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Public Service Commission of Wisconsin
P.O. Box 7854
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Subject: Docket No. 5-UR-107 Comments

The Institute for Policy Integrity ("Policy Integrity") at NYU School of Law[1] respectfully submits the following comments to the Public Service Commission of Wisconsin ("the Commission") for the public hearing on the Joint Application of Wisconsin Electric Power Company and Wisconsin Gas LLC, both d/b/a We Energies, for Authority to Adjust Electric, Natural Gas, and Steam Rates.

Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in the fields of administrative law, economics, and public policy.

In its biennial cost and rate review, the Wisconsin Electric Power Company and Wisconsin Gas LLC, both d/b/a We Energies ("the Company"), proposed changes to its net metering rates for distributed solar generation ("DSG"). The rate at which the Company proposes to buy back the solar generation in excess of customer demand is equal to the sum of the avoided wholesale energy cost, which is also referred to as Locational Marginal Price ("LMP")[2], avoided marginal transmission cost, and avoided line losses.[3]

DSG has a value to society due to the savings from the reduced need for production from other sources. DSG also lowers transmission costs and line losses, because less electricity is

[1] No part of this document purports to present New York University School of Law's views, if any.
[2] Locational Marginal Price (LMP) is the "cost to serve the next MW of load at a specific location using the lowest production cost of all available generation, while observing all transmission limits. It has three major components: generation marginal cost plus transmission congestion costs plus the cost of marginal losses." JAMES MOMOH & LAMINE MILI, OPERATION AND CONTROL OF ELECTRIC ENERGY PROCESSING SYSTEMS §3.81 (2010).
[3] Direct Testimony of Eric A. Rogers, Wis. P.S.C. Docket No. 05-UR-107, Direct-WEPCO/WG-Rogers at 56-57 (June 27, 2014); Direct Testimony of Eric A. Rogers, Wis. P.S.C. Docket No. 05-UR-107, Ex. WEPCO/WG-Rogers-11 at Sched. 7 (June 27, 2014).

transmitted and it is transmitted shorter distances.[4] Therefore, using avoided wholesale energy cost, avoided marginal transmission cost, and avoided line losses is a good starting point in determining the base energy value of DSG to society. However, the approach the Company suggests does not take into account other quantifiable benefits and costs that accrue to society. Unless all the benefits and costs of DSG are internalized in the net metering price, the outcome will be economically inefficient.[5]

We categorize the externalities (both positive and negative) related to DSG into two main groups: Environmental and health benefits, and the costs and benefits related to the grid integration of DSG. Establishing the correct net value of DSG by quantifying all these benefits and costs should be the Commission's first step.[6] The Commission should order an independent study to calculate these benefits and costs, and adjust the proposed rates accordingly. Specifically, the Commission should:

- Adjust the proposed net metering rate to include the health and environmental benefits associated with the avoided greenhouse gas (GHG) emissions and emissions of local pollutants;
- Adjust the proposed net metering rate to include the value of the net impact of distributed solar generation on the local grid; and
- Consider regulatory reforms to better achieve Wisconsin's energy goals.

We are not suggesting that the net metering rate should definitely be higher (or lower) than the avoided energy costs, but that a net metering rate cannot be socially optimal unless all of the benefits and costs of distributed generation are quantified and incorporated into the rate.

I. The Commission should adjust the proposed net metering rate to include the health and environmental benefits associated with the avoided greenhouse gas (GHG) emissions.

In a 2013 Order on a petition to amend the Commission's rules related to interconnecting distributed resources, the Commission stated, "[c]urrent tariffs may need to be re-examined to ensure distributed generation buyback rates fairly reflect costs and benefits associated with distributed generation, and to ensure that utility rate structures appropriately recover the costs associated with providing utility service to customers with distributed generation."[7] In contrast with the Commission's statement, the Company does not take into account all the quantifiable benefits of DSG in its rate proposal. One important benefit that the Company does not take into

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[4] RÁBAGO ENERGY LLC & INTERSTATE RENEWABLE ENERGY COUNCIL, INC., A REGULATOR'S GUIDEBOOK: CALCULATING THE BENEFITS AND COSTS OF DISTRIBUTED SOLAR GENERATION 23 (2014) *available at* http://www.irecusa.org/publications; TIM WOOLF ET AL, SYNAPSE ENERGY ECONOMICS, BENEFIT-COST ANALYSIS FOR DISTRIBUTED ENERGY RESOURCES 22 (Sept. 2014) *available at* http://synapse-energy.com/project/benefit-cost-analysis-distributed-energy-resources.
[5] ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 646, 648 (7th ed., 2009).
[6] Richard L. Revesz, *Quantifying Regulatory Benefits* 32 (Institute for Policy Integrity, Working Paper No. 2014/2, 2014) (characterizing quantification of benefits and costs as the "first-best" approach in regulatory rulemaking).
[7] Re Distributed Resources Interconnection Rules, WIS. P.S.C. Order 5-GF-233, 2013 WL 7869153 (Nov. 2013).

account is the effect of avoided emissions on the environment and public health. These are external benefits that may not be taken into account when decisions are made by private parties; it is the Commission's duty to intervene and ensure that they are internalized.

To properly account for health and environmental benefits of the DSG in the net metering rate, the Commission should:

- Carefully analyze the amount of avoided emissions based on location;
- Use the Social Cost of Carbon to estimate the climate benefits of distributed solar generation due to avoided carbon dioxide emissions; and
- Estimate the external health benefits related to all the avoided emissions, including the emissions of local pollutants.

a. The Commission should carefully analyze the amount of avoided emissions based on location and time.

The amount of avoided emissions depends upon the type of the generator that is being displaced at a particular location at the time of solar generation. If solar generation is displacing a generator with low emissions, such as a nuclear plant, the displaced emissions would be low. If the solar generation is displacing a coal-fired plant, the displaced emissions would be high.

For example, as natural gas is the dominant marginal fuel in California, the average carbon dioxide displacement by a solar panel there is lower than in more coal-intensive states, such as Kansas.[8] The environmental and health benefits depend, in part, on the location and timing of distributed generation. According to a study published in the Proceedings of the National Academy of Sciences of the United States of America, "[t]he average solar panel in Nebraska displaces 20% more CO_2 than a panel in Arizona, although energy output from the Nebraska panel is 20% less."[9]

A similar, Wisconsin-specific study that compares solar generation patterns to the mix of conventional generators used at the corresponding time and location is needed to calculate the correct value of avoided emissions before setting a net metering rate.

b. The Commission should use the Social Cost of Carbon to estimate the climate benefits of distributed solar generation due to avoided carbon dioxide emissions.

Once the amount of carbon dioxide emissions that are being displaced by solar generation at a given time and location is calculated, the Commission should use the Social Cost of Carbon ("SCC")[10] to estimate the environmental benefits of these avoided emissions.

[8] Kyle Siler-Evans, Inês Lima Azevedo, Granger Morgan & Jay Apt, *Regional variations in the health, environmental, and climate benefits of wind and solar generation*, 110 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. OF THE U.S. 11768, 11770 (2013).
[9] *Id.*
[10] Interagency Working Group on Social Cost of Carbon, U.S. Gov't, *Technical Support Document: - Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* (2013) *available at* http://www.epa.gov/climatechange/EPAactivities/economics/scc.html.

The SCC is "an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year."[11] It is calculated by an Interagency Working Group on Social Cost of Carbon which consists of major federal agencies.[12] While the SCC may underestimate the damages that are associated with carbon emissions[13], it is still useful when assessing the benefits of reductions in carbon emissions.[14] It is used by the Environmental Protection Agency (EPA) and many other federal agencies to estimate the effects of carbon emissions. Recently, the Minnesota Department of Commerce used the SCC to calculate the Value of Solar ("VOS") Tariff[15] to comply with 2013 legislation that allows Investor-Owned Utilities (IOUs) to apply to the Public Utility Commission for a VOS tariff as an alternative to net metering.[16] Specifically, the Minnesota agency calculated the average level carbon emissions from their fuel sources, multiplied it by EPA's SCC to calculate the current environmental benefits of avoided carbon emissions, and used this value to adjust the net metering tariff.[17] The Commission should undertake a similar approach here.

c. The Commission should estimate the external health benefits related to the avoided emissions.

In addition to environmental benefits, reduced carbon emissions and reduced local pollutants such as sulfur dioxide, nitrogen oxides, and fine particulate matter provide external health benefits such as improved morbidity and reduced risk of premature mortality.[18] The Commission should estimate the local value of these health benefits and incorporate this value into the net metering rate. For this purpose, the commission can use local externality values, like the Minnesota Department of Commerce did, or calculate the avoided cost of pollutants using another established method, such as the Air Pollution Emissions Experiments and Policy analysis model ("APEEP").[19]

Neither the environmental nor the health benefits of displaced emissions by distributed solar generation are trivial. According to Siler-Evans, et. al., a 1-kW solar panel in Ohio provides $75/MWh in annual health and environmental benefits if the value of the displaced CO_2 emissions and other local pollutants such as sulfur dioxide, nitrogen oxides, and fine particulate

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[11] *Id.*
[12] The Interagency Working Group on Social Cost of Carbon includes the Council of Economic Advisers, Council on Environmental Quality, Domestic Policy Council, Environmental Protection Agency, National Economic Council, Office of Management and Budget, Office of Science and Technology Policy, and the Departments of Agriculture, Commerce, Energy, Transportation, and the Treasury. *Id.*
[13] *See generally* PETER HOWARD, OMITTED DAMAGES: WHAT'S MISSING FROM THE SOCIAL COST OF CARBON (Institute for Policy Integrity ed., 2014); LENNY BERNSTEIN ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT §5.7 at 69 (Abdelkader Allali et al., eds. 2007) *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm.
[14] See Howard, *supra* note 13, at 5.
[15] CLEAN POWER RESEARCH, MINNESOTA VALUE OF SOLAR: METHODOLOGY 39 (2014) *available at* http://www.cleanpower.com/wp-content/uploads/MN-VOS-Methodology-2014-01-30-FINAL.pdf.
[16] *See* MINN. STAT. ANN § 216B.164 Subd. 10 (West)
[17] CLEAN POWER RESEARCH, *supra*, note 15, at 5.
[18] Nicholas Z. Muller et. al., *Measuring the damages of air pollution in the US*, 54 J. OF ENVTL. ECON. AND MGMT. 1, 8-13 (2007); Dallas Burtraw et al., Costs and Benefits of Reducing Air Pollutants Related to Acid Rain, 16 CONTEMPORARY ECON. POLICY 379, 397-399 (1998).
[19] *Cf. generally* Muller, *supra* note 18.

matter are taken into account.[20] The same study estimates that in Wisconsin, depending on the region, the avoided emissions lead provide annual benefits ranging from $22-$26/MWh to $48-$57/MWh depending on the Value of Statistical Life ("VSL") that they used.[21] Even these values underestimate the actual benefits of avoided emissions because the study used VSL values in the range of $2 to 6 million dollars[22], whereas the value of VSL that is generally used for regulatory proceedings in the U.S. is in the range of $8 to 9 million current dollars.[23] Any rate design that does not internalize the full value of these benefits will not be socially optimal.

II. The Commission should adjust the proposed net metering rate to include the value of the net impact of distributed solar generation on the local grid.

When DSG penetration was low, the main focus of the debate was the environmental benefits of solar power, as the impact of DSG integration on the grid was considered minimal. However, the increasingly rapid adoption of DSG[24] over the past five years necessitates a closer look at its impacts on the grid. While there is little debate about how the value of avoided energy costs should be reflected in the DSG rates, there is mounting debate about what the other benefits and grid related costs of DSG are and how they should be reflected in the rates.[25] The Commission can make effective decisions about net metering rates only by understanding these trade-offs associated with the increased penetration of DSG.

In setting the net metering rate, the Commission should consider:

- The capacity value of DSG;
- The internal and the external costs of DSG on the grid;
- The other externalities associated with increasing DSG penetration; and

[20] The authors use $20 as the social cost of carbon, and use the "APEEP" model to estimate the cost of other local pollutants. Siler-Evans et al., *supra* note 8, at 11770, *citing* Nicholas Z. Muller et. al., *Environmental accounting for pollution in the United States economy*, 101 AM. ECON. REV. 1649–1675. (2011) (developing the APEEP model for estimating damage from other pollutants).

[21] *See generally* Siler-Evans. K., Azevedo, I.L., Morgan, M.G., Apt, J., *Marginal Emissions Factors Repository*, CTR. FOR CLIMATE AND ENERGY DECISION MAKING (last visited Oct. 5, 2014), http://cedmcenter.org/wp-content/uploads/2013/10/PNAS-Data_As-Published.zip (collecting all data used in Siler-Evens et al., *supra* note 8).

[22] *Id.* at Readme file for data repository for Regional Variations in the Health, Environmental, and Climate Benefits of Wind and Solar Generation.

[23] CURTIS W. COPELAND, CONG. RESEARCH SERV., HOW AGENCIES MONETIZE "STATISTICAL LIVES" EXPECTED TO BE SAVED BY REGULATIONS 17-18 (March 2010) *available at* http://assets.opencrs.com/rpts/R41140_20100324.pdf; *Frequently Asked Questions on Mortality Risk Valuation*, ENVTL. PROT. AGENCY (Oct. 5, 2014) http://yosemite.epa.gov/EE%5Cepa%5Ceed.nsf/webpages/MortalityRiskValuation.html.

[24] JUSTIN BACA ET AL., SOLAR ENERGY INDUS. OF AM., U.S. SOLAR MARKET INSIGHT REPORT: EXECUTIVE SUMMARY 4 (2013) *available at* http://www.alta-energy.com/reports/US%20Solar%20Market%20Insight%20-%202013%20YIR%20-%20Executive%20Summary.pdf ("The U.S. installed 4,751 MW of solar PV in 2013, up 41% over 2012 and nearly fifteen times the amount installed in 2008."); INT'L ENERGY AGENCY, PVPS REPORT SNAPSHOT OF GLOBAL PV 1992-2013 *at* 5, (2014) ("At least 36.9 GW of PV systems have been installed and connected to the grid in the world last year. . . Germany, Italy and Greece have now enough PV capacity to produce respectively 6.2%, 7.8% and 5.8% of their annual electricity demand with PV. 15 countries have enough PV to produce at least 1% of their electricity demand with PV.").

[25] *See generally* ROCKY MOUNTAIN INST., A REVIEW OF SOLAR PV BENEFIT & COST STUDIES (2nd ed., 2013) *available at* http://www.rmi.org/Knowledge-Center%2FLibrary%2F2013-13_eLabDERCostValue.

- The dependence of the benefits and costs of DSG on the rate design.

a. The Commission should consider the capacity value of distributed solar generation.

By decreasing the demand for power generation from traditional plants, DSG reduces the need for investments to provide additional generating capacity. Further, it reduces strain on the current capacity when solar generation occurs in times of high demand. The energy generation value of distributed solar generation—the LMP[26]— that the Company is proposing to use to calculate its rate, does not accurately reflect both of these factors.

b. The Commission should consider all the internal and external costs of distributed solar generation on the grid.

An appropriate net metering rate should also reflect all the costs of integrating DSG into the current grid. These costs go beyond the costs of installing new meters that can measure the flow of electricity in both directions and ensuring interconnection standards for safe grid integration. The introduction of two-way power flow into the current grid may adversely affect the grid, leading to increased flow management and voltage regulation costs.[27] Unregulated two-way flow may overload the circuits close to the distributed generator that are not built to handle high flow volume.[28] Furthermore, an unexpected reverse energy flow may jeopardize the safety of the utility workers.[29]

Increased DSG penetration may also increase the costs related to balancing the supply and the demand in real time.[30] Electricity suppliers need to react quickly to changes in electricity production to meet changes in the net electricity demand, and require resources with ramping[31] flexibility and the ability to start and stop multiple times per day.[32]

Finally, in the absence of reliable and affordable power storage systems, the intermittent and variable nature of solar power necessitates that electricity providers have adequate back-up power.

All of these costs must be quantified and incorporated into the net metering rate design.

In its proposal, the Company proposes a "stand-by" charge.[33] However, according to Company testimony, only the annual costs related to providing back-up power generation and related transmission costs are included in the calculation of this fee.[34] Just as with benefits, not

[26] Rogers, *supra* note 3, at 56-57.
[27] *See* ELEC. POWER RESEARCH INST., THE INTEGRATED GRID: REALIZING THE FULL VALUE OF CENTRAL AND DISTRIBUTED ENERGY RESOURCES 14 (2014) *available at* http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=3002002733.
[28] *Id.*
[29] Rebuttal Testimony of Ashley C. Brown on Behalf of Wisconsin Electric Power Company, Wis. P.S.C. Docket No. 05-UR-107, REBUTTAL-WEPCO/WG-BROWN at 33 (Sept. 12, 2014).
[30] Fact Sheet, California Independent System Operator, What the Duck Curve Tells us About Managing a Green Grid 3 (2013) *available at* http://www.caiso.com/documents/flexibleresourceshelprenewables_fastfacts.pdf.
[31] *Id.*, at 2.
[32] *Id.*, at 4.
[33] Rogers, *supra* note 3, at 56-57.
[34] *Id.*, at 56-57, 60-61.

internalizing the full suite of external costs will also lead to economic inefficiency. The Commission should require a more comprehensive cost analysis before adjusting the rates.

c. The Commission should also consider all the other externalities associated with increasing distributed solar generation penetration.

In addition to the benefits and costs discussed above, DSG provides other benefits to the society. These benefits include reduced financial and security risks, increased grid resiliency, and other social benefits, such as economic development.[35] All of these benefits should be quantified and incorporated into the net metering price, which are absent from the Company's proposal. Even though some of these benefits may be difficult to quantify, that does not provide a justification for counting these values as zero. If a particular benefit cannot be quantified, alternative methods such as proxies or benchmarks could be used.

d. The Commission should be aware that the costs and benefits of DSG depend on the rate design.

The costs and benefits of DSG depend on the retail rate design that is in effect. The amount of avoided carbon emissions, for example, will change if a time-varying rate design shifts consumption from an on-peak time period (when gas-fired plants are being displaced) to an off-peak time period (when coal-fired plants are being displaced). Similarly, if the rate design reduces peak demand, then the risk of overloading circuits would decrease. Therefore, the Commission should set the net metering rate considering possible future rate design changes, to the extent possible.

Once the net value of the impact of DSG on the grid is established, this value, in addition to the health and environmental benefits, should be used to adjust the energy value of DSG to set the net metering rate. This approach will ensure that all of the societal benefits and costs are be taken into account when customers are making installation and sizing decisions about photovoltaic panels, and when solar firms are making production and investment decisions ensuring that the market outcome in the solar sector is socially optimal.

III. The Commission should consider a renewed approach to the regulatory design to achieve Wisconsin's energy goals.

It is the goal of state of Wisconsin "to reduce the ratio of energy consumption to economic activity in the state."[36] To achieve this goal of energy efficiency and conservation, the Commission should consider a revised rate design that addresses the inefficiencies of the current system and incorporates the true economic and social costs of energy use.

In its proposal, the Company asserts that non-DSG customers are subsidizing DSG-customers[37] without supporting this claim with a rate impact study for their customers. Even if one is to

[35] ROCKY MOUNTAIN INST., *supra* note 25, at 13.
[36] WIS. STAT. ANN. § 1.12(3)(a) (West).
[37] Rogers, *supra* note 3, at 53-54.

assume that this assertion is true for Wisconsin[38] with the current rate design, there may be other possible instances of cross subsidization between different customer groups such as high-volume and low-volume customers, or on-peak and off-peak customers. Trying to fix only one of the problems of the current rate design, such as the inability of the Company to recover all of the costs a net-metered customer imposes on the system without considering other inefficiencies of the rate design would not only be incomplete, but might lead to even higher cross subsidization between other customer groups. For example, if the Company's proposed rates go into effect and lead to a decrease in DSG, the demand that would have been met by solar generation will instead need to be met by an increased strain on the Company's generators. Under this scenario, the wholesale energy costs would rise. Given that the majority of DSG happens during the Company's designated on-peak hours[39], this additional demand would increase the cost of serving on-peak customers. Since the retail rates for non-DSG customers, even the time-of-use rates, are not designed to reflect all of the variations in the cost of providing energy, the Company in this case would not be able to recover all of these additional costs from on-peak customers, and it would instead need to spread them to all its customers.

To avoid such inefficiencies, the Commission should develop a forward looking comprehensive rate design, taking into account the progress in technology such as increasing use of advanced meters and smart devices with two-way communication capacities.[40] These devices will increase customers' ability to quickly respond to changing price signals, making the use of time-varying rate designs feasible. Such designs will improve economic efficiency, as they will allow the actual marginal cost of energy use at a particular time and location to be immediately reflected in the retail price, giving customers the ability to adjust their use based on the true cost of energy that they use. A time-varying volumetric charge reflecting the actual (private and social) marginal cost of energy, in combination with a customer-group specific fixed charge designed to recover the Company's fixed costs related to that particular customer group, will improve efficiency.

In addition, if both the retail electricity rates and the net metering rates reflect all the costs and benefits of their respective sources, including the social costs and benefits, it would improve the efficiency of the investments in the energy sector by eliminating incorrect price signals that inefficiently favor one resource over the other. Furthermore, such designs will allow the Company to recover all of its costs without having to require a certain level of energy use, as it is the case with the current rate design. They will also reduce the firm's inherent disincentive for energy conservation programs as it will no longer have to rely on a minimum level of volumetric sales to recover its fixed costs. Any further incentives for energy conservation can be built into

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[38] California PUC rate impact studies have produced conflicting results. *Compare* R. THOMAS BEACH & PATRICK G. MCGUIRE, CROSSBORDER ENERGY, EVALUATING THE BENEFITS AND COSTS OF NET ENERGY METERING IN CALIFORNIA (Jan. 2013) (finding that net energy metering does not impose any cost on non-participating ratepayers, instead creating a small net benefit), *with* CAL. PUB. UTIL. COMM'N, CALIFORNIA NET ENERGY METERING RATEPAYER IMPACTS EVALUATION (Oct. 2013) (projecting cost shifting to non-users between 1.06% and 3.13% of the utility revenue requirement in 2020 under a full net energy metering subscription scenario).

[39] Direct Testimony of Eric A. Rogers, Wis. P.S.C. Docket No. 05-UR-107, Ex. WEPCO/WG-Rogers-11 at Sched. 2 (June 27, 2014) ("On-Peak Period is Monday - Friday 8 AM to 8 PM Central Prevailing Time").

[40] FED. ENERGY REGULATORY COMM'N, ASSESSMENT OF DEMAND RESPONSE AND ADVANCED METERING 7-17, (Dec. 2012) *available at* http://www.ferc.gov/legal/staff-reports/12-20-12-demand-response.pdf.

the regulatory design by the use of incentive based schemes such as gain sharing plans[41] or other performance based regulatory schemes[42] without having to resort to regulatory policies that distort prices.

Respectfully submitted,

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[41] *See generally*, Leon Yang Chu & David E. M. Sappington, *Designing Optimal Gain Sharing Plans to Promote Energy Conservation*, 42 J. OF REGULATORY ECON. 115 (2012) (reviewing economics literature on gain sharing plans for energy conservation programs); INST. FOR ELEC. INNOVATION, STATE ELECTRIC EFFICIENCY REGULATORY FRAMEWORKS (July 2013) *available at* http://www.edisonfoundation.net/iee/documents/iee_stateregulatoryframe_0713.pdf (summarizing current state practice in energy efficiency policy); *see also* Leon Yang Chu & David E. M. Sappington, *Motivating Energy Suppliers To Promote Energy Conservation*, 43 J. OF REGULATORY ECON. 229 (2013).

[42] *See generally*, David E.M. Sappington et al., *The State of Performance-Based Regulation in the U.S. Electric Utility Industry*, 14 ELEC. J. 71 (2001).