Exhibit No.:	_____
Issue(s):	Rebound Effect
Witness/Type of Exhibit:	Marke/Direct
Sponsoring Party:	Public Counsel
Case No.:	EO-2012-0142

DIRECT TESTIMONY

OF

GEOFF MARKE

Submitted on Behalf of
the Office of the Public Counsel

**UNION ELECTRIC COMPANY D/B/A
AMEREN MISSOURI'S**

Case No. EO-2012-0142

October 22, 2014

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company d/b/a Ameren Missouri's Filing to Implement Regulatory Changes in Furtherance of Energy Efficiency as Allowed by MEEIA.	))))	**Case No. EO-2012-0142**

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Geoff Marke, of lawful age and being first duly sworn, deposes and states:

1. My name is Geoff Marke. I am a Regulatory Economist for the Office of the Public Counsel.

2. Attached hereto and made a part hereof for all purposes is my direct testimony.

3. I hereby swear and affirm that my statements contained in the attached affidavit are true and correct to the best of my knowledge and belief.

Geoff Marke

Subscribed and sworn to me this 22nd day of October 2014.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

JERENE A. BUCKMAN
My Commission Expires
August 23, 2017
Cole County
Commission #13754037

Jerene A. Buckman
Notary Public

My commission expires August 23, 2017.

TABLE OF CONTENTS

DIRECT TESTIMONY

OF

GEOFF MARKE

UNION ELECTRIC COMPANY

d/b/a Ameren Missouri

CASE NO. EO-2012-0142

I. INTRODUCTION AND EXPLANATION OF CHANGES TO THE RESPONSE TO CHANGE REQUEST

Q. Please state your name, title and business address.

A. Dr. Geoffrey Marke, Economist, Office of the Public Counsel (OPC or Public Counsel), P.O. Box 2230, Jefferson City, Missouri 65102.

Q. Are you the same Geoff Marke that filed the Response to Change Requests in EO-2012-0142?

A. I am.

Q. What is the purpose of your direct testimony?

A. The purpose of my direct testimony is to adopt and incorporate by reference my previous submitted Response to Change Requests with the amended changes stated below and to provide additional evidence OPC believes is relevant to the question of determining the final EM&V results of Union Electric Company d/b/a Ameren Missouri's ("Ameren Missouri" or "Ameren") PY2013 MEEIA portfolio. Specifically, this testimony will introduce the concept of the rebound effect and why it supports OPC's previous suggestions to the Commission regarding the appropriate net-to-gross (NTG) ratio. Those recommendations include:

- Adopting Staff's original Change Request that calls for the elimination of market effects and accepting the Auditor's spillover estimates.

- Rejecting Ameren's downward adjustment of free ridership.
- Including a 9% downward adjustment to the NTG ratio for the LightSavers Program to account for conservative direct rebound effect estimates.

OPC raises the concept of the rebound effect as another factor that should be considered by the Commission when determining the EM&V results for PY2013.

This testimony offers that not properly accounting for the rebound effect will overstate actual energy savings attributable to Ameren Missouri PY2013 EM&V. Public Counsel proposes a conservative adjustment to the LightSavers program based on an appropriate mid-range estimate of the direct rebound effect attributable to energy efficient residential lighting. Public Counsel does not propose an additional adjustment for an indirect rebound effect at this time.

Q. What is the purpose of the corrections to your Response to Change Requests?

A. These corrections are made to clarify Public Counsel's position on Staff's initial Change Request. As background, when asked to summarize our primary recommendations in the Response to Change Request we stated that the Commission should adopt Staff's initial change request that calls for the elimination of market effects in the formula used to calculate the LightSavers net-to-gross ratio. We reiterated this position later:

> **Under our scenario, and as initially proposed by Staff,** Ameren would have achieved 39% of their target goal in the first year leaving them only 31% away from being eligible for a performance incentive with two additional years to reach that (emphasis added, p. 62, 5-8).

And at the conclusion, OPC also indicates its support for the weight that should be given to the independent auditor's results which were included in Staff's recommendation that OPC supports:

> Furthermore, the black box agreement does not address EM&V considerations moving forward and in this case undermines the process currently in place by minimizing the evaluation and results of the Commission's independent auditor (p. 65, 1-4).

This position is consistent with Staff's primary recommendation to adopt the Auditor's estimates without market effects. However, as indicated earlier, OPC has made changes to portions of its Response that discuss the spillover estimates. OPC previously stated that the differences between the Evaluator's and Auditor's estimates were not pronounced, that OPC did not have a strong position on adopting one or the other, and OPC suggested generally that the Cadmus/ADM spillover estimates should be used to calculate the NTG. These statements, now corrected for consistency and described below, had initially used the general term "spillover" when the more specific term, "nonparticipant spillover," would have been more accurate. It is the nonparticipant spillover estimates for the overall portfolio where the differences are not pronounced, and therefore it is necessary for OPC to clarify its position that the Auditor's estimates should be used for both participant and nonparticipant spillover NTG ratios. Absent these changes to differentiate between participant and non-participant spillover, it is unclear which spillover estimate Public Counsel recommends the Commission adopt.

Applying the corrections, Public Counsel's Corrected Response to Change Requests, attached as an Appendix, reflects the position that Staff's initial Change Request adopting the Auditor's results that excludes market effects should be adopted, as articulated throughout the rest of the Response.

Q. Please state the corrections you have made to your Response to Change Requests[1] as initially filed.

[1] Case No. ER-2012-0142 (Doc. No. 203).

A. There are four textual changes in my Response to Change Requests. Attached hereto as an Appendix and incorporated by reference is a Corrected Response to Change Requests. Those corrections are as follows:

1.) Page 7, lines 16-18 now states:

- Cadmus and the Auditor disagree on participant spillover estimates for only one program. In the LightSavers program the Auditor estimated participant spillover to be 7.5% and Cadmus estimated it to be 28%.

2.) Page 45, lines 19-21 now states:

- Public Counsel believes the Commission should accept the Auditor's estimates for participant and non-participant spillover.

3.) Page 59, line 2 now states:

- Accept Auditor reports without market effects.

4.) Page 64, lines 10-12 now states:

- Additionally, the Auditor's recommended participant and nonparticipant spillover estimates should be utilized to calculate the overall net-to-gross ratio for the portfolio.

Q. Please state Public Counsel's position on Staff's initial Change Requests.

As stated on page 11, lines 22-24 of the Response to Change Requests, the Commission should adopt Staff's initial change request which calls for the elimination of market effects in the formula used to calculate the LightSavers net-to-gross ratio. This includes adoption of the independent Auditor's recommended participant spillover and nonparticipant spillover estimates.

Q. Do you have any additional testimony besides the corrections in the original draft?

A. Yes. I will provide further testimony on the rebound effect.

II. THE REBOUND EFFECT

Q Does this new testimony on the rebound effect change the Office of Public Counsel's position on the PY2013 EM&V results and net-to-gross calculation?

A. Yes, it does. Public Counsel recommends that the Commission resolve Ameren Missouri's disputed PY2013 EM&V results by adjusting Staff's initial change request to include a conservative downward 9% adjustment for the direct rebound effect to the LightSavers program's net-to-gross ratio. Because the Lightsaver's program is the largest component of the PY2013 Ameren Missouri MEEIA program, this adjustment will impact the overall results as illustrated in table 1 below. Table 1 includes the five portfolio estimates to date as well as OPC's proposed adjustment. This results in a 3.0% reduction in the overall NTG ratio from our original suggestion to the Commission.

Table 1: The five portfolio estimates to date & Public Counsel's proposed estimate

Source (EO-2012-0142)	**NTG**	MWh Saving[2]	Difference	% 3yr-goal 793,100 MWh
Ameren[3]	116.1%	397,499	-	50.1%
Cadmus [4]	114.5%	390,039	7,460	49.2%
Black box[5]	107.4%	369,500	27,999	46.5%
Auditor 2[6]	93.3%	322,296	75,203	40.6%
Auditor 1[7]	89.7%	310,041	87,458	39.1%
OPC	86.7%	300,532	96,967	37.9%

Table 2 provides a breakdown of MWh estimates specifically for the LightSavers program with a reference to the Commission-approved savings target in order to illustrate how greatly the savings exceeded targets under all filed estimates.

[2] 1.0 NTG = 346,519 MWh
[3] Application for Approval of Change Request (Ameren Missouri-Investor), 7/3/14.
[4] Revised Evaluation, Measurement and Verification (EM&V) Reports, 6/12/14.
[5] Non-Unanimous Stipulation and Agreement Settling the Program Year 2013 Change Request, 9/19/14.
[6] Final EM&V Auditor Report and Supporting Documentation, 8/27/14 with market effects.
[7] Final EM&V Auditor Report and Supporting Documentation, 8/27/14 without market effects.

Table 2: Comparison of LightSavers Net Savings Ex Post Estimates to Approved PSC Target

Program	PSC Approved Target	Net Savings Ex Post: Cadmus[8]	Net Savings Ex Post: Auditor 2	Net Savings Ex Post: Auditor 1	Net Savings Ex Post: OPC
LightSavers MWh savings	121,258	279,127	214,814	196,470	182,160
% of Target Achieved	100%	230%	177%	162%	150%

Q. What is the Rebound Effect?

A. A rebound effect involves increases in energy use that are paradoxically caused by increased energy efficiency. The result is a reduction of expected overall energy savings. The rebound effect runs counter to an assumption of energy efficiency programs that a given percent gain in efficiency is assumed to lead simply and directly to an equivalent and equal percent reduction in total energy use. In reality, the economy and consumer behavior is anything but direct, linear, or simple.

To explain the rebound effect, I will offer two examples which include the direct rebound effect and the indirect rebound effect:[9]

Direct Rebound Effect:

This represents a change in patterns of usage after an energy efficient product is installed. When energy use is more efficient, consumers may actually increase some of their energy-using activities. For example, we can reduce lighting energy consumption in our houses by up to 75% by installing more efficient light bulbs if usage remains constant. However, as the lighting service has effectively become cheaper, one may decide to leave the lights on for a

[8] Ameren Missouri agrees with the Cadmus estimates for LightSavers. Ameren Missouri had proposed additional energy savings for the rest of their portfolio which is why they are included in table 1.

[9] Time constrained readers can watch the abstract video from research conducted by the Scott Institute for Energy Innovation of Carnegie Mellon University at: https://www.youtube.com/watch?v=1MIsNp4sSms. The corresponding academic paper can be found at: http://iopscience.iop.org/1748-9326/9/7/074010/pdf/1748-9326_9_7_074010.pdf

longer period of time. This will result in having less energy savings than what was anticipated.[10]

Indirect Rebound Effect:

In general, when customers use less power, they will have lower electrical bills. This gives consumers more money to spend on other things, and many of those other things may require energy to produce or use.[11]

Q. Has the rebound effect been raised in any other previous testimony in this case?

A. Yes. The rebound effect was discussed in the initial Ameren Missouri MEEIA application in 2012 in the rebuttal testimony of Staff witness of Dr. Hojang Kang.[12] It was further discussed in the surrebuttal testimony of Staff witness Michael Stahlman[13] and Ameren Missouri witness Rick Voytas.[14] Incidentally, there was considerably more testimony from stakeholders regarding the concept of the rebound effect than there was regarding market effects at that time.

Q. Was there any attempt to calculate the rebound effect by either the evaluators (Cadmus/ADM) or the state auditor (Johnson Consulting)?

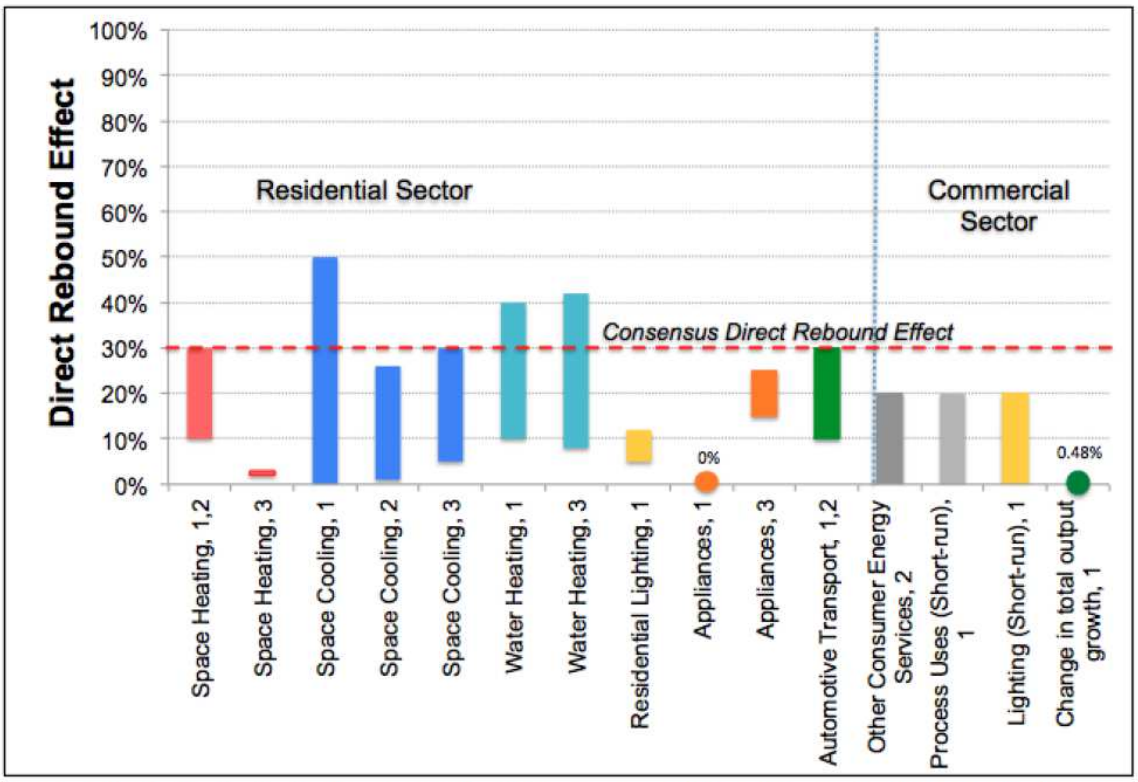
A. No. There was no attempt to calculate the rebound effect in determining the net energy savings for Ameren Missouri's MEEIA PY2013.

Q. Is there any empirical research that has attempted to calculate the rebound effect?

[10] Micahels, R.J. (2012) Energy Efficiency and Climate Policy: The Rebound Dilemma. *Institute for Energy Research*. http://instituteforenergyresearch.org/wp-content/uploads/2012/07/NJI_IER_MichaelsStudy_WEB_20120706_v5.pdf
[11] Ibid.
[12] Case No. ER-2012-0142 (Doc. No. 51)
[13] Case No. ER-2012-0142 (Doc. No. 78)
[14] Case No. ER-2012-0142 (Doc. No. 81)

A. Yes. As listed in Attachment GM-1 (as well as referenced throughout this testimony), there is an extensive amount of empirical research substantiating the existence of a rebound effect associated with energy efficiency investments. Within those studies, there is no argument that the rebound effect occurs. However, there is debate about how large the rebound effects are likely to be in any given context. Table 3 presents a sample of empirical studies looking at the direct rebound effect on various energy efficiency measures. Residential lighting, for example, has a direct rebound effect and corresponding reduction in realized energy savings estimated to be in the range of 5-12%. Accordingly, I applied a 9% direct rebound effect to the LightSavers program as a conservative mid-point to come up with an appropriate direct rebound effect adjustment in this case.

Table 3: Empirical results of direct rebound effect and energy efficient measures[15]



Direct rebound effect estimates by sector and end-use. Sources: (1) Greening et al., 2000; (2) Sorrell et al., 2009; (3) Parti and Parti (1980), with appliances defined as freezers, dryers, and electric ranges.

Q. Please speak more to how you decided a 9% rebound effect would be appropriate for the LightSavers program.

[15] Ines-Azevedo (2011) Energy Efficiency and the Rebound Effect. *Center for Climate and Energy Decision Making*. Slide 23. http://cedmcenter.org/wp-content/uploads/2013/01/Ines-Azevedo.pdf sources include:

A. Greening, L. et al. (2000). Energy efficiency and consumption—the rebound effect—a survey. *Energy Policy*, 28 (6), 389-401. http://www.sciencedirect.com/science/article/pii/S0301421500000215;

B. Sorrell, S. et al.(2009) Empirical estimates of the direct rebound effect: a review. *Energy Policy* 37: 1356-71., http://www.sciencedirect.com/science/article/pii/S0301421508007131 ;

C. Parti and Parti (1980) The total and appliance-specific conditional demand for electricity in the household sector. *The Bell Journal of Economics*. 309-321. http://sedc-coalition.eu/wp-content/uploads/2011/07/Parti-The-Total-and-Appliance-Specific-Conditional-Demand-.pdf

A. I applied a 9% direct rebound effect to the LightSavers program as a conservative mid-point from the range developed from the Greening et al. (2000) residential lighting study referenced above. This estimate is supported from the two most conservative estimates I was able to locate regarding the rebound effect on residential programs. These include a 2013 article in *Nature* by Gillingham et al. that states:

> Because people respond more strongly to price than to efficiency cues when deciding how much energy to use, these numbers are overestimates. **The direct rebound effect for efficiency alone should be nearer the low end of this range, or around 5-10%.** Money saved through efficiency can also be spent on another product, such as a new phone, causing an 'indirect' rebound effect if extra energy is needed to manufacture and use the additional item. **Assessments of household spending indicate that 5-15% of energy-efficiency savings are displaced in this way** (emphasis added).[16]

The second is from a white paper from The American Council for an Energy-Efficient Economy (ACEEE) "The Rebound Effect: Large or Small?" which concludes with the following statement:

> There are both direct and indirect rebound effects, but these tend to be modest. Direct rebound effects are generally 10% or less. Indirect rebound effects are less well understood but the best available estimate is somewhere at about 11%. . . . **Overall, even if total rebound is about 20%, then 80% of the savings from energy efficiency programs and policies register in terms of reduced energy use.** And the 20% rebound contributes to

[16] Gillingham, K. et al. (2013)The rebound effect is over-played. Nature, 493: 475-476. http://www.ourenergypolicy.org/wp-content/uploads/2013/12/rebound.pdf

increased consumer amenities and a larger economy. These savings are not "lost" but are put to other generally beneficial uses (emphasis added).[17]

Q. Have any government and/or research institutions recognized the rebound effect with energy efficiency?

Yes. Most recently, the International Risk Governance Council (IRGC) in conjunction with Carnegie Mellon University's Center for Climate and Energy Decision Making (CEDM) convened a series of workshops[18] to produce a report in which the concluding chapter, *Policy Implications*, states:

> **The evidence to date from econometric studies that generally use price elasticity, income elasticity and elasticity of substitution suggests that direct and indirect rebound effects in developed economies are moderate and that investments in energy efficiency can save between 70 and 85 percent of the anticipated energy reduction, while allowing households to enjoy the benefits of higher consumption.** Such moderate rebound effects would imply that energy efficiency policies such as utility energy efficiency programmes, appliance and vehicle efficiency standards, energy efficiency resource standards, and rebates and tax credits for energy efficiency **all will produce energy savings, although not as much as an engineering analysis would suggest.** However, rebound assessments should be incorporated in the development of these energy

[17] Nadel, S. (2012) The Rebound Effect: Large or Small?. *ACEEE*. http://www.aceee.org/files/pdf/white-paper/rebound-large-and-small.pdf

[18] The participants in the workshop included ideologically diverse experts from around the world who were asked to submit short think pieces regarding energy efficiency and the rebound effect. These documents can be found and downloaded at http://cedmcenter.org/energy-efficiency-and-the-rebound-effect-presentations/ and at http://cedmcenter.org/energy-efficiency-and-the-rebound-effect-stuttgart-presentations/ .

> efficiency policy instruments, so that realistic forecasts of their cost and effectiveness can be made (emphasis added). [19]

In addition to the IRCG report, the Intergovernmental Panel on Climate Change (IPCC)[20] recognized the importance in accounting for the rebound effect in their report, *Climate Change 2014: Mitigation of Climate Change.* The rebound effect is discussed in both, Chapter 3: *Social, Economic and Ethical Concepts and Methods*[21] and in Chapter 5: *Drivers, Trends and Mitigation*.[22] In the latter chapter, the rebound effect section concludes with the following statement:

> **In conclusion, rebound effects cannot be ignored, but at the same time do not make energy efficiency measures completely redundant**. By considering the size of the rebound effect, a more-realistic calculation of energy-efficiency measures can be achieved providing a clearer understanding of their contribution to climate policy. Particular attention is required where efficiency savings are made with no change in the unit cost of energy (emphasis added).

In the United States, rebound effects associated with energy efficiency increases are utilized by the U.S. Energy Information Administration (EIA) in their National Energy Modeling System (NEMS) which "projects the production, imports, conversion, consumption, and prices of energy, subject to assumptions on macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria,

[19] International Risk Governance Council (2013) The Rebound Effect: Implications of Consumer Behaviour for Robust Energy Policies http://www.irgc.org/wp-content/uploads/2013/04/IRGC_ReboundEffect-FINAL.pdf
[20] Established by the United Nations and World Meteorological Organization (WMO) in 1988, the IPCC includes thousands of scientists from around the globe who contribute voluntarily. According to their website: "Because of its scientific and intergovernmental nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers. By endorsing the IPCC reports, governments acknowledge the authority of their scientific content. The work of the organization is therefore policy-relevant and yet policy-neutral, never policy-perspective." http://www.ipcc.ch/organization/organization.shtml
[21] http://report.mitigation2014.org/drafts/final-draft-postplenary/ipcc_wg3_ar5_final-draft_postplenary_chapter3.pdf
[22] http://report.mitigation2014.org/drafts/final-draft-postplenary/ipcc_wg3_ar5_final-draft_postplenary_chapter5.pdf

cost and performance characteristics of energy technologies, and demographics."[23] In the NEMS Overview describing the Energy Consumption Submodule, rebound effects are specifically identified:

> Once the required equipment choices have been made the total shock and efficiency of equipment for a particular end use are determined. Energy consumption by fuel can be calculated from the amount of service demand satisfied by each technology and the corresponding efficiency of the technology. At this stage, adjustments to energy consumption are also made. These include adjustments for changes in real energy prices (short-run price elasticity effects), **adjustments in utilization rates caused by efficiency increases (efficiency rebound effects),** and changes for weather relative to the CBECS survey year (emphasis added).[24]

From these examples it is clear that energy savings estimates from energy efficiency programs should be reduced to accurately account for the presence of a rebound effect. In further support, I have also included Attachment GM-1 which is a bibliography of 31 papers either produced by reputable institutions or included in peer-reviewed academic journals that discuss the importance of accounting for the rebound effect.

Q. Has the Uniform Methods Projects specifically addressed rebound effects in residential lighting programs?

A. Yes. The rebound effect, as related to residential lighting, is mentioned in the February 2014 version of Chapter 6: *Residential Lighting Evaluation Protocol*, as follows:

> **4:10 Snapback/Rebound or Conservation Effect**

[23] http://www.eia.gov/oiaf/aeo/overview/
[24] DOE-EIA (2009) The National Energy Modeling System: An Overview 2009. http://www.eia.gov/oiaf/aeo/overview/pdf/0581(2009).pdf

"Snapback" or "rebound" refers to changes in use patterns that occur after the installation of an energy-efficient product and result in reducing the overall measure savings. For example, when residential lighting customers use a CFL for more hours per day than they used the replaced incandescent bulb, this constitutes snapback. This behavior change may be due to factors such as the cost savings per unit of time from the CFL or a concern that turning CFLs on and off shortens their effective life (although it is unlikely most consumers are aware of this effect on bulb life). Some customers, however, might have lower hours of use after installing a CFL, perhaps due to a corresponding desire to reduce energy consumption or dissatisfaction with the quality of the light.

Due to the nature of residential lighting programs, it is not typically possible to conduct metering both before and after installation of energy-efficient lighting. **However, a recent lighting study in the Northeast found that the hours of use were greater for sockets with efficient bulbs compared to all sockets in the house (NMR Group 2014).** The difference was believed to be either due to: 1.) differential socket selection (households selecting higher-use locations for their high-efficiency light bulbs); 2) Shifting usage (households install an efficient bulb in a socket and then begin to use that socket in lieu of sockets containing inefficient bulbs); and 3) snapback. However, this evaluation did not collect any data to determine which of these three theories is correct, or the proportion of the difference between efficient and inefficient HOU [hours-of-use] that is attributable to each type of behavior. **Therefore, the Residential**

> **Lighting Protocol recommends researching for snapback/rebound effects in future HOU estimates** (emphasis added).[25]

I contacted the NMR group to gain a better understating of what their study concluded. The NMR group performed onsite visits of 848 homes with over 5,730 loggers (time tracking mechanism for the light bulb) between December 2012 and March 2013. The study included residential locations throughout Connecticut, Massachusetts, New York and Rhode Island. In section 3.4.3 of their report, titled: *HOU by Saturation of Efficient Bulbs* the following conclusion is made:

> In other words, **the patterns of HOU for efficient and inefficient bulbs appear to mirror each other, except that the efficient HOU are always a bit higher.** This suggests that, for some reason, efficient bulbs simply have a universally higher level of usage than inefficient bulbs across the overall region (emphasis added).[26]

The results of the NMR study as well as the recommendations made by the Uniformed Methods Project suggest that a greater emphasis should be placed on EM&V efforts regarding capturing direct rebound effect estimates moving forward in ratepayer-sponsored energy efficiency programs.

Q. Was a lighting hour-of-use (HOU) study performed by Cadmus in their evaluation of the LightSavers program and included in the 2013 results?

A. No. The results for PY2013 utilize the HOU estimates that were conducted in Ameren Missouri's service territory in 2010. An HOU study was performed, but the results will not be available until 2014. Moreover, it is unclear whether or not the study examined HOU

[25] Dimetrosky, S. et al. (2014) Chapter 6: Residential Lighting Evaluation Protocol. National Renewable Energy Laboratory. http://www.nrel.gov/extranet/ump/pdfs/20140514_ump_res_lighting_draft.pdf
[26] NMR Group, Inc. (2014) Northeast Residential Lighting Hours-of-Use Study. https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2014ContractorReports/2014-EMEP-Northeast-Residential-Lighting.pdf

times for inefficient bulbs as a comparison similar to what the NMR group did as referenced above.

Q. Would you summarize Public Counsel's comments regarding the rebound effect.

A. The rebound effect is another consideration to take into account when measuring energy savings. Nationally and internationally recognized energy and climate institutions have recognized the phenomenon and the need to study it more carefully so that energy efficiency gains are not overstated.

The presence of a rebound effect should not detract from the value of promoting energy efficiency as a least-cost resource moving forward. Clearly, energy savings are occurring, but it is important that those savings are not overstated, especially when Ameren Missouri is rewarded with additional financial compensation for estimated energy savings achieved.

Public Counsel presents the rebound effect as an additional consideration for the Commission in determining the appropriate EM&V results. OPC incorporates its Corrected Response to Change Request and recommends the Commission:

- Adopt Staff's original Change Request that calls for the elimination of market effects and accepting the Auditor's spillover estimates
- Reject Ameren's downward adjustment of free ridership
- Include a 9% downward adjustment to the NTG ratio for the LightSavers Program to account for conservative direct rebound effect estimates.

In the Response to Change Requests, Public Counsel discussed at length why factoring in market effects for Ameren Missouri's PY2013 is inappropriate in the Response to Change Request. This direct testimony introduced another factor, the rebound effect, which should be accounted for to accurately estimate energy savings attributable to ratepayer funded programs. As illustrated in table 1 above, Public Counsel suggests the Commission adjust

the LightSavers program by the 9% rebound effect resulting in an annual estimated energy savings of 303,012 MWh for PY2013.

Q. Does this conclude your direct testimony?

A. Yes, it does.

Energy Efficiency and the Rebound Effect: Background Readings[1]

An empirical general equilibrium analysis of the factors that govern the extent of energy rebound effects in the UK economy
Economic and Social Research Council
http://www.esrc.ac.uk/my-esrc/grants/RES-061-25-0010/read

Consumption and the Rebound Effect: An Industrial Ecology Perspective
Edgar G. Hertwich
Massachusetts Institute of Technology and Yale University
http://onlinelibrary.wiley.com/doi/10.1162/1088198054084635/pdf

Defining the rebound effect
Peter H. G. Berkhout, Jos C. Muskens, and Jan W. Velthuijsen
University of Amsterdam
http://www.sciencedirect.com/science/article/pii/S0301421500000227

Do increases in energy efficiency improve environmental quality and sustainability?
Nick Hanley, Peter G. McGregor, J. Kim Swales, and Karen Turner
Universities of Stirling, Strathclyde, and Glasgow
http://www.sciencedirect.com/science/article/pii/S0921800908002589

Does the hybrid Toyota Prius lead to rebound effects? Analysis of size and number of cars previously owned by Swiss Prius buyers
Peter de Haan, Michel G. Mueller, and Anja Peters
Swiss Federal Institute of Technology
http://www.sciencedirect.com/science/article/pii/S0921800905003654

Effect of Thermal Improvements in Housing on Residential Energy Demand
Li-min Hsueh, Jennifer Gerner
Chung-Hua Institution for Economic Research and Department of Consumer Economics and Housing
http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.1993.tb00739.x/abstract?systemMessage=Wiley+Online+Library+will+be+disrupted+4+June+from+10-12+BST+for+monthly+maintenance

Energy efficiency and consumption — the rebound effect — a survey
Lorna A. Greening, David L. Greene, and Carmen Difiglio
International Resources Group, Oak Ridge National Laboratory, and International Energy Agency
http://www.sciencedirect.com/science/article/pii/S0301421500000215

[1] Bibliography adapted from the Center for Climate and Energy Decision Making (2013) Energy Efficiency and the Rebound Effect: Background Readings. http://cedmcenter.org/energy-efficiency-and-the-rebound-efffect-background-readin gs/

Energy efficiency, rebound effects and the environmental Kuznets Curve
Karen Turner and Nick Hanley
University of Stirling
http://www.sciencedirect.com/science/article/pii/S0140988310002070

Energy efficiency: rebounding to a sound analytical perspective
John A. "Skip" Laitner
EPA Office of Atmospheric Programs
http://www.sciencedirect.com/science/article/pii/S030142150000032X

Energy Efficiency and Economic Growth
Richard B. Howarth
University of California
http://onlinelibrary.wiley.com/doi/10.1111/j.1465-7287.1997.tb00484.x/abstract#fn1

Final Rule on Model Year 2012-2016 Light-Duty Vehicle GHG and CAFE Standards (75 FR 25324, May 7, 2010)
Environmental Protection Agency
http://www.theicct.org/us-epa-light-duty-vehicle-ghg-and-cafe-standards-2012%E2%80%932016

Fuel conserving (and using) production functions
Harry D. Saunders
Decision Processes Incorporated
http://www.sciencedirect.com/science/article/pii/S0140988307001454

Historical Evidence for Energy Consumption Rebound in 30 US Sectors and a Toolkit for Rebound Analysts
Harry D. Saunders
Decision Processes Incorporated
http://thebreakthrough.org/blog/Historical%20Evidence%20Article%2011-11-10.pdf

Incorporating macroeconomic feedback into an energy systems model using an IO approach: Evaluating the rebound effect in the Korean electricity system
Mark Howells, Kiho Jeong, Lucille Langlois, Man Ki Lee, Kee-Yung Nam and Hans Holger Rogner
Planning and Economic Studies Section, School of Economics and Trade, and Korea Atomic Energy Research Institute
http://www.sciencedirect.com/science/article/pii/S0301421508005922

Increased ecoefficiency and gross rebound effect: Evidence from USA and six European countries 1960–2002
Stig-Olof Holm and Göran Englund
Umeå University
http://www.sciencedirect.com/science/article/pii/S0921800908003091

Jevons' Paradox revisited: The evidence for backfire from improved energy efficiency
Steve Sorrell
Sussex Energy Group
http://www.sciencedirect.com/science/article/pii/S0301421508007428

Missing carbon reductions? Exploring rebound and backfire effects in UK households
Druckman A, Chitnis M, Sorrell S and Jackson T
Food Climate Research Network
http://www.fcrn.org.uk/research-library/consumption/behaviour/missing-carbon-reductions-exploring-rebound-and-backfire-effects-uk-households

Negative rebound and disinvestment effects in response to an improvement in energy efficiency in the UK economy
Karen Turner
University of Strathclyde Glasgow
http://www.webmeets.com/files/papers/EAERE/2009/31/Turner_EAERE_Dec%2008.pdf

New Report: How Efficiency Can Increase Energy Consumption
Jesse Jenkins, Michael Shellenberger, and Ted Nordhaus
Breakthrough Institute
http://thebreakthrough.org/archive/new_report_how_efficiency_can

On the rebound? Feedback between energy intensities and energy uses in IEA countries
Lee Schipper and Michael Grubb
International Energy Agency and RIIA
http://www.sciencedirect.com/science/article/pii/S0301421500000185

People-Centered Initiatives for Increasing Energy Savings
John A. "Skip" Laitner and Karen Ehrhardt-Martinez
American Council for an Energy-Efficient Economy
http://www.aceee.org/node/9275

REBOUND – The Social Dimension of the Rebound Effect
Marco Sonnberger, M. A. and Juergen Deuschle, M. A.
University of Stuttgart – ZIRN
http://www.zirius.eu/projects_e/rebound.htm

Rebound 2007: Analysis of U.S. light-duty vehicle travel statistics
David L. Greene
Oak Ridge National Laboratory
http://www.sciencedirect.com/science/article/pii/S0301421510002739

Rebound and disinvestment effects in refined oil consumption and supply resulting from an increase in energy efficiency in the Scottish commercial transport sector
Sam Anson and Karen Turner
Scottish Government and University of Strathclyde
http://www.sciencedirect.com/science/article/pii/S0301421509002705

Rethinking economy-wide rebound measures: An unbiased proposal
Ana-Isabel Guerra and Ferran Sancho
Universitat Autònoma de Barcelona
http://www.sciencedirect.com/science/article/pii/S030142151000501X

Study commissioned by the EU – DG environment on the rebound effect
Bio Intelligence Service
http://rebound.eu-smr.eu/home

Technological progress and sustainable development: what about the rebound effect?
Mathias Binswanger
University of St. Gallen
http://www.sciencedirect.com/science/article/pii/S0921800900002147

The impact of increased efficiency in the industrial use of energy: A computable general equilibrium analysis for the United Kingdom
Grant Allan, Nick Hanley, Peter McGregor, Kim Swales, and Karen Turner
University of Strathclyde, University of Stirling, and University of Glasgow
http://www.sciencedirect.com/science/article/pii/S0140988306001514

The macro-economic rebound effect and the UK economy
Terry Barker, Paul Ekins, and Tim Foxon
University of Cambridge and Policy Studies Institute
http://www.sciencedirect.com/science/article/pii/S0301421507001565

The rebound effect: Microeconomic definitions, limitations and extensions
Steve Sorrell and John Dimitropoulos
University of Sussex
http://www.sciencedirect.com/science/article/pii/S0921800907004405

The Rebound Effect: Some Questions Answered
Maggie Koerth-Bakera, Karen Turnerb, Janine De Fencec, Cathy Xin Cuic
University of Strathclyde
http://biblioteca.universia.net/html_bura/ficha/params/title/the-rebound-effect-some-questions-answered/id/54079567.html