YOU CAN'T MANAGE WHAT YOU CAN'T MEASURE: EXPLORING RESTRUCTURING'S IMPACT ON RETAIL-ELECTRIC MARKETS

Katie Johnson[*†]

INTRODUCTION

"You can't manage what you can't measure."[**]

The electric market is the mechanism behind virtually every economic activity in the United States. Without affordable electricity, businesses cannot operate, hospitals cannot run, and citizens' lives are at risk because they cannot heat or cool their homes. In spite of the importance of an effectively operating electric market, policymakers in various states have begun to restructure retail-electric markets to introduce competition without establishing a method to determine whether restructuring is a benefit or a detriment to the public. Today, sixteen jurisdictions in the United States have actively restructured their retail-electric markets, and seven jurisdictions have suspended their retail-electric-market restructuring efforts.[1] Literature on the topic and experts in the field largely disagree as to whether retail-electric-market restructuring has been a benefit or a detriment to efficiently operating retail-electric markets.

As former Federal Energy Regulatory Commissioner (FERC) Nora Brownell asserted, it is "the customers' future and the customers' economic and environmental well-being" at stake; and consequently, it is vital to hold policymakers accountable.[2] Thus, it is essential to "look at whatever . . . decisions are made against a very clear set of metrics."[3] This Article will explore a set of metrics to measure the success of restructuring state-retail-electric markets. It will also provide a framework for policymakers to use to analyze the impact of retail-electric-market restructuring. First, I will provide a background about restructuring and

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* J.D. 2013, Vermont Law School; B.S. 2009, Otterbein University.

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** Now an oft used business adage, "you can't manage what you can't measure" has been attributed to several people including Peter F. Drucker. See "You Can't Manage What You Can't Measure", ROTA CONSULTING GROUP LLC (Oct. 3, 2011), http://rota-consulting.com/?p=211, for further discussion of the origins of this axiom.

1. *Status of Electricity Restructuring by State*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/cneaf/electricity/page/restructuring/restructure_elect.html (last visited Nov. 6, 2013).

2. Transcript of Examination of Petitioners' Witness Nora Brownell at 136, Vt. Pub. Serv. Bd. Technical Hearing (Mar. 27, 2012) (No. 7770).

3. *Id.* at 135.

state and federal policies that have restructured certain electric markets in the United States. Next, I will identify and explain twenty metrics that recent literature has set forth. To identify these metrics, I reviewed forty-five articles and five books related to the restructuring of wholesale and retail-electric markets. Finally, I will provide a framework for a study that a researcher may perform to analyze the impacts that restructuring has on (1) the economy, (2) the environment, and (3) electric-grid reliability.[4] The analysis in this paper is deliberately not quantitative. Rather, this analysis will provide a useful framework for state regulators and legislators who want to measure the impact that restructuring has on electric markets and will commence a study to do so.

I. RESTRUCTURING DEFINED

According to the Energy Information Administration, the process of restructuring has three main attributes: (1) replacing monopolistic retail-electric markets with competitive markets,[5] (2) giving customers the opportunity to choose their retail-electric provider, and (3) reconfiguring vertically-integrated markets.[6] Despite this basic definition, it is hard to pinpoint exactly what it means for a state electric market to be "restructured." Unlike other industries, such as the airline industry, electric-market restructuring was not a single event that occurred at one point in time.[7] Furthermore, some state policies did not trigger an immediate change in the electric industry but rather phased in changes over a number of years.[8] Consequently, studying the impact of restructuring is difficult because it is challenging to pinpoint a date when the electric market was "restructured."

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4. Michael Dworkin, Class Lecture, Energy Policy for a Carbon Constrained World: An Introduction to Our Trilemma (2011) (asserting that all energy issues should be analyzed in the context of the energy trilemma, which includes the economy, environment, and reliability) (presentation slides on file with the *Vermont Law Review*).

5. "Competition in the electric industry generally means competition only in the production (generation) of electricity and in the commercial functions of wholesaling and retailing." Sally Hunt, *The State of U.S. Electricity Restructuring*, ELECTRICITY J., June 2002, at 11, 12.

6. Reconfiguring vertically integrated markets, also referred to as "unbundling," means that a company's electric services are split into their basic components of generation, transmission, and distribution. Each of these components is then sold separately with separate electric rates charged for each component. Kwok Lun Lo & Yee Shan Yuen, *Deregulation of Electric Utilities, in* POWER SYSTEM RESTRUCTURING AND DEREGULATION: TRADING, PERFORMANCE AND INFORMATION TECHNOLOGY 50, 50 (Loi Lei Lai ed., 2001) [hereinafter POWER SYSTEM RESTRUCTURING].

7. JOHN KWOKA, RESTRUCTURING OF THE U.S. ELECTRIC POWER SECTOR: A REVIEW OF RECENT STUDIES 7 (2006), *available at* http://www.economics.neu.edu/papers/documents/06-005.pdf.

8. *Id.*

II. History of Electric Markets and Restructuring

A. History of Electric Markets

The motivation for restructuring state-retail-electric markets stems from the U.S. electric market's history as a regulated, natural monopoly.[9] To restructure electric markets to introduce competition, policymakers generally use legislation to modify the structure of electric companies.[10] Consequently, a basic understanding of the structure of the United States' electric market and physical functions of the electric industry provides insight about the movement towards restructuring and how legislatures restructure the electric market. "The physical functions of the industry are generation (production), system operations, transmission, and distribution."[11] Electricity is generated and then transported large distances using transmission wires and transported locally using distribution wires.[12]

Generally, experts have asserted that electric companies enjoy economies of scale.[13] In other words, the cost of producing a single unit of power decreases as the total number of units produced increases.[14] Therefore, a single large electric company can theoretically generate, transmit, and distribute electricity more cheaply than several small companies could.[15] Under such conditions, a natural monopoly exists.[16] A monopolist's cost structure enables it to push virtually all competition from the market.[17] Then, unconstrained by competitors, the monopolist is in a position to raise the prices of its products and reduce output, which imposes a loss on society.[18]

To prevent natural monopolies from abusing their market power by decreasing output and increasing prices, and to ensure reliable service, the

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9. *See* Hunt, *supra* note 5, at 13 (arguing that there is no longer a need for the electric market to be a monopoly).

10. *Id.* at 15.

11. *Id.* at 12.

12. *Id.*

13. John Gaffney, *What Blight Through Yonder Window Breaks?: A Survey of the Environmental Implications of Electric Utility Deregulation in Connecticut*, 32 CONN. L. REV. 1443, 1446 (2000).

14. *Id.*

15. *Id.*

16. *Id.* (quoting John C. Moorhouse, *Introduction: The Uncertain Future of the Electric Power Industry*, *in* ELECTRIC POWER: DEREGULATION AND THE PUBLIC INTEREST 1, 5 (John C. Moorhouse ed., 1986)).

17. *Id.*

18. Christopher Bond, *Shedding New Light on the Economics of Electric Restructuring: Are Retail Markets for Electricity the Answer to Rising Energy Costs?*, 33 CONN. L. REV. 1311, 1323 (2001) (citing SIDNEY A. SHAPIRO & JOSEPH P. TOMAIN, REGULATORY LAW & POLICY 190 (1993)).

government began regulating electric companies and their returns.[19] Today, wholesale electric markets (markets where electricity is sold to companies for resale) are in effect restructured so that electric generation operates in a free market.[20] However, FERC continues to regulate transmission, and state commissions continue to regulate retail-electric markets (markets where electricity is sold to customers for end use) in the majority of states.[21] Typically, state commissions regulate state-retail-electric markets using rate-of-return regulation, in which commissions aim to allow the company's revenues to cover all operational costs and provide for a "normal" rate of return.[22]

Advocates of restructuring do not agree that rate-of-return regulation can most effectively manage state retail-electric markets.[23] Rather, they argue that competitive markets are more efficient.[24] To support this argument, they cite the difficulties of accurately computing appropriate revenues under rate-of-return regulation and advance the notion that competition among electric providers will lead to higher efficiency and lower costs for final consumers.[25]

B. History of Restructuring Legislation

A series of state and federal legislation has restructured the U.S. electricity market over the course of forty years.[26] The federal government, including FERC and Congress, began the process of restructuring the wholesale-electric market in the 1970s.[27] Then, in the 1990s state legislatures and utility commissions began restructuring retail-electric markets.[28] The first major step towards restructuring took place when

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19. RICHARD ROSEN ET AL., TELLUS INSTITUTE, CAN ELECTRIC UTILITY RESTRUCTURING MEET THE CHALLENGES IT HAS CREATED? Forward ¶ 2 (2000), *available at* http://citizenpower.com/ElectricChoice/Tellus.pdf.

20. Sheila Slocum Hollis & James W. Checkley, Jr., *Electric Industry Restructuring*, 31 ABA TRENDS 1, Sept.–Oct. 1999, at 4, 4.

21. *Id.*

22. Alexander Sharabaroff et al., *The Environmental and Efficiency Effects of Restructuring on the Electric Power Sector in the United States: An Empirical Analysis*, 37 ENERGY POL'Y 4884, 4885 (2009).

23. *See id.* at 4885–86 (maintaining that a guaranteed, previously determined, "normal" rate-of-return lessens the incentive for electricity producers to maximize efficiency).

24. *Id.* at 4884.

25. *Id.* at 4884, 4885.

26. *See generally* Lester Lave et al., *Deregulation/Restructuring Part I: Reregulation Will Not Fix the Problems*, ELECTRICITY J., Oct. 2007, 9–22 (summarizing that restructuring began in the 1970s and continued into the twenty-first century).

27. *Id.* at 12–13.

28. *Id.* at 14.

Congress passed the Public Utility Regulatory Policies Act of 1978 (PURPA) as a reaction to the 1973 energy crisis.[29] Under PURPA, electric companies were obliged to purchase electricity from independent power producers at the price that the utility itself would have to pay to generate the equivalent amount of electricity.[30] Then, Congress passed the Energy Policy Act of 1992.[31] This legislation granted members of a specific category of generators, called "exempt wholesale generators," an exemption from the Public Utility Holding Act of 1935 and therefore allowed them to build or purchase "non-rate based" electric generation sources to sell electricity in the wholesale market.[32]

FERC further lowered the barriers to competition in the wholesale-electric market when it issued Orders 888 and 889.[33] FERC Order 888 aimed to decrease discriminatory practices by transmission companies that prevented independent power producers from gaining access to transmission lines.[34] To do this, FERC Order 888 unbundled wholesale services, obliged transmission companies to take transmission services at the same rate that it offered to other generators, and defined separate rates for generators, transmission providers, and ancillary service providers.[35] FERC Order 889 required utilities that owned or operated transmission capacity not to use their power to obtain preferential access to transmission information.[36]

Then, in 1998, states began to pass legislation to restructure state-retail-electric markets.[37] The methods that legislatures and commissions use to restructure retail-electric markets vary from state to state, but the policies generally require companies to unbundle their generation, transmission, and distribution so that different tariffs are filed for each activity.[38] While transmission generally remains regulated, generation, retail services, and

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29. *Id.* at 13.

30. This is otherwise known as "avoided cost." Sharabaroff et al., *supra* note 22, at 4886.

31. *Id.*

32. Sharabaroff et al., *supra* note 22, at 4886 (quoting FED. ENERGY REGULATORY COMM'N, REPORT TO CONGRESS ON COMPETITION IN THE WHOLESALE AND RETAIL MARKETS FOR ELECTRIC ENERGY, DRAFT, 19 (2006) [Hereinafter COMM'N REPORT DRAFT]).

33. *Id.*

34. *Id.*

35. *Id.* (quoting COMM'N REPORT DRAFT, *supra* note 32, at 19).

36. Sharabaroff et al., *supra* note 22, at 4886.

37. *See* Magali Delmas & Yesim Tokat, *Deregulation, Governance Structures, and Efficiency: The U.S. Electric Utility Sector*, 26 STRATEGIC MGMT. J. 441, 443 (2005) (claiming that legislation states passed were retail deregulation initiatives).

38. *Cf. Glossary*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/tools/glossary (last visited Sept. 18, 2013) (defining tariff); *see* POWER SYSTEM RESTRUCTURING, *supra* note 6, at 50 (claiming that deregulation often involves unbundling).

distribution remain open to competition.[39] Additionally, state legislation typically requires companies to divest of their assets so they do not own assets in generation, transmission, and distribution.[40] Today, sixteen jurisdictions in the United States have actively restructured retail-electric markets and seven jurisdictions have suspended their retail-electric market restructuring.[41]

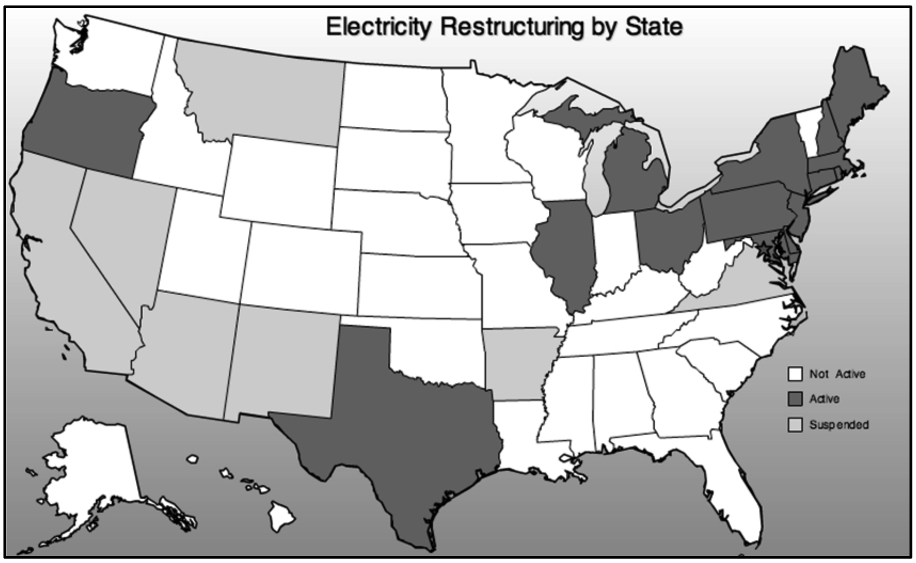

Figure 1: Depicting the sixteen states that have actively restructured retail-electric markets and seven states that have suspended restructuring.[42]

III. RESTRUCTURING'S IMPACT ON THE ECONOMY, THE ENVIRONMENT, AND GRID RELIABILITY

To understand the impact that retail-electric-market restructuring has on a state, policymakers need to consider the impact that restructuring has on the state's economy, the environment, and grid reliability.[43] First, it is important to study the impact that restructuring has on the economy because

39. Hollis & Checkley, Jr., *supra* note 20, at 4.

40. *Cf.* Lester Lave et al., *supra* note 26, at 19 (providing examples of states that did not require divesture of assets); *see* PAROMA SANYAL & LINDA COHEN, POWERING PROGRESS: RESTRUCTURING, COMPETITION, AND R&D IN THE U.S. ELECTRIC UTILITY INDUSTRY 1, 9 (2008), *available at* http://people.brandeis.edu/~psanyal/Elec_Restruc_RD_Tot.pdf (explaining that state legislation specifies divesture rules).

41. *Status of Electricity Restructuring by State, supra* note 1.

42. *Id.*

43. Dworkin, *supra* note 4.

the less money that customers in a state have to dedicate towards paying for electricity the more money they will have to spend on other goods. Second, any analysis that considers the impact of a new energy policy must consider the environmental impacts because electric generation contributes to climate change and degrades both air and water quality; indeed, "[e]lectricity generation is the dominant industrial source of air emissions in the United States today,"[44] with Fossil-fuel plants accounting for 67% of the nation's sulfur dioxide emissions, 23% of nitrogen oxide emissions, and 40% of man-made carbon dioxide emissions.[45] Third, whenever making any changes to the structure of electricity markets, it is important to consider the impact on grid reliability.[46]

The 2003 Northeast blackout portrayed just how extensive the damage from a blackout can be and how quickly it can spread if the electric market is not properly secured and reliable.[47] On August 14, 2003, a tree brushed a high-voltage line in Ohio triggering blackouts throughout the Northeastern United States and parts of Canada.[48] The event was the largest blackout in North American history with 50 million people losing power for up to two days.[49] The blackout contributed to at least eleven deaths and cost an estimated $6 billion.[50] Therefore, regulators should always analyze decisions relating to electric markets in the context of these three factors. After doing so, the challenge is to determine how much weight and importance to give each factor when making decisions.

IV. THE TWENTY IDENTIFIED METRICS

The following is a list of metrics that the literature and industry experts use to measure the impact of restructuring, a brief explanation of the metrics, important considerations about the metrics, and sources to use for further analysis on how to compute these metrics. This list provides a brief introduction to the metrics that the literature and market experts have identified. State regulators who want to calculate the impact restructuring

44. *Clean Energy: Air Emissions*, EPA.GOV, http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html (last updated June 20, 2013).

45. *Id.*

46. Dworkin, *supra* note 4.

47. *See generally* J.R. Minkel, *The 2003 Northeast Blackout: 5 Years Later*, SCI. AM. (Aug. 13, 2008), http://www.scientificamerican.com/article.cfm?id=2003-blackout-five-years-later (discussing the causes and effects of the 2003 blackout, as well as recommendations to reduce the risk of future widespread blackouts).

48. *Id.*

49. *Id.*

50. *Id.*

has on these metrics should consult the more in-depth studies referenced in this Article.

A. Economic Impacts

1. Impact on Private Research and Development Investment

Several studies indicate that when legislators even consider restructuring, regulated utilities decrease their research and development (R&D) spending because of increased uncertainty in recovering costs and their focus on short payback periods.[51] This metric is important to analyze because R&D investment drives economic growth; however, the electricity industry has historically had low rates of R&D investment.[52] The sample analysis that follows includes a more detailed explanation of this metric.

2. Impact on Electricity Cost Burden

Over half of the forty-five articles reviewed indicate cost is an important metric used to analyze the impact of restructuring.[53] Additionally, many experts assert that electric markets should be restructured because restructuring drives down electricity prices.[54] Therefore, cost is an essential metric for policymakers to consider. However, defining this metric and capturing the impact that restructuring has on the cost burden for electricity is difficult. A more detailed explanation of this metric follows in the sample analysis below.

3. Impact on Plant Operating Efficiency

Plant operating efficiency refers to a firm's ability to use fewer inputs such as capital, fuel, and labor, to produce a given amount of electricity.[55] All other variables constant, an increase in plant operating efficiency will theoretically enable electric companies to lower prices for customers

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51. *See* Lave et al., *supra* note 26, at 16 (asserting that the uncertainty from restructuring leads to decreased rates of investment); *see* SANYAL & COHEN, *supra* note 40, at 13–14 (asserting that uncertainty from market restructuring will decrease R&D investment).

52. Lave et al., *supra* note 26, at 16 (understanding that R&D investment leads to innovation and the introduction of new technologies).

53. *See, e.g.*, ROSEN ET AL., *supra* note 19, at 18 ("[L]ower electricity prices[] rests on the efficacy of greater efficiency in reducing overall costs of providing electricity service to consumers.").

54. *See id.* (discussing that a competitive environment leads to greater economic efficiency and an elimination of the need for price regulation).

55. *See id.* at 79 (discussing long-term economic efficiency in terms of factors such as cost of capital and labor costs).

because it will cost less to produce the same amount of electricity.[56] Studies provide various ways to measure this variable.[57] One study uses Cobb-Douglas production, or cost functions, and Leontif production functions over various states, and adjusts these functions for time shocks.[58] Another study simply measures the number of employees required for each gigawatt hour (Gwh) produced and how it changes over time.[59] However, this method does not analyze other inputs such as capital and does not take into account factors other than restructuring that could influence technical efficiency, such as improvements in technology. A third study uses stochastic-frontier analysis to observe changes in inputs over time for generation, transmission, and distribution.[60] A fourth study uses Data Envelopment Analysis (DEA), which measures the relative efficiency of decision-making units with multiple inputs and outputs, but without a production function to aggregate the data.[61] While plant operating efficiency is an important metric, it alone will not adequately capture restructuring's impact on the public. In a competitive market, electric companies may decide whether to pass the savings of technical efficiency on to customers.[62]

4. Impact on Producer Financial Stability

Several studies note the importance of studying the impact that restructuring has on individual producers rather than the public as a whole.[63] To examine this metric, state policymakers can analyze the effect that restructuring has on profits, systematic risks (increased company exposure to market fluctuations), and utility returns.[64] However, when

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56. *See* Kira Fabrizio et al., *Has Restructuring Improved Operating Efficiency at U.S. Electricity Generating Plants?* 5 (Center for the Study of Energy Markets, University of California Energy Institute, Working Paper No. 135, 2004), *available at* http://www.ucei.berkeley.edu/PDF/csemwp135.pdf (employing the basic economic principle that an increase in efficiency results in a decrease in price).

57. *Id.*

58. *Id.*

59. Erik R. Larsen et al., *Lessons from Deregulation in Colombia: Successes, Failures and the Way Ahead*, 32 ENERGY POL'Y 1767, 1774 (2004).

60. Mika Goto & Miki Tsutsui, *Technical Efficiency and Impacts of Deregulation: An Analysis of Three Functions in U.S. Electric Power Utilities During the Period from 1992 through 2000*, 30 ENERGY ECON. 15, 17–18 (2008).

61. Delmas & Tokat, *supra* note 37, at 442.

62. *Id.* (understanding that while DEA is powerful it is not the only tool that should be used).

63. Emeka T. Nwaeze, *Deregulation of the Electric Power Industry: The Earnings, Risk, and Return Effects*, 17:1 J. REG. ECON. 49, 49 (2000).

64. *See id.* (studying the effects of electric-utility industry reforms on profits, risk, and return for the utilities).

performing regression analysis for this metric, other independent variables that may impact producer profits,[65] systematic risks, and returns should be included. This could include factors like fuel costs, costs of capital, population growth, and the overall strength of the economy.

5. Impact on the Allocation of Costs and Savings

Even if restructuring decreases costs and saves money, analysts should determine whether those savings are allocated evenly among stakeholders.[66] Studies measure the allocation of costs and savings between producers and consumers and between various customer types, including residential, commercial, and industrial customers.[67] One study indicates that industrial and commercial customers benefit more from restructuring than residential customers.[68] Other studies use change in consumer and producer surplus to determine the benefits of restructuring and disagree whether producers or consumers reap more benefits from restructuring.[69] For state policymakers trying to understand restructuring's impact on individual stakeholders, the allocation of costs and savings is an important variable to consider.

6. Impact on the Number of Firms and Dispersal of Market Power

If a state restructures its electric market and yet market power is too concentrated in a few companies, those companies may abuse their market power to increase prices.[70] Therefore, to measure restructuring's impact on the dispersal of market power, studies have suggested using the Herfindahl-

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65. Regression models use a set of variables independent from the equation to determine a correlation between those independent variables and a dependent variable. For example, let's say we want to determine what factors influence how much a person spends on DVDs. DVD expenditures is the dependent variable and independent variables that may impact that person's DVD expenditures include personal income, the price of DVDs, and the number of new releases at a given time. Therefore, we could use regression analysis to determine the correlation between overall expenditures on DVDs and DVD prices, personal income, and the number of new releases. *See* DENNIS HALCOUSSIS, UNDERSTANDING ECONOMETRICS 4–5 (2005) (explaining regression analysis).

66. *See* John A. Sautter, *Where Have All the Benefits Gone? Cost Allocation Toward Residential Ratepayers in Restructured Electricity Markets*, ELECTRICITY J., Mar. 2007, at 36, 37 (arguing that not all ratepayers benefit from restructuring).

67. *See id.* (asking if market theorists are correct by questioning whether all consumer classes benefit from restructuring)

68. *See id.* at 37 (claiming that restructuring will result in decreased prices for commercial and industrial consumers and increased prices for residential consumers).

69. *See, e.g.*, C. K. Woo et al., *Costs of Electricity Deregulation*, 31 ENERGY 747, 761 (2006); *see generally* RONALD SUTHERLAND, ESTIMATING THE BENEFITS OF RESTRUCTURING ELECTRICITY MARKETS: AN APPLICATION TO THE PJM REGION (2003) (highlighting the various benefits available to both consumers and producers as a result of restructuring).

70. Larsen et al., *supra* note 59, at 1772.

Hirschmann index (HHI index) to measure market concentration[71] and Pivotal Firm analysis to determine the power of one company to disrupt the grid by withholding supply from the market.[72]

7. Impact on the Cost of Capital

Studies suggest that retail-electric-market restructuring decreases company and lender certainty about returns on investment, which increases the cost of capital and discourages generation investment.[73] If increases in the cost of capital cause investments in electric generation to decrease, then grid reliability may be negatively impacted.[74] One effective way to measure the impact that restructuring has on the cost of capital is to gather data about utilities' capital costs for investment,[75] including cost of equity and return on debt, and to run a regression analysis while adjusting for the prime interest rate—the Treasury Bill rate—and other variables that may impact the financial risk of the electric industry.

8. Stranded Costs Incurred[76]

This metric is an important tool to understand the impact that restructuring has on electric companies.[77] However, if the objective of analyzing these metrics is to determine the impact that restructuring has on the public, then this metric may not be highly insightful because it primarily

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71. *Id.*; *see* Stephen Rhoades, *The Herfindahl-Hirschmann Index*, 79 FED. RESERVE BULLETIN 164, 188 (1993) (providing an explanation on how to calculate the HHI Index).

72. Seth Blumsack et al., *Market Power in Deregulated Wholesale Electricity Markets: Issues in Measurement and the Cost of Mitigation*, ELECTRICITY J., Nov. 2002, at 13.

73. Woo et al., *supra* note 69, at 756; Lave et al., *supra* note 26, at 15.

74. *See* Woo et al., *supra* note 69, at 756, 758 (arguing that an increased cost of capital decreases investment and reliability).

75. U.S. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, UPDATED CAPITAL COST ESTIMATES FOR UTILITY SCALE ELECTRICITY GENERATING PLANTS 1 (April 2013), *available at* http://www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf.

76. Stranded costs are capital and infrastructure investments that incumbent firms made under the assumption that costs would be amortized in a regulated environment, but that utilities are unlikely to recover in a competitive market. Sharabaroff et al., *supra* note 22, at 4886; KWOKA, *supra* note 7, at 18.

77. *See* Gaffney, *supra* note 13, at 1456 (citing William J. Baumol & J. Gregory Sidak, *Stranded Costs,* 18 HARV. J.L. & PUB. POL'Y 835 (1995); CONN. GEN. STAT. § 16-245e(b) (1999)) (describing stranded costs and explaining that the Department of Public Utility Control determines the dollar amount of stranded costs that each utility is entitled to recover by statute); SUTHERLAND, *supra* note 69, at 37 n.45; KWOKA, *supra* note 7, at 18 (explaining that in many states rate freezes were accompanied by provisions for stranded costs and the three-step recovery process).

captures the impact that restructuring has on companies' ability to recoup investments.[78]

9. Bankruptcies

The number of bankruptcies that result from restructuring is an important measure of restructuring's impact on investor loss.[79] An increase in bankruptcies is also a concern for regulators who must assure that there is a utility company that is able to serve customers in the event of a retail provider's bankruptcy.[80] To measure the impact of bankruptcies, analysts should consider the number of customers that lose service and who among investors and customers incur costs as a result of bankruptcies.[81]

B. Environmental Impacts

1. Impact on Customer Choice for "Green" Sources of Electricity

To measure the potential impacts restructuring has on the environment, analysts should look at company offerings for "green" sources of electricity before and after restructuring.[82] First, analysts need to determine what constitutes a "green" source of electricity. For example, do fossil-fuel sources such as natural gas constitute a "green" source of electricity as compared to coal, or do only renewable resources constitute "green" sources of electricity? Additionally, if the analyst performs a regression analysis on this metric, the analyst should include factors other than restructuring that may impact choices for "green" sources of electricity,

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78. *See* Gaffney, *supra* note 13, at 1456–57 (citing CONN. GEN. STAT. § 16-245e-g (1999)) (explaining that utility companies can recover stranded costs through the issuance of rate reduction bonds, thereby recouping their investments).

79. *See* Elvia Aguilar, *Electric Provider Files for Chapter 11*, CORPUS CHRISTI CALLER – TIMES (June 9, 2008, 6:01 PM), http://www.caller.com/news/2008/jun/09/electric-provider-files-chapter-11/ (explaining that three electric providers in Texas have gone out of business within a short period of time in 2008).

80. For example, in Texas, the Public Utility Commission recommended customers shop for a utility company that would provide them with service in the event their electric company defaulted after three electric providers went out of business in 2008 and had to transfer about 1,000 customers to a utility company that was able to provide service. *Id.*

81. *See*, *e.g.*, *id.* (describing how the effect of the 2008 electric provider bankruptcies in Texas left 30,000 customers with providers of last resort).

82. *See* Gaffney, *supra* note 13, at 1457 (quoting CONN. GEN. STAT. § 16-244(9) (1999)) (explaining that the Connecticut legislature adopted significant provisions intended to address environmental concerns as a motive for deregulation).

such as renewable portfolio standards, the cost of capital for various types of generation facilities, and fuel costs.[83]

2. Impact on Emissions of Greenhouse Gases and Criteria Pollutants[84]

Another key consideration regarding restructuring is its impact on air quality and climate change. Studies disagree whether restructuring has a negative or positive impact on greenhouse gas emissions and pollutants like sulfur dioxide and nitrogen oxides.[85] A more detailed explanation of this factor follows in the sample analysis below.

3. Impact on Water Withdrawal and Consumption

While this factor does not often receive attention, the electric industry has a significant impact on the nation's water supply.[86] For example, recent data suggests that thermoelectric power plants[87] use more than 190 billion gallons of water per day, or 47% of the country's total.[88] The following Part provides a more in-depth analysis of this factor.

C. Reliability Impacts

1. Impact on Number and Duration of Outages

The change in the number of power outages is an important metric to determine the impact that restructuring has on reliability.[89] Analysts should consider the number of outages, the duration of those outages, and the

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83. *See id.* (quoting CONN. GEN. STAT. § 16-245o (1999); Kevin G. DeMarrais, *Electricity Will Be Sold in New Jersey with Environmental Labels*, RECORD (Bergen County, N.J.), Oct. 6, 1999, at B1 (explaining that Connecticut, New Jersey, and California have instituted programs that allow customers to choose electricity and that many do so based on environmental concerns).

84. Criteria pollutants are six pollutants that the EPA regulates because they are harmful to human health and the environment. *What Are the Six Common Air Pollutants?*, EPA.GOV, http://www.epa.gov/airquality/urbanair (last updated Apr. 20, 2012). These pollutants include: ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead. *Id.*

85. *See, e.g.*, Sharabaroff et al., *supra* note 22, at 4885 (addressing whether restructuring's effect on efficiency and the environment is positive or negative); *see* Karen Palmer & Dallas Burtraw, *Electricity Restructuring and Regional Air Pollution*, 19 RES. & ENERGY ECON. 139, 142 (1997) (finding that restructuring increases greenhouse gas emissions).

86. Benjamin K. Sovacool & Kelly E. Sovacool, *Identifying Future Electricity—Water Tradeoffs in the United States*, 37 ENERGY POL'Y 2763, 2763 (2009).

87. Thermoelectric power plants include nuclear power plants and power stations that combust coal, oil, natural gas, biomass, or waste to produce electricity. *See id.* at 2764.

88. *Id.* at 2764.

89. *See* Woo et al., *supra* note 69, at 758 (giving examples of increased power outages due to deregulation); SUTHERLAND, *supra* note 69, at 7.

number of customers impacted.[90] A more in-depth analysis of this factor follows.

2. Impact on Voltage Reduction

Changes in periods of voltage reduction also capture restructuring's impact on grid reliability.[91] While no studies used this as a recommended metric, for industrial customers, periods of voltage reduction (brownouts) can interrupt operations and compromise output.[92] For example, if a computer chip manufacturer produces chips made according to strict specifications, interrupted electricity supply may cause the plant to produce defective chips.[93]

3. Impact on Investment in New Generation

This reliability metric is strongly related to Economic Metric #7: "Impact on the Cost of Capital." Several studies mention concern that restructuring may decrease investment in new generation.[94] These concerns stem from the theory that increased risk-of-return may make the cost of capital higher for electric companies and therefore decrease investment in new generation.[95] Also, studies indicate concern that to decrease costs in a competitive market, electric companies will look for low-cost solutions to increase capacity and will not construct facilities to ensure reliability above a certain minimum level.[96] Therefore, policymakers need to determine

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90. *See* JEFFREY S. SIMONOFF ET AL., UNIV. OF S. CAL., ELECTRICITY CASE: STATISTICAL ANALYSIS OF ELECTRIC POWER OUTAGES, CREATE REPORT 1 (July 26, 2005), *available at* http://research.create.usc.edu/cgi/viewcontent.cgi?article=1161&context=published_papers (considering the number of outages, duration of outages, and number of customers without power in its analysis of power outages).

91. Interview with Michael Dworkin, Former Chairman, Vt. Pub. Serv. Bd. (Mar. 2012) (transcript on file with author).

92. *Id.*

93. *Id.*

94. *See* J. Lon Carlson & David Loomis, *An Assessment of the Impact of Deregulation on the Relative Price of Electricity in Illinois*, ELECTRICITY J., July 2008, at 60, 68 (stating that restructuring may have an impact on investment in new generating capacity); *see* Woo et al., *supra* note 69, at 756 (arguing that restructuring decreases investment in new capacity); *see* Lester Lave et al., *supra* note 26, at 15–16 (highlighting that New York and California report shortages of generation "in part due to investors demanding higher rates of return to compensate for the additional uncertainty brought about by restructuring").

95. Woo et al., *supra* note 69, at 756.

96. *See* Alexander E. Farrell et al., *Bolstering the Security of the Electric Power System*, ISSUES IN SCI. & TECH. 49, 50 (Spring 2002), *available at* http://www.issues.org/18.3/farrell.html (arguing that competitive electric markets will force utilities to seek the lowest-cost solutions to generate electricity).

whether restructuring's impact on new generation has a positive or negative impact on grid reliability.

4. Impact on Total Kilowatt Hours Produced and Peak Demand

Finally, the impact that restructuring has on total kilowatt hours (kWh) produced and peak demand is an important metric to consider.[97] If restructuring strongly increases or decreases the total quantity of electricity demanded or the rate of demand, then current infrastructure may be insufficient to provide adequate supply.[98] This situation could potentially lead to devastating blackouts.[99]

D. Additional Metrics

The following additional metrics have been cited as ways to measure the success of state restructuring programs:

1. Customer Switching Rates
2. Number of Customers Served by Retail-Electric Providers
3. Increased Customer Choice
4. Impact on Number of Customer Complaints[100]

Metrics such as customer switching rates and the number of customers served by retail-electric providers do not express whether the outcome of restructuring is beneficial to the public; rather, it solely expresses customer participation.[101] Additionally, increased customer choice for retail-provider services does not necessarily measure a benefit to customers unless people value those additional choices and utilize them to receive some sort of benefit.[102] On the other hand, the impact on customer complaints may express customer satisfaction with restructuring, which may be important for state regulators to consider.

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97. *See, e.g.*, Woo et al., *supra* note 69, at 758 (giving an example of capacity not meeting demand).

98. *See id.* (warning that deregulation may result in insufficient investment in Italy).

99. *See, e.g.*, *id.* at 758 (giving an example of power outages caused by capacity shortages).

100. KWOKA, *supra* note 7, at 70.

101. *See* ALBERTA DEP'T OF ENERGY, RETAIL MARKET REVIEW 14, (2012), *available at* http://www.energy.gov.ab.ca/Electricity/pdfs/RetailMarketReview.pdf (defining customer switching rates to mean the number of customers participating in competitive markets).

102. *See id.* at 18 (defining product diversity in terms of customer choices, and not public benefit).

V. FRAMEWORK FOR A STATE ANALYSIS

Now that I have identified twenty metrics used to measure restructuring's impact on retail-electric markets, I will provide a framework for state policymakers to formulate an effective study to measure the impact restructuring has had on their state. It is essential that any study proceeds in three basic steps. First, and most importantly, the analyst must choose metrics that will measure actual benefit to the public and justify why the metric should be analyzed. Second, it is important that the analyst specifically and appropriately defines the metric. Third, the analyst must choose a proper economic model and must include variables other than restructuring that may impact that metric. In the following example framework, the only type of economic modeling that I suggest using is regression modeling. However, different variables may require other types of economic modeling, which I have briefly explained in the prior section.

It is important for the analyst to limit the number of metrics studied because it would be a time consuming and burdensome task for an analyst to conduct a study for all twenty metrics identified in this report. The analyst should choose an equal number of metrics that relate to the economy, the environment, and reliability. For the example framework below, I have chosen two metrics that measure the economic impact of restructuring, two that measure the environmental impact of restructuring, and two that measure the impact that restructuring has on grid reliability.

Furthermore, it is important to note that the dataset for each metric will consist of time-series data with the initial year at ten years before introducing any restructuring bill or utility commission docket regarding restructuring, whichever is earlier. The end year should be the most recently ended calendar year or at least ten years after restructuring. This will ensure that the model captures the state of the market before restructuring was ordered, the impact of the consideration of restructuring, and the impact of the restructuring order itself.

VI. EXAMPLE FRAMEWORK FOR A STATE ANALYSIS

I will consider the following six metrics in this example state analysis of restructuring's impact on retail-electric markets:

Economic	**Environmental**	**Reliability**
1. Private R&D Investment 2. Electricity Cost Burden	1. Emissions of Greenhouse Gases & Criteria Pollutants 2. Water Withdrawal & Consumption	1. Number & Duration of Outages 2. Investment in New Generation

Next, I will apply the three necessary analytical steps to each variable.

A. Economic Metric 1: Impact on Private R&D Investment

1. Step 1: Justification for Metric Analysis

"Impact on Private R&D Investment" was chosen as the first economic metric for four primary reasons. First, R&D investment is vastly important for both the state and national economy. Estimates indicate that as much as 90% of the economy's overall economic growth stems from innovation in science and technology.[103] Second, investment in R&D in the electric industry can lead to enhanced economic and geopolitical security and lessen the electric industry's impact on climate change and air pollution.[104] Third, R&D in the electric industry has historically been very low as compared to other industries, and recent trends indicate that R&D in the electric industry is decreasing further.[105] For example, between 1991 and 2003, investments in electric-industry R&D fell by 50%.[106] Additionally, in 2007, according to Nemet and Kammen, the United States invested $1 billion less in energy R&D than it did a decade before while overall U.S. R&D increased by 6% per year.[107] Fourth, several studies indicate that even the consideration of restructuring may have a negative impact on electric-company R&D

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103. Gregory Nemet & Daniel M. Kammen, *U.S. Energy Research and Development: Declining Investment, Increasing Need, and the Feasibility of Expansion*, 35 ENERGY POL'Y 746, 746 (2007).

104. *Id.*

105. *Id.* at 746–47.

106. *Id.* at 747.

107. *Id.*

spending.[108] Therefore, electric-company R&D spending is hugely important for the U.S. economy, environment, and the reliability of the grid, making it a valuable metric to evaluate.

2. Step 2: Specifying the Metric

To establish the R&D metric, the analyst should obtain data regarding R&D expenditures from electric companies and adjust those expenditures for inflation based on a particular base year. A valuable source for R&D expenditure data may be FERC Form-1 or rate cases filed with the state utility commission. However, one weakness of this dataset may be that R&D data that is not reported to the utility commissions or the FERC Form-1 may not be available, such as when the company is not a public utility.

3. Step 3: Identifying the Variables and Model to Use

When analyzing any metric using a regression model, the model must include any variables which may impact the metric, including state restructuring laws. For this metric, it will be important to include other variables that may impact R&D investments, such as: FERC Orders 888 and 889 dummy variables,[109] a restructuring-investigation dummy variable, a restructuring-order dummy variable, a divesture-dummy variable, a stranded-cost-recovery dummy variable, the share of generation in total electricity shares, changes in gross state product (GSP), and firm size.[110]

B. Economic Metric 2: Impact on Electricity Cost Burden

1. Step 1: Justification for Metric Analysis

I included this metric for three major reasons. First, in the literature review conducted for this Article, impact on the retail prices of electricity was the most cited metric.[111] Second, decreased prices are often cited as the

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108. *Id.* (claiming that the consideration of restructuring is a regulatory obstacle that has a negative impact on investment); SANYAL & COHEN, *supra* note 40, at 27.

109. If you would like to include qualitative variables in a regression model that are not numerical, like “yes” or “no” responses or “male” or “female,” use a dummy variable to give value to this non numerical data. For example, “yes”=1 and “no”=0, or “male”=1 and “female”=0. *See* HALCOUSSIS, *supra* note 65, at 85–86 (explaining dummy variables).

110. *See, e.g.*, SANYAL & COHEN, *supra* note 40 (providing a more detailed example of a model to estimate this metric).

111. *See* KWOKA, *supra* note 7, at 1 (naming lower retail prices to customers as the main objective of electricity restructuring).

objective of state electric-market restructuring.[112] Third, decreasing the electricity cost burden in a state allows customers to spend more money on other goods and services in the state.[113]

2. Step 2: Specifying the Metric

To accurately define this metric, it is important to consider why retail price of electricity is so often cited as a metric of success or failure of state-electric-market restructuring. Many studies use the theory that decreased retail-electric rates allow customers to spend money on other items because less of their income will be devoted to paying for electricity.[114] However, this theory is flawed. Retail-electricity rates are inadequate to measure the amount of money that a person dedicates to electricity purchases and the impact that restructuring has on this for several reasons. First, retail-electric rates may not accurately reflect restructuring's impact on the market because many state restructuring laws freeze rates and adjust for stranded costs and excess capacity for several years after the state orders restructuring.[115] Second, most states incorporated deferral accounts into their deregulation legislation so that increases in prices are deferred to a later date.[116] Therefore, investigating retail-electric prices does not reflect the effect that restructuring has had on electricity rates.[117]

Additionally, rates are generally not the most effective way to measure the electric industry's economic impact on society.[118] Customer bills are calculated by multiplying customer usage (in kWh) by the rate that electric companies charge (cents per kWh).[119] Therefore, either decreasing the usage *or* the electric rates charged decreases the social cost of electricity because either can lower bills for customers.

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112. *Id.* at 2 (explaining the changes implemented by state restructuring were all designed to foster competition resulting in lower retail prices).

113. *See id.* at 44 (describing a study which estimates the consumer benefit from current restructuring efforts at $38.8 billion).

114. *Id.* at 45.

115. *See id.* at 8 (describing state-level restructuring efforts that involved rate reductions and freezes).

116. Sautter, *supra* note 66, at 41; *see* KWOKA, *supra* note 7, at 9 (stating that the effect of the freezes were to keep retail prices low temporarily, but after expiration of the freeze prices would jump substantially in the catch-up phase).

117. *Id.*

118. *See* Sautter, *supra* note 66, at 41 (using state electricity revenues instead of rates to determine the economic impact).

119. *How to Calculate Your Bill*, EPB, https://www.epb.net/power/home/support/how-to-calculate-your-bill/ (last visited Nov. 5, 2013).

For example, consider a customer who uses 1,000 kWh a month at fifteen cents/kWh and pays $150 for electricity for the month, while another customer who uses 2,000 kWh a month at ten cents/kWh and pays $200 for electricity for the month.[120] In this example, even though the second customer's price per kWh was less, his or her monthly bill was higher. This example indicates that using electricity rates to calculate the social cost of the electric industry can be inadequate. Because retail price does not accurately capture the effect that restructuring has on the market, it is desirable to identify a metric that more effectively measures restructuring's impact on customers' burden to pay for electricity.

A more accurate measure of the social cost of retail electricity results from analyzing both: (1) utility-company revenue as a percentage of the gross state product (GSP) and (2) utility-company revenue as a percentage of customers' disposable income spent on electricity.[121] These metrics reflect the amount that customers pay for electricity bills as a percentage of the individual's spending and as a percentage of state economic output. FERC Form-1 and most recent rate cases are useful sources to find information about utility revenues. Additionally, the U.S. Bureau of Economic Analysis is a useful source for state GSP and state-disposable-income data.

3. Step 3: Identifying the Variables and Model to Use

Other variables that may impact the electricity cost burden and should be included in the regression model include: fuel costs multiplied by fuel generation mix, change in wholesale-electricity prices, rate reductions and rate freezes, and dummy variables for the various pieces of restructuring legislation that are passed over time.[122]

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120. Interview with Michael Dworkin, *supra* note 91.

121. *Disposable Income*, INVESTOPEDIA.COM, http://www.investopedia.com/terms/d/disposableincome.asp (last visited Nov. 5, 2013).

122. *See* Adam Swadley & Mine Yücel, *Did Residential Electricity Rates Fall After Retail Competition? A Dynamic Panel Analysis*, 39 ENERGY POL'Y 7702, 7704 (2011) (explaining the included metrics to control for input costs of electric generating facilities that might be passed on to customers); Woo et al., *supra* note 69, at 760 (claiming that variations in fuel prices will impact the costs of both restructured and integrated utilities); SUTHERLAND, *supra* note 69, at 46; KWOKA, *supra* note 7, at vi (providing methodologies for quantifying electricity cost burden and examples of independent variables).

C. Environmental Metric 1: Impact on Emissions of Greenhouse Gases and Criteria Pollutants

1. Step 1: Justification for Metric Analysis

Analysts must capture the impact that restructuring has on criteria pollutants and greenhouse gas emissions. As stated previously, fossil-fuel plants account for 67% of the nation's sulfur dioxide emissions, 23% of nitrogen dioxide emissions, and 40% of man-made carbon dioxide emissions.[123] State policymakers can more effectively address air pollution and climate change issues if they use metrics to monitor the impacts that changes in the electric industry have on criteria pollutants and carbon dioxide emissions.

2. Step 2: Specifying the Metric

To determine restructuring's impact on this metric, the analyst must create separate regression models in which emissions of carbon dioxide and emissions of each criteria pollutant are the dependent variable for each regression model. Criteria pollutants include: ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead.[124] In the interest of time, analysts can reduce the number of pollutants that they study. State data for criteria pollutants and carbon dioxide are available through the U.S. EPA's *National Emissions Inventory*.[125]

3. Step 3: Identifying the Variables and Model to Use

To accurately measure restructuring's impact on pollutant emissions, the regression model must include variables other than restructuring that may impact emissions. Such variables include: generation fuel mix, population changes, share of manufacturing in total gross state product, changes in technology, and total gross state product.[126]

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123. *Clean Energy: Air Emissions, supra* note 44.

124. *See National Ambient Air Quality Standards (NAAQS),* EPA.GOV, http://www.epa.gov/air/criteria.html (last visited September 1, 2013) (listing the six "criteria" pollutants).

125. *The National Emissions Inventory*, EPA.GOV, http://www.epa.gov/ttn/chief/net/2008inventory.html (last updated Oct. 10, 2013).

126. *See* Sharabaroff et al., *supra* note 22, at 4885 (detailing information of modeling impacts on air emissions in regional markets); *see* Palmer & Burtraw, *supra* note 85, at 151 (using fuel type as a variable); *see* Erin Mansur, *Do Oligopolists Pollute Less? Evidence from a Restructured Electricity Market*, 55:4 J. INDUS. ECON. 661, 664 (2007) (explaining variables other than restructuring that may impact air emissions).

D. Environmental Metric 2: Impact on Water Consumption and Withdrawal

1. Step 1: Justification for Metric Analysis

Water is one of the most precious resources for a region. However, studies often overlook the severe impact that the electric-power industry has on water withdrawals and consumption. Recent data suggests that thermoelectric power plants use more than 201 billion gallons of water per day, or 49% of the country's total.[127] Moreover, The National Energy Technology Laboratory estimated that by 2025, under a high consumption case, the thermoelectric sector could use 165% more water than in 1995.[128] Therefore, any analysis on restructuring's environmental implications should analyze changes in the retail-electric sector's water demand and use.

2. Step 2: Specifying the Metric

Thermoelectric plants withdraw water and use it to cool generation equipment.[129] The plant will return some of this water to the water table, and some of this water the plant will "consume" through evaporation.[130] This metric will not distinguish between water that is "withdrawn" and water that is "consumed." Rather, it will focus on total electric-industry water demand, including withdrawals and consumption. At a given time, total water demand will indicate when water shortages may occur. The analyst may calculate this metric using FERC Form-1 to obtain utility-specific data on the number of kilowatt-hours thermoelectric plants generate. Since different types of generation plants such as nuclear and coal use varying amounts of water, the analyst must next determine each type of facilities' water demand per kWh to calculate the state's thermoelectric plants' total water demand.

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127. *Thermoelectric Power Water Use,* U.S. GEOLOGICAL SERV., http://ga.water.usgs.gov/edu/wupt.html (last modified Aug. 14, 2013).

128. Barbara Carney & Thomas J. Feeley III, *Advanced Cooling Strategies/Tech. Conference: NETL Water Program Overview*, US DEP'T OF ENERGY/NAT'L ENERGY TECH. LAB., (June 1, 2005), http://www.energy.ca.gov/pier/conferences+seminars/2005-06_advanced_cooling_conference/presentations/B_NETLWater.pdf.

129. Carolyn F. Burr et al., *Water: The Fuel for Colorado Energy*, 15 U. DENV. WATER L. REV. 275, 281 (2011–2012).

130. *See generally Cooling Power Plants*, WORLD NUCLEAR ASSOCIATION, http://www.world-nuclear.org/info/Current-and-Future-Generation/Cooling-Power-Plants/#.UiJc5RvENCE (last updated Sept. 2013) (describing water cooling systems and corresponding evaporation in thermoelectric plants).

3. Step 3: Identifying the Variables and Model to Use

Next, the analyst must perform a regression analysis and include variables that impact water demand. Similar to the variables that impact air emissions, these variables include: generation fuel mix, population changes, share of manufacturing in total gross state product, changes in technology, and total gross state product.[131] Unfortunately, no literature was found that constructed and evaluated a model for this metric.

E. Reliability Metric 1: Impact on Number and Duration of Outages

1. Step 1: Justification for Metric Analysis

The electric grid is a highly interconnected system that assures power supply. However, when this interconnected system fails, "it fails in complex and dramatic ways."[132] As described previously, blackouts can devastate the economy and the safety of Americans. Consequently, analysts must consider the number of system outages when analyzing restructuring's impact on grid reliability.[133] The number of outages, the duration of those outages, and the number of customers affected are important factors that capture the severity of blackouts and their impact on people.[134]

2. Step 2: Specifying the Metric

An analyst can find some regional data on the number of outages, duration of outages, and number of customers impacted in the North American Electric Reliability Corporation's (NERC) *System Disturbance Reports*.[135] However, to make more detailed information available about state outages, states may require electric companies to file informative reports about the number of outages, duration of outages, and number of

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131. *See* Sharabaroff et al., *supra* note 22, at 4888 (explaining variables other than restructuring that may impact air emissions).

132. Thomas J. Overbye, *Reengineering the Electric Grid: Deregulation Places New Demands on One of the World's Largest Engineered Structures—and Presents New Opportunities for Educated Consumers*, 88 AM. SCIENTIST 220, 220 (2000).

133. SUTHERLAND, *supra* note 69, at 65 n.89.

134. *See id.*at 62 (stating the importance of taking more than just the number of outages into consideration when analyzing their significance).

135. *See*, *e.g.*, N. AM. ELECTRIC RELIABILITY CORP., STANDARD EOP-004-2—DISTURBANCE REPORTING (June 18, 2010), http://www.nerc.com/pa/Stand/Project201012%20Order%20693%20Directives/EOP-004-2_Cln_2010June18.pdf (providing a copy of a NERC Disturbance Report Form).

customers affected by outages in the area. For example, Vermont requires electric companies to file Service Quality and Reliability Plans.[136]

3. Step 3: Identifying the Variables and Model to Use

Finally, the analyst must construct three regression models for the number of outages, duration of outages, and number of people affected, and must include in each model the variables other than restructuring that will impact each of those reliability metrics. For the metrics "number of outages" and "duration of outages," an analyst would likely run a regression analysis and include independent variables that represent restructuring legislation, weather conditions, and investment in capital.[137] For the metric "number of people impacted," analysts would run a regression analysis and include the variables that represent restructuring legislation, weather conditions, and population density.

F. Reliability Metric 2: Impact on Investment in New Generation

1. Step 1: Justification for Metric Analysis

The regulated utility industry is often accused of over investment in capital, such as generation and transmission facilities.[138] However, additional transmission lines and generation stations can lead to greater redundancy in the grid and increase reliability.[139] Since retail-electric-market restructuring decreases company and lender certainty about returns on investment, it can lead to increased cost of capital and discourage generation investment.[140] Additionally, there is concern that to decrease costs in a competitive market, electric companies will look for low-cost solutions to increase capacity and will not construct facilities to ensure reliability above a certain minimum.[141] These decreased investments lead to lower reserve margins and an increased risk of blackouts.[142] Therefore, it is important to quantify this risk.

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136. *Cf.*, *Service Quality*, VT. PUB. SERV. BD., http://psb.vermont.gov/utilityindustries/electric/backgroundinfo/sqrp (last visited Nov. 5, 2013). (defining Service Quality and Reliability Plans).

137. *See* KWOKA, *supra* note 7, at 77–78 (discussing the interim report of DOE's Power Outage Study Team and findings regarding causes of outages).

138. Woo et al., *supra* note 69, at 758.

139. *Id.*

140. Lave et al., *supra* note 26, at 15 (understanding that increased costs of capital and less generation investment is a result of demanding higher rates of return due to uncertainty).

141. Farrell et al., *supra* note 96, at 50.

142. Lave et al., *supra* note 26, at 16.

2. Step 2: Specifying the Metric

Data about capital investment in new infrastructure for public companies is available in FERC Form-1 and utility commission rate cases.[143] However, if the company is not public then the information on capital expenditures for generation may not be available, and the analyst must disclose the lack of data in the study.[144]

3. Step 3: Identifying the Variables and Model to Use

Once the analyst obtains data about capital investment in new infrastructure, he or she should run a regression analysis and include several independent variables such as: a restructuring variable, the cost of equity and cost of debt (interest rates), inflation, population change, changes in state GSP, and changes in electricity demand. Then, once the analyst determines the impact that restructuring has had on investment in new infrastructure, he or she will need to determine if the decrease in infrastructure will compromise grid reliability. To do so, the analyst must determine if there is sufficient infrastructure available to satisfy current and forecasted demand and if the decreases in infrastructure investment as a result of restructuring will compromise the ability to meet this demand. No literature review provided an example of such an analysis.

CONCLUSION

Restructuring will likely have a positive impact on some metrics and a negative impact on others. In that instance, the policymaker must remember the serious impact that a change in the electric industry may have on the economy, the environment, and grid reliability, and consider all three when making decisions about restructuring. Nevertheless, using this analysis, policymakers will be able to make more educated and effective decisions about whether to restructure electric markets further, curtail restructuring, or continue on the same path that the state is on.

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143. *See* RICHARD J. CAMPBELL, CONG. RESEARCH SERV., R42068, REGULATORY INCENTIVES FOR ELECTRICITY TRANSMISSIONS—ISSUES AND COST CONCERNS 2–3 (Oct. 28, 2011), *available at* http://www.ieeeusa.org/policy/eyeonwashington/2011/documents/electrans.pdf (analyzing historical capital investment data in transmission infrastructure from FERC Form-1).

144. *See*, *e.g.*, Byron C. Keeling, *Attempting to Keep the Tablets Undisclosed: Susceptibility of Private Entities to the Texas Open Records Act,* 41 BAYLOR L. REV. 203, 205–06 (analyzing the legislative history of the Texas Open Records Act and concluding it does not support the release to the public of information in the possession of a private entity).

Regulators, legislators, and the public all want to create an electric industry that provides economical electric services while maximizing grid reliability and minimizing harm to the environment. Restructuring may accomplish this. However, policymakers can more effectively make decisions that will be in the best interest of the public if they have metrics in place that show whether restructuring has been a benefit or a detriment to the state-retail-electric market. Using the framework set forth in this article, stakeholders can develop a study to measure the impacts of electric-market restructuring.

This Article should be a call to action for policymakers. Policymakers should not lose sight of the fact that the fundamental purpose of both regulation and the free-market is to maximize benefits to the American people. Therefore, policymakers must take the time to analyze the benefits or detriments restructuring has already brought to retail-electric markets before making a decision to either advance or curtail retail-electric market restructuring. A decision-making process that takes restructuring's benefits and detriments into account will ensure that policymakers will better manage electric markets for us all.