, “Local Economic Impacts Analysis of the North Dakota Pipeline Company LLC Sandpiper Pipeline Project”, July 2014.
2. Jim Skurla with Richard Lichty “Economic Impact: Mesaba Metals Copper and Nickel Mining in Northeast Minnesota, Mesaba Metals, LLC,“
3. “Tax Revenue Impacts and Marketing Northern Minnesota’s Iron Trail 2003,” Richard Lichty with Jim Skurla; also with Jean Jacobson, Malita Barkataki, and Amber Paukner. May 2003

4. "BWCAW Land Valuation Report 2003," Richard Lichty, Curt L. Anderson, and Jim Skurla; with research partners Minnesota Department of Natural Resources, University of Minnesota Natural Resources Research Institute, Ramsland & Vigen, Inc., and Tom Turner & Associates.
  5. "East Central Minnesota: Social and Economic Trends and Implications," with Jim Skurla and William Fleischman, February 2004.
  6. With Don McTavich, Matthew Poret, Jean Jacobson, "Northeast Minnesota Skills Assessment: Northeastern Minnesota Firm Survey II," UMD Bureau of Business and Economic Research Paper, 2000.
  7. With Jean Jacobson and others, "Hibbing Industries' Trends, Economic Base Update 1999 and Data Appendix," UMD Bureau of Business and Economic Research Paper #2000-1, January, 2000.
- B. Published Books or Chapters in Books
1. "Establishing a Value for Water", "Applying the Concept of a Multiplier to a Regional Economy", and "Economics and the Environment, The Reserve Mining Case", in John P. Blair, Wayne D. Carroll, and Richard W. Lichty, Current Regional Issues: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin, The Dryden Press (New York 1994), pp 45-72.
  2. Wilbur Maki and Richard Lichty, Urban Regional Economics: Concepts, Tools, Applications, 2000, (Ames) Iowa State University Press, ISBN 0813826799.
- C. Journal Articles and Proceedings
1. With Raymond Raab, "Identifying Subareas that Comprise a Greater Metropolitan Area: The Criterion of County Relative Efficiency", The Journal of Regional Science, Volume 42, Number 3, pp. 579 – 594, August 2002.
  2. With Kjell Knudsen, "Underemployment in the Northeast Minnesota", The Arrowhead Journal of Business, Volume 2, March, 2001.
  3. With Wayne Jesswein; Kjell Knudsen; and Donald McTavish, "Determining Demand for Skilled Workers in Northeast Minnesota, Economic Development Review, Volume 17, No. 3, Winter, 2001.
  4. With Wayne Jesswein and Carolyn Zanko, "Regional Workforce Needs and Training: The Case of Northeast Minnesota/Northwest Wisconsin," Rural America, Volume 16, Issue 1, May 2001.
  5. With Kjell Knudsen and Kathy Stewart, "Five Years of Public and Private Partnerships Conference Proceedings: A Typology, in Luiz Montanheiro and Margaret Linehan, (eds.) Public and Private Sector Partnerships: The Enabling Mix, (Proceedings of a Conference), Sheffield Hallam University Press, 2001.

6. With Kjell Knudsen, "Community Economic Development Strategic Planning: Growth and Development, a Case Study," in Luiz Montanheiro and Margaret Linehan, (eds.) Public and Private Sector Partnerships: The Enabling Mix, (Proceedings of a Conference), Sheffield Hallam University Press, 2000.
7. (41 Total)

IV. Honors and Awards

- 2001 Received outstanding paper award, International Conference on Public Private Partnerships
- 2001 Received Distinguished Service Plaque, Mid-Continent Regional Science Association
- 1999 Principal Investigator for Skills Assessment Project. Project received a Certificate of Commendation from Governor Arne Carlson
- 1999 Admitted to the University of Minnesota Academy of Distinguished Teachers
- 1993 Plaque for service as Program Chairperson, Mid-Continent Regional Science Association.
- 1991 Plaque for service as Acting Director, Minnesota Council on Economic Education at the Board of Directors' Meeting, October 17, 1991.

**Report on the Economic Impacts Analysis for the  
Line 3 Replacement Project**

January 2017

Richard W. Lichty, Ph.D, Professor Emeritus  
University of Minnesota Duluth

and

Julie M. Carey  
Navigant Consulting, Inc.

## I. Introduction

### A. Project Description

The Line 3 Replacement Project (“Project”) is the Minnesota portion of Enbridge Energy, Limited Partnership’s (“Enbridge”) broader replacement program to replace the existing Line 3 pipeline from Alberta, Canada, to Superior, Wisconsin. The Project includes the replacement of approximately 282 miles of the existing 34-inch diameter Line 3 pipeline with approximately 340 miles of 36-inch diameter pipeline and associated facilities between the North Dakota/Minnesota border and the Minnesota/Wisconsin border. The Project will cross Kittson, Marshall, Pennington, Polk, Red Lake, Clearwater, Hubbard, Wadena, Cass, Crow Wing, Aitkin, and Carlton counties. In Minnesota, the Project is anticipated to cost approximately \$2.1 billion, with construction anticipated to begin in 2018 and extend into 2019.

### B. Economic Impact Analysis and Authors

Enbridge requested that the authors of this report, Dr. Richard Lichty, Professor Emeritus, University of Minnesota Duluth and Julie Carey, Navigant Consulting (“Navigant”), undertake economic impacts analyses (the “Analysis”) to provide the Minnesota Public Utilities Commission (“MPUC”) with a forecast of the economic benefits that will accrue to the State of Minnesota from construction of the Project. The objectives of the Analysis summarized in the Report were to:

- 1) Quantify the economic impact from the construction of the Project on the regional Minnesota economy.
- 2) Assess the economic impact from the continuation of operation of the Project on the regional Minnesota economy.

The economic modeling data and software used was IMPLAN version 3. The Analysis used IMPLAN’s economic multiplier analysis and input/output modeling. Input-output economics is widely used by government agencies, corporate entities, and universities to study national economies and regional economies within a country and has been proven to be a useful tool for national and regional economic planning. Input-output modeling uses a mathematic representation of a region’s economy to predict the effect of changes in one industry on other, related regional industries. One of the primary uses of input-output is to estimate the economic impact of an event like the construction of a pipeline on all of the intertwined economic sectors in a specific geographic region. The Analysis relies on the most recent IMPLAN data available, 2015 (released December 2016). The results were adjusted to 2016 dollars to account for inflation. Ms. Carey and Navigant conducted the modeling and data analysis in coordination with Dr. Lichty. Dr. Lichty was involved in every phase of the Analysis, including the collection of input data, the use of the IMPLAN model in analyzing the data, and the evaluation of results using alternative IMPLAN methodologies.

Dr. Lichty began his university career in 1965 as a visiting instructor at Kansas State Teachers College in Emporia, Kansas. Dr. Lichty worked as a Graduate Research Assistant at Kansas State University, where he worked on the development of one of the early sub-national input-output tables for the State of Kansas under the direction of Professor M. Jarvin Emerson, a leader in regional economic modelling. Dr. Lichty has several peer reviewed articles to his credit and is the co-author of Urban Regional Economics: Concepts, Tools, Applications, a book



published by Iowa State University Press. Dr. Lichty served as Acting Director of the Minnesota State Council on Economic Education, as Director of the University of Minnesota Duluth Center for Economic Education, and as Director of the UMD Bureau of Business and Economic Research. Dr. Lichty was inducted into the University of Minnesota's Academy of Distinguished Teachers before retiring from the University of Minnesota in 2007.

Ms. Carey is an energy economist with Navigant Consulting. She has over 20 years of experience analyzing economic issues within the oil and gas, pipeline and broader energy industry. Ms. Carey routinely conducts macroeconomic analyses and quantifies the economic impact of the construction and operations of energy infrastructure, including natural gas and crude oil pipelines, power generation facilities, among others. She also routinely conducts economic analyses of oil pipelines including competition analyses for market-based rate proceedings, as well as other regulatory analyses and economic damages assessments within commercial disputes. Ms. Carey also analyzes energy economic issues within commercial and regulatory disputes for approximately 20 years and has provided expert reports and testimony before U.S. and Canadian regulatory agencies, U.S. courts, and before international arbitration tribunals on dozens of occasions. Ms. Carey has a Master's in economics with coursework in a Ph.D. economics program at Pennsylvania State University. She is an Adjunct Professor at Georgetown University where she teaches energy economics in the graduate economics program.

### **C. Executive Summary**

The Project will have significant economic benefits to Minnesota. The Project is a substantial undertaking that will result in significant private investment in the State. The estimated Project construction cost for the portion of the Project located in Minnesota is approximately \$2.1 billion. To place this number in perspective, the announced construction cost of the new Minnesota Vikings stadium was approximately \$1.1 billion.<sup>1</sup>

The key findings of the Analysis include:

1. Construction of the Project is expected to result in an estimated 13,604 jobs<sup>2</sup> in 2018 and 2019;
2. The Project is expected to create \$864,721,326 in labor income over the same time frame;

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<sup>1</sup> E.g., <http://www.vikings.com/stadium/new-stadium/by-the-numbers.html> (last accessed Jan. 21, 2017).

<sup>2</sup> For the purposes of this Report, jobs are reported in terms of "FTE." FTE Employment refers to Full Time Equivalent Employment. FTE reflects part-time and full-time annual average jobs converted to full-time equivalent jobs. Employment is measured in terms of full-time equivalent jobs. If an employer hires a full-time employee to work 40 hours per week and a part-time employee to work 20 hours per week, the full-time worker and half-time worker combined would be counted as 1½ full-time equivalent jobs. Labor income is the incremental wages associated with the employment. Value added by an industry is the total income generated within that industry and equals the sum of: (1) wages, salaries, and benefits; (2) profits of the industry; (3) depreciation; (4) net interest paid; (5) excise taxes paid; and (6) business transfer payments (mostly bad debt). Value added by an industry is also equal to the value of the goods and services sold by the industry less the value of goods and services purchased from other industries. Economic output reflects the sum of gross sales revenues resulting from the economic activities associated with the Project.

3. The Project is expected to create total economic output of \$2,253,696,670; and
4. Operation of the Project will continue Enbridge's investment in Minnesota and provide ongoing economic benefits. For example, Enbridge anticipates hiring additional full time employees to operate the Project.

## **II. Methodology**

### **A. Background to Economic Impact Analyses**

The development of energy infrastructure such as the Project causes a swell of economic activity associated with purchasing goods and services for construction and delivers future goods and services that help the regional and national economy in many ways. Positive economic impacts are also sometimes referred to as economic benefits, as they represent positive contributions to the economy.

The most common economic impact generally quantified and discussed are employment-related benefits such as jobs. Further, the Project provides an additional economic benefit to the economy related to the quality of jobs created.

Another economic benefit statistic is the additional tax revenues from the Project, which provides government agencies with increased revenues aiding fiscal budgets to assist with ongoing operations and economic initiatives. Two remaining economic benefit statistics include gross domestic product ("GDP") and economic output. These statistics are aggregate measures of economic activities.

Further, the economic activities from the Project create a positive ripple effect through many sectors of Minnesota's economy. This occurs because industries are dependent on other industries in order to operate. First, an action (such as construction of the Project) creates direct effects, which are the specific economic benefits caused directly by that action. For the Project, the direct spending occurs because Enbridge must hire local labor, purchase needed professional services and equipment and other supplies from Minnesota businesses to construct the pipeline. These economic activities create a "direct economic benefit."

Professionals and material and equipment suppliers must, in turn, purchase goods and services from the local economy to produce their own goods and services. For example, a local business supplying Enbridge with construction materials, such as gravel or fuel, will use some of the money received from that sale to pay its employees. Those employees, in turn, spend their money purchasing goods and services in the community. These additional purchases enhance economic activity to further extend industries and provide an extra benefit to the economy, and they are referred to as "indirect economic benefits."

In addition, an "induced economic impact" to the economy results from additional spending on general discretionary items that arise from the higher wages and personal income earned by local employees in the direct and indirect industries that received additional business activity from the Project. When employees receive additional disposable income, an increase in discretionary spending on merchandises (e.g., clothes and electronics) and services (e.g., entertainment activities including dinners) occurs. The resulting effect is that the local economy receives an induced economic benefit.

The overall economic impact arising from the construction and operation of a proposed energy infrastructure project equals the sum of its direct, indirect, and induced effects. For new energy infrastructure projects, economic impact analyses are frequently completed for the construction phase of the project and the ongoing operational phase of the project.

## **B. Input-Output Methodology Using IMPLAN**

As discussed above, the Analysis relies on IMPLAN, an economic modeling and software data package. IMPLAN is widely used with over 2,000 public and private clients currently utilizing its features. Here in Minnesota, IMPLAN is used by the Minnesota Department of Agriculture, the Minnesota Office of the Legislative Auditor, the Minnesota Pollution Control Agency, universities, and federal agencies.<sup>3</sup>

IMPLAN is an input-output model that mathematically represents a region's economy to predict the effect of changes in one industry on other, related industries. Input-output modelling is widely used to predict the effects of a large series of complicated economic transactions. The IMPLAN database contains economic statistics organized by county, state, and zip code. This granularity of input data enables more accurate predictions by using data that is specific to each region, instead of using estimates from national averages.<sup>4</sup> These statistics are used to measure the effect of a given change or event on a regional or local economy.

IMPLAN's set of databases and algorithms are operated by a software package that enables specific data inputs under review (i.e., the Project's estimated construction costs) to be specifically analyzed. In turn, IMPLAN uses two primary systems to predict economic impacts. First, the social accounting system describes transactions between producers and intermediate and final consumers. As described by IMPLAN, the social accounting matrix "includes all commodity flows, not only purchases and production of sales of commodities, but transfer payments to and from institutions."<sup>5</sup>

The second system is a multiplier model. Multipliers describe the impact of a change. For example, an employment multiplier of 1.9 would suggest for every 10 employees hired in the given industry, 9 additional jobs would be added to the given economic region.

Use of both the social accounting and multiplier systems provides a clear picture of the economy in any given region. The economy's reaction to a defined event, such as the construction and operation of the Project, can then be modeled.

The Analysis of the Project utilized construction cost data provided by Enbridge. Enbridge's construction cost data was assigned to IMPLAN economic sectors (i.e., industries) for use in the Analysis. The construction cost data only includes spending on materials and services expected to occur to vendors located in the Minnesota regional economy. Therefore, expenditures were

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<sup>3</sup> Client list provided by IMPLAN Group LLC.

<sup>4</sup> IMPLAN data files use various federal government data sources, including but not limited to: U.S. Bureau of Economic Analysis Benchmark I/O Accounts of the U.S.; U.S. Bureau of Economic Analysis Output Estimates; U.S. Bureau of Economic Analysis REIS Program; U.S. Bureau of Labor Statistics County Employment and Wages (CEW) Program; U.S. Bureau of Labor Statistics Consumer Expenditure Survey; U.S. Census Bureau County Business Patterns; U.S. Census Bureau Decennial Census and Population Surveys; U.S. Census Bureau Economic Censuses and Surveys; and U.S. Department of Agriculture Crop and Livestock Statistics.

<sup>5</sup> IMPLAN User's Guide, Analysis Guide, Data Guide, MIG, Minnesota IMPLAN Group, 1999-2004, p. 74.

excluded when information from Enbridge indicated that materials or supplies would be purchased outside of Minnesota and delivered to the region to construct the Project. For example, because there is no pipe mill in Minnesota, Enbridge will not purchase pipeline from a Minnesota manufacturer, so the cost of the pipeline used to construct the Project in Minnesota is excluded from the Analysis.

This approach to quantifying economic benefits based on Enbridge's anticipated local spending to the Minnesota region based on its supply chain is a rigorous approach that provides a realistic estimate of the economic benefits from the Project. To the extent that Enbridge ultimately purchases additional material and services in the Minnesota region than it initially expected, the economic benefits results are conservative.

The Analysis of the Project includes the direct, indirect, and induced effects. The overall economic impact arising from the construction and operation of the Project equals the sum of its direct, indirect, and induced effects.

### **III. Analysis of the Economic Impacts of the Project in Minnesota**

#### **A. Minnesota's Economy**

Minnesota's GDP, i.e. the value of all finished goods and services produced, was \$328 billion in 2015.<sup>6</sup> Minnesota ranked 17<sup>th</sup> in the nation in growth of GDP between 2014 and 2015, and 3<sup>rd</sup> among the Plains and Great Lakes States,<sup>7</sup> behind Pennsylvania and South Dakota. Leading industries contributing to Minnesota's GDP growth include: Finance, Insurance, Real Estate, Rental, and Leasing; Professional and Business Services; Education Services, Health Care, and Social Assistance; Government; and Durable Goods Manufacturing. Minnesota's unemployment rate was 3.8% in November 2016, below the national average of 4.6%.<sup>8</sup> Minnesota's unemployment rate is the 12<sup>th</sup> lowest in the United States.<sup>9</sup> Minnesota's unemployment rate is 5<sup>th</sup> lowest out of the 14 Plains and Great Lakes States, behind North Dakota, Nebraska, Iowa and South Dakota. Minnesota outperformed the national economy in the rate of growth in GDP and in the rate of unemployment throughout the recent recession and recovery. In short, Minnesota's economy is and has been strong relative to other upper Midwestern states.

Enbridge is a strong contributor to the Minnesota economy and currently employs 354 people in Minnesota (287 employees and 67 contractors).

#### **B. IMPLAN Analysis**

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<sup>6</sup> U.S. Bureau of Economic Analysis Estimate.

<sup>7</sup> Great Lakes States include: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin. Plains States include: North and South Dakota, Nebraska, Kansas and sometimes Iowa and Missouri.

<sup>8</sup> Bureau of Labor Statistics.

<sup>9</sup> The definition of "employed" for purposes of this statistic is "an individual 16 years old or older who, in a given week, (a) works minimum one hour for an emolument or minimum 15 hours of unpaid work in a family business, or (b) who is not working but has a job or business from which he or she is temporarily absent, whether or not being paid for the time off." Bureau of Labor Statistics Glossary, available on-line at <http://www.bls.gov/bls/glossary.htm>

The IMPLAN model predicts significant economic benefits to Minnesota’s economy from construction of the Project. In total output, construction of the Project is anticipated to result in more than \$2.2 billion in benefits to Minnesota. Table 1, below, summarizes the predicted impacts.

**Table 1:  
Total Estimated Economic Impacts from Construction of the Project 2017-2019  
(Statewide)<sup>10</sup>**

<b>IMPACT Type</b>	<b>FTE Employment</b>	<b>Labor Income</b>	<b>Value Added</b>	<b>Output</b>	<b>Federal and State Taxes</b>
Direct Effect	7,292	\$497,624,592	\$630,111,797	\$1,183,524,712	\$214,165,204
Indirect Effect	2,481	\$160,772,034	\$240,220,749	\$439,519,985	\$71,756,484
Induced Effect	3,830	\$206,324,699	\$364,062,793	\$630,651,973	\$95,990,840
<b>Total Effect</b>	<b>13,604</b>	<b>\$864,721,326</b>	<b>\$1,234,395,339</b>	<b>\$2,253,696,670</b>	<b>\$381,912,528</b>

Table 1 (and subsequent tables) includes columns for Employment, Labor Income, Value Added, and Output impacts from the construction of the Project. The direct effect employment data is generated by IMPLAN from the construction spending associated with the Project and represents the total FTE employment IMPLAN expects to be involved during construction.<sup>11</sup> The input-output assumption is that employees are locally available either through increases in the labor force or from new workers moving to the area. IMPLAN also assumes that local industries are operating at capacity so that the indirect and induced effects are new employees. The output increase can be handled at least partially without new hires if local industries have excess capacity with existing employees. This is only of significance, however, for the indirect and induced effects. For example, induced effects are purchases made with income earned by individuals resulting from new industry activity, such as Enbridge or its contractors purchasing construction supplies. The employees of the business that sold construction supplies will take their income from their jobs and spend it at other businesses, such as grocery stores. In this example, both the construction supply business and the grocery store may be able to accommodate the increased business resulting from the Project through the use of existing employees instead of newly hired employees. In our opinion, because of the low unemployment rate in Minnesota, these businesses will likely have to hire new employees.

The “labor income” column provides IMPLAN’s prediction of before-tax income earned from producing the region’s output. Value Added is one approach to estimating the region’s GDP. It consists of locally earned wages, interest, rents and profits associated with producing the region’s output. The Output column provides IMPLAN’s predicted total economic impact by adding both the direct, indirect, and induced impacts on local industries plus the final users of the region’s goods and services. Final users of goods and services include government, physical investment, household consumption, and exports minus imports (a second approach for measuring the region’s GDP).

<sup>10</sup> All monetary figures are in 2016 prices. Source: IMPLAN.

<sup>11</sup> The economic impact analysis excluded certain construction investments that Enbridge expected to be directed to suppliers external to the state.

The direct, indirect, and induced effects of construction will be spread among multiple industries. Unsurprisingly, the greatest impact will be to the construction sector, with other significant impacts to industries that typically support large construction projects and employees. The top spending impacts from the construction phase of the Project are shown in Table 2.<sup>12</sup>

**Table 2:  
 Minnesota Industry Sectors with Observed Spending on Pipeline Construction  
 (Statewide)<sup>13</sup>**

Industry Description	FTE Employment	Labor Income	Value Added	Output
Agriculture	24	\$1,195,472	\$1,644,178	\$3,910,241
Mining	17	\$708,374	\$1,817,256	\$3,222,948
Construction	2,268	\$137,664,064	\$187,621,447	\$354,381,092
Manufacturing	791	\$58,944,665	\$98,206,080	\$289,845,403
Transportation, Information and Public Utilities	1,842	\$133,016,005	\$219,304,125	\$475,942,756
Trade	1,091	\$58,899,103	\$94,032,000	\$146,372,783
Services	5,188	\$323,485,695	\$467,056,290	\$790,795,916
Government	2,383	\$150,807,948	\$164,713,963	\$189,225,531
Total	13,604	\$864,721,326	\$1,234,395,339	\$2,253,696,670

The totals reflected in Table 2 summarize the direct, indirect and induced impacts on these top eight broadly-defined industries. Most of the industries are self-explanatory, such as Construction, Mining (mostly sand and gravel), Agriculture, and Manufacturing. Transportation and Public Utilities includes all forms of transportation but especially the Trucking industry.

Trade includes industries in both retail and wholesale sectors. Many of the supplies purchased by Construction will come from industries classified as Wholesale while much of the induced impacts will appear in the Retail Trade and Service sectors, including examples such as General Merchandise Stores. Services is a broad category that includes everything from professional services purchased by the Construction sector such as legal or engineering services, to personal services which, like restaurants or medical services, cater to workers earning income and spending that income in the region. Government includes all levels, Federal, State and Local, the caveat being that the government services has to be occurring in Minnesota. Input-output utilizes producer prices in arriving at impact forecasts. If prices are in terms of purchaser prices, as is the case for the Trade sectors (retail and wholesale) the values need to be divided to be consistent. This is done by assigning margins to the Trade sectors.

<sup>12</sup> IMPLAN predicts direct, indirect, and induced impacts to more than 440 sectors of the economy. Several of these individual sectors are summarized in Table 2 under broader classifications. The top eight of these were selected here because they capture the majority of economic impacts caused by construction of the Project.

<sup>13</sup> Note: All monetary figures are in 2016 prices. Source: IMPLAN. Input-output uses current Producer Price Indices in calculating impacts. Producer Price Indices are produced by the Bureau of Labor Statistics and are embedded in 2015 IMPLAN model along with projections of changes for future years.

In addition, although the Analysis conducted using IMPLAN does not include a quantification of the economic impact from the operation of the Project, it is expected that the Project will have both significant and continuing economic impacts. The Project will extend the life of this component of the Enbridge transportation system in the State of Minnesota. Additional employees are anticipated to be required in association with this new investment, although the exact numbers are not known at this time. Enbridge will include the Project in its ongoing operations with its other pipelines in Minnesota.

In addition, Enbridge estimates that annual operating and maintenance costs for the Project in the United States will be approximately \$84 million.<sup>14</sup> An analysis of the economic impact from the annual spending of \$84 million resulted in economic benefits of approximately \$61.1 million in value added and 369 FTE direct, indirect and induced jobs.<sup>15</sup> Many of these jobs are currently located in North Dakota, Minnesota and Wisconsin. Thus, the Project will allow Enbridge to continue to contribute to the Minnesota economy at the same level, and to the extent that additional permanent employees are needed, at an increased level for years to come.

#### **IV. Conclusion**

Construction of the Project will have significant economic benefits to the Minnesota economy. The estimated Project construction cost for the portion located in Minnesota is approximately \$2.1 billion. This private investment in Minnesota is anticipated to be responsible for an estimated 13,604 jobs, \$864,721,326 in labor income, and total economic output of \$2,253,696,670.

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<sup>14</sup> See *In the Matter of the Applications of Enbridge Energy, Limited Partnership for a Certificate of Need and Pipeline Routing Permit for the Line 3 Replacement Project in Minnesota from the North Dakota Border to the Wisconsin Border*, MPUC Docket Nos. PL-9/CN-14-916 & PL-9/PPL-15-137 Reply Comments of Enbridge Energy, Limited Partnership, at p. 8 (May 19, 2015).

<sup>15</sup> The Analysis relied upon the Minnesota economy as the study area for this estimate. The majority of the U.S. portion of Line 3 is located in Minnesota. The Analysis applies the expenditures to pipeline transportation related costs and electricity costs to estimate economic benefits.



## Julie M. Carey

Director | [julie.carey@navigant.com](mailto:julie.carey@navigant.com)

Washington, D.C. | Direct: 202.481.7551

### Professional Summary

Julie Carey is an energy economist and a Director with Navigant Consulting, Inc. She is also an adjunct professor at Georgetown University where she teaches a graduate level course in energy economics.

Julie has more than 20 years of experience addressing economic issues across the energy sector including: power, crude oil, natural gas, natural gas liquids, renewables, coal, pipelines and railroad industries as well as energy intensive industries such as manufacturing and chemicals. She frequently provides expert reports and testimony in regulatory proceedings and in commercial disputes, including courts and international arbitrations.

Julie's expertise includes economic analyses of market dynamics (supply, demand and pricing) as well as competition, claims of market manipulation and anticompetitive behavior, and regulatory economics.

She frequently analyzes economic damages (historical and future lost profit analyses) and conducts asset valuation analyses. She has assessed and quantified economic damages and valuations in dozens of cases. She has completed this work in breach of contract, antitrust, class action and other types of disputes.

Julie also has substantial experience conducting environmental analysis (e.g. greenhouse gases and other types of emissions) and frequently completes macroeconomic modeling (i.e. jobs, GDP, taxes) to study the impact of energy infrastructure construction and operations on the economy.

For her assignments, she frequently employs statistical and econometric analyses.

### Areas of Expertise

#### Electricity Industry Experience

Ms. Carey provides expert consulting and testifying services in commercial disputes and regulatory proceedings addressing electricity industry issues. Within commercial disputes she has been involved in claims of breach of contracts, partnership disputes, delayed plant operations, diminished value claims, replacement power, antitrust and manipulation claims, EPA clean air act, among others. Within regulatory proceedings she has been involved in matters evaluating potential impact on competition for regulatory approval of mergers and acquisitions, market-based rate authority, proposed energy infrastructure projects and evaluations of energy manipulation claims and market rules and market design features of wholesale power markets. Her work often includes economic analysis of energy, capacity and ancillary services within wholesale power markets, competition, damages, valuation, energy contracts, macroeconomic and other issues. A few examples include:

- Expert testimony in matters related to competition within wholesale electricity markets, such as market power screens and delivered price test analyses for regulatory approval of mergers and acquisitions and market-based rate authority. Within this work, she analyzes product and geographic markets, including assessments of transmission constraints. The economic analysis includes evaluation of delivered fuel costs and operational characteristics of power plants (seasonal capabilities, short run marginal costs, efficiency rates, etc.).



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- Expert report analyzing economic and environmental analysis of the GHG impact from the construction and operation of a new coal terminal export facility and downstream power markets for regulatory approval. This work included long-term market and economic analysis of the elasticity of demand of coal, forecast of GHG emission and other energy market impacts within downstream energy markets (U.S. and Pacific Basin). This work also included analysis of power generation economics (short run marginal costs, power plant efficiencies), fuel price forecasts, and an evaluation of the range of potential outcomes of the GHG forecasts.
- Expert testimony regarding the economics of a power purchase agreement and evaluation of the claim of economic damages (past and future) associated with the alleged breach of a contract. This work included analysis of the appropriate economic theory of damages.
- Expert testimony regarding the impact of a proposed market rule regarding the transmission allocation among market participants, incentives for new entry and an evaluation of economic efficiency and potential market power within the wholesale electricity market.
- Retained testifying expert in an investigation involving claims of market manipulation of wholesale power markets to evaluate of the energy companies' economic behavior, including economic purpose of the transactions and the reasonableness of the prices reflective of market outcomes.
- Expert consulting to evaluate the asset valuations of numerous natural gas-fired power plants, including long term forecasts of market prices, revenues and costs, cost of capital, and the development of a discounted cash flow analysis. This work included a probabilistic analysis using monte carlo simulations to forecast cash flows under different financial and operational conditions.
- Expert report analyzing the economic impact (GDP, jobs etc.) from constructing and operating a proposed power plant and evaluating the potential impact on competition.
- Expert consulting to quantify the asset valuations of a substantial portfolio of electricity generation plants, including coal, nuclear, natural gas and renewable assets in the Northeastern U.S. This assignment was used to aid the client in business decision making during an evolving market and regulatory climate. This work included the development of long term forecasts of market prices, revenues and costs, cost of capital, and the development of a discounted cash flow analysis.
- Consulting expert analysis in a Clean Air Act dispute between a utility and the EPA involving a coal-fired power plant's numerous power plant modifications. The work included the impact of increasing market demand on power plant emissions as a consideration to whether the utility violated the EPA rules.
- Provided expert reports in a coal contract dispute involving replacement coal purchases, and evaluation of economic damages and impact of market prices, and coal quality attributes.
- Expert consulting regarding proposed market rules for capacity markets, including an evaluation of economic incentives and implications for market power.
- Numerous expert reports regarding power plant performance, forecasts of new electric generating capacity and fuel supply projections.

### Renewable Industry Experience

Ms. Carey frequently provides expert consulting and testifying services in commercial disputes and regulatory proceedings involving the renewable energy industry. Within commercial disputes she has been involved in claims of breach of contracts, antitrust and bankruptcy claims. Before regulators Ms. Carey has evaluated the potential impact on competition for approval of market-based rate authority. Her work often includes analysis of energy markets (supply, demand, and pricing), competition, damages, valuation, energy contracts, macroeconomic and other issues. A few examples include:

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- Expert testimony on economic damages in a dispute involving a power purchase agreement for geothermal power with an aluminum manufacturer in an international arbitration.
- Expert report in an international arbitration providing an analysis of the solar panel market, reasonableness of market prices and the market value of solar power products.
- Expert consulting regarding antitrust claims regarding the solar panel manufacturing industry. This work included economic analysis of the potential anticompetitive behavior and a valuation analysis of a solar panel company, including the development of a discounted cash flow analysis analyzing the future cash flows and net present value of the enterprise.
- Expert report in a bankruptcy court proceeding regarding the outlook for silane gas and the thin film solar market and past and future economic damages associated with the failure to fulfill a take or pay contract obligation.
- Expert consulting regarding the reasonableness of contract prices in wind power purchase agreement for regulatory approval.
- Expert consulting regarding economic damages with respect to delayed operations of a polysilicon and silane gas manufacturing plants and effect on solar module sales.
- Expert consulting and economic analysis regarding the capital and operating costs of different types of renewable power facilities and environmental and economic impact analyses of investments.
- Expert consulting regarding economics of power purchase agreements for renewable power and ancillary services.
- Expert reports in numerous cases regarding the unique economics and operational aspects of wind, solar, geothermal, and hydro power supply within competition analysis for wholesale power markets.
- Expert consulting regarding the economic impact (GDP, jobs, taxes etc.) and environmental analyses from constructing and operating renewable energy facilities.

### Oil and Gas Industry Experience

Ms. Carey provides expert consulting and testifying services in commercial disputes and regulatory proceedings involving oil and gas industry issues. Within commercial disputes she has been involved in claims of breach of product and transportation contract, other commercial disputes involving antitrust and manipulation operational, environmental, and bankruptcy claims. Before U.S. and Canadian regulators Ms. Carey has evaluated the potential impact on competition for approval of market-based rate authority, negotiated rates, proposed energy infrastructure projects and evaluations of energy manipulation claims. Her work often includes analysis of energy markets (supply, demand, and pricing), competition, damages, valuation, energy contracts, macroeconomic and other issues. A few examples include:

- Expert report regarding past and future economic damages and economics of the product market, supply, demand and pricing in a chemical product contract dispute before a bankruptcy court.
- Retained testifying expert to conduct economic analysis of crude oil markets, pricing and alternative transportation economics (rail, truck, waterborne and pipeline) in a crude oil contract dispute.
- Expert consulting assisting the Canadian Competition Bureau in an investigations of potential energy market manipulation within the natural gas liquids product markets and price spikes. This work includes market analysis and econometric analysis to evaluate whether the actual market prices reflect competitive market prices (i.e. consistent with supply, demand, prices and constraints

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etc.) or if manipulative or anticompetitive behavior occurred. The CCB concluded that market forces caused the price spikes.

- Expert consulting in numerous disputes/investigations involving claims of market manipulation and anticompetitive behavior within natural gas product markets. This work included evaluating of economic purpose of natural gas product trades as well as economic analysis to evaluate whether the market prices reflect competitive market prices (i.e. consistent with supply, demand, prices and constraints etc.).
- Expert analysis for numerous regulatory filings conducting economic impact assessments of constructing and operating proposed oil and gas pipeline project.
- Evaluation and economic analysis of the potential effects of EPA gasoline sulfur content regulations (Tier 3) on U.S. retail gasoline prices, macro-economic impacts, sulfur reduction and other benefits.
- Expert consulting providing economic analysis of the competitiveness of crude oil transportation market in Western Canada to evaluate competition within pipeline markets. This work also included economic analysis of the negotiations process and negotiated rates for new transportation contract sales to determine if the process was competitive and the rates were consistent with fair market value prices.
- Expert testimony in numerous cases regarding delivered fuel cost and economics of natural gas, crude oil and refined products to downstream energy markets and evaluation of competition.
- Expert consulting in numerous cases to evaluate competition for transportation of crude oil and refined products and the reasonableness of negotiated and market-based rates.
- Expert consulting in a refined product contract dispute involving economic analysis of crude oil and refined product markets and rail, truck, and pipeline transportation economics and economic damages.
- Expert consulting economic analyses of price formation/separation of crude oil price indices for energy contract dispute.
- Expert consulting in a natural gas tolling contract dispute conducting an economic analysis of natural gas markets and an analysis of past and the future economic damages.
- Consulting expert on the reasonableness of business decisions and damages related to an area of mutual interest purchase agreement and acquisitions of oil and gas assets in a shale basin.

### Railroad Transportation Industry Experience

Ms. Carey frequently provides expert consulting and testifying services in commercial disputes and regulatory proceedings involving the railroad transportation industry. A few examples include:

- Expert report before the U.S. federal transportation regulatory, Surface Transportation Board (“STB”) regarding the potential introduction of indirect competition analyses within market dominance determinations for coal transportation to utility generation facilities for purpose of in coal transportation rate disputes.
- Expert consulting conducting numerous competition analyses of rail and pipeline transportation (and other modes of transportation) for crude oil and refined products in the U.S. and Western Canada in a commercial dispute.
- Expert consulting analyzing economics of containerized freight transportation, including intermodal rail and competition with alternative transportation modes in a transportation contract dispute and claims of anticompetitive behavior.

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- Expert consulting analyzing the economics of competition and anticompetitive behavior in railroad transportation services including evaluating the impact of fuel surcharges in a commercial dispute.
- Expert reports in numerous regulatory proceedings involving rail transportation rate disputes for coal, including evaluation of appropriate regulatory construct long term forecasts of coal deliveries, transportation rates (all modes), and revenue attribution methodologies for shared facilities.

### Coal Industry Experience

Ms. Carey has experience analyzing coal markets and has proffered testimony on long term fuel supply assessments and analyzed economic damages from claims of breach of coal contracts. Ms. Carey routinely analyzes the economics of the delivered cost of coal, natural gas and other fuels to electric utilities in the U.S., Canada and elsewhere to evaluate the impact on competition for regulatory proceedings or commercial disputes. She has provided expert evidence regarding the long term elasticity of demand of coal and greenhouse gas and other energy market impacts within downstream energy markets U.S. and Pacific Basin. Ms. Carey has provided expert reports to the regulators on issues such as long term forecasts of coal volumes from U.S. coal basins and import from foreign sources to U.S. coal fired power plants, industrial facilities and to export terminals in disputes regarding the reasonableness of rail transportation rates. Ms. Carey has provided expert reports in coal contract disputes and served as a consulting expert in a lawsuit alleging violations against the EPA clean air act. She has analyzed the impact of regulations of SO<sub>2</sub>, NO<sub>x</sub> and carbon emissions on coal generation facilities and evaluated the substitutability of different types of coal in terms of quality attributes and economics.

### Selected Publications and Presentations

- **Comments to the FERC Notice of Inquiry:** Modifications to Commission Requirements for Review of Transactions under Section 203 of the Federal Power Act and Market-Based Rate Applications under Section 205 of the Federal Power Act RM16-21-000, Market Power Experts (including Julie Carey), November 28, 2016.
- **Crude Oil and Transportation Market and Regulatory Developments**, Julie Carey, Association of Oil Pipeline Business Conference, Sept 16, 2016.
- **Will Trudeau and Obama Fulfill Their Energy Promises?** Julie Carey, The Energy Advisors, March 25, 2016.
- **NGL Market Development Panel**, Infocast Midstream Summit, February 17, 2016.
- **Energy Market Trends, Economic Implications, and the Outlook for Infrastructure**, Construction Superconference, December 8, 2015.
- **Effects of Rising Demand for Energy Infrastructure Development on Labor, Other Resources, and the Economy**, Julie Carey (with Chris Ring and Rebekah Hannif-Ali), Navigant Construction Forum, Dec. 2015.
- **Trials, Tribulations and Turmoil in Crude Oil Markets**, Association of Corporate Counsel, November 24, 2015.
- **Near Term Energy Market Dynamics and the Clean Power Plan**, Western Coal Traffic League Fall Meetings, Julie Carey (with Maggie Shober), November, 19, 2015.
- **The Impact of Crude Oil and Natural Gas Market Trends on Litigation**, Energy Litigation Journal (ABA Section), Julie M. Carey (with Bob Broxson and Sonya Kwon), November 2015.

## Julie M. Carey

- **Today's Energy Market and the Cost of Artificially Suppressing Demand with the Crude Oil Export Ban**, Kelley, Drye, and Warren, Energy Regulatory Conference, October 22, 2015.
- **Regulation and Competition in Oil Pipelines and Related Industries**, Association of Oil Pipelines Business Conference, Julie Carey (with Julie Solomon), September 17, 2015.
- **Low Crude Oil Price Impacts: Market Dynamics, Economic Implications and Disputes**, Texas Lawyers Houston, Julie Carey (with Robert Lang), May 21, 2015.
- **Rising Tide: Litigation Wave from Low Oil Prices & Economic Implications**, Texas Lawyers- Dallas, Julie Carey (with Robert Lang), May 8, 2015.
- **What Is the Future of the Long-Delayed Keystone XL Pipeline?** Inter-American Dialogue's Latin America Advisor – Energy, May 5, 2014.
- **Enforcement Shifts Energy-Trading Strategies**, Energy Litigation Journal (ABA Section), Julie M. Carey (with Cliff Hamal and Ben Ullman), March 2014.
- **Energy Commodity Trading's Evolving Regulatory Frontier**, Natural Gas Notes, January 2014.
- **Trading Firms in the Bullseye Amid Stepped Up Oversight Of Energy Markets**, Forbes October 11, 2013.
- **Rail Emerging as Long-Term North American Crude Option**, Oil and Gas Journal, August 5, 2013.
- **How Unconventional Oil and Gas Is Supercharging the U.S. Economy**, Forbes (online), December 13, 2012.
- **Unconventional Resources, Economic Growth and Power Generation Implications**, Julie M. Carey, PowerGen Conference, Orlando, Florida, December 13, 2012.
- **Surprise Side Effect Of Shale Gas Boom: A Plunge in U.S. Greenhouse Gas Emissions**, Forbes, December 7, 2012.
- **The Economics of Unconventional Oil and Gas**, North American Gas Summit, Julie M. Carey, November 15, 2012.
- **The Unconventional Path for Domestic Crude Oil and Natural Gas Resources**, U.S. Association for Energy Economists Dialog, Julie M. Carey and Christopher L. Ring, September, 2012.
- **Shale Gas and Oil: Economy-Wide Game Changers**, Natural Gas Notes, August 1, 2012.
- **The Renewable Transformation and Nine Trends to Watch For**, Julie Carey (with Cliff W. Hamal), US Association for Energy Economists Dialog, November 2010.
- **Capacity Market Design Fundamentals**, EUCI conference workshop, Julie Carey (with Cliff Hamal and Cleve Tyler), Baltimore, MD, October 27, 2010.
- **Market Forum Participant for the Future Outlook for Fuel Cell Generating Technology**, April 13, 2005.

### Client Reports

- **Economic Analysis of Electric Vehicle Market from Illinois' Proposed Legislation** May 17, 2016. Julie M. Carey (with Celia David and John Gartner). (Updated August 10, 2016)
- **Economic Analysis of Clean Energy Jobs from Illinois' Proposed Legislation** May 11, 2016 and September 16, 2015. Julie M. Carey (with Celia David and Bruce Hamilton).
- **Evaluation of the Economic Contributions of Littoral Combat Ship (LCS) Program**, Lockheed Martin Corporation, Julie M. Carey (with Kate Rodenrys), January 7, 2015. (Supplemented December 2015)

## Julie M. Carey

- An Analysis of a Refined Product Pipeline Competitive Tariff Rates and of the Current Competitiveness of the Refined Product Pipelines Market-Based Rate Markets, Confidential Report, June 9, 2014, Julie M. Carey (with Kate Rodenrys and George Schink).
- Oil Pipeline Regulation and Competition, Confidential White Paper for the Association of Oil Pipe Lines, Julie Carey (with George Schink, Rick Smead, and Julie Solomon), August 2013.
- Report on the Preliminary Analysis of the Potential Competition Faced by a Reversed Crude Oil Pipeline and Competition Faced by an Existing System, Confidential Report, June 24, 2013, Julie Carey (with Kate Rodenrys and George Schink).
- Report on the Preliminary Analysis of the Competition Faced by a Crude Oil Pipeline System, Confidential Report, June 7, 2013, Julie Carey (with Kate Rodenrys and George Schink).
- Spent Nuclear Fuel Management: How centralized interim storage might expand options and reduce costs; A study conducted for the Blue Ribbon Commission on America's Nuclear Future, Julie Carey (with Cliff W. Hamal and Christopher L. Ring), May 2011.
- Meeting the Challenge of Spent Fuel in Decommissioned Storage, Presentation to Blue Ribbon Commission on America's Nuclear Future, Julie Carey (with Cliff Hamal and Chris Ring), January 3, 2011.
- Clean Energy Policy Initiative Impacts on the Environment and the Economy, Confidential Client Report, May, 2009.
- Strategic Recommendations for Expiring Power Contracts, Confidential Report, Julie Carey (with Cliff W. Hamal), Prepared On Behalf of Ontario Power Authority, January 22, 2009.
- Force Majeure Risks and Ontario Power Authority's Power Contracts, Julie Carey (with Cliff W. Hamal), Prepared On Behalf of Ontario Power Authority, March 31, 2008.
- Financial Accommodation for Force Majeure Events, Julie Carey (with Cliff W. Hamal), Prepared On Behalf of Ontario Power Authority, January 21, 2008.
- Power Generation Investments in a Capacity Demand-Curve Market, Cliff W. Hamal and Julie A. Murphy, The Energy and Utility Project, May 2005.

### Expert Affidavits & Testimony Experience

December 29, 2016	FERC Docket No. ER10-1823-__ et al., Triennial Update for Market Based Rate Authority for Dominion Energy Marketing, et al. in the Northeast region, Affidavit of Julie M. Carey (with Julie R. Solomon).
December 29, 2016	FERC Docket No. ER13-1536-__ et al., Triennial Update for Market Based Rate Authority for Exelon Generation Company, LLC, et al. in the Northeast region, Affidavit of Julie M. Carey (with Julie R. Solomon).
December 29, 2016	FERC Docket No. ER10-2179-__ et al., Triennial Update for Market Based Rate Authority for Calvert Cliffs Nuclear Power Plant, LLC, et al. in the Northeast region, Affidavit of Julie M. Carey (with Julie R. Solomon).
December 27, 2016	FERC Docket No. ER11-47 et al., Triennial Update for Market Based Rate Authority for American Electric Power Company, et al. in the Northeast region, Affidavit of Julie M. Carey.
December 23, 2016	FERC Docket No. ER11-1933 et al., Triennial Update for Market Based Rate Authority for Green Mountain Power, et al. in the Northeast region, Affidavit of Julie M. Carey.

## Julie M. Carey

November 29, 2016	U.S. Army Corps of Engineers, Seattle District, Response to Draft Environmental Impact Statement for the National Environmental Policy Act Regarding the Proposed Millennium Bulk Terminals Longview Project, Expert Evidence.
June 13, 2016	Cowlitz County and the Washington State Department of Ecology, Response to Draft Environmental Impact Statement for the State Environmental Policy Act Regarding the Proposed Millennium Bulk Terminals Longview Project, Expert Evidence.
January 17, 2016	FERC Docket No. Docket No. EC16-__, Supplemental Affidavit of Julie M. Carey to Support Ohio Valley Electric Corporation's Application for Market Based Rate Authority in PJM, MISO and other market areas. (Initial Report November 6, 2015)
December 28, 2015	FERC Docket No. ER10-2302__, Triennial Update for Market Based Rate Authority for Public Service Company of New Mexico, Affidavit of Julie M. Carey.
December 16, 2015	Wisconsin Public Service Commission, Docket No. 6800-CE-176, Surrebuttal Testimony of Julie M. Carey.
December 4, 2015	Wisconsin Public Service Commission, Docket No. 6800-CE-176, Application for a CPCN To Build a Natural Gas-Fueled Power Plant at its Riverside Energy Center Facility, Rebuttal Testimony of Julie M. Carey.
November 6, 2015	FERC Docket No. Docket No. EC15-__, Supplemental Affidavit of Julie M. Carey to Support PNM's Application for Authorization of Disposition of Jurisdictional Facilities. (Initial Report September 25, 2015)
June 30, 2015	FERC Docket No. ER11-47 et al., Triennial Update for Market Based Rate Authority for American Electric Power Company, et al. in the Southwestern Power Pool region, Affidavit of Julie M. Carey.
April 25, 2015	Minnesota Public Utilities Commission Docket No. PL-9/PPL-15-137, In the Matter of the Application of Enbridge Energy, Limited Partnership for a Routing Permit for the Line 3 Replacement Project in Minnesota from the North Dakota Border to the Wisconsin Border. Economic Impact Assessment Study.
November 5, 2014	National Energy Board Application of Enbridge Energy, Line 3 Replacement Program; Economic Impact Assessment Study.
August 15, 2014	FERC Docket No. ER10-2302-__ Change in Status Filing for Public Service Company of New Mexico, et al., Affidavit of Julie M. Carey.
December 27, 2013	FERC Docket No. ER14-__, Change in Status Filing for American Electric Power Company, et al., Southwest Power Pool, Affidavit of Julie M. Carey (with Ben Ullman).
December 20, 2013	FERC Docket No. ER11-47 et al., Triennial Update for Market Based Rate Authority for American Electric Power Company, et al. in the PJM RTO region, Affidavit of Julie M. Carey.
July 5, 2013	FERC Docket No. ER13-1896-000, Application of American Generation Resources Inc. for Market Based Rate Authority, Affidavit of Julie Carey.
June 11, 2013	ULVAC, INC vs. China Solar Power (Holdings) Ltd., In the Matter of a Commercial Arbitration, Hong Kong International Arbitration Centre, HKIAC /A11013, Expert Report of Julie Carey.

## Julie M. Carey

April 17, 2013	Energy Conversion Devices, Inc., et al., Chapter 11, Case No. 12-43166, U.S. Bankruptcy Court Eastern District of Michigan Southern Division, Expert Report for Praxair by Julie Carey (with Graham Stevens).
February 5, 2013	HS Orka hf. vs. Nordural Grundartangi, ehf and Orkauveita Reykjavikur, In the Matter of a Commercial Arbitration, Stockholm Chamber of Commerce Arbitration V (191/2011), Expert Testimony of Julie M. Carey.
January 14, 2013	Surface Transportation Board (“STB”), Ex. Parte No. 717, Reply Verified Statement of Julie M. Carey (with James M. Speyer) to Petition of Association of American Railroads to Institute a Rulemaking Proceeding to Reintroduce Indirect Competition As A Factor Considered in Market Dominance Determinations For Coal Transported to Utility Generation Facilities.
December 21, 2012	FERC Docket No. ER96-1551-__ and ER01-615-__ and ER09-74-__, Triennial Update for Market Based Rate Authority for Public Service Company of New Mexico, Affidavit of Julie M. Carey.
October 24, 2012	HS Orka hf. vs. Nordural Grundartangi, ehf and Orkauveita Reykjavikur, In the Matter of a Commercial Arbitration, Stockholm Chamber of Commerce Arbitration V (191/2011), Expert Rebuttal Report of Julie M. Carey.
September 18-19, 2012	On behalf of Montana Alberta Tie Ltd (“Enbridge – MATL”), Alberta Utilities Commission, Proceeding 1633, Expert Testimony of Julie M. Carey (with Cliff Hamal).
August 29, 2012	HS Orka hf. vs. Nordural Grundartangi, ehf and Orkauveita Reykjavikur, In the Matter of a Commercial Arbitration, Stockholm Chamber of Commerce Arbitration V (191/2011), Expert Report of Julie M. Carey.
June 29, 2012	FERC Docket No. ER11-47, Triennial Update for Market Based Rate Authority for American Electric Power Company, et al. in the Southwestern Power Pool region, Affidavit of Julie M. Carey.
June 15, 2012	On behalf of Montana Alberta Tie Ltd (“Enbridge – MATL”), Alberta Utilities Commission, Proceeding 1633, Testimony of Julie M. Carey (with Cliff Hamal).
March 1, 2012	FERC Docket No. ER97-4143, Change in Status Filing for Market Based Rates for the American Electric Power Company, et al, Affidavit of Julie M. Carey.
March 23, 2010	FERC Docket No. ER10-727-001, Request for Market Based Rate Authority for AEP Retail Energy Partners LLC, Affidavit of Julie M. Carey.
March 8, 2010	FERC Docket No. ER96-1551-__ and ER01-615-__ and ER09-74-__, Triennial Update for Market Based Rate Authority for Public Service Company of New Mexico, Affidavit of Julie M. Carey.
December 11, 2008	On behalf of COALSALES II, L.L.C., in the matter of Gulf Power Company v. COALSALES II, L.L.C. Docket no. 3:06 CV 270/MCR/MD, before the US District Court for the Northern District of Florida, Pensacola Division, Expert Report of Julie M. Carey (with Cliff Hamal).
August 19, 2008	On behalf of COALSALES II, L.L.C., in the matter of Gulf Power Company v. COALSALES II, L.L.C. Docket no. 3:06 CV 270/MCR/MD, before the US District Court for the Northern District of Florida, Pensacola Division, Expert Report of Julie M. Carey (with Cliff Hamal)



## Julie M. Carey

May 25, 2007	FERC Docket Nos. ER96-2495-_, ER97-4143-_, ER97-1238-_, ER98-2075-__ and ER98-542-__, Change in Status Filing for American Electric Power for Market-Based Rate Authority, Affidavit of Julie M. Carey.
April 17, 2006	FERC Docket No. Docket EC06-113-000, Application for Asset Transfer of Contra Costa #8 for Pacific Gas and Electric Company, Mirant Delta, LLC and Mirant Special Procurement, Inc., Affidavit of Julie A. Murphy.
January 12, 2006	FERC Docket No. ER96-1551-__ and ER01-615-__, Change in Status Filing for Public Service Company of New Mexico for Market-Based Rate Authority, Affidavit of Julie A. Murphy.
July 21, 2005	FERC Docket No. ER05-1244-000 and ER05-1244-001, Application by Societe Generale Energie (USA) Corp. for Market-Based Rate Authority, Affidavit of Julie A. Murphy.
July 15, 2005	FERC Docket No. ER96-1551-006 and ER01-615-003, Compliance Filing for Public Service Company of New Mexico for Market-Based Rate Authority, Affidavit of Julie Murphy.
April 21, 2005	Testimony of Julie Murphy on behalf of Onvoy, Inc., Onvoy, Inc. v. Allete, Inc. f/k/a Minnesota Power, Inc. d/b/a Minnesota Power and Light Company and, Enventis Telecom, Inc., Sixth Judicial District Court File No. 69-C9-03-601595, St. Louis County, Minnesota.
April 4, 2005	STB Docket No. 42071, Otter Tail Power Company v. BNSF Railway Company, Sponsored Testimony within Section III-A Stand-Alone Traffic Group of the Response Testimony of Burlington Northern Santa Fe Railway Company.
March 1, 2005	STB Docket No. 42071, Otter Tail Power Company v. BNSF Railway Company, Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Supplemental Evidence of Burlington Northern Santa Fe Railway Company.
December 5, 2004	Expert Report Julie A. Murphy (with John Klick) on behalf of Onvoy, Inc., Onvoy, Inc. v. Allete, Inc. f/k/a Minnesota Power, Inc. d/b/a Minnesota Power and Light Company and, Enventis Telecom, Inc., Sixth Judicial District Court File No. 69-C9-03-601595, St. Louis County, Minnesota.
September 9, 2004	STB Docket No. 41191 (Sub-No. 1), AEP Texas North Company v. Burlington Northern and Santa Fe Railway Company, Verified Statement of Julie A. Murphy.
May 24, 2004	STB Docket No. 41191 (Sub-No. 1), AEP Texas North Company v. Burlington Northern and Santa Fe Railway Company, Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Reply Evidence and Argument of Burlington Northern Santa Fe Railway Company.
May 10, 2004	MI PSC Case No. U-13531, In the Matter of the Commission's Own Motion to Review the Costs of Telecommunication Services Provided by SBC Michigan, Final Reply Declaration of Julie A. Murphy (with Michael Baranowski).
April 18, 2004	STB Docket No. 41185, Arizona Public Service and PacifiCorp v. Burlington Northern Santa Fe Railway Company, Verified Statement of Julie Murphy.
March 22, 2004	STB Docket No. 42071, Otter Tail Power Company v. Burlington Northern and Santa Fe Railway Company, Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Supplemental Reply Evidence and Argument of Burlington Northern Santa Fe Railway Company.

## Julie M. Carey

- February 19, 2004 Texas PUC SOAH Docket. No.473-04-0001, PUC Project No. 27957, Application of CenturyTel of San Marcos, Inc. for Approval of a Plan for Disaggregation of State and Federal Universal Service Support, Testimony of Julie Murphy on Behalf of Grande Communications Networks, Inc.
- January 26, 2004 STB Docket No. 42058. Arizona Electric Power Cooperative Inc. v. the Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad Company, Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Reply Evidence and Argument of Burlington Northern Santa Fe Railway Co..
- January 20, 2004 MI PSC Case No. U-13531, In the Matter of the Commission's Own Motion to Review the Costs of Telecommunication Services Provided by SBC Michigan, Reply Declaration of Julie A. Murphy (with Michael Baranowski).
- January 12, 2004 STB Docket No. 42070, Duke Energy v. CSX Transportation, Inc., Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Response to Supplemental Testimony of CSX Transportation, Inc.
- January 5, 2004 STB Docket No. 42070, Duke Energy v. CSX Transportation, Inc., Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Supplemental Testimony of CSX Transportation, Inc.
- December 29, 2003 Texas PUC SOAH Docket. No.473-04-0001, PUC Project No. 27957, Application of CenturyTel of San Marcos, Inc. for Approval of a Plan for Disaggregation of State and Federal Universal Service Support, Direct Testimony of Julie Murphy on Behalf of Grande Communications Networks, Inc.
- October 8, 2003 STB Docket No. 42071, Otter Tail Power Co. v. Burlington Northern Santa Fe Railway Company, Sponsored Testimony within Section III-A Stand-Alone Traffic Group A of Reply Evidence and Argument of Burlington Northern Santa Fe Railway Co.
- April 18, 2003 STB Docket No. 42058, Arizona Electric Power Coop, Inc. v. Burlington Northern Santa Fe Railway Co. and Union Pacific Railroad, In Support of UP's Petition to Require Submission of New Opening Evidence, Or, Alternatively, To Dismiss, Verified Statement of Julie Murphy (with John Klick).
- April 4, 2003 FCC WCB Docket No.03-18. In the Matter of Alascom, Inc. Request for Waiver of Commission Rule and Orders Requiring Annual Tariff Revision, Alascom, Inc. Petition for Waiver, Declaration of John Klick and Julie Murphy, Supplement to Waiver Request and Response to FOIA Request.
- April 4, 2003 STB Docket No. 42057, Xcel v. Burlington Northern Santa Fe Railway Co., Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Reply Evidence and Argument of Burlington Northern Santa Fe Railway Co.
- March 13, 2003 FCC WCB Docket No.03-18. In the Matter of Alascom, Inc. Request for Waiver of Commission Rule and Orders Requiring Annual Tariff Revision, Alascom, Inc. Petition for Waiver, Declaration of Julie Murphy (with John Klick), Alascom's Opposition to General Communication, Inc. FOIA, Control No. 2003-208.
- March 5, 2003 FCC WCB Docket No.03-18. In the Matter of Alascom, Inc. Request for Waiver of Commission Rule and Orders Requiring Annual Tariff Revision, Alascom, Inc. Petition for Waiver, Reply Declaration of Julie Murphy (with John Klick).

## Julie M. Carey

February 7, 2003	CA PUC Application No. 01-02-024. Joint Application of AT&T Communications of California, Inc. (U 5002 C) and WorldCom, Inc. for the Commission to Reexamine the Recurring Costs and Prices of Unbundled Switching, Loop, Transport and Other Network Elements in Its First Annual Review of Unbundled Network Element Cost Pursuant to Ordering Parag. 11 of D.99-11-050. Reply Declaration of Julie Murphy (with Robert A. Mercer).
January 7, 2003	FCC WCB Docket No. 03-18. In the Matter of Alascom, Inc. Request for Waiver of Commission Rule and Orders Requiring Annual Tariff Revision, Alascom, Inc. Petition for Waiver, Declaration of Julie Murphy (with John Klick).
October 11, 2002	STB Docket No. 42072, Carolina Power & Light Co. v. Norfolk Southern Railway Co., Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Reply Evidence and Argument of Norfolk Southern Railway Co.
September 27, 2002	STB Docket No. 42069, Duke Energy Corporation v. Norfolk Southern Railway Company, Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Reply Evidence and Argument of Norfolk Southern Railway Co.
September 20, 2002	STB Docket No. 42070, Duke Energy Corporation v. CSX Transportation, Inc., Sponsored Testimony within Section III-A Stand-Alone Traffic Group of Reply Evidence and Argument of CSX Transportation, Inc.

### Work History

Georgetown University (Adjunct Professor)	2016 - Present
Navigant Consulting, Inc. (Director)	2011 - Present
LECG, Inc. (Principal)	2004 - 2010
FTI Consulting, Inc. (Manager, Director)	2000 - 2004
LECG, Inc. (Associate, Senior Associate, Economist)	1996 - 2000
American Public Power Association (Research Analyst)	1994 - 1996

### Certifications, Memberships and Awards

International Association for Energy Economists  
U.S. Association for Energy Economists

### Education

Doctoral Studies Program Coursework/M.A., Economics	Pennsylvania State University
Bachelor of Science, Economics	Allegheny College