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| Witness: | John A. Rogers |
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| File No.: | ER-2011-0028 |
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# MISSOURI PUBLIC SERVICE COMMISSION

# UTILITY OPERATIONS DIVISION

# SURREBUTTAL TESTIMONY

# OF

# JOHN A. ROGERS

# UNION ELECTRIC COMPANY
# d/b/a Ameren Missouri

# FILE NO. ER-2011-0028

***Jefferson City, Missouri***
***April 2011***

## BEFORE THE PUBLIC SERVICE COMMISSION

## OF THE STATE OF MISSOURI

| | | |
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| In the Matter of Union Electric Company d/b/a AmerenUE's Tariff to Increase its Annual Revenues for Electric Service | ) ) ) | File No. ER-2011-0028 |

### AFFIDAVIT OF JOHN A. ROGERS

**STATE OF MISSOURI** )
) **ss**
**COUNTY OF COLE** )

John A. Rogers, of lawful age, on his oath states: that he has participated in the preparation of the following Surrebuttal Testimony in question and answer form, consisting of 22 pages of Surrebuttal Testimony to be presented in the above case, that the answers in the following Surrebuttal Testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such matters are true to the best of his knowledge and belief.

John A Rogers
John A. Rogers

Subscribed and sworn to before me this 13th day of April, 2011.

SUSAN L. SUNDERMEYER
Notary Public - Notary Seal
State of Missouri
Commissioned for Callaway County
My Commission Expires: October 03, 2014
Commission Number: 10942086

Susan L Sundermeyer
Notary Public

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**UNION ELECTRIC COMPANY**
**d/b/a Ameren Missouri**

**FILE NO. ER-2011-0028**

Q. Please state your name and business address.

A. My name is John A. Rogers, and my business address is Missouri Public Service Commission, P. O. Box 360, Jefferson City, Missouri 65102.

Q. What is your present position at the Missouri Public Service Commission?

A. I am a Utility Regulatory Manager in the Energy Department of the Utility Operations Division.

Q. Are you the same John A. Rogers that contributed to Staff's Revenue Requirement Cost of Service Report (COS Report) filed on February 4, 2011 and that filed rebuttal testimony in this case on March 25, 2011?

A. Yes, I am.

Q. Would you please summarize the purpose of your surrebuttal testimony?

A. I address certain rebuttal testimony of Union Electric Company d/b/a Ameren Missouri (Ameren Missouri or Company) witnesses Richard J. Mark, Daniel G. Laurent and/or William R. Davis related to: a) aligning customer and utility interests through compliance with the Missouri Energy Efficiency Investment Act of 2009 (MEEIA), Section 393.1075, RSMo, Supp. 2009; b) Ameren Missouri's level of compliance with MEEIA in this case; c) Ameren Missouri's experience with and plans for its demand-side management

(DSM) programs; d) the appropriate DSM cost recovery treatment in this case; and e) the prudence of the Company's Residential Lighting and Appliance program (L&A). I provide Staff's recommended strategy for Ameren Missouri to align its financial incentives with helping its customers use energy more efficiently through compliance with MEEIA. Finally, I provide Staff's view of the important role that the utility-stakeholder process will play during the transition to and following the implementation of MEEIA rules. On these issues, Staff makes the following recommendations in this case:

1. That the Commission not change Ameren Missouri's current DSM cost recovery mechanism from its current six year amortization to a three year amortization, because approval of Ameren Missouri's request will not create the necessary financial incentives for the Company to comply with the MEEIA;

2. That the Commission not approve either of the mechanisms for recovery of lost revenue proposed by Ameren Missouri in the direct and rebuttal testimony of Mr. Davis, because: a) these mechanisms proposed by Ameren Missouri are lost revenue recovery mechanisms, which are inconsistent with the provisions for a utility lost revenue component of a demand-side programs investment mechanism (DSIM) included within the Commission's recently-approved MEEIA rules; b) approval of either mechanism will not create the necessary financial incentives for Ameren Missouri to comply with MEEIA; c) neither mechanism removes the Company's throughput incentive; and d) the Company has not requested Commission approval of its demand-side programs under MEEIA, a statutory condition for receiving a Commission-approved DSIM;

3. That the Commission encourage Ameren Missouri to pursue a comprehensive strategy consistent with the Commission's MEEIA rules that aligns the Company's financial incentives with helping its customers use energy more efficiently. The Company should focus its attention on working with its stakeholders to achieve by January 1, 2012, the filing of applications for approval of its realistic achievable potential (RAP) demand-side programs (described in Ameren Missouri's recently filed Chapter 22 Electric Utility Resource Planning compliance filing in File No. EO-2011-0271(Chapter 22 compliance filing)[1]) and for approval of a DSIM under the soon-to-be-effective MEEIA rules or, should MEEIA rules[2] not be effective, under 393.1075, RSMo, Supp. 2009; and

4. That all costs for the Ameren Missouri L&A program incurred through the February 28, 2011 true-up cut-off date be included in rate base and amortized over a six year period, consistent with Staff's recommended rate treatment for other prudently incurred DSM costs.

**Aligning customer and utility interests through MEEIA**

Q. Does Ameren Missouri mention the need for a constructive solution to align customer and utility interests as contemplated by MEEIA?

A. Yes. Mr. Mark's rebuttal testimony on page 6, lines 3 through 14 make this very clear:

> The Company is seeking a way to align the interests of the utility with that of its customers so that they can use energy efficiently, a goal

[1] Staff references Ameren Missouri's Chapter 22 Electric Utility Resource Planning compliance filing in File No. EO-2011-0271 in this surrebuttal testimony. The Staff reserves the right to finish its review of the Company's resource plan within that filing and the discussion of the filing herein shall not be taken as a waiver by the Staff to contest any and all information within that filing after further review.

[2] Commission's final rules for 4 CSR 240-3.163, 4 CSR 240-3.164, 4 CSR 240-20.093 and 4 CSR 240-20.094 in File No. EX-2010-0368 were sent to the Administrative Rules Division on April 14, 2011, for publication in the Missouri Register.

> which is specifically set forth in MEEIA. All parties must recognize the financial impact of energy efficiency programs upon the Company. The issue is the essence of utility regulation – balancing a utility's obligation to provide reliable service at a reasonable cost and providing utilities the opportunity to earn reasonable returns. Ameren Missouri's management has a legal obligation to its shareholders to protect their interest. Ameren Missouri is not asking the Commission to place Company shareholder interests *above* those of our customers; rather we are asking the Commission to work with us to find a constructive solution to *align* customer and Company interests, as contemplated by MEEIA. In other words, there must be a solution that provides an equitable balance between, and an alignment of, the interest of the utility shareholders and utility customers.

Q. Do the Commission's MEEIA rules and MEEIA itself provide a regulatory framework that balances a utility's obligation to provide reliable service at a reasonable cost and the opportunity to earn reasonable returns on the utility's demand-side investments?

A. Yes. With the enactment of MEEIA, the State of Missouri has declared and directed the following:

> 3. It shall be the policy of the state to value demand-side investments equal to traditional investments in supply and delivery infrastructure and allow recovery of all reasonable and prudent costs of delivering cost-effective demand-side programs. In support of this policy, the commission shall:
> (1) Provide timely cost recovery for utilities;
> (2) Ensure that utility financial incentives are aligned with helping customers use energy more efficiently and in a manner that sustains or enhances utility customers' incentives to use energy more efficiently; and
> (3) Provide timely earnings opportunities associated with cost-effective measurable and verifiable efficiency savings.
> 4. The commission shall permit electric corporations to implement commission-approved demand-side programs proposed pursuant to this section with a goal of achieving all cost-effective demand-side savings. Recovery for such programs shall not be permitted unless the programs are approved by the commission, result in energy or demand savings and are beneficial to all customers in the customer class in which the programs are proposed, regardless of whether the programs are utilized by all customers. The commission shall consider the total resource cost test a preferred cost-effectiveness test. Programs targeted to low-income customers or general education campaigns do not need to meet

> a cost-effectiveness test, so long as the commission determines that the program or campaign is in the public interest. Nothing herein shall preclude the approval of demand-side programs that do not meet the test if the costs of the program above the level determined to be cost-effective are funded by the customers participating in the program or through tax or other governmental credits or incentives specifically designed for that purpose.

The Commission promulgated MEEIA rules pursuant to the authority granted within MEEIA.

Q. Does the Commission believe that utilities must comply with MEEIA and that MEEIA is the appropriate framework for utility regulation of demand-side investments?

A. Yes. The Commission expressed its view on this issue when it stated the following on page 88 in its April 12, 2011 Report and Order in File No. ER-2010-0355 regarding its Conclusions of Law – Demand-Side Management:

> Utilities within the Commission's jurisdiction must comply with The Missouri Energy Efficiency Investment Act (MEEIA) regardless of whether or not proposed rules under the law are effective. The language of MEEIA allows KCP&L and GMO to propose a different method of recovery regardless of whether specific Commission rules are in place or not[3].

**Ameren Missouri's compliance with MEEIA in this case**

Q. Does Ameren Missouri's request for cost recovery and for "adjusting billing units" in this case comply with MEEIA?

A. No.

Q. Why not?

A. The MEEIA and the MEEIA rules require that a utility receive Commission approval of its demand-side programs as a condition for receiving a recovery mechanism, respectively below:

[3] Case No. ER-2010-0355, *Report and Order*, p. 88, para. 26 (April 12, 2011).

> 4. The commission shall permit electric corporations to implement commission-approved demand-side programs proposed pursuant to this section with a goal of achieving all cost-effective demand-side savings. *Recovery for such programs shall not be permitted unless the programs are approved by the commission*, result in energy or demand savings and are beneficial to all customers in the customer class in which the programs are proposed, regardless of whether the programs are utilized by all customers[4]

and

> (3) Applications for Approval of Electric Utility Demand-Side Programs or Program Plans. Pursuant to the provisions of this rule, 4 CSR 240-2.060, and section 393.1075, RSMo, an electric utility may file an application with the commission for approval of demand-side programs or program plans by filing information and documentation required by 4 CSR 240-3.164(2). *Any existing demand-side program with tariff sheets in effect prior to the effective date of this rule shall be included in the initial application for approval of demand-side programs if the utility intends for unrecovered and/or new costs related to the existing demand-side program be included in the DSIM cost recovery revenue requirement, and/or if the utility intends to establish a utility lost revenue component of a DSIM or a utility incentive component of a DSIM for the existing demand-side program*. The commission shall approve, approve with modification acceptable to the electric utility, or reject such applications for approval of demand-side program plans within one hundred twenty (120) days of the filing of an application under this section only after providing the opportunity for a hearing. In the case of a utility filing an application for approval of an individual demand-side program, the commission shall approve, approve with modification acceptable to the electric utility, or reject applications within sixty (60) days of the filing of an application under this section only after providing the opportunity for a hearing[5].

(emphasis added).

Ameren Missouri has not filed an application for approval of its demand-side programs under MEEIA or under the MEEIA rules as a part of this case. Therefore, the Commission cannot approve demand-side programs or a demand-side programs investment mechanism which comply with MEEIA in this case.

[4] Section 393.1075.4, RSMo (Supp. 2009).
[5] Commission's final version of 4 CSR 240-20.094(3).

**Ameren Missouri's experience with and plans for its DSM programs**

Q. Has Ameren Missouri been successful in implementing DSM programs?

A. Yes. The Staff COS Report[6] provides a summary of Ameren Missouri's demand-side programs' spending levels, estimated energy savings and estimated demand savings levels. The Staff COS Report also contains the following summary of Ameren Missouri's spending levels for its DSM programs:

> Ameren Missouri has a total budget of $85 million for its business Energy Efficiency tariff and its Residential Energy Efficiency tariff through September 30, 2011 (the end of Program Year 3) and has spent a total of $38 million through December 31, 2010. Assuming a spending rate of $2.5 million per month (the average monthly spending for October through December 2010 total spending level in Schedule JAR-2) for the period January through September 2011, Ameren Missouri will spend a total of $60 million through September 30, 2011 which is $25 million less than the $85 million total budget for its Business Energy Efficiency and Residential Energy Efficiency tariffs. Such "under spending" is not unusual during the early years of demand-side programs' implementation as the utility climbs the learning curve and as its customers become familiar with newly offered demand-side programs and decide to take actions necessary to participate in demand-side programs.

The Company's DSM programs spending level in 2010 was $23 million[7]. However, the $2.5 million average monthly spending rate for the last four months of 2010 equates to an annualized spending level of $30 million.

Q. What DSM spending level does the Company plan to have in the coming years?

A. There is uncertainty on what the Company plans to spend on DSM in the coming years. The testimony of Mr. Mark and Mr. Davis states that the Company plans to spend $25 million per year on its DSM programs as long as the Company receives approval of

[6] *Staff COS Report*, p. 35, l. 20 - p. 38, l. 8.
[7] Ameren Missouri's response to Staff data request MPSC 0352 in File No. ER-2011-0028.

its request for cost recovery and for "adjusting billing units.[8]" However, Mr. Mark's rebuttal testimony at page 8, lines 4 through 19 makes it clear **that the Company will likely reduce its level of DSM spending** should the Commission not approve the Company's request for DSM cost recovery and for "adjusting billing units":

> Q. What if the Commission does not grant Ameren Missouri the treatment you are requesting?
> A. I certainly hope the Commission will grant us the treatment we are requesting. However, *if the Company is not given full and timely cost recovery, it will be unable to sustain its energy efficiency funding at the level it has in the past few years. I do not know exactly what level of energy efficiency funding Ameren Missouri will provide, but I do know that the Company will have no choice but to significantly reduce its expenditures on energy efficiency programs.*
> …
> A commission decision that achieves the MEEIA goal of providing timely cost recovery and alignment of utility incentives with helping customers use energy more efficiently is necessary if Ameren Missouri is to continue making substantial investment in energy efficiency.

(emphasis added).

Q. What are the demand-side resources in the Company's preferred resource plan?

A. Ameren Missouri filed its Chapter 22 compliance filing on February 23, 2011, in File No. EO-2011-0271. Staff is reviewing the compliance filing and will file its report to include any alleged filing deficiencies by June 23, 2011. Schedule JAR-1 to this surrebuttal testimony is the Executive Summary in the Company's Chapter 22 compliance filing. On page eight (8) of the Executive Summary are two charts which clearly illustrate the relative levels of DSM annual spending and relative levels of estimated annual cumulative energy savings from DSM programs for four cases: maximum achievable potential (MAP), RAP, Low Risk DSM, and business as usual. The business as usual case represents the demand-

[8] Rebuttal testimony of Mr. Mark at page 8, lines 1 through 4.

side resources in the Company's previous Chapter 22 compliance filing in File No. EO-2007-0409. The Staff COS Report on pages 40 through 42 also provides information on MAP, RAP and business as usual DSM based on the Ameren Missouri DSM Market Potential Study.[9]

According to Ameren Missouri's Chapter 22 compliance filing, Low Risk DSM represents the demand-side resources in the Company's preferred resource plan under existing regulatory treatment of DSM cost recovery ordered in the Company's last rate case in File No. ER-2010-0036 (approved DSM regulatory asset to include allowance for funds used during construction (AFUDC), rate base treatment of prudent DSM costs and six year amortization period). The preferred resource plan includes Low Risk DSM at an annual spending of approximately $20 million in 2012 and in 2013, a decrease of approximately $3 million from 2010 spending levels. The RAP alternative resource plan has the lowest utility cost (net present value of revenue requirements) and RAP demand-side resources have a lower levelized cost of energy (4 cents per kWh)[10] compared to supply-side resources (existing generation at 5 cents per kWh, nuclear at 10 cents per kWh, wind at 11 cents per kWh, combined cycle natural gas at 12 cents per kWh, simple cycle natural gas at 17 cents per kWh, and solar at 37 cents per kWh) over the planning horizon. The Company did not choose the RAP alternative resource plan for its preferred resource plan due to its expected impact on Company earnings under existing DSM cost recovery treatment. The Chapter 22 compliance filing summarizes the Company's strategy for DSM as: "Ameren Missouri will continue to advocate for better alignment of utility financial incentives to ultimately support the state's goal of achieving all cost-effective DSM. Ameren Missouri will continue pursuing a modest

[9] Vol. 1, *Executive Summary of the Market Potential Study*, is included in the Staff COS Report as Appendix 3, Schedule JAR-3.
[10] File No. EO-2011-0271, *Executive Summary*, p. 8 (February 23, 2011).

energy efficiency portfolio, which helps to preserve the option to switch to a more aggressive path.[11]"

Q. Please summarize Staff's understanding of the Company's planned DSM annual spending levels in the next few years.

A. Staff is uncertain what the Company's DSM annual spending levels will be. Ameren Missouri gives different amounts as demonstrated in this section of my surrebuttal testimony and summarized below:

1. $25 million represents the maximum level if the Company receives approval of its request in rebuttal testimony for DSM cost recovery and "adjusting billing units"[12];

2. $20 million in the Company's preferred resource plan under current regulatory treatment ; and

3. "Significantly less" [than $25 million] if the Company does not receive approval of its request in rebuttal testimony for DSM cost recovery and "adjusting billing units.[13]"

**Appropriate DSM cost recovery treatment in this case**

Q. What DSM cost recovery treatment does the Company request in this case?

A. In its direct case the Company requested: a) DSM costs and interest accrued at the Company's AFUDC rate be included in rate base and amortized over three years, and b) a fixed cost recovery mechanism (FCRM). However, in its rebuttal testimony, the Company changed its request to include: a) DSM costs and interest accrued at the Company's AFUDC rate be included in rate base and amortized over three years, and b) "adjusting billing units" in

[11] File No. EO-2011-0271, *Executive Summary* , p. 22 (February 23, 2011).
[12] Rebuttal Testimony of William R. Davis, p. 7, ll. 1-5.
[13] Rebuttal Testimony of Richard J. Mark, p. 8, ll. 9-12.

this case to provide recovery of lost revenue due to energy and demand savings from the Company's planned DSM programs.

Q. Did Staff provide rebuttal testimony on the Company's DSM cost recovery request in its direct case?

A. Yes. Staff made the following recommendations concerning the Company's DSM cost recovery [14]request in its rebuttal testimony:

> 1. That the Commission not change Ameren Missouri's current DSM cost recovery mechanism from its current six year amortization to a three year amortization, because approval of Ameren Missouri's request will not create the necessary financial incentives for the Company to comply with the Missouri Energy Efficiency Investment Act of 2009 ("MEEIA"), Section 393.1075, RSMo, Supp. 2009;
> 2. That the Commission not approve the FCRM proposed by Ameren Missouri, because a) the FCRM proposed by Ameren Missouri is a lost revenue recovery mechanism, which is inconsistent with the provisions for a utility lost revenue component of a demand-side programs investment mechanism ("DSIM") included within the Commission's recently-approved MEEIA rules; b) approval of the proposed FCRM will not create the necessary financial incentives for Ameren Missouri to comply with MEEIA; c) the proposed FCRM does not remove the Company's throughput incentive; and d) the Company has not requested Commission approval of its demand-side programs under MEEIA, a condition for receiving a Commission-approved DSIM;

Q. Why is the Company requesting "adjusting billing units" in this case?

A. Mr. Mark discusses how additional DSM expenditures and the resulting reduction in energy sales result in a "throughput disincentive" under current DSM cost recovery regulatory treatment and how "[t]he Company has already lost approximately $15 million because of its investment in energy efficiency since 2009. If the Company spends $25

[14] Rebuttal Testimony of John A. Rogers, p. 2, 11. 5-19.

million per year on energy efficiency programs going forward, it expects to experience $53.6 million in lost revenues over the next two years.[15]"

Further, Mr. Mark testifies that the Company does not believe the Commission's MEEIA rules provide the proper regulatory treatment to remove the "throughput disincentive." In his rebuttal testimony, Mr. Mark describes how:

> "[t]he Company's inability to recover lost revenues is a significant concern and, until this issue is addressed, serves as a major disincentive for the Company to make large investments in energy efficiency and is inconsistent with the intent of MEEIA. While the legislature recognized this in MEEIA, the rules recently approved by the Commission define lost revenue in a manner that fails to resolve this problem, primarily because the definition [of lost revenues] requires the utility to offset revenues due to energy efficiency against natural customer load growth. … [T]he Company already relies upon this natural load growth to offset the additional cost associated with putting new customers on our system as well as to offset other increasing cost it must absorb due to regulatory lag.[16]"

Q. Please describe the Company's request for "adjusting billing units."

A. Mr. Davis provides a detailed discussion of the proposal for "adjusting billing units" in his rebuttal testimony at page 6, line 12 through page 7 line 21:

> I am proposing an adjustment to the test year sales used to set rates after all other rate design has been completed. This is advantageous because it allows the revenue requirement to be set and the rate design process to be followed as normal. Once that process is complete I would simply *reduce the sales used to set rates based on expected savings* from Ameren Missouri's energy efficiency programs.
>
> …
>
> Based on continued expenditures of $25 million annually, I propose the residential sales be reduced by 250,951 MWh. For the Small General Service, Large General Service, Small Primary Service, and Large Primary Service classes, I propose a total reduction of 227,678 MWh to be allocated based on the 2010 energy savings estimates. For classes

[15] Rebuttal Testimony of Richard J.Mark, p. 3, ll. 18-21.

[16] Rebuttal Testimony of Richard J. Mark, p. 3, l. 21 – p. 4, l. 11.

> with demand-related charges I propose those demand units be reduced by the same percentage as the energy.
>
> …
>
> As with any cost or revenue element impacting the setting of rates, a difference in the actual level of that element from the amount used to set rates can produce over- or under-collection during the period when rates are in effect, all other things being equal. However, because my proposal seeks to use forward-looking information and also is a new concept for the Commission, the Company is willing to commit to building in a mechanism to prevent such an over-collection for occurring.
>
> …
>
> The Company would, in its next rate case, compare the adjustment to the final MWh savings result using its DSM evaluation for the time period that those rates are in effect. The Company would then make an adjustment to correct for any over collection related to this billing adjustment in order to keep customers whole if Ameren Missouri's energy efficiency programs don't obtain the level of MWh savings which is anticipated.

(emphasis added).

Q. Does Staff support approval of "adjusting billing units" in this case?

A. No.

Q. Why not?

A. Staff opposes approval of the Company's proposal for "adjusting billing units" for the following reasons:

1. After careful consideration of the lost revenue issue in its MEEIA rulemaking case, the Commission established its policy concerning recovery of lost revenue in its MEEIA rules to allow recovery of lost revenue only to the extent the Company has not recovered its fixed costs through sales growth and only on a retrospective basis as a result of energy savings measured and verified by a third party

evaluation, measurement and verification contractor, whose analysis and report is then subject to audit by a Commission-selected independent auditor[17].

2. Staff believes approval of "adjusting billing units" could result in the Company recovering lost revenue amounts in the future, which are in excess of what is allowed under the Commission's MEEIA rules.

3. The "adjusting billing units" mechanism does nothing to remove the "throughput incentive," since the Company will continue to benefit from increases in energy sales at the same time it will benefit from having "guaranteed" recovery of all lost revenue resulting from its DSM programs. This fact is acknowledged by Mr. Davis.[18]

4. The "adjusting billing units" discussion in Mr. Davis's rebuttal testimony applies to all costs, both fixed and variable costs. If "adjusting billing units" is approved by the Commission, the amount of the adjustment to billing units should be reduced to account for the fact that variable costs should not be recovered through such a mechanism.

5. The "adjusting billing units" amounts of 250,951 MWh for residential and 227,678 MWh for other rate classes proposed by Mr. Davis are cumulative energy savings from the time the programs started (mostly in 2009). Thus, the "adjusting billing units" amounts are double accounting for energy savings which have already been recognized in the setting of rates in the last rate case.

[17] 4 CSR 240-20.093(1)(Y) and 4 CSR 240-20.093(2)(G).
[18] Direct Testimony of William R. Davis, p. 10, ll. Davis direct testimony at page, 10 lines 14 through 14.

6. The "adjusting billing units" amounts are not annualized and would result in a collection of all the revenue lost from 2009 through 2013 each year until rates go into effect in the next rate case.

Q. What is Staff's recommendation concerning the Company's request for DSM cost recovery and "adjusting billing units"?

A. Staff recommends that the Commission not change the DSM cost recovery treatment approved in its Report and Order in Ameren Missouri's last rate case. The Company's proposal for "adjusting billing units" should not be approved by the Commission, because it will not remove the "throughput incentive" and may contribute to the Company over earning as a result of the concerns expressed in the previous answer. But most importantly, this mechanism is inconsistent with the Commission's final MEEIA rules.

**Strategy for Ameren Missouri to align its financial incentives with helping its customers use energy more efficiently through its compliance with MEEIA**

Q. Did you previously recommend a strategy for Ameren Missouri to align its financial incentives with helping its customers use energy more efficiently through its compliance with MEEIA?

A. In the Staff COS Report on page 43, lines 6 through 12:

> Staff recommends that the Commission not change the current Ameren Missouri DSM cost recovery mechanism and not approve a fixed cost recovery mechanism for Ameren Missouri in this case. Staff recommends that Ameren Missouri instead focus its attention on working with its stakeholders during the upcoming Chapter 22 compliance filing review to reach alignment on the strategy for the Company's demand-side resources. Such alignment in the Chapter 22 compliance case is possible by June 2011, the same month in which the MEEIA rules are expected to become effective. As discussed earlier in this section of Staff's COS Report, Ameren Missouri could have approved DSM programs and an approved DSIM under the MEEIA rules by the end of October 2011.

Q. How did the Company respond to this recommendation?

A. Other than continuing to express the Company's concerns for the MEEIA rules, Mr. Davis expressed that Staff's proposed schedule for the Company to file applications under the MEEIA in June 2011 was overly optimistic.

Q. Do you agree with Mr. Davis?

A. Upon reflection, I do agree. I now feel that the Company should take more time to prepare its MEEIA filings, and I believe a more reasonable date for the Company making its MEEIA filings is January 1, 2012.

**Prudence of L&A**

Q. Has Staff completed its review of the Cadmus Group's evaluation, measurement and verification report for the L&A (L&A EMV Report)?

A. The L&A EMV Report was received by Staff on March 24, 2011. Staff has had time to complete only an initial review of the L&A EMV Report which totals 131 pages and is included in this testimony as Schedule JAR-2. Staff has also had the opportunity to receive clarification of some information in the report through its productive and open conversations with the Company and with members of the Cadmus Group project team.

Q. Is the L&A different from other DSM programs being delivered by Missouri investor-owned electric utilities?

A. The compact florescent light (CFL) portion of the L&A is the only market transformation program and has a delivery strategy which uses product promotions with retail partners and a "buy-down" and/or "mark-down" strategy to reduce the wholesale price of program products for retailers and/or to reduce the retail price for consumers. Through this market transformation strategy the objectives[19] are to:

[19] Cadmus Group Lighting and Appliance Evaluation PY2, March 2011 at page 1

1. Increase the supply of qualifying products through program partnerships with retailers, manufacturers, and distributors;

2. Create demand through consumer awareness and understanding of the ENERGY STAR label and through consumer education about energy efficiency benefits; and

3. Create a lasting retailer preference for stocking and selling ENERGY STAR products, as well as a lasting consumer preference for purchasing these items.

Q. Is there any other feature which distinguishes market transformation programs from other types of DSM programs which are based on direct customer incentives?

A. Yes. It is very difficult to measure the impact of energy and demand savings due to market transformation programs. The benefits from the "spillover" due to changes in program participants attitudes and behaviors as a result of market transformation programs cannot be measured directly.

Q. How much energy (MWh) and demand (MW) does the L&A EMV Report estimate the L&A saved and how were these estimates of energy and demand savings obtained?

A. Table ES2 on page 3 of the L&A EMV Report indicates that the estimate of net energy savings is 69,759 MWh and the estimated net demand savings is 12,238 MW for the program year 2. The largest components of energy and demand savings are from the sale of ENERGY STAR CFL bulbs with much smaller levels of energy and demand savings from CFL fixtures, room air conditioners, dehumidifiers and freezers. To estimate the impact of the L&A, Cadmus Group recently developed a multistate model using demand-side program, econometric and demographic data for 11 areas of the country (including Ameren Missouri's

service territory) with CFL programs similar to that of Ameren Missouri and 4 areas of the country without any history of such programs. Five of the other CFL program areas are also utility clients of Cadmus Group. The resulting zero-inflated negative binomial regression (ZINB) model is used to estimate the "lift" that the L&A has on increasing the total number of CFL bulbs (total of L&A CFLs and non-L&A CFLs) sold in the Ameren Missouri service territory. To estimate the impact of L&A fixture and appliance sales, Cadmus Group used a more traditional approach of using retailer interviews and in store customer intercepts to determine: a) whether L&A products were being purchased by Ameren Missouri customers or by customers of another utility (leakage), and b) whether customers purchased the L&A products due to the L&A promotions and prices or whether customers were not influenced by the L&A promotions and prices, i. e., customers would have made the purchases without the L&A promotions and prices (free riders).

Q. Does Staff have concerns regarding the estimated net energy savings of 69,759 MWh and the estimated net demand savings of 12,238 MW for the program year 2?

A. Yes. Staff is primarily concerned over the estimated impacts of the CFL bulbs, since Staff has not gained a full understanding of the ZINB which estimates the net-to-gross (NTG) ratio for program CFL bulbs to be 0.96. The L&A EMV Report includes several references to also using the more traditional retailer interview (and sales data) and customer store intercept data to estimate NTG for program CFL bulbs. However, this approach is not used even though the information to make such an estimate of NTG is available in the L&A EMV Report. Cadmus Group could not provide Staff with an adequate explanation for not using the more traditional retailer interview (and sales data) and customer store intercept data to estimate NTG for program CFL bulbs (as promised in the L&A EMV Report), other than to

say it feels the retailer interviews data is biased and employees being interviewed were not well informed.

Q. Does Staff accept this explanation of Cadmus Group?

A. No. If traditional estimating procedures can be used for room air conditioners (NTG = 0.62), dehumidifiers (NTG = 0.52) and freezers (NTG = 0.58), staff sees no reason this procedure cannot be relied upon as an alternative piece of information to understand and to estimate the impact of the program on transforming the market.

Q. Has Staff performed its own estimate of NTG for program CFL bulbs?

A. Yes. Staff uses the information from the retailer interviews on page 56 of the L&A EMV Report which suggests that "CFL sales would be 35 percent lower in absence of the program" along with the program "leakage" rate of 8.7 percent (3.4 percent for St. Louis metro and 40.3 percent for rural areas) to estimate NTG of 0.32 (= 0.35 x (1 – 0.087)).

Q. Can the Cadmus Group's NTG of 0.96 be compared directly to the Staff's NTG of 0.32?

A. Not entirely. Staff's approach accounts for "leakage" and "free riders" but does not account for "spillover" (in this case, purchase of non-L&A CFL bulbs as a result of the L&A's influence on transforming customers attitudes and behaviors concerning CFL bulbs). The ZINB was developed by Cadmus Group with the objective of capturing the "spillover" in the estimation of NTG. However, the ZINB has the disadvantage of not being able to identify the amount of "free riders" and the amount of "spillover" in the model of the market.

Q. Does Staff feel that there will be much "spillover" from the L&A CFL program?

A. Staff has reason to believe that there will not be much spillover, since 78 percent of customers intercepted indicated that they had an initial intention of buying CFLs when they entered the store and Staff feels that the CFL market has experienced significant naturally occurring market transformation as a result of the ENERGY STAR retailer program and brand which have been in existence since 1992[20].

Q. Are there total resource cost (TRC) test calculations available for the L&A using the Cadmus Group's NTG of 0.96 for the CFL program and the Staff's NTG of 0.32 for the CFL program?

A. Yes. Ameren has run the DSMore software model to estimate a TRC of 2.65 for the NTG of 0.96 and a TRC of 1.79 for the NTG of 0.32.

Q. What does Staff conclude from its review of the L&A EMV Report and from its independent calculation of NTG and TRC for the L&A?

A. Staff concludes that the L&A has an estimated TRC of at least 1.79 and, therefore, all costs for the L&A in the DSM regulatory asset at the end of the true-up test year period should be included for recovery through rates in this case.

Q. What else has Staff learned as a result of its review of the L&A EMV Report?

A. Staff continues to have concerns for the ability of an EMV process to accurately estimate the energy savings and demand savings from market transformation programs such as the L&A. This concern is heightened by the expectations that such a process may soon be used in the determination of the utility lost revenue requirement and utility incentive revenue requirement for approved demand-side programs investment mechanisms under the Commission's MEEIA rules. For example, the L&A's estimated avoided cost of production and capacity is $24.3 million if the L&A's estimated NTG is 0.96

[20] http://www.energystar.gov/index.cfm?c=join.join_index

(TRC = 2.65), but the L&A's avoided cost of production and capacity is only $8.5 million if the L&A's NTG is 0.32 (TRC = 1.79). The difference of $15.8 million in this example points out the importance of having good methodologies to measure the impact of DSM programs, especially DSM market transformation programs.

Q. Is Ameren Missouri in full compliance with the conditions included in the Commission's May 21, 2009 Order Approving Tariff for the L&A[21]?

A. Two conditions do not apply until after the end of the initial term of the program since they require that Ameren Missouri share the final EMV report for the L&A with all electric utilities in Missouri and then invite all other Missouri utilities to participate in the L&A should Ameren Missouri choose to continue the program beyond September 30, 2011. Ameren Missouri is in compliance with the condition that it provide program data to interested stakeholders quarterly. One condition states: "Program EM&V (evaluation, measurement and verification) and reporting shall be done separately for the St. Louis metro area, rural areas, and for the program in total." This was not done in the L&A EMV Report which includes only the estimations of "leakage" for St. Louis metro area, rural areas, and for the program in total. All other elements of the L&A EMV Report are analyzed and reported on a total program basis. Staff recommends that Ameren Missouri assure that the final EMV report following completion of the three year term of the L&A complies with the Commission's condition or else explain in detail in a filing to the Commission why this cannot be done.

[21] File No. ET-2009-0404.

**Role of utility-stakeholder process during transition to and following implementation of MEEIA**

Q. Please comment on Staff's view of the utility-stakeholder process during the transition to and following implementation of MEEIA.

A. Staff encourages each electric utility and its DSM stakeholders to work in a cooperative way to make MEEIA successful. DSM is clearly Missouri's least cost resource. At the same time, the transition to new regulatory treatment for DSM investments through MEEIA will be challenging and will require some acceptance of disappointing outcomes and some give and take along the way as we learn together. MEEIA may be the pathway to "a solution that provides an equitable balance between, and an alignment of, the interest of the utility shareholders and utility customers.[22]"

Q. Does this conclude your surrebuttal testimony at this time?

A. Yes, it does.

[22] Mr. Mark rebuttal testimony page 6 lines 12 through 14.

# 1. Executive Summary

## *Highlights*

- *Ameren Missouri has conducted a thorough evaluation of options to meet future customer demand in a safe and reliable manner at a reasonable cost*
- *Future environmental regulation is expected to be a significant driver of the need for new resources*
- *There are several potentially viable paths that Ameren Missouri could pursue, each of which presents unique opportunities and challenges*
- *Ameren Missouri has developed a complete decision roadmap to detail the Preferred Resource Plan and its relationship to several contingency options.*

Ameren Missouri's Integrated Resource Plan (IRP) serves as the basis for the utility's resource acquisition strategy over the next three years and the overall direction of resource procurements for the remainder of the 20-year planning horizon. The IRP provides a snapshot of the Company's resources and loads, and provides guidance regarding resource needs and acquisitions. Since the filing of Ameren Missouri's 2008 IRP there have been several key changes that have impacted Ameren Missouri's long-term planning. Those changes include adoption of a state Renewable Energy Standard (RES), the passage of the Missouri Energy Efficiency Investment Act (MEEIA), the prospect for more stringent environmental regulations, and a severe recession. The current Missouri resource planning rules make it clear that regulators are to evaluate the *process* Ameren Missouri follows to arrive at its Preferred Resource Plan. However, Ameren Missouri believes the importance of resource planning rises above simple rule compliance and includes the need to discuss the *plan*. It is clear based on the analysis included in this IRP that Ameren Missouri and the entire state will be facing some serious challenges in the planning horizon.

The immediate challenges are largely driven by emerging environmental policies. Although activity has recently cooled with respect to greenhouse gas legislation, general activity around more stringent environmental regulations affecting coal plants has increased substantially. New regulations governing air emissions, use of water, and disposal of coal ash are likely to require significant investment in control equipment for coal-fired plants. Given Ameren Missouri's strong reliance on coal (75% today), there could be a substantial impact to Ameren Missouri customers. Ameren Missouri's Preferred Resource Plan balances low cost, reliable service at reasonable rates by including a mix of renewable resources, demand-side resources, upgrades at existing facilities, and new gas-fired generation. This plan is optimal for our customers should existing environmental regulations remain largely unchanged over our planning horizon.

Should environmental regulations become more stringent, which we expect to be the case, Ameren Missouri has developed a robust set of contingency options to consider.

### *Stakeholder Involvement*

Throughout the IRP planning process Ameren Missouri has hosted several meetings of key stakeholders with the purpose of providing a status update and an opportunity to provide feedback at a time when the feedback is most useful. The discussions ranged from conceptual to technical depending on the stage of the analysis. In limited cases offline discussions were held to answer questions. Ameren Missouri also posted meeting materials, transcripts, and supporting studies online to facilitate information sharing. Below is a list of the meetings with a summary of the topics that were discussed.

- January 9th, 2009 – Renewables study conducted by Black & Veatch
- April 2nd, 2009 – Waivers requested by Ameren Missouri for certain requirements of the IRP rules
- August 26th, 2009 – Renewables Follow-up, Coal and Gas Resource Options study conducted by Black & Veatch
- November 20th, 2009 – 2008 IRP Implementation Plan update, Overview of Planning Process
- January 26th, 2010 – Conference Call on Financing Analysis Plan
- March 8th, 2010 – Scenarios, Uncertain Factors, Load Analysis and Forecasting, EPRI End-to-End Efficiency Study, Initial Supply-Side Screening Results
- April 16th, 2010 – Conference Call on Financing Analysis Plan
- May 25th, 2010 – Forecasting Results, DSM Analysis, Alternative Resource Plan Development, Scenario Modeling Results
- September 14th, 2010 – Integration Analysis, Sensitivity Analysis, Critical Independent Uncertain Factors, Decision Framework
- February 22nd, 2011 – Risk Analysis, Environmental Scenarios and Strategy Selection

### *Drivers of Resource Needs*

In determining our future resource needs we must first understand what the future demand for electricity is likely to be. Then, we must consider factors that may impact the ability of our existing power plants to meet those needs. Here are some of the critical drivers we analyze:

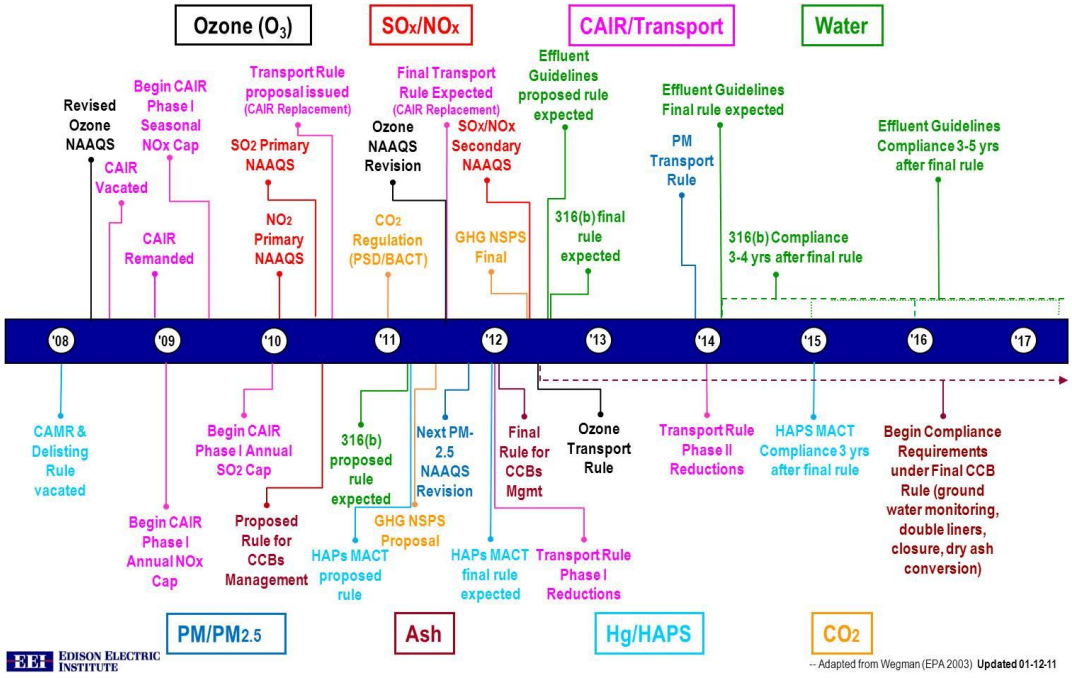
Customer Demand**:** Missouri's population has grown about 7 percent in the last decade, and this growth has also contributed to the rising demand for power. In the last 20 years, demand for electricity increased by 50% among Ameren Missouri customers.

In the next 20 years, our forecasts show demand for power rising almost another 20% in the Ameren Missouri service area alone.

Customer Expectations: Customers increasingly expect to have near-perfect service reliability. Customers believe that our product provides essential comfort and convenience and is critical to providing health care, personal security, recreation and many other services, so our customers expect us to have an abundant supply of electricity available when they want it.

Environmental Regulations: An area that has received a great deal of focus and attention over the last several years has been environmental regulations. In particular, the U.S. Environmental Protection Agency (EPA) is expected to issue new environmental regulations in the next 12 to 24 months related to air emissions, ash waste and water. Figure 1.1 highlights some of the regulations under consideration.

**Figure 1.1 Potential Environmental Regulations**




Source: Edison Electric Institute

These new regulations will likely require the installation of expensive environmental control equipment on our coal-fired plants over the next several years. The cost to comply with these regulations will be in the billions of dollars for Ameren Missouri and billions more for the rest of Missouri and the Midwest. These environmental regulations, along with potential legislation limiting the emission of greenhouse gases, will have a significant impact on electric rates and on our state's energy future because coal currently accounts for about 80% of the energy supplied in Missouri. As a result, we are

diligently working with legislators, regulators and other key stakeholders to find solutions that balance the need to address environmental concerns with the need to protect our state's economy, energy security and our customers' costs.

Aging Infrastructure: Across the nation and our region, large coal-fired plants that provide most of our power are growing older. The average age of Missouri's large plants is 40 years, and that's at least middle age for a power plant. These plants will not operate forever. In addition, the need to install billions of dollars of environmental controls may not be prudent on some of the older, less efficient plants and may force Ameren Missouri and other generators across the region, state and nation to shutter such plants. Not only does this have economic consequences, but the closing of some of these plants could impact the reliability of our power grid.

These plants won't be quickly or easily replaced. Planning for new generation must be done years in advance. That's why we need clear state and federal energy policies and regulation, as well as a reasonable transition period to implement these regulations so that we can plan effectively for the need to meet our customers' future energy needs in the most prudent and affordable fashion.

### *Future Resource Options*

Meeting existing power demand requires a vast network of different types of power plants, big and small, connected by a network of power lines. For a sense of scale, we can consider how many power plants of a given type would be required to generate the same amount of electricity. One single-unit nuclear power plant or two coal-fired units, for example, produce enough electricity to meet the annual needs of one million households. To meet the needs of the same number of consumers, it could take 1.6 million solar energy panels, 2,000 wind turbines, or three natural gas-fired plants. As the U.S. and other countries seek to ramp up renewable energy production, land use is becoming a more contentious issue; wind and solar energy farms may require 70 – 80 times more land than what is typically needed for traditional energy sources.

Clearly, it takes a combination of resources to reliably supply electricity. What we strive for is a number of power generation options working together within and across regions—so we aren't dependent on any single generation source. Each technology has distinct advantages and disadvantages.

Coal-fired power plants have been our state's energy workhorses for decades and are important energy resources for our state. Today they generate large quantities of low-cost electricity around the clock, but they emit greenhouse gases and other pollutants and release coal combustion byproducts that present waste disposal issues. Due to the potential new environmental regulations discussed previously, future coal plants will likely have to meet more stringent environmental standards in the future. New

technologies are under development to meet these standards, including those to capture and sequester carbon dioxide ($CO_2$). These offer promise as long-term solutions to climate change, but they are still mostly experimental.

Nuclear energy is by far the world's largest source of carbon-free generation. The U.S. is the largest nuclear energy producer with 104 nuclear plants in 31 states, generating about 20% of the nation's electricity. For Ameren Missouri, nuclear energy accounts for approximately 20% of our total generating capacity. U.S. energy providers recently began exploring development of new nuclear plants after decades with no new nuclear units constructed in the nation. Building a new nuclear plant can be a boost to local and regional economies—adding jobs in the tens of thousands during construction and hundreds of permanent jobs. Since 2001, nuclear power plants have achieved the lowest production costs when compared to plants fired with coal, natural gas and oil. However, due to their complexity and the significant regulation controlling nuclear energy, nuclear power plants can be more challenging to build, finance and operate than plants fueled by other sources.

Natural gas-fired generation is generally simpler to build and produces lower greenhouse gas emissions (about half the $CO_2$ emissions of a coal-fired power plant), but it too presents price uncertainty because natural gas costs have historically been very volatile. However, new uses of existing technologies have opened new domestic sources of natural gas, driving down prices. The current low prices for natural gas have encouraged some electric generators to substitute gas for coal. Environmental concerns about the use of these technologies have surfaced recently and could impact natural gas prices in the future.

Renewable power – solar and wind energy resources don't produce harmful greenhouse gases that contribute to climate change. However, the wind does not always blow, and the sun does not always shine, so you can't depend on these resources for predictable electricity production. Renewable energy also requires development of additional transmission lines to move wind and solar energy to the urban areas where it is needed from windy rural areas, or sunny environments, where it is often generated. That said, the cost of installing wind and solar energy systems has dropped with improvements in renewable technology, attracting customer interest in renewable energy.

To help our customers evaluate various solar power systems, we recently installed five solar power systems at our downtown headquarters building. The project will provide customers with practical information on the effectiveness of solar energy in our area. In the spring of 2011, we will open a viewing area and classroom where visitors will be able to see the rooftop solar systems along with monitors showing how much energy the units are generating.

Hydroelectric generation is environmentally friendly, but it relies on available water supplies and is very time-consuming to permit and costly to build. Largely financed through insurance proceeds, Ameren Missouri's newly rebuilt 440-megawatt Taum Sauk Hydroelectric Plant, which returned to service in 2010, is proving to be a valuable hydroelectric storage resource that can be quickly started during times of high demand for electricity. Taum Sauk Plant stores energy in the form of water, pumped from a lower elevation reservoir to a higher elevation. Low-cost off-peak electric power is used to run the pumps. During periods of high electrical demand, the stored water is released through turbines to create electricity.

Biomass – Common examples of biomass include food crops, crops for energy (e.g., switchgrass or prairie perennials), crop residues, wood waste and byproducts, and animal manure. Biomass can be burned directly in boilers to provide heat or in high-pressure boilers to generate electricity and then provide heat. Biomass can be used to generate electricity 24 hours a day. Coal-fired plants can be modified to burn biomass with coal, a process called "co-firing." Nationwide, biomass fuels less than 1% of the nation's electricity. Power generated from biomass is classified as "renewable" by the current Missouri Renewable Energy Standard, and may qualify as a renewable resource in potential federal legislation. However, biomass has seen limited use as an energy source thus far because it is not readily available as a year-round feedstock, can be expensive to transport and requires costly technology to convert to energy. Ameren Missouri is supporting research on biomass fuel resources, feed systems, storage facilities, and transportation options.

Landfill gas-to-energy projects can generate enough energy to power thousands of homes every day, reducing emissions of greenhouse gases in the process. The Ameren Missouri Methane to Megawatts project, slated to be up and running in 2012, will be the largest landfill gas-electric facility in the state and among the largest in the nation. It will generate enough electricity to meet the demands of about 10,000 homes. But this energy option requires the right kind of landfill and the right kind of technology to be installed, as well as lots of land to obtain meaningful scale.

Energy efficiency – Using energy more efficiently can defer the need for new generation resources. The following section discusses Ameren Missouri's experience to date and the potential for additional energy saving opportunities.

### *Demand-Side Resources*

Demand-Side Management ("DSM") entails actions by the utility that influence the quantity or patterns of energy consumption. DSM can further be divided into energy efficiency and demand response programs. Energy efficiency programs are designed to reduce overall consumption of electricity; whereas, demand response programs are designed to reduce electricity consumption during the few periods of highest demand.

Ameren Missouri has been implementing full-scale energy efficiency programs since 2009 and has several programs for both residential and business customers. Below is a brief description of the existing energy efficiency programs, all of which are scheduled to end September 2011. The future level of investment in these programs is highly dependent on the regulatory framework applied to DSM.

**Residential Programs**

- Lighting and Appliance Program – Provides an instant rebate or manufacturer buy-downs on Compact Fluorescent Lights (CFLs) and mail-in rebates on new ENERGY STAR®-qualified appliances.
- Social Marketing Distribution Program – Reduces energy use in residential lighting by leveraging the distribution and education capabilities of organizations to distribute CFLs and educational material at no charge to their residential constituents.
- Multi-Family Income Qualified Program – Partners with multi-family building owners and managers to remove energy inefficient lighting and appliances and install program-specified energy efficiency measures (EEMs) in income qualified building units.
- Refrigerator Recycling Program – Prevents the continued use of inefficient, working refrigerators and freezers by taking the units out of homes and recycling them in an environmentally safe manner.
- HVAC CheckMe!® Program – Encourages residential customers to have existing cooling systems evaluated and if feasible, brought back to factory specifications (re-commissioned), or replace less efficient, working central cooling systems with high efficiency central cooling systems.

**Business Programs**

- Standard Incentive Program – Provides pre-set incentives for energy efficient products that are readily available in the marketplace and will target measures for which energy savings can be reliably deemed, or calculated using simple threshold criteria. Incentives are available for lighting, motor, heating, ventilation and air conditioning (HVAC) and refrigeration projects.
- Custom Incentive Program – The Custom Incentive Program is for projects that save electricity, but are not on the Standard Incentive list. The incentive is $.05 per kWh saved during the first year of operation, with program incentives not to exceed 50 percent of the overall energy efficiency measure costs.
- New Construction Program – Provides financial incentives and technical assistance for energy efficient building design and construction. Eligible facilities include new facilities built from the ground up, additions to existing facilities, or major renovation of existing facilities requiring significant mechanical and/or electrical equipment alteration.

- Retro-Commissioning Program – Provides incentives for energy and demand reduction opportunities achievable through optimizing building control systems.

In January 2010, Ameren Missouri published the results of a major research study aimed at understanding the potential for energy efficiency improvements on the customer side of the meter. To understand customer energy efficiency plans and future needs, a third-party vendor surveyed more than 4,000 residential and commercial customers using both online and onsite surveys. Ultimately the customer research was integrated with cost and performance data of end uses to estimate potential demand and energy savings. Ameren Missouri also developed several portfolios that represent a wide range of energy savings and cost. Figure 1.2 shows the annual energy efficiency budgets for the portfolios while Figure 1.3 shows the potential annual savings.

**Figure 1.2 Annual Budgets**

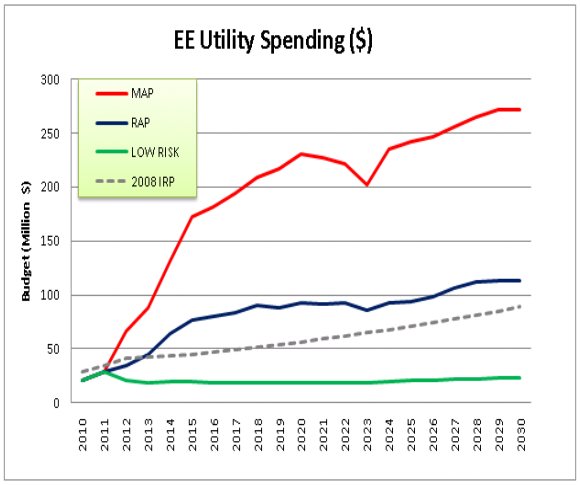
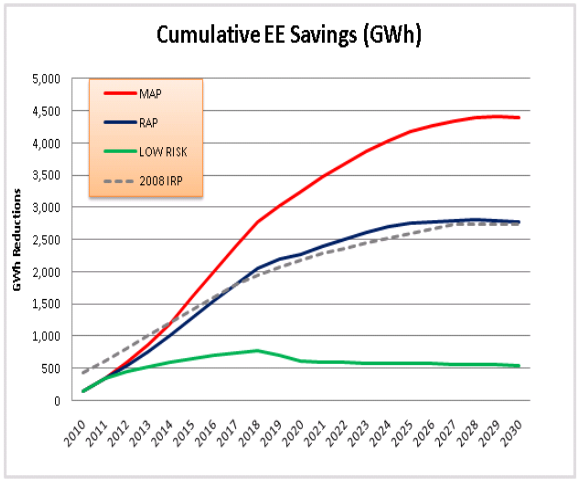



**Figure 1.3 Annual Savings**




*RAP-Realistic Achievable Potential, MAP-Maximum Achievable Potential

A DSM portfolio is initially measured by its cost-effectiveness. The Total Resource Cost (TRC) test, which measures benefits and costs from the perspective of the utility's customers and society as a whole, is a commonly used measure of cost-effectiveness. In short, if the benefits outweigh the costs then the ratio will be greater than one. It should be noted that the TRC is a screening-level assessment that does not reflect risk and that the results of integration and risk analysis determine cost-effectiveness on a risk-adjusted basis. With a levelized cost of energy near 4 cents/kwh, energy efficiency is less expensive than the supply-side alternatives. Ameren Missouri's analysis has also quantified some of the unique risks associated with implementing demand-side programs.

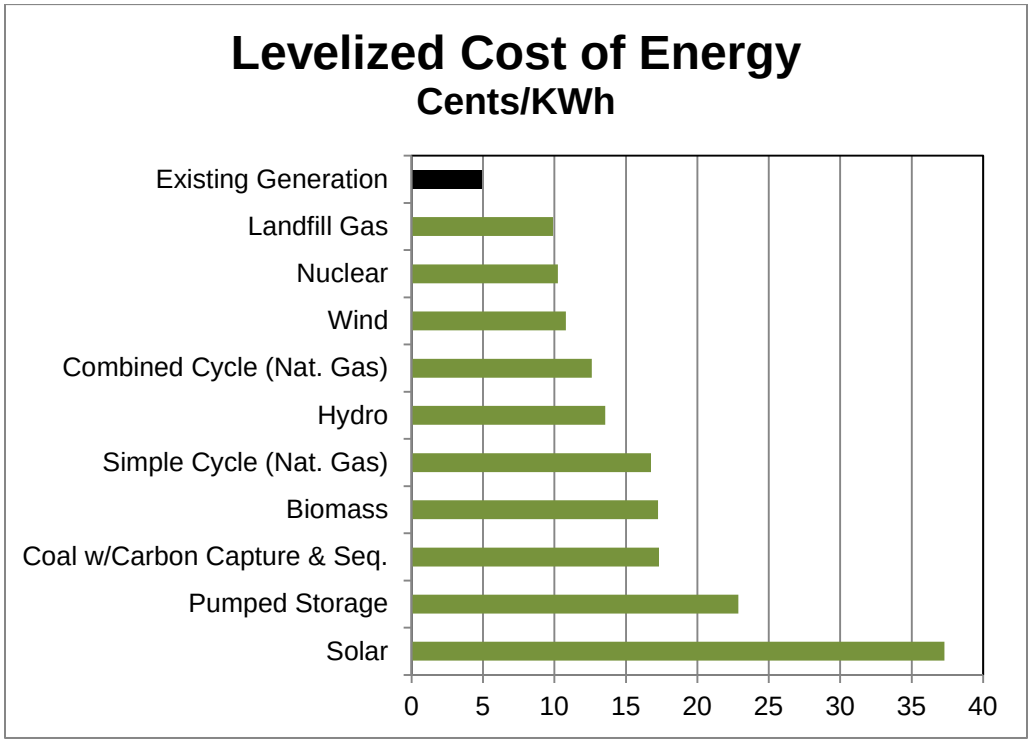
### *Relative Costs of Future Resource Options*

Some generation technologies cost a lot more to construct and then have much lower operating costs. Others cost a lot less to construct but have higher operating costs. The

expected lifetime of generation assets also varies by technology. One way to compare the relative costs of different generation technologies is to calculate a levelized cost of energy. To do this, we calculate the total costs of production - construction and operating costs, including environmental and fuel costs - over the expected life of the plant. Then we divide that by the amount of energy the plant produces over its lifetime. Coal traditionally has been an economically attractive fuel for generating power because it is so abundant.

As shown in Figure 1.4, the levelized cost of energy produced by Ameren Missouri's existing generation fleet (mainly electricity generated by coal and nuclear facilities) is much lower than any new generation resource we might add in future years to meet our customers' rising need for power.

**Figure 1.4 Levelized Cost of Energy (Without Incentives)**




With potential mandates requiring the reduction of $CO_2$ and other air emissions and potentially more stringent environmental regulations on water quality and ash disposal, coal becomes more expensive as a future generation source unless technological advances drive these costs down.

Natural gas is also a strong choice, particularly with efficient, smaller gas-fired facilities that are less expensive to build than coal or nuclear plants. But fuel costs for natural gas are about double the price of coal right now, and natural gas prices have traditionally been volatile, meaning that they can change rapidly.

Since 2001, nuclear power plants have achieved the lowest production costs when compared to plants fired with coal, natural gas and oil. In addition, nuclear power produces virtually no air emissions and is a great choice to address future environmental regulations. However, due to their large scale and the significant regulation controlling nuclear energy, nuclear power plants can be more challenging to build, finance and operate than plants fueled by other sources.

It is clear that all new supply-side options are more expensive than Ameren Missouri's existing resources and thus would likely result in increased rates when implemented. This is not unexpected given the age of existing units, some of which were constructed in the 1950's, and the less stringent environmental regulations at the time they were built. It is also why Ameren Missouri has and will continue to evaluate options to extend the life of its existing fleet and increase the production capabilities of existing plants.

Finally, energy efficiency might seem to be a good choice. While not typically considered a traditional generation option, an energy efficiency program that is significantly embraced by customers could be the cheapest choice (that is, similar to our existing generation costs) to meet our customers' future energy needs. However, there are meaningful expenses related to offering customer rebates and discounts on energy efficient appliances, providing weatherization services and energy audits, installing energy efficient equipment, and promoting the efficient use of electricity. In addition, proper incentives and customer acceptance are key drivers.

### *Key Factors Influencing Resource Choices*

Costs alone do not dictate which energy resources offer the greatest development potential. In our planning process, we looked at a range of factors in analyzing possible resources. They include:

Portfolio Diversity: Consistent with other electric energy providers in our state, Ameren Missouri's generation portfolio is heavily weighted toward coal. We must thoughtfully transition our portfolio of generation to other sources, including potentially cleaner coal.

Environmental Regulation: We must assess the current and potential long-term impacts of expected environmental regulations on our power plants.

Costs to Customers: We must be mindful of the impact that our future energy choices will have on our customers' rates and future energy bills.

Ability to Finance Future Energy Sources: In determining the right energy resource, we analyze our ability to finance its construction and the long-term costs to our customers.

Economic Development Impact: We evaluate the economic impact of any decision to add new energy resource projects – the number of jobs, tax revenues, and other

economic benefits a project is expected to bring can be very important to the communities we serve and the entire state of Missouri.

Regulatory and Legislative Matters: We need to assess how well the current or future regulatory and legislative frameworks enable our ability to move forward on certain energy resource options. In particular, those frameworks need to provide timely recovery of, and fair returns on, these significant investments, as well as provide appropriate safeguards for our customers.

One example in this arena is the mechanism (or lack thereof) to finance a large new generating plant during construction. Under current Missouri law, costs associated with building a new generating plant cannot be reimbursed through customer rates until construction is completed and the plant is serving customers. Projects of this magnitude take several years to plan and complete and cost hundreds of millions of dollars and in some cases several billion dollars. This framework creates significant challenges to finance and move large scale projects forward and will be a factor in choosing energy resource options in the future.

Another example is the issue of utility incentives for promoting energy efficiency. Because the existing regulatory framework provides an incentive for utilities to maximize sales of electricity, shifting utility incentives in favor of energy efficiency require the use of alternative ratemaking approaches. Rate treatment related to utility energy efficiency programs can be separated into three categories – program cost recovery, lost revenue, and performance incentives. Of these, lost revenue represents the greatest hurdle which must be overcome to align utility incentives with promotion of energy efficiency. The reason for this, simply put, is that for each kwh of reduced sales the utility loses revenue for that kwh until it is reflected in the development of rates in the utility's next general rate case. Until this significant disincentive is addressed, utilities will be reluctant to pursue aggressive energy efficiency goals.

In order to support a more transparent discussion of the trade-offs between cost and other factors, Ameren Missouri used a scorecard approach to screen alternative resource plans and ultimately select its Preferred Resource Plan. Table 1.1 shows the six major categories that represent Ameren Missouri's policy objectives and the various measures used to evaluate plans in each category, reflecting our

**Table 1.1 Policy Objectives**

| Policy Objective Category(ies) | Measure(s) |
|---|---|
| Environmental & Resource Diversity | Resource Diversity, Carbon Emissions, SO2 Emissions, NOx Emissions |
| Energy Efficiency | Energy Savings |
| Financial/Regulatory | ROE, ROIC, EPS, Free Cash Flow, Stranded Cost Risk, Transaction Risk, Recovery |
| Customer Satisfaction | Average Rates Single-Year Rate Increase |
| Economic Development | Primary Job Growth (FTE-years) |
| Cost | PV Revenue Requirement |

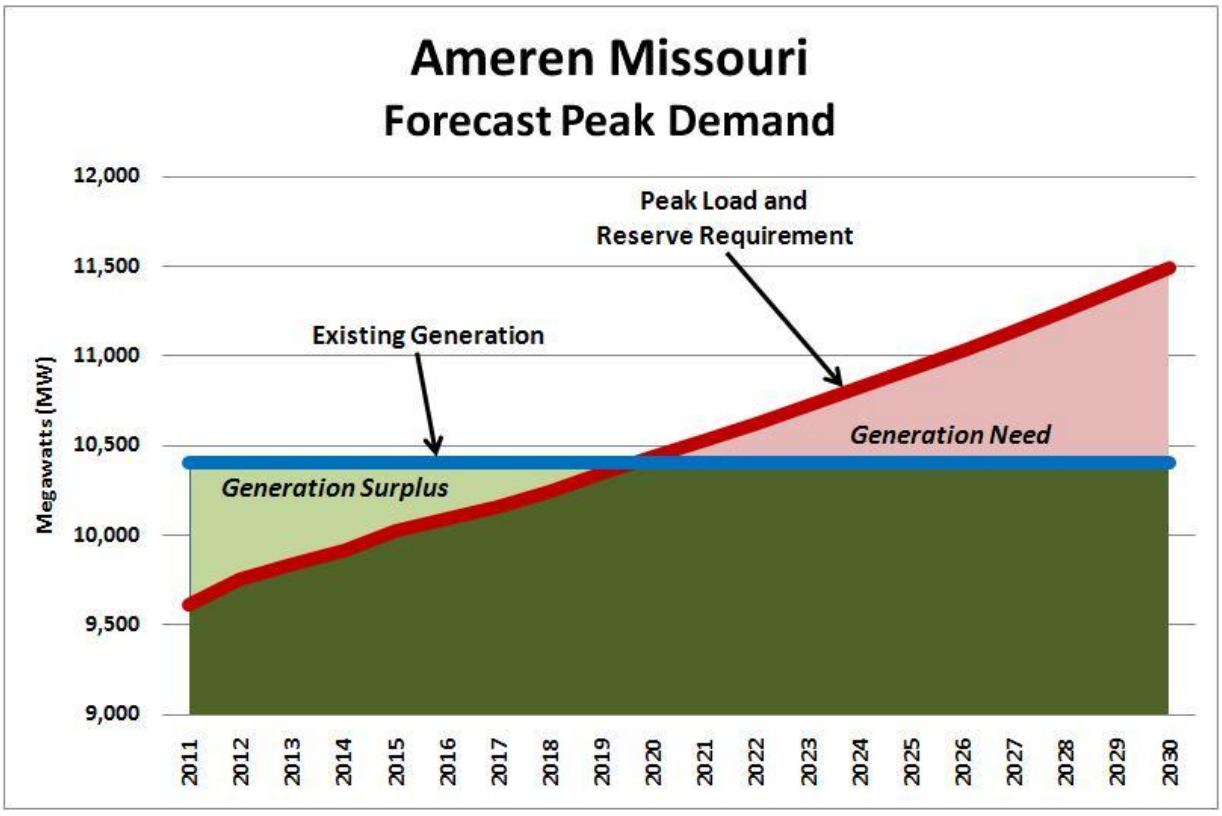
consideration of the factors listed above. Initially, as described in Chapter 9, the 216 alternative resource plans were all screened using this scorecard. At that time only one measure was used per category since there were so many plans being analyzed. Once there were only a few plans remaining, more measures (including qualitative measures) were included to support a richer discussion and differentiation of each plan. While cost remained the primary driver, the other factors weighed heavily into the decision making.

### *Resource Needs*

As stated earlier, we believe the demand for power will continue to grow—in fact, we forecast demand will increase about 20% in our service territory over the next two decades.

As shown in the chart in Figure 1.5, Ameren Missouri currently has about 10,400 megawatts of electric generation capability. The chart also indicates that by 2020, with expected load growth and existing environmental regulations, Ameren Missouri will need additional resources to meet expected customer demand and reliability reserve requirements.

**Figure 1.5 Ameren Missouri Resource Position**

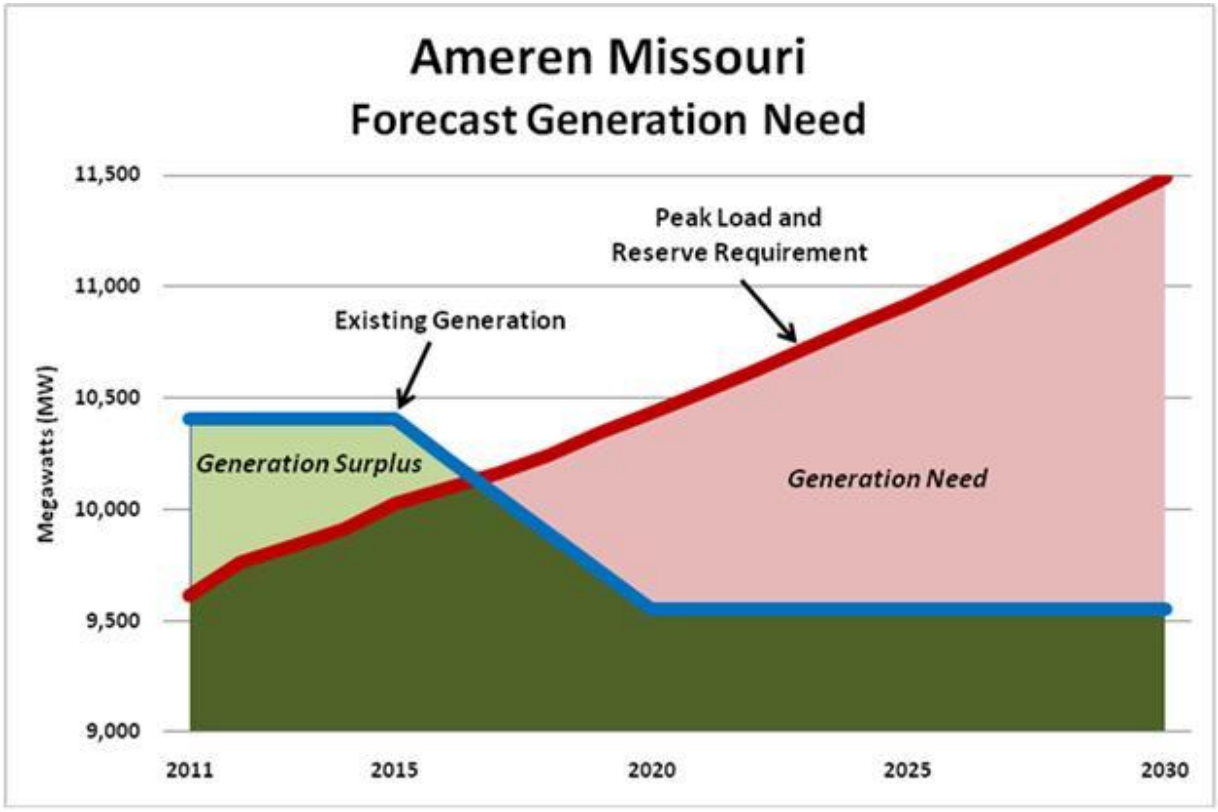



The previous chart identifies a need for more generation by 2030 should no new environmental regulation be mandated. As stated previously, while there is a great deal of uncertainty in the area of environmental regulation, we do believe that more stringent

regulations on air emissions, water and waste will be in place between 2015 and 2020. The costs to meet those regulations are expected to be significant, will drive up energy costs, and are likely to cause older, less efficient coal-fired plants to shut down, including our Meramec Power Plant.

Rising customer demand, when coupled with the shutdown of Meramec Plant, will result in a meaningful shortfall of generation available to meet our customers' needs – about 1000 megawatts by 2020. That shortfall continues to grow through 2030. The chart in Figure 1.6 illustrates the need for resources under such circumstances. The chart presents the resource position in five-year steps to recognize the uncertain nature of the timing of new environmental rules and the potential need for retirement of Meramec.

**Figure 1.6 Ameren Missouri Resource Position with Meramec Retired**




The adoption by Missouri voters of a state Renewable Electricity Standard ("RES") in 2008 has introduced a new layer into the planning process. Not only does Ameren Missouri need to meet future capacity needs but it also needs to do so while meeting the RES requirements. The state RES has both a solar and non-solar requirement. Ameren Missouri recently installed solar panels at its St. Louis General Office Building, but must acquire additional solar resources to comply in 2011. Table 1.2 shows

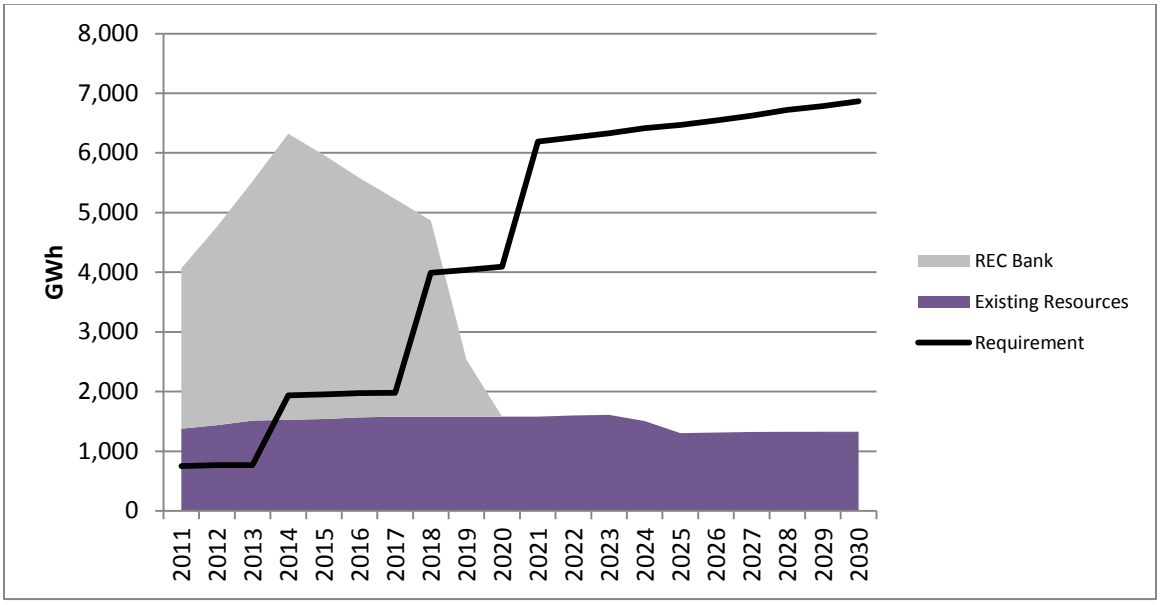
**Table 1.2**
**Solar Energy Needs (MWh)**

| Year | Solar Requirement |
|---|---|
| 2011 | 15,049 |
| 2012 | 15,312 |
| 2013 | 15,387 |
| 2014 | 38,718 |

the megawatt-hour solar requirements over the next several years while Figure 1.7 depicts how Ameren Missouri's existing renewables resource compare to the non-solar RES requirements once banking of credits is considered. It is evident that no additional non-solar resources are needed until 2019.

With the resource needs outlined above in mind, Ameren Missouri has evaluated a range of options to meet these needs. Both supply side options, such as power plants, and demand side options, such as energy efficiency programs, were considered.

**Figure 1.7 Ameren Missouri Renewable Position**




### *Alternative Resource Plans*

Developing alternative resource plans includes the combination of various demand-side and supply-side resources to meet future capacity needs. However, there are other factors that could cause dramatic changes in the capacity position that need to be considered when developing plans. Figure 1.8 includes the five dimensions considered during the development of resource plans. The permutations of these five dimensions would create 416 plans. However, some combinations may create duplicate resource plans or plans that do not make sense. For example, the Meramec combined cycle option is contingent on Meramec's retirement so the interaction of Meramec continuing and the Meramec combined cycle option would produce an infeasible plan. Ultimately there were 216 plans to be analyzed.

**Figure 1.8 Five Attributes of Alternative Resource Plans**

**Supply-Side Types**
- Coal with Carbon Capture
- Combined Cycle (Greenfield)
- Combined Cycle (Meramec)
- Combined Cycle (Venice)
- Simple Cycle (Greenfield)
- Pumped Storage
- Nuke 30% (Partial Ownership)
- Nuke 50% (Partial Ownership)
- Wind with Simple Cycle

**Renewable Portfolios**
- Federal
- Missouri

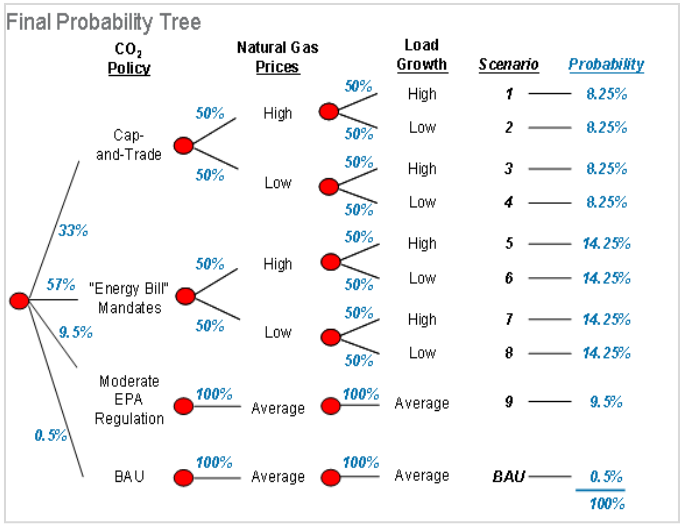
**Demand-Side Portfolios**
- Maximum Achievable Potential
- Realistic Achievable Potential
- Low Risk
- None

**Meramec Status**
- Meramec Retired 2015
- Meramec Retired 2022
- Meramec Continues As-Is

**Noranda Status**
-Noranda Continues
-Noranda Contract Expires 2020

## *Planning Scenarios*

**Figure 1.9 Scenario Probability Tree**




There are various uncertainties that can influence future resource decisions. Some of these uncertainties are highly interactive. That is, a change in one variable may cause a substantial change in another. For this reason it is useful to develop internally consistent scenarios of these uncertain variables. To develop its scenarios Ameren Missouri concluded the three factors with the largest influence on future resource decisions are carbon policy, natural gas prices, and economy-wide load growth. A third party interviewed Ameren Missouri experts to determine the likelihood of different future outcomes of each of those important factors. Figure 1.9 represents the end result those interviews, which culminated in the creation of 10 unique scenarios and associated probabilities. Each scenario is internally consistent with respect to the range of uncertain variables analyzed. This was achieved by using a model that simulates interactions in fuel and energy markets, electricity generation system operation, non-electricity sector outcomes, macroeconomic activity levels, and sector-specific responses to emissions limits. These scenarios and probabilities together comprise a probability tree and allow Ameren Missouri to test potential resource plans under a range of potential futures.

### *Environmental Regulation*

Coal-fired and other fossil-fired generating resources are subject to an ever-increasing range of environmental regulation. In particular, efforts by the U.S. Environmental Protection Agency in recent years indicate the desire to further limit power plant emissions and environmental impacts. Considering the gamut of potential environmental regulation, Ameren Missouri developed two scenarios, Moderate and Aggressive, to describe combinations of more stringent regulations and then translated those into expected requirements for equipment retrofits for its existing coal fleet. Table 1.3 contains the retrofit timing by scenario and power plant for each category of regulation.

**Table 1.3**
**Plant Retrofit Timing by Scenario**

| Plant/Unit | Scenario | FGD (Scrubber) | ACI (Mercury) | Mesh Screens | Ash & Landfill | Cooling Tower | Water Plant |
|---|---|---|---|---|---|---|---|
| Labadie 1&2 | Moderate | 2020 | 2015 | 2017 | | | |
| | Aggressive | 2016 | 2015 | | 2017 | 2017 | 2017 |
| Labadie 3&4 | Moderate | 2024 | 2015 | 2017 | | | |
| | Aggressive | 2016 | 2015 | | 2017 | 2017 | 2017 |
| Meramec 1-4 | Moderate | | 2015 | 2017 | | | |
| | Aggressive | 2016 | 2015 | 2017 | 2017 | | 2017 |
| Rush Island 1&2 | Moderate | 2016 | 2015 | 2017 | | | |
| | Aggressive | 2016 | 2015 | 2017 | 2017 | | 2017 |
| Sioux 1&2 | Moderate | *2010* | 2015 | 2017 | | | |
| | Aggressive | *2010* | 2015 | 2017 | 2017 | | 2017 |

The characterization of environmental scenarios was used in the Meramec retirement analysis which considered the retirement of Meramec versus adding environmental controls or converting to a natural gas boiler. The comparisons ultimately indicated, under aggressive environmental regulations, it would be better to retire Meramec.

### *Financial Analysis*

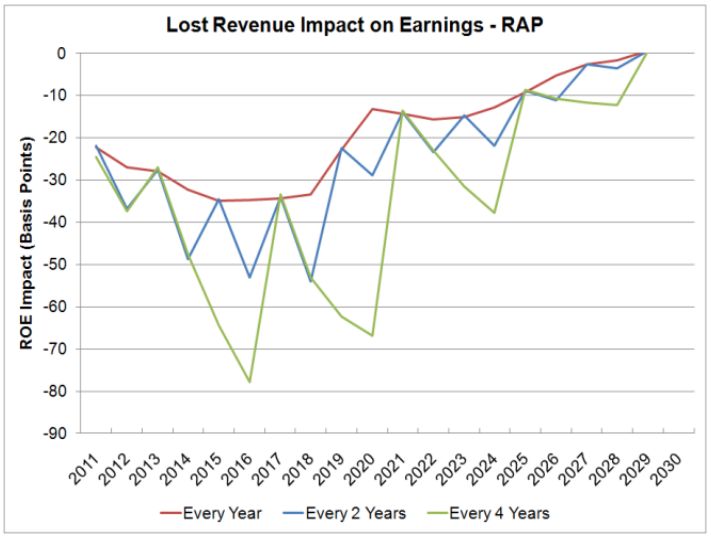
In a perfect world resources and plans can be evaluated assuming perfect ratemaking, unlimited access to capital markets, and perfect knowledge of the future. To accommodate the imperfections of forecasting and general market conditions Ameren Missouri has expanded its analysis to include a more realistic representation of the ratemaking environment and the realities of financial markets. Assuming a rate case every other year and a 6-month lag between the cost period on which rates are set and when they go into effect helps better emulate the financial effects of implementing aggressive energy efficiency programs and large plant capital investments.

The large investment financial analysis indicated compliance with more stringent environmental regulations or construction of large baseload generation assets could strain Ameren Missouri's ability to finance such investments at reasonable rates. It was evident that non-traditional ratemaking treatment may be needed to preserve Ameren Missouri's access to low-cost sources of capital.

The DSM financing analysis highlighted the substantial negative financial impacts to the Company from the implementation of energy efficiency under traditional Missouri regulation. The issue of "Lost Revenue" presents the greatest potential financial impact.

Lost Revenue is revenue the utility is not able to collect, because of reduced sales from energy efficiency gains, between the time energy savings begin to occur and the time customer rates reflect the reduction in sales. Figure 1.10 shows the impact to utility earnings due to lost revenue associated with implementation of the RAP DSM portfolio under varying assumptions for rate case frequency. It will be imperative to Ameren Missouri's DSM expansion plans to properly align utility financial incentives with efforts to help customers use energy more efficiently.

**Figure 1.10 Lost Revenue Impact on ROE**




### *Resource Acquisition Strategy – Preferred Plan and Contingency Options*

Considering all the factors that we discussed earlier in this report, a few alternatives rise to the top—from business as usual, to relying heavily on natural gas-fired power, to a combination of natural gas and nuclear energy to a heavy reliance on energy efficiency. Under each of these options, we believe our customers' future energy rates could rise meaningfully from current levels. Here is a summary of our options:

The Preferred Resource Plan

Among the top alternatives, the lowest cost resource plan for our customers under Missouri's current regulatory framework would occur should the environmental regulations for air, ash and water that are in place today remain largely unchanged for the next 20 years. Under this scenario, our current generation portfolio would not change significantly until 2030, when we would add combined cycle natural gas generation to our portfolio. At that time, coal would drop to 66% from its current level of 75%; natural gas would grow to 7% from 1% currently; renewable energy would grow to 5% in compliance with the renewable energy standard in Missouri; and nuclear would remain at about 20%. We would employ a modest program offering incentives to customers to use energy efficiently. Figure 1.11 shows the generation mix for the Preferred Resource Plan.

**Figure 1.11 Generation Mix – Preferred Resource Plan**


While this is the lowest cost resource plan, it is not likely to be sufficient in light of expected new regulations to be issued by the EPA. As stated previously, we expect those new regulations could be significant and will drive us to consider other resource options in the future. Each of these options will drive customer rates higher to address these new environmental regulations and to meet future customer energy needs. We currently believe the following three options are the best to consider for the future.

The Natural Gas / Nuclear Plan

Under this plan, new environmental regulations in the 2015 to 2020 time frame would cause us to replace Meramec with a combined cycle natural gas plant. As demand continues to grow in the future, those needs would be met with new nuclear generation. With this plan, by 2030 coal's percentage of the total portfolio would drop to 58% with the closing of our oldest coal-fired power plant. Our use of nuclear energy would rise from a current level of 18% to 28%. With the addition of combined cycle units in the 2016 to 2020 timeframe, natural gas-fired generation would grow to around 7%. Figure 1.12 shows the generation mix for the Natural Gas / Nuclear Plan.

**Figure 1.12 Generation Mix – Natural Gas / Nuclear Plan**

This approach to meeting our future energy needs has several important advantages. First, it would allow us to effectively comply with tougher environmental regulations on a timely basis and better position our future generation portfolio to address more stringent environmental regulations down the road. Second, building a new nuclear plant would create significant jobs and strong economic development opportunities for the state. However, moving forward on a nuclear plant presents construction, financing and operating challenges.

The Natural Gas Only Plan

This plan calls for natural gas to meet the vast majority of our new energy needs. This plan would result in natural gas growing to 12% of the total portfolio, twelve times its current level, while coal-fired generation would drop to 60%. Meramec would be closed between 2016 and 2020, while highly efficient natural gas-fired units were built. The percentage produced by nuclear energy rises slightly to 22% as a result of dispatch changes due to expected future market conditions. Figure 1.13 shows the generation mix for the Natural Gas Only Plan.

**Figure 1.13 Generation Mix – Natural Gas Only Plan**


This plan helps us reduce carbon emissions, but natural gas fired plants would still emit half the carbon dioxide of coal-fired units. In addition, as mentioned earlier, natural gas prices have historically been very volatile. Not as many jobs would be created with this option, but construction and operating risks would be lower.

The Energy Efficiency Plan

Under this plan, our future energy needs would be met solely through greater energy efficiency. With this plan, we would aggressively expand our portfolio of energy efficiency programs, with the hope that customers would embrace these programs and realize energy savings. Our oldest coal-fired plant would be retired in the 2016 to 2020 timeframe. This plan calls for nuclear energy's percentage of the total to rise slightly to 24% as a result of dispatch changes due to expected future market conditions. Figure 1.14 shows the generation mix for the Energy Efficiency Plan.

**Figure 1.14 Generation Mix – Energy Efficiency Plan**


This plan helps us reduce overall emissions with less total generation required. Some jobs would be created as well, through energy efficiency projects completed by our customers at their homes and businesses. The success of this approach depends on a state regulatory framework that encourages utility investment in energy efficiency programs and the willingness of customers to embrace energy efficiency programs and work with us to save energy.

### *Resource Acquisition Strategy – Decision Roadmap*

Each of these plans represents a viable approach that meets our customers' future energy needs and creates different opportunities for our state. Each also has its share of challenges, including cost, construction and financing risks.

The IRP analysis indicated that retiring Meramec is preferred if future environmental regulations require significant capital investment. Until we have an accurate picture of new regulations and the implications to our existing fleet, Meramec will continue operating without the addition of expensive environmental controls. While both nuclear and aggressive DSM plans are potentially viable alternatives to the natural gas combined cycle plan, both face significant regulatory and financial barriers.

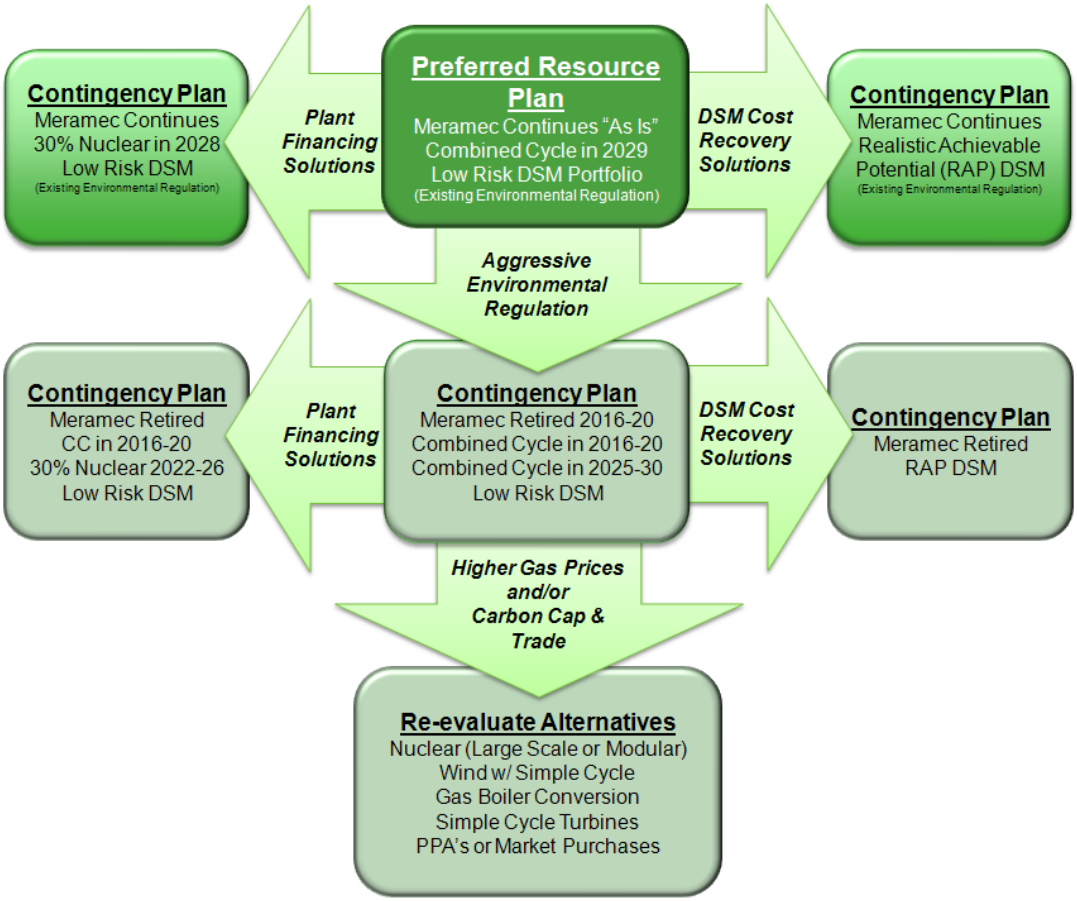
The IRP analysis showed aggressive DSM plans are likely to result in the lowest cost to customers over the planning horizon, so if regulatory barriers to implementation are removed the aggressive DSM plan could become the preferred plan. Although the MAP portfolio was more cost-effective from a TRC perspective, once the additional risk of portfolio energy savings and cost was considered RAP emerged as the dominant DSM portfolio. The significant uncertainty around achieving targeted energy savings levels necessitates that Ameren Missouri preserve viable supply-side resource options and pursue ratemaking options that enable them.

The IRP analysis showed that significant investment in new resources could necessitate the use of alternative ratemaking or financing methods to ensure access to low-cost

sources of capital. If alternative ratemaking structures are enabled, then the financial hurdles for those options could be easier to overcome

Figure 1.15 shows Ameren Missouri's Preferred Plan as well as a robust set of contingency options that reflect the alternative paths described above, both with existing environmental regulation and more aggressive environmental regulation. This "Decision Roadmap" highlights the paths that could be taken should regulation change to a degree that causes Ameren Missouri's management to select a different course of action from that represented in the Preferred Plan. Such changes represent seismic shifts in the resource planning landscape that go beyond the capabilities of analyzing uncertainty with ranges and probabilities. However, by considering such important decision factors we can better prepare ourselves to change course when appropriate.

**Figure 1.15 Decision Roadmap**




### *Resource Acquisition Strategy - Implementation Plan*

Over the next three years Ameren Missouri will be engaging in several activities to implement the Preferred Resource Plan and to keep contingency options open. Although the Preferred Resource Plan does not show the need for a supply-side resource until the latter portion of the planning horizon, the contingency options call for

a combined cycle plant as early as 2016 if more stringent environmental regulations result in the retirement of Meramec. Ameren Missouri will start investigating viable sites for combined cycle generation and begin engineering studies in the case environmental regulations become more aggressive and accelerate the need for new resources.

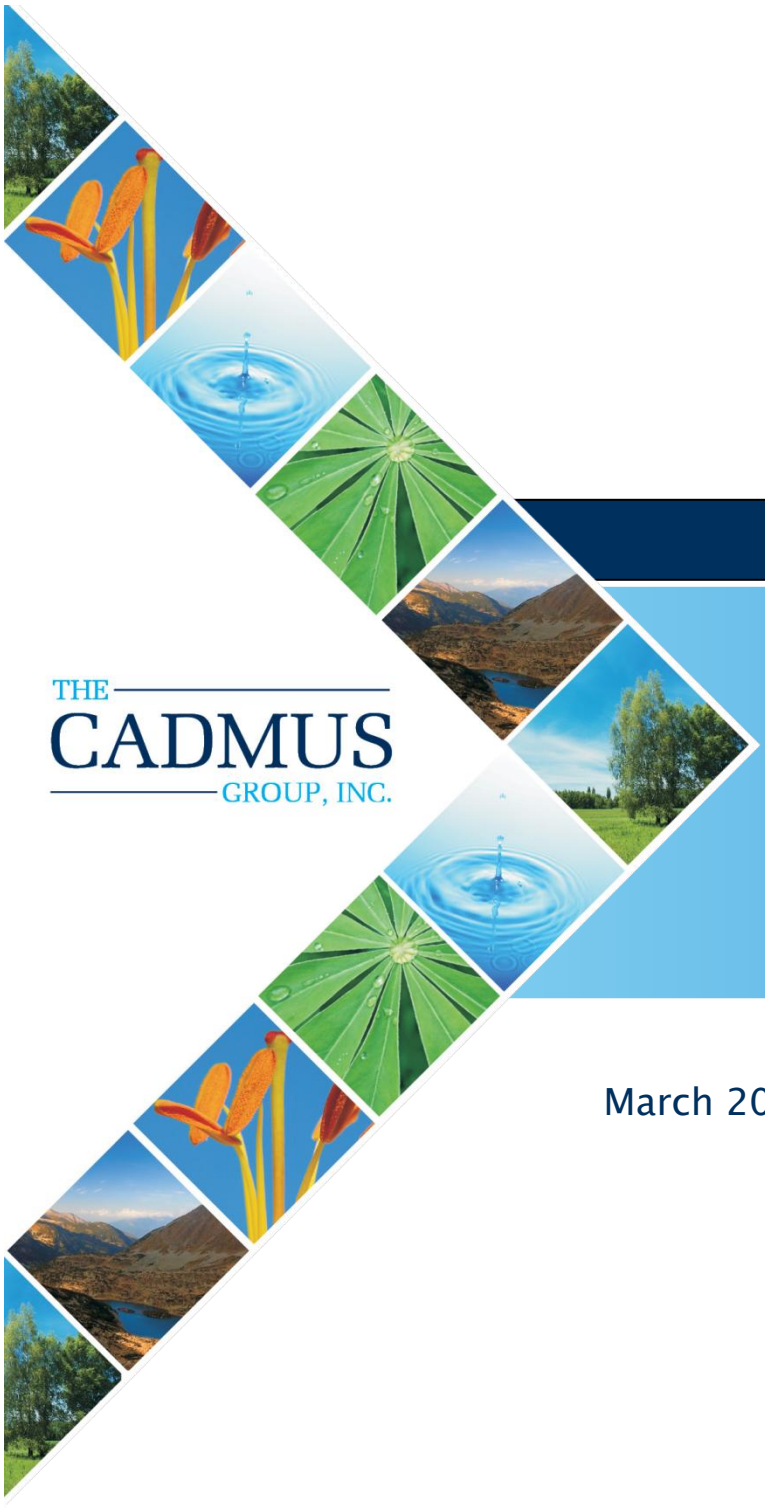
To preserve the nuclear option, Ameren Missouri and a coalition of other utilities will be seeking an Early Site Permit for a second nuclear unit at Ameren Missouri's Callaway site, should appropriate legislation be passed. Furthermore, the cost to continue operations at a plant of Meramec's vintage will impact that retirement decision, so Ameren Missouri will continue to study the ongoing costs to keep Meramec operating safely and reliably.

Ameren Missouri will continue to advocate for better alignment of utility financial incentives to ultimately support the state's goal of achieving all cost-effective DSM. Ameren Missouri will continue pursuing a modest energy efficiency portfolio, which helps to preserve the option to switch to a more aggressive path. To comply with renewable energy mandates in the short term, Ameren Missouri is purchasing solar renewable energy credits to supplement the production from its recently installed solar panels at its St. Louis Headquarters. Some additional solar support will come from Ameren Missouri's existing tariff to procure solar credits through customer-owned generation.

Because the consideration of uncertainty and risk is an important aspect of the IRP process, Ameren Missouri will continue to monitor those factors that may cause it to consider pursuing a different plan than the Preferred Plan. Ameren Missouri considered 22 uncertain factors and concluded several are critical to future resource decisions. Below is a list of factors Ameren Missouri will be watching closely to determine whether changes to its plan are necessary.

- Carbon Policy
- Natural Gas Prices
- Project Costs
- Environmental Regulations
- DSM Impacts and Costs
- Load Growth
- Interest Rates and Financial Metrics

While Ameren Missouri believes it has conducted a thorough analysis of resource needs, options and uncertainties, it is important to note that this IRP represents a snapshot of the Company's expected resources and loads, and provides guidance regarding potential resource needs and acquisitions. Ameren Missouri is continuously planning and adapting to market conditions. In doing so, there will be opportunities for interested parties to engage in discussions on every topic analyzed in this IRP. For that reason the value of the IRP transcends simple compliance with PSC rules and serves as an analytical backdrop to discussions that can shape constructive Missouri energy policies.



THE CADMUS GROUP, INC.

# Lighting and Appliance Evaluation – PY 2

March 2011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# 1. Executive Summary

The Lighting and Appliance Program (L&A program, or the program) has the greatest expected savings of the efficiency programs implemented in 2010 as part of Ameren Missouri's residential demand-side management portfolio. The program, implemented by Applied Proactive Technologies (APT), sought to deliver energy savings of 43,319 MWh in Program Year 2 (PY2) through higher sales of residential, energy-efficient, ENERGY STAR® products, including compact fluorescent lamps (CFLs) and ENERGY STAR labeled appliances.

The L&A program is a market transformation program, based on an assumption that consumer education and use of market forces, combined with the recognizable and trusted ENERGY STAR label, will provide long-term, permanent changes in consumer purchasing and retailer stocking patterns. To achieve its market transformation goal, the program has developed a delivery strategy based on a three-tiered approach:

1. Increase the supply of qualifying products through program partnerships with retailers, manufacturers, and distributors;
2. Create demand through consumer awareness and understanding of the ENERGY STAR label, and through consumer education about energy-efficiency benefits; and
3. Create a lasting retailer preference for stocking and selling ENERGY STAR products, as well as a lasting consumer preference for purchasing these items.

The program focuses on subsidizing retailer markdowns by working directly with manufacturers and has expanded the program into additional retail chains from PY1, in particular large big-box stores. The following is a summary of the eligible ENERGY STAR products in PY2.

**Retail Markdown Products:**

- ENERGY STAR CFLs
- ENERGY STAR Lighting Fixtures

**Customer Mail-in Rebate Products:**

- ENERGY STAR Room Air Conditioners
- ENERGY STAR Freezers
- ENERGY STAR Dehumidifiers

In addition to retail markdowns and mail-in rebates, a new program component was introduced in PY2: an online store selling marked-down lighting products. A Social Marketing Distribution (SMD) program also began in PY2, which distributed free CFLs to customers, with some marketing targeted toward hard-to-reach segments (low-income, disabled, and elderly customers).

The research activities that informed this evaluation are summarized in Table ES1 below.

**Table ES1. Summary of Evaluation Approach (PY2)**

| Action | Impact | Process | Details |
|---|---|---|---|
| CFL User Survey | ✓ | ✓ | Lighting: Estimate CFL awareness, sales, and saturation. (n=451) |
| Site Visits | ✓ | | Lighting: Assess CFL purchase, saturations, and installation rates.(n=87) |
| Participant Retail Store Sales Analysis | ✓ | | Lighting and Appliances: Obtain an unbiased assessment of program sales from database tracking. (n=census) |
| Store Intercepts | ✓ | | Lighting: Assess CFL leakage rates. (n=611) |
| Metering | ✓ | | Lighting: Estimate hours-of-use. (n=44) |
| Retailer Interviews | ✓ | ✓ | Lighting: Obtain supplier self-reported estimates of NTG and review of program approach and opportunities for improvement. (n=75) |
| Multistate Analysis | ✓ | | Lighting: Analyze NTG and benchmarking. |
| Social Marketing Distribution Survey | ✓ | ✓ | Lighting: Obtain installation rate for social marketing distribution CFLs. (n=70) |
| Engineering Estimates of Appliance Savings | ✓ | | Appliances: Obtain information based on rebate applications and secondary research. |
| Appliance Participant Survey | ✓ | ✓ | Appliances: Analyze NTG and process results for appliance rebates.(n=150) |
| Program Document Review | | ✓ | Lighting and Appliances: Understand program approach and identify opportunities for improvement, ensure all data necessary for evaluation are available, |
| Stakeholder Interviews | | ✓ | Lighting and Appliances: Understand program approach and identify opportunities for improvement.(n=5) |

## Findings

Key findings are listed below:

- Based on metering in 44 homes over a period of 6 months, we estimated average hours of CFL usage per day to be 2.91.
- Per unit energy savings are estimated to be 48.4 kWh per bulb
- Our intercept study estimated that overall average leakage rates (discounted CFL purchases by non-Ameren retail customers) were 8.7 percent, driven by higher rates (40.3 percent) in rural areas compared to 3.4 percent in the greater St. Louis area. This estimate does not include "leakage-in," where Ameren Missouri customers may be purchasing discounted CFLs in outside areas.
- Upstream lighting net-to-gross (NTG), as estimated by the multistate regression analysis, was 0.96. This NTG ratio includes CFL freeridership and spillover, but does not consider possible spillover that may occur when consumers implement additional energy efficiency measures not promoted by the program (other efficient appliances or weatherization).
- Appliance free-ridership estimates were 0.48, 0.42, and 0.38 for dehumidifiers, freezers, and room air conditioners, respectively.

The program's evaluated results exceeded its goals for CFL sales and energy savings during PY2; Table ES2 and Table ES3 show overall participation and gross and net savings as well as the results compared to Ameren Missouri's goals.

**Table ES2. PY2 Evaluated Participation, Gross and Net Savings**

| Product | Total Program Sales | *Ex Post* Energy Savings (MWh) | *Ex Post* Demand Savings (kW) | NTG Ratio* | Net Energy Savings (MWh) | Net Demand Saving* (kW) |
|---|---|---|---|---|---|---|
| Upstream CFLs | 1,547,459 | 72,097 | 12,435 | 0.96 | 69,214 | 11,938 |
| Fixtures | 591 | 73.3 | 8.3 | 1 | 73.3 | 8.3 |
| Room Air Conditioner | 3,853 | 443.1 | 231.18 | 0.62 | 274.7 | 143.3 |
| Dehumidifier | 3,545 | 347 | 283.6 | 0.52 | 180.4 | 147.5 |
| Freezers | 490 | 29.9 | 2.0 | 0.58 | 17.3 | 1.1 |
| **Total-PY2** | 1,555,938 | **72,991** | **12,960** | **0.96** | **69,759** | **12,238** |

* Appliance NTG estimates are based on free-ridership only.

**Table ES3. PY2 Sales and Participation Targets and Results**

| ENERGY STAR Lighting or Appliance Type | Program Targets | Results |
|---|---|---|
| Upstream CFLs | 1,177,537 | 1,547,459 |
| Dehumidifiers | 1,500 | 3,545 |
| Freezers | 2,600 | 490 |
| Room Air Conditioner | 8,000 | 3,853 |
| CFL Fixtures | 2,500 | 591 |
| **Total Net Energy Saving (MWh)** | **64,928** | **69,759** |
| **Total Net Peak Demand Savings (kW)** | **5,600** | **12,238** |

As shown in Table ES5, the SMD program distributed 114, 690 bulbs saving a total of 5,789 MWh and 898 kW.

**Table ES5. SMD Results**

| | Total Bulbs Distributed | *Ex Post* Total Gross Energy Savings (MWh) | *Ex Post* Gross Demand Savings CFL (kW) | NTG Ratio | Net Energy Savings (MWh) | Net Demand Savings (kW) |
|---|---|---|---|---|---|---|
| Social Marketing Distribution CFLs | 114,690 | 5,789 | 898 | 1.0 | 5,789 | 898 |

Combining the totals from the upstream lighting and appliance programs (Table ES2) with the SMD CFL program (Table ES5) yields an overall portfolio PY2 savings of 78,780 gross MWh and 13,858 gross kW. Net savings are slightly lower with 75,549 net MWh and 13,136 net kW. These savings do not include possible additional spillover which may occur when program participants purchase and install additional types of energy efficient measures outside of the

program. This type of spillover is difficult to verify and quantify without detailed surveys and site verifications to identify additional measures installed.

The evaluation found evidence that market transformation is occurring, as the multistate site visits indicated that Ameren Missouri's CFL market penetration (number of homes with at least one CFL is 93 percent, which is higher than all the non-program areas, the newer program areas, and even the average of all long-running program areas. This may be evidence that Ameren's unique SMD program is broadening the reach of CFLs. A high market penetration indicates the program is wide-reaching; however, Ameren Missouri's low average saturation compared to long-running programs (16.3 percent vs. 23 percent, respectively) indicates significant opportunities for increased CFL purchases within customers' homes.

Ameren Missouri's program and incentive costs were lower than most other participating program areas in the multistate study, yet CFL sales (both program bulbs and non-program bulbs) were higher, perhaps indicating an effective program delivery strategy.

Program stakeholders reported being pleased with the program, and plan to continue adding more retail outlets in the coming year. An additional two appliance types have been added for PY3.

As reported by retailers, the program has been successful in increasing the supply of energy-efficient CFLs and appliances in the market, and most retailers report significant increases in their sales due to the program. Program staff also reported success in product placement in end-caps and other visible store locations, which were likely to induce more sales.

## Recommendations

Based on the findings of this evaluation, Cadmus offers the following recommendations for Ameren Missouri's consideration:

- ***Continue focusing on consumer education.*** As reported by APT, store events and trainings were effective in increasing consumer awareness and knowledge of CFLs. The high level of market penetration is indicative of this effort. Cadmus recommends incorporating education regarding proper disposal of CFLs and proper application of specialty CFLs in specialty fixtures.
- ***Consider switching to the coupon approach in stores vulnerable to leakage.*** Evidence of leakage rates as high as 49 percent was found in one rural big-box store. The coupon approach, which requires customers to complete an instant rebate form and ensures bulbs are purchased by Ameren Missouri customers, could alleviate this problem without eliminating the rural stores from the program.
- ***Update appliance savings estimates in the tracking database.*** Cadmus independently calculated the estimated savings for freezers, dehumidifiers, and room air conditioners. The *ex ante* estimates for freezers, in particular, were higher than our estimates, which occurred because the original planning assumption considered freezer savings from early replacement rather than replacement at burnout. New savings estimates for freezers were approximately 25 percent of *ex ante* savings. *Ex ante* and *ex post* savings estimates for dehumidifiers and room air conditioners were close and are dependent on particular sizes installed.

- ***Incorporate evaluation requirements into corporate retailer/manufacturer MOUs:*** Retailers are not always cooperative in responding to interview requests, allowing store intercepts, providing opinions on program processes, and providing information on their CFL sales levels; information that is needed to perform an evaluation. In some cases during PY2, Cadmus was unable to collect data from all the retailers in our planned sample. The current memorandum of understanding (MOU) does not require specific cooperation with interviews or in-store customer surveys. Cadmus recommends modifying retailer and manufacturer MOU's to require cooperation with evaluation approaches.
- ***Perform additional mass marketing***: Based on a small level of dissatisfaction by retailers and the fact that many intercepted customers were unaware of Ameren Missouri's program, Cadmus recommends Ameren Missouri perform broader program marketing or advertising. General advertising can increase program spillover and hasten the market transformation as consumers will think more about their choices wherever they shop. Participating retailers will also feel they are benefitting more from the program.
- ***Perform general marketing regarding appliance rebates***: While appliance rebate freeridership was not unnecessarily high, Ameren Missouri may be able to achieve greater savings by broadly marketing the program. The current approach attempts to convert customers already shopping for appliances from purchasing standard efficiency to higher efficiency products. Adding general marketing could encourage some customers to replace older, inefficient appliances early, which would result in greater energy savings and fewer free riders.

# 2. Introduction

## Program Description

The Lighting and Appliance Program (L&A program, or the program) has the greatest expected savings of the efficiency programs implemented in 2010 as part of Ameren Missouri's residential demand-side management portfolio. The program, implemented by Applied Proactive Technologies (APT), sought to deliver energy savings of 43,319MWh through PY2 via higher sales of residential, energy-efficient, ENERGY STAR® products, including compact fluorescent lamps (CFLs) and ENERGY STAR labeled appliances.

While major changes in implementation occurred in PY2, the underlying logic remained very similar to PY1. L&A remains a market transformation program, based on an assumption that consumer education and use of market forces, combined with the recognizable and trusted ENERGY STAR label, will provide long-term, permanent changes in consumer purchasing and retailer stocking patterns. To achieve its market transformation goal, the program has developed a delivery strategy based on a three-tiered approach:

1. Increase the supply of qualifying products through program partnerships with retailers, manufacturers, and distributors;
2. Create demand through consumer awareness and understanding of the ENERGY STAR label, and through consumer education about energy-efficiency benefits; and
3. Create a lasting retailer preference for stocking and selling ENERGY STAR products, as well as lasting consumer preferences for purchasing these items.

## Program Implementation

Ameren Missouri's PY1 L&A program focused mainly on lighting, and offered retail markdowns, manufacturer buy downs, and cooperative advertising incentives to encourage CFL sales. In PY2, Ameren Missouri changed its approach and subcontracted implementation to Applied Proactive Technologies (APT). APT has implemented upstream lighting programs in a number of areas and has ongoing relationships with many national retail chains. APT's approach focuses on retailer markdowns through manufacturers and expanding the program into additional retail chains, in particular large big-box stores. The appliance component of the program introduced mail-in customer rebates for three measures. Ameren Missouri also continued to provide branded point-of-purchase (POP) materials.

APT's responsibilities included program design and fieldwork, which entailed:

- Initiating relationships with retailers through field representatives;
- Negotiating Memoranda of Understanding (MOUs) with manufacturers and retailers;
- Developing and maintaining the program tracking database;
- Training program staff;
- Training retail store employees;

- Developing point-of-puchase (POP) materials and ensuring proper placement in retail stores;
- Responding to retailer requests to develop cooperative advertising and promotion materials;
- Conducting lighting clinics for retail store customers; and

APT hired a subcontractor, Energy Federation Incorporated (EFI), to process rebates and administer the online store.

## Program Offerings

Using retail markdowns and mail-in rebates as the two primary vehicles for market transformation, the program sought to promote the following eligible ENERGY STAR products in PY2.

**Retail Markdown Products:**

- ENERGY STAR CFLs
- ENERGY STAR Lighting Fixtures

**Customer Mail-in Rebate Products:**

- ENERGY STAR Room Air Conditioners
- ENERGY STAR Freezers
- ENERGY STAR Dehumidifiers

In addition to retail markdowns and mail-in rebates, a new program component was introduced in PY2: an online store selling marked-down lighting products.

Customers can reach the store, administered by EFI and shown in Figure 1, via Ameren Missouri's website.

The Social Marketing Distribution (SMD) Program, which also launched during PY2, operates separately from the L&A program, and is discussed in Section 6 of this report.

**Figure 1. Ameren Missouri Online Store**


## Program Goals

Ameren Missouri set annual performance goals for the program over its planned three-year implementation period as part of its integrated resource planning (IRP). To meet its PY2 cumulative savings goals of 64,928 MWh of energy and 5.6 MW of demand, the target sales levels for each L&A program measure were set as shown in Table 1.

**Table 1. PY2 Sales and Participation Targets**

| ENERGY STAR Lighting or Appliance Type | Program Targets |
|---|---|
| CFLs | 1,177,537 |
| Dehumidifiers | 1,500 |
| Freezers | 2,600 |
| Room Air Conditioners | 8,000 |
| CFL Fixtures | 2,500 |

A variety of lights are discounted through the program, with an average incentive of $1.09 per bulb and $15 for CFL fixtures. The appliance portion of the program is incented through mail-in rebates in the amounts listed in Table 2.

**Table 2. Appliance Rebate Amounts**

| Appliance Type | Rebate |
|---|---|
| Freezers | $50 |
| Dehumidifier | $25 |
| Room Air Conditioner | $50 |

# Evaluation Questions

Cadmus' evaluation of the PY2 L&A program sought to answer the following key questions:

**Impact Questions**

1. What are the program's gross energy and demand savings?
2. What are the program's net energy and demand savings?
3. What are the market effects associated with program activities?
4. What percent of program bulbs were purchased by non-Ameren Missouri customers?
5. How many hours, on average, are program CFL used each day?
6. What are the appropriate per-unit savings for each lighting and appliance measure?

**Process Questions**

1. How has the program design changed from PY1?
2. How effective were program implementation, design and processes, and marketing efforts?
3. What are retailer and manufacturer experiences and satisfaction with the program?
4. What were program staff experiences and satisfaction with the program?
5. What were customers' perceptions of CFLs and what issues did they report with CFL use?

# Report Organization

The remainder of this report is organized as follows:

- Section 3. Evaluation Methods
- Section 4. Impact Results
- Section 5.Process Results
- Section 6.Social Marketing Distribution
- Section 7.Conclusions and Recommendations
- The appendices of this report contain more detail on methodologies and results from the various research efforts.
- Appendix A contains analysis of responses from the CFL User Survey.

- Appendix B contains an analysis of the Site Visits.
- Appendix C contains additional detailed analysis from the Store Intercept Surveys.
- Appendix D contains additional detail regarding data preparation from the Metering Study.
- Appendix E contains comparative statistics from all 15 areas surveyed as part of the Multistate Study.
- Appendix F contains the survey instruments used for data collection.

# 3. Evaluation Methods

## Analytical Methods

The research activities that informed this evaluation are summarized in Table 3. This chapter describes each major task and data source.

**Table 3. Summary of Evaluation Approach (PY2)**

| Action | Impact | Process | Details |
|---|---|---|---|
| CFL User Survey | ✓ | ✓ | Lighting: Estimate CFL awareness, sales, and saturation. (n=451) |
| Site Visits | ✓ | | Lighting: Assess CFL purchase, saturations, and installation rates.(n=87) |
| Participant Retail Store Sales Analysis | ✓ | | Lighting and Appliances: Obtain an unbiased assessment of program sales from database tracking. (n=census) |
| Store Intercepts | ✓ | | Lighting: Assess CFL leakage rates. (n=611) |
| Metering | ✓ | | Lighting: Estimate hours-of-use. (n=44) |
| Retailer Interviews | ✓ | ✓ | Lighting: Obtain supplier self-reported estimates of NTG and review of program approach and opportunities for improvement. (n=75) |
| Multistate Analysis | ✓ | | Lighting: Analyze NTG and benchmarking. |
| | | | |
| Engineering Estimates of Appliance Savings | ✓ | | Appliances: Obtain information based on rebate applications and secondary research. |
| Appliance Participant Survey | ✓ | ✓ | Appliances: Analyze NTG and process results for appliance rebates.(n=150) |
| Program Document Review | | ✓ | Lighting and Appliances: Understand program approach and identify opportunities for improvement, ensure all data necessary for evaluation are available, |
| Stakeholder Interviews | | ✓ | Lighting and Appliances: Understand program approach and identify opportunities for improvement.(n=5) |

### CFL User Survey and Site Visits

The primary purpose of the CFL User Survey was to recruit participants for the site visits to be used as part of the multistate CFL analysis. However, the survey also estimated a number of important program indicators, including:

- ***CFL Awareness***. These questions gathered data on the respondents awareness and familiarity with both standard and specialty CFL bulbs.
- ***CFL Satisfaction***. This section asked about participants' satisfaction with CFLs, including reasons for dissatisfaction.
- ***CFL Purchasing***. These questions focused on whether customers had purchased CFLs in the last six months and how many of those were installed, where they typically purchase CFLs and other lights, and how many CFLs are currently installed in their home.
- ***Concerns and Removal Rates of CFLs***. Questions in this section gathered information on customer concerns about CFL bulbs and what they did with bulbs no longer in use.

- ***Demographics***. This section captured household and respondent characteristics, including income, age, home type, home square-footage, and energy expenditures.

A total of 451 surveys and 87 site visits were performed yielding precisions of 3.9 percent and 8.8 percent with a confidence of 90 percent for each study respectively. The CFL User Survey Results are included in Appendix A. Site Visit Results are included in Appendix B.

## Participant Store Retail Sales Analysis

APT tracks retail sales of incented CFLs and data from rebate applications for appliances in a database. These files tie payment requests to identified transactions and track:

- Program activity by product or product type;
- Program activity on an aggregated basis of products rebated and dollars spent;
- Program activity by various identified components (e.g., by product, by store chain, by manufacturer, by month); and
- Ameren Missouri's estimated energy and demand savings.

Cadmus reviewed the energy and demand savings assumptions in the database, and summarized and analyzed the transactions to compute relevant totals for PY2.

## Store Intercepts

Cadmus and its subcontractor, ICC/Decision Services, interviewed 611 consumers as they purchased lighting products in 24 different stores. The purpose was to determine the percentage of CFLs purchased by customers outside of Ameren Missouri territory and whether the CFLs were to be installed in a home or business. Store Intercept results are discussed in the Impact Results section with additional details provided in Appendix C.

## Metering

Cadmus installed up to five light logger meters per home in a random sample of 44 Ameren Missouri homes with at least one CFL installed (22 from December 2009 through June 2010, and another 22 from June 2010 through December 2011). Through metering, we gathered information on lighting use patterns and developed estimates of overall hours-of-use (HOU) and average HOU for each room type. On a total home basis, the sample precision was ± 12.4 percent at the 90 percent confidence level; on a socket basis, sample precision was ±6.1 percent at the 90 percent confidence level. Metering results are discussed in the Impact Results section with additional details provided in Appendix D.

## Retailer Interviews

Interviews of lighting retailers form the basis for one estimate of net-to-gross (NTG) for PY2. Interview questions regarding estimated changes in CFL sales due to the program, the share of CFLs sold through the program, and the total overall CFL sales are used to estimate NTG. In addition, the 60 lighting retailers and 15 appliance retailers were asked about changes in customer awareness, stocking, and sales trends for CFLs compared to one year ago.

## Multistate Analysis

The multistate analysis is conducted via a non-linear statistical regression tool used to calculate NTG results by predicting the program's effect on net sales. After capturing CFL purchases and installations through the CFL User Survey and follow-up site visits from Ameren Missouri and 13 other program and non-program areas of the United States, we developed a regression model to predict CFL purchases while controlling for factors impacting CFL sales, such as income, education, home ownership, size of home, electricity rates, and the presence of big-box stores. The regression model isolates the program's effect on sales and establishes a modeled baseline of CFL purchases in the program's absence. The "lift" in purchases, as indicated by the program variable, is the effect attributable to program activities. This evaluation approach required the coordination of nine other utility groups to ensure consistent data collection and coordinated site visits. The final output also includes a benchmark comparison of the 10 different utility programs involved. This benchmarking, or comparative statistics are provided in Appendix E.

## Engineering Estimate of Appliance Savings

Cadmus independently developed engineering estimates of appliance savings for use in determining program impacts. We used the ENERGY STAR calculator to estimate savings using St. Louis, Missouri as the reference location.

## Appliance Participant Survey

An appliance survey of 70 rebate program participants was conducted so that Cadmus could assess self reported estimates of freeridership and determine how the program processes worked from the viewpoint of the participating consumer. The sample size was designed to produce a sampling error of ±10 percent at the 90 percent confidence level.

## Stakeholder Interviews

To assess the program's effectiveness and implementation, Cadmus conducted interviews with four stakeholders intimately familiar with the program. The four stakeholders came from Ameren Missouri and APT. Details regarding interviewed stakeholders are provided in Table 4.

**Table 4. Stakeholder Interviewees**

| Title | Organization |
|---|---|
| Residential Program Manager | Ameren Missouri |
| Senior Program Manager | Ameren Missouri |
| Regional Director of Operations | APT |
| Program Manager | APT |

Cadmus conducted stakeholder interviews utilizing interview guides aimed at discussing the program's design, implementation and delivery, marketing efforts, implementation barriers, and communication.

We used information obtained from stakeholders to inform the following evaluation elements:

- Determination of program progress;
- Identification of changes during implementation; and

- Assessment of program marketing.

### Program Document Review

Cadmus reviewed program documents consisting of rebate applications and marketing materials. We also reviewed APT's data tracking reports, which provided an ongoing understanding of marketing and training events as well as progress in signing up participating retailers.

## Data Sources

The following data sources informed the impact and process evaluation:

- Final PY2 program database;
- Information gathered through the CFL User Survey;
- Information gathered through stakeholder interviews;
- Information gathered through retailer interviews;
- ENERGY STAR Savings Calculator for Room Air Conditioners, Freezers, and Dehumidifiers;[1]
- Marketing and informational materials (provided by Ameren Missouri);
- Progress reports (provided by APT);
- Metered data gathered through the lighting logger study; and
- Information gathered through store intercept surveys.

[1] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerRoomAC.xls.

# 4. Impact Results

Impact evaluation findings are presented in the following five subsections, with each covering lighting, fixtures, and appliances separately:

1. Per unit savings
2. Summary of program sales
3. Determination of gross savings
4. Determination of net savings
5. Impact evaluation summary

## Per Unit Savings

### Lighting - Upstream

To calculate lighting per unit savings for the upstream portion of the program, the analysis required the following inputs:

- An estimate of the wattage displaced by program-discounted products (delta watts);
- An estimate of the average daily HOU;
- An estimate of the coincident CFL use at the time of Ameren Missouri's system peak; and
- An estimate of bulbs installed in non-residential applications and the associated HOU.

#### Delta Watts

Using Ameren Missouri's tracking database, we determined the weighted average wattage of all CFLs sold through the Ameren Missouri program in 2010 was 15.2 watts (W). **Error! Reference source not found.** shows the theoretical lumen-equivalent wattages associated with the CFLs sold by Ameren Missouri, with a calculated average of 66. Using the 66 lumen-equivalent incandescent wattage, the estimated average incandescent to CFL ratio is 4.3.

**Table 5. CFL Wattage and Amount Sold**

| CFL Wattage | Total Number Sold* | Lumen-Equivalent Incandescent Wattage |
|---|---|---|
| 7 | 13,098 | 40 |
| 9 | 50,300 | 40 |
| 10 | 42,638 | 40 |
| 11 | 23,995 | 40 |
| 12 | 3 | 40 |
| 13 | 526,807 | 60 |
| 14 | 493,452 | 60 |
| 15 | 70,730 | 60 |
| 16 | 265 | 60 |
| 17 | 3,531 | 75 |
| 18 | 37,254 | 75 |
| 19 | 17,079 | 75 |
| 20 | 30,468 | 75 |
| 22 | 543 | 100 |
| 23 | 138,085 | 100 |
| 25 | 334 | 100 |
| 26 | 88,434 | 100 |
| 27 | 5,677 | 100 |
| 28 | 449 | 150 |
| 29 | 1,650 | 150 |
| 30 | 67 | 150 |
| 33 | 21 | 150 |
| 39 | 665 | 150 |
| 40 | 370 | 150 |
| 42 | 1,314 | 150 |
| **Total** | 1,547,229 | |
| **Weighted Average** | 15.2 | 66 |

* Includes coupons and on-line sales, does not include SMD bulbs

Cadmus does not recommend using the theoretical lumen-equivalent incandescent wattage ratio directly as calculated, because consumers sometimes replace incandescent light bulbs with higher lumen CFLs to overcome perceived CFL "dimness". Manufacturers recommend an approximate 4:1 ratio for incandescent-to-CFL wattage and incandescent packaging typically recommends the lumen-equivalent wattage as shown in Figure 2, below; however, a number of websites suggest that a 3:1 ratio might provide higher consumer satisfaction with the quantity of light.[2] Further, brightness was listed as a concern by some Ameren Missouri survey participants reporting dissatisfaction with CFLs in the CFL User Survey.

When considering the appropriate incandescent-to-CFL wattage ratio, Cadmus also reviewed other primary research regarding the estimation of replaced incandescent wattage:

[2] See recent websites for both Consumer Reports (http://www.consumerreports.org/cro/magazine-archive/october-2009/home-garden/compact-fluorescents/how-to-choose/compact-fluorescents-how-to-choose htm) and Flex Your Power (http://www fypower.org/res/tools/products_results.html?id=100195).

1. The most recent 2006-2008 California Upstream Lighting Evaluation[3] conducted lighting inventories at approximately 1,200 homes and found that the average incandescent wattage of 61.7 was being replaced by average CFL program wattage of 17.2 (incandescent-to-CFL ratio of 3.6). In this study, technicians completed a full inventory of lighting wattages in the home and assumed the replaced wattage was equal to the corresponding wattage used in a similar room with similar lamp type bulbs that were not replaced.
2. A 2010 study for Duke Energy[4] used program participant's self-reported information for both replacement and purchased wattages, and found that the average incandescent wattage of 66.7 was replaced by average CFL program wattage of 15.7, resulting in an incandescent-to-CFL ratio of 4.25. This study also formed the basis for Ohio's Technical Reference manual.

The average Ameren Missouri program CFL wattage is lower than in California (15.2 vs. 17.2) and slightly lower than in Ohio (15.2 vs. 15.7). Based on these different studies and the other information discussed above, Cadmus recommends discounting the lumen-equivalent incandescent-to-CFL wattage ratio from 4.3 calculated in Table 5, to 4.0 by accounting for the above mentioned human factor (where some customers replace incandescent bulbs with higher lumen CFLs). Cadmus calculated the *ex post* energy savings for this evaluation using a 4.0 incandescent-to-CFL wattage ratio.

**Figure 2. Example of CFL Packaging with Equivalent Incandescent**


[3] KEMA, Inc., The Cadmus Group Inc., Itron, Inc., PA Consulting Group, and Jai J. Mitchell Analytics. Draft Evaluation Report: Upstream Lighting Program. Prepared for the California Public Utilities Commission, Energy Division, December 10, 2009.

[4] TekMarketWorks. Draft Report:Ohio Residential Smart Saver CFL. Prepared for Duke Energy, June 2010.

## Average Daily HOU

Cadmus performed a metering study to estimate HOU specific to Ameren Missouri customers. Cadmus conducted two waves of CFL metering for the PY2 evaluation. The first wave coincided with residential lighting audits in December 2009. Cadmus field technicians installed 98 light loggers in 22 households with electricity service provided by Ameren Missouri. The first wave of metering ended in June 2010 when Cadmus field technicians removed the loggers and then installed 82 light loggers in 22 additional households to begin the second wave of metering. The sample error is ±12.4 percent on a per household basis and ±6.1 percent on a logger basis, at the 90 percent confidence level. The second wave of metering ended in December 2010. Each wave collected lighting usage data for a period of six months, resulting in a full year of lighting usage data.

Wave 1 participants were recruited through an on-line survey conducted in June 2009. As part of this effort, 478 respondents agreed to participate in a six month light logger study. From this sample, Cadmus randomly recruited 22 respondents who indicated at least one CFL was installed in their home for the Wave 1 metering effort.

The CFL User Survey, conducted by Tetra Tech for information and recruitment to the multistate study was also used to recruit 22 participants for Wave 2 metering in the same fashion described for Wave 1. The two waves were designed to capture the seasonal differences of lighting use and allow for additional participant samples. As a result, we have lighting use data covering an entire year. Table 6 summarizes the data collection and metering schedule.

**Table 6. Data Collection and Metering Schedule**

| Metering Wave | Data Collection Task | Sample Size | Date Completed |
|---|---|---|---|
| Wave 1 | Ameren Online Survey | 478 | 6/2009 |
| | Cadmus Audit/Metering Recruitment | 22 | 11/2009 |
| | Meter Installation and Lighting Audits | 22 | 12/09/2009 – 12/12/2009 |
| | Meter Removal and Onsite Survey | 22 | 6/21/2010 – 6/24/2010 |
| Wave 2 | Tetra Tech Phone Survey | 451 | 6/2010 |
| | Cadmus Audit/Metering Recruitment | 22 | 6/2010 |
| | Meter Installation and Lighting Audits | 22 | 6/28/2010 – 7/2/2010 |
| | Meter Removal and Onsite Survey | 22 | 12/6/2010 – 12/9/2010 |

***Logger Sampling Methodology.*** For homes with five or fewer CFL fixture groups identified, field technicians installed a logger on each CFL fixture. For homes with more than five CFL fixture groups, field technicians used the random selection method described below and shown in Table 7 to determine which five fixtures to meter.

Each household was assigned a random start number, used as the fixture number from which to begin the random count, based on possible ranges of CFL fixture groups. After determining the

number of CFL fixture groups from the audit, field technicians identified the range (the number of CFL fixtures) and the corresponding random start number (the first and second columns of Table 7). Field technicians then counted a predetermined number of fixture groups from the random start number, and installed a logger on every $n^{th}$ CFL fixture group from the random start number. Field technicians adhered to this protocol to install up to five loggers per household.

**Table 7. CFL Fixture Random Selection Protocol**

| Range of CFL Fixture Groups | Random CFL Fixture Group Start Number | Meter Every $n^{th}$ CFL |
|---|---|---|
| 1-5 | 4 | 1st |
| 6-10 | 2 | 2nd |
| 11-15 | 12 | 3rd |
| 16-20 | 9 | 4th |
| 21-25 | 18 | 5th |
| 26-30 | 5 | 6th |
| More than 30 | 24 | 7th |

Cadmus field technicians installed up to five light loggers per household on both interior and exterior CFL fixtures. Light loggers record the time and date of each on and off event on the metered fixture. These data enable analysts to estimate average HOU per day per CFL fixture, as well as average HOU per household and room. Additionally, light logger data can provide a clear understanding of lighting usage during peak and off-peak hours. Details on data cleaning and preparation are described in Appendix J.

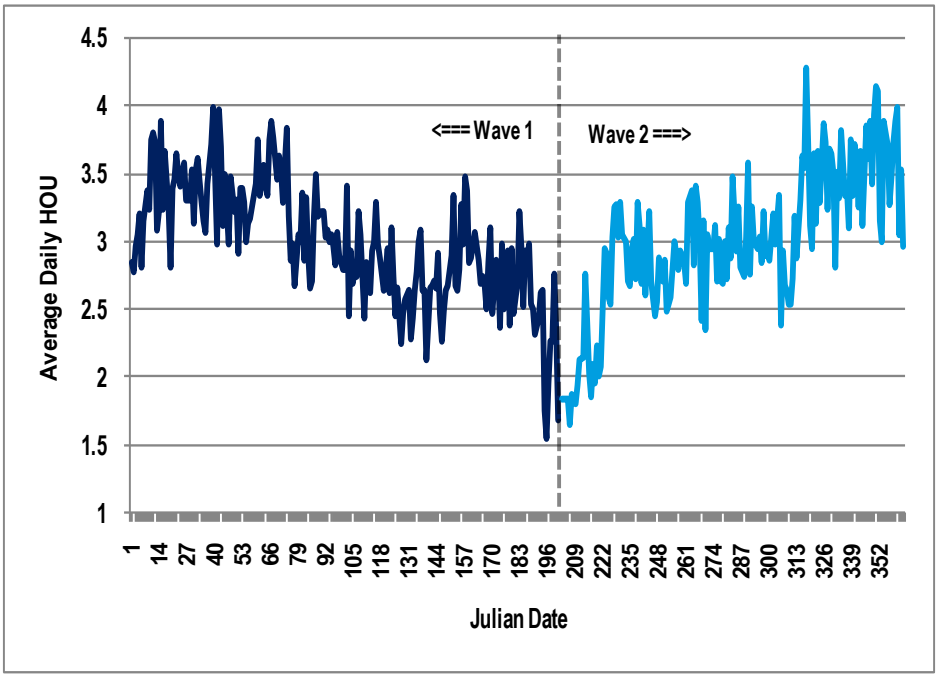
To calculate HOU estimates we determine the total time "on" for each individual light logger per day. We used the following guidelines to assign "on" intervals to each light logger:

- If a light logger did not record any light for an entire day, that day's HOU was 0.
- If a light logger registered that a light was turned on at 8:30 p.m. on Monday, and registered the light being turned off at 1:30 a.m. on Tuesday morning, 3.5 were added to Monday's HOU, and 1.5 hours were added to Tuesday's HOU.

We calculated the average daily HOU as the average time "on" across the entire metering period (daily from 12:00:00 a.m. to 11:59:59 p.m.) across all light loggers. The average HOU is the average of all HOU estimated for each logger across all days. The primary un-weighted mean HOU estimate across all loggers was 3.01.

Figure 3 shows that average daily HOU for each wave are almost symmetrical; with HOU decreasing from winter to summer and then increasing from summer to winter. Figure 3 demonstrates how lighting usage varies inversely with daylight hours over the course of a year, confirming our expectation that lighting use is highly correlated with hours of daylight.

**Figure 3. Average Daily Unweighted HOU – Wave 1 and Wave 2**




After calculating the average HOU for the raw metered data, analysts weighted the data based on responses to an on-site survey that took place during logger removals for wave 1 and a phone survey that took place prior to logger installations for wave 2. These weights were determined by participant educational attainment, home ownership status (i.e., home owner or renter) to approximate population demographics along with the total number of CFLs associated with the fixture for all light loggers and the room-based number of CFLs per fixture. In weighting for CFLs per fixture, if a logger was installed on a fixture with only one associated CFL, it would have half the weight of a logger installed on a fixture with two CFLs. Even though a logger collected lighting data from a single lamp, all other CFL lamps in common with that fixture were assumed to have the same HOU. The weighting logic by room type is shown in the third column of Table 8. The initial weight for each room type is representative of the percent of all CFLs associated with each room type by the total CFL lamps across all metered households. We calculated this weight as the percent of the sum of all CFLs associated with each room by all CFLs found in the total audit population (i.e., the total CFLs found in all audited households). We then adjusted each room's HOU by this population-based CFL saturation. Table 8 shows the sample distribution and the final population distribution. Based on our weighted findings, we estimate HOU to be 2.91.

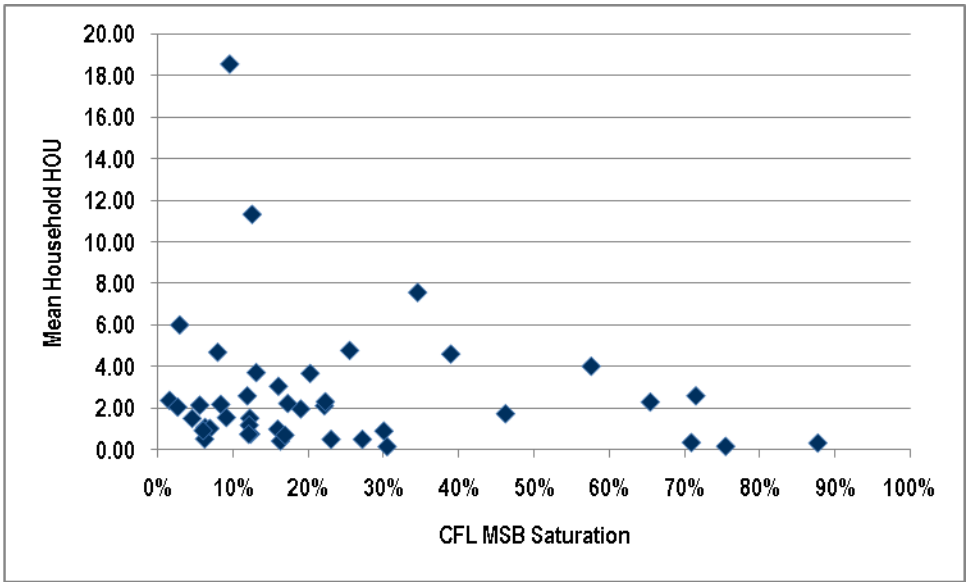
**Table 8. Weighted HOU Estimates (n = 164)**

| Room Type | Demographic Weighted HOU | Sample Population BPF Weight | Audit Population BPF Weight |
|---|---|---|---|
| Basement | 5.76 | 5.3% | 8.1% |
| Bathroom | 1.68 | 7.8% | 11.5% |
| Bedroom | 1.32 | 25.6% | 20.8% |
| Closet | 0.80 | 2.5% | 1.4% |
| Dining | 1.21 | 3.2% | 3.6% |
| Foyer | 1.39 | 2.1% | 2.2% |
| Garage | 2.06 | 3.9% | 3.6% |
| Hallway | 1.32 | 2.1% | 3.2% |
| Kitchen | 4.32 | 15.3% | 13.1% |
| Living Space | 4.37 | 23.1% | 20.1% |
| Office/Den | 2.76 | 3.9% | 2.4% |
| Other | 0.32 | 0.4% | 0.4% |
| Outdoor | 3.20 | 3.2% | 7.9% |
| Utility | 0.47 | 1.4% | 1.6% |
| **Mean HOU** | **3.01** | **2.87** | **2.91** |

As a final step for the HOU analysis, analysts tested the relationship between CFL saturation at a household level and the mean-weighted household HOU. The general assumption is that CFL saturation and HOU have an inverse relationship; as CFL saturation increases, mean HOU decreases. The logic around this assumption is that as people purchase CFLs, they tend to install them in high-use areas first (such as kitchens or living spaces or where lamps typically burn out first). As households saturate high-use sockets, they will eventually begin to install CFLs in secondary low-traffic rooms such as closets, garages, guest bedrooms, and offices. The low-use associated with these secondary low-traffic rooms will decrease the average HOU. Therefore, the overall average HOU is assumed to decrease as CFL saturation increases.

Cadmus did not find evidence of a strong statistical relationship between CFL saturation of medium screw-base sockets and mean-weighted household HOU across the two metering waves. Figure 4 presents these findings. A visual inspection of the data scatter plot is convincing that there is little to no statistical relationship between saturation and HOU. The Pearson correlation coefficient of -0.15 indicates that there is a weak negative correlation, but largely confirms that there is no statistical relationship between CFL saturation and mean-weighted household HOU.

**Figure 4. CFL MSB Saturation and HOU (n = 44)**




Cadmus constructed a two-tailed 90 percent confidence interval around the un-weighted mean HOU as shown in Table 9. Some variance around the mean HOU is expected, as Cadmus field technicians randomly selected fixtures to meter. As discussed above, lighting usage depends on daylight hours, room type, and frequency of room usage. For example, high-traffic areas such as kitchens and living rooms typically have higher lighting usage. Low-traffic areas such as closets and guest rooms typically have lower lighting usage.

**Table 9. Confidence Intervals for Mean HOU – Two-Tailed at 90 Percent**

| Loggers | Unweighted Mean HOU | Standard Error | Standard Deviation | Margin of Error +/- | Coefficient of Variation | Two-Tailed Confidence Interval |
|---|---|---|---|---|---|---|
| 164 | 3.01 | 0.36 | 4.56 | 45.83% | 1.52 | 1.63 – 4.39 |

## Coincident Peak Demand Savings

Analysts also calculated peak coincidence factors for metered CFL fixtures. The peak period is defined as non-holiday weekdays from 4:00 p.m. to5:00 p.m., beginning on August1, 2010 and ending August 31 2010. This peak period coincided with the wave 2 metering period. The mean peak coincidence factor is 12.2 percent; indicating that during the 60-minute peak period, metered CFLs were on for an average of 12.2 percent of the time, or roughly 7.3 minutes.

## Per Unit Energy Savings and Demand Reduction

Table 10 compares Cadmus' estimates of per-unit energy savings to Ameren Missouri's estimates. Cadmus used the following formula:

$$\frac{CFL\ Watts\ X\ Watt\ Ratio - CFL\ Watts\ X\ HOU\ X\ 365}{1000}$$

$$\frac{CFL\ Watts\ X\ 4 - CFL\ Watts\ X\ 2.91\ hours\ X\ 365\ days}{1000} = 48.4\ \text{kWh}$$

As shown in Table 10, per unit CFL energy savings determined by this evaluation is higher than the program's *ex ante* per unit value because the *ex ante* estimates assumed a lower HOU of 2.34 hours per day and an incandescent-to-CFL wattage ratio of 3.8**.**

**Table 10. Per Unit Lighting Energy Savings Comparison**

| *Ex Ante* Per Unit Energy Savings* (kWh/Year) | Ex Post Per Unit Energy Savings (kWh/Year) |
|---|---|
| 36.49 | 48.4 |

* Weighted average energy savings from lighting program tracking database.

As part of the metering study discussed later in this report, Cadmus calculated that 12.2 percent of metered CFLs were in operation at the time of Ameren Missouri's system peak. Using this information, Cadmus calculated the peak coincident demand savings per bulb shown in Table 11 using the following formula:

$$CFL\ Watts\ X\ Watt\ Ratio\ X\ .122 = 15.2\ X\ 4\ X\ .122 = .0075\ \text{kW/bulb}$$

**Table 11. Per Unit Lighting Fixture Demand Savings Comparison**

| *Ex Ante* Per Unit Demand Savings (kW)* | Ex Post Per Unit Demand Savings(kW) |
|---|---|
| .0031 | .0075 |

* Based on IRP goals

## Bulbs Installed in Non-Residential Locations

Based on store intercept surveys (summarized later in this report), three percent of the purchased CFLswere intended to be installed in non-residential facilities in Ameren Missouri territory. For those CFLs, we used 10 HOU and 0.86 coincident peak demand/kW of bulb wattage,[5] and computed the average per-unit energy savings and per-unit coincident peak demand using the same formula as above. Table 12 shows the per-unit, non-residential energy and demand savings.

[5] Energy Efficiency/Demand Response Plan Year 2 Evaluation Residential Energy Star Lighting, Commonwealth Edison. Company, September 1, 2010: "non-residential HOU and CF parameter estimates were taken from the ex-post findings from the PY1 Small C&I Intro kit final report (HOU = 10.0 per day and CF = 0.86)."

**Table 12. Per-Unit, Non-Residential Lighting Energy and Demand Savings**

| Realized Per Unit Energy Savings kWh per bulb | Realized Per Unit Demand Savings kW per bulb |
|---|---|
| 166.4 | 0.054 |

## Fixtures

We determined gross per-unit energy savings for ENERGY STAR® fixtures through an engineering analysis. Since the savings of ENERGY STAR fixtures come from the CFLs bulbs that fit (incandescent bulbs do not fit ENERGY STAR fixtures), we calculated per-bulb unit savings as described in the upstream lighting section above. Weighted average CFL wattages from the tracking database are 39 W per fixture, and applying a similar 4.0 ratio results in kW savings of 117 W per fixture (incandescent wattage = 156). HOU is 2.91 and peak demand savings are 0.122 peak kw/fixture wattage savings multiplied by the kW savings of 117. Applying these calculations, our estimated energy and peak demand savings are shown in Table 13.

**Table 13. Unit Energy Savings for ENERGY STAR Fixtures**

| Ex Ante Per Unit Energy Savings (kWh/Year) | Ex Post Per Unit Energy Savings (kWh/Year) | Ex Ante Per Unit Coincident Demand Savings (kW) | Ex Post Coincident Demand Savings (kW) |
|---|---|---|---|
| 88 | 124 | .007 | .014 |

## Appliances

Cadmus independently estimated per unit energy savings for each type of appliance also using an engineering analysis. Given that appliances were planned to be a small percentage of overall program results, the majority of evaluation resources in 2010 were focused on lighting. Should the appliances portion of the program grow over time, we would recommend more rigorous evaluation approaches. Our specific assumptions and estimations for each appliance are detailed in the following paragraphs.

### Air Conditioner Savings

Cadmus determined gross per-unit energy savings for ENERGY STAR room air conditioners through an engineering analysis based on the ENERGY STAR savings calculator.[6] Using Saint Louis, Missouri as a reference city, energy savings were assumed to be equivalent to a full year of energy consumption with 1,215 full load cooling hours. The calculator used the average purchased EER value from the program of 10.7, replacing the federal standard efficiency of 9.7 EER (these values were the average reported). Cadmus determined the efficiencies using the ENERGY STAR list of qualified units that contains both ENERGY STAR and federal standard

[6] http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=AC

efficiency levels by matching brand and models from the Ameren database. We used a 9,761 BTU/hr unit to determine the energy savings estimates (the average of reported purchases).

We based peak demand savings on load shapes developed for another Midwest utility[7] (0.05kWx115kWh/95.7kWh = 0.08 kW). The energy and peak demand savings are shown in Table 14.

**Table 14. Per-Unit Gross Savings for Room Air Conditioners**

| Appliance | *Ex Ante* Gross Energy Savings (kWh/Year) | *Ex Post* Gross Energy Savings (kWh/Year) | *Ex Post* Gross Coincident Demand Savings (kW) |
|---|---|---|---|
| Room Air Conditioner | 95.7 | 115 | .06 |

## Dehumidifier Savings

Cadmus determined gross per-unit energy savings for ENERGY STAR dehumidifiers through an engineering analysis based on the ENERGY STARs avings calculator.[8]We assumed savings are equal to a full year of energy consumption with 1,620 operating hours. The calculator assumed an ENERGY STAR dehumidifier was replacing a standard dehumidifier. The ENERGY STAR savings calculator evaluates multiple different sizes of dehumidifiers, ranging from 1-24 pints per day to 75-185 pints per day. We calculated an energy savings result for each specific size, and used weights to determine one gross savings estimate. This involved converting liters/day to pints/day using a factor of approximately 2.11. The per-unit gross energy savings and weights based on actual program purchases are shown in Table 15.

**Table 15. Per-Unit Gross Energy Savings and Weights by Size for Dehumidifier**

| Size | 1-24 Pints/Day | 25-34 Pints/Day | 35-44 Pints/Day | 45-54 Pints/Day | 55-74 Pints/Day | 75-185 Pints/Day |
|---|---|---|---|---|---|---|
| Energy Savings | 54 | 117 | 213 | 297 | 185* | 374 |
| Weights | 0% | 30% | 5% | 42% | 23% | 0% |

*This value is a computation based on the difference between the federal standard efficiency and ENERGY STAR standard efficiency, which has a lower spread than other dehumidifier sizes.

We based peak demand savings on the original default value.[9] We adjusted the demand savings using a ratio of updated energy savings divided by the originally proposed energy savings (0.099 kW x 213 kWh / 270 kWh = 0.08 kW). The energy and peak demand savings are shown in Table 16.

7 From Ameren Illinois (Ameren EE DR Plan Appendices 11.15.07).From Ameren Missouri (Attachment B - APT-EFI_TRC_2009-11-03 (2)).

8 http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=DE

9 From Ameren Missouri, Attachment B - APT-EFI_TRC_2009-11-03 (2).

**Table 16. Per-Unit Gross Savings for Dehumidifiers**

| Appliance | *Ex Ante* Gross Energy Savings (kWh/Year) | *Ex Post* Gross Energy Savings (kWh/Year) | *Ex Post* Gross Coincident Demand Savings (kW) |
|---|---|---|---|
| Dehumidifier | 249.8 | 213 | 0.08 |

### Freezer Savings

Cadmus determined gross per-unit energy savings for ENERGY STAR freezers through an engineering analysis based on the ENERGY STAR qualified unit list.[10] This list includes the average consumption for both a federal standard unit and the specific ENERGY STAR freezer. All units included in the database contained a matching unit in the ENERGY STAR qualified unit list for freezers. We determined the total federal consumption and ENERGY STAR consumption for all of the participating units and then divided by the total number of participating units to determine an average energy savings. As shown in Table 17 the ex ante and ex post estimates differ significantly. In reviewing the Ameren Missouri estimation approach, it appears the savings assumptions were based on early replacement rather than replacement at burnout or new purchases.

We based peak demand savings on the original default peak demand savings.[11] We then adjusted the demand savings using a ratio of updated energy savings divided by the originally proposed energy savings (0.016 kW x 61 kWh / 247.1 kWh = 0.004 kW). The energy and peak demand savings are shown Table 17.

**Table 17. Per-Unit Gross Savings for Freezers**

| Appliance | *Ex Ante* Gross Energy Savings (kWh/Year) | *Ex Post* Gross Energy Savings (kWh/Year) | *Ex Post* Gross Coincident Demand Savings (kW) |
|---|---|---|---|
| Freezer | 247.1 | 61 | 0.004 |

# Summary of Program Sales

## Lighting

Total upstream program sales amounted to 1,547,459 CFLs: 861 through the online stores, 5,069 through coupon efforts, and 1,546,007 through retailers. Program sales took place through 185 different retailers throughout Ameren Missouri's service territory.

Table 18 summarizes the number of CFLs sold and incentives paid through the different retail channels.

[10] http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=FRZ

[11] From Ameren Missouri, Attachment B - APT-EFI_TRC_2009-11-03 (2).

**Table 18. CFLs Sold and Incentives Paid by Retail Channel**

| Store | Qty Sold | Incentives $ |
|---|---|---|
| Big Box | 192,902 | $194,729 |
| DIY Big Box | 622,809 | $656,906 |
| Dollar Stores | 8,711 | $10,453 |
| Hardware Stores | 5,069 | $4,436 |
| Farm Supply | 47 | $64 |
| Grocery Store | 29,315 | $30,410 |
| On-Line | 861 | $1,542 |
| Warehouse | 687,745 | $749,066 |
| Total | 1,547,459 | $1,643,170 |

Of the many types of CFLs sold through the program, the three top selling models from December 2009 through September 2010 were TCP's 14W, mini-spiral four packs (351,596 bulbs, or 87,899 packs sold); GE's 13W eight packs (257,904 bulbs, or 32,238 packs sold); and Feit's 13W, mini twist four packs (154,652 bulbs, or 38,663 packs sold). See Figure 5.

**Figure 5. Top Ten Selling Program Bulbs**

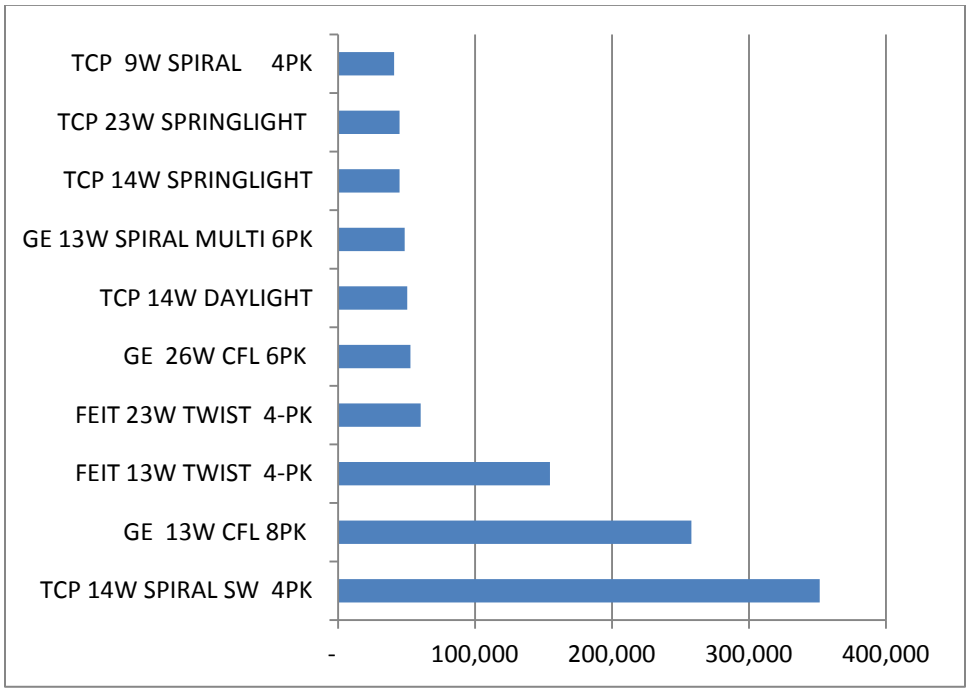
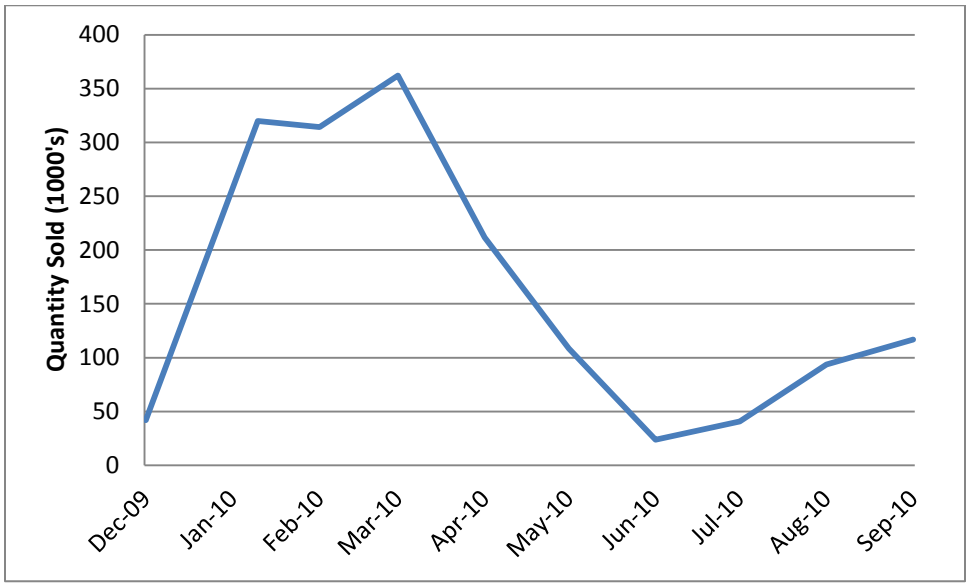



Figure 6 shows program CFL sales by month. Sales significantly increased from the end of 2009 into the beginning of 2010. Sales then began to drop after February 2010 through July, with a positive trend beginning again after July 2010. This trend is somewhat consistent with general lighting sales trends which dip during the summer; however, Ameren Missouri also removed incentives for standard spiral CFLs from May through August to maintain its overall program budget.

**Figure 6. CFL Sales by Program Month**




As shown in Table 19, the majority of bulbs sold though the upstream program through markdown retailers were standard spiral bulbs, with a total of 1,547,459 sold, accounting for approximately 88 percent of total bulb sales during the PY2 program year. Specialty bulbs accounted for approximately 12 percent of bulb sales for the program year, but represented a larger portion of total incentives, 18 percent.

**Table 19. Standard and Specialty Bulb Sales Through Markdown Retailers and Online**

| Bulb Type | Qty Sold* | Incentives $ | Incentives $/Bulb |
|---|---|---|---|
| Specialty Bulbs | 192,365 | $293,114 | $1.52 |
| Standard Bulbs | 1,355,094 | $1,354,491 | $1.00 |
| **Grand Total** | 1,547,459 | $1,647,606 | $1.06 |

Since the specialty bulb category encompasses a wide variety of bulb types, it is interesting to note the proportions within the specialty bulb grouping. Flood lights and spotlights account for almost 60 percent of total specialty bulb sales. Globe-shaped bulbs represent the second largest category, accounting for approximately 16.1 percent of specialty bulb sales, and A-lamp bulbs represented approximately 13 percent of sales. The remaining bulb types collectively represent 12 percent of sales. The incentive percentages by bulb type are proportionately very similar to the bulb quantity percentages, see Table 20.

**Table 20. Specialty Bulb Sales by Bulb Type**

| Specialty Bulb Type | Qty Sold | % of Total Bulbs | Incentives $ | % of Total Incentives |
|---|---|---|---|---|
| 3-Way Bulbs* | 2,732 | 1.42% | $3,347.25 | 1.14% |
| A-Lamp Bulbs | 24,401 | 12.68% | $37,745.59 | 12.88% |
| Candelabra Bulbs | 13,154 | 6.84% | $19,728.00 | 6.73% |
| Night Lights | 186 | 0.10% | $372.00 | 0.13% |
| Dimmable Bulbs | 1,203 | 0.63% | $1,895.50 | 0.65% |
| Fan Bulbs | 4,043 | 2.10% | $5,401.50 | 1.84% |
| Globe Bulbs | 31,429 | 16.34% | $47,311.25 | 16.14% |
| Flood and Spotlights | 115,217 | 59.89% | $177,313.33 | 60.49% |
| Grand Total | 192,365 | 100% | $293,114.42 | 100% |

* We calculated energy savings from 3-way bulbs based on the highest of the three wattage levels.

## Fixtures

A total of 591 lighting fixtures were sold in PY2. All of them were designed to hold three 13 W CFLs.

## Appliances

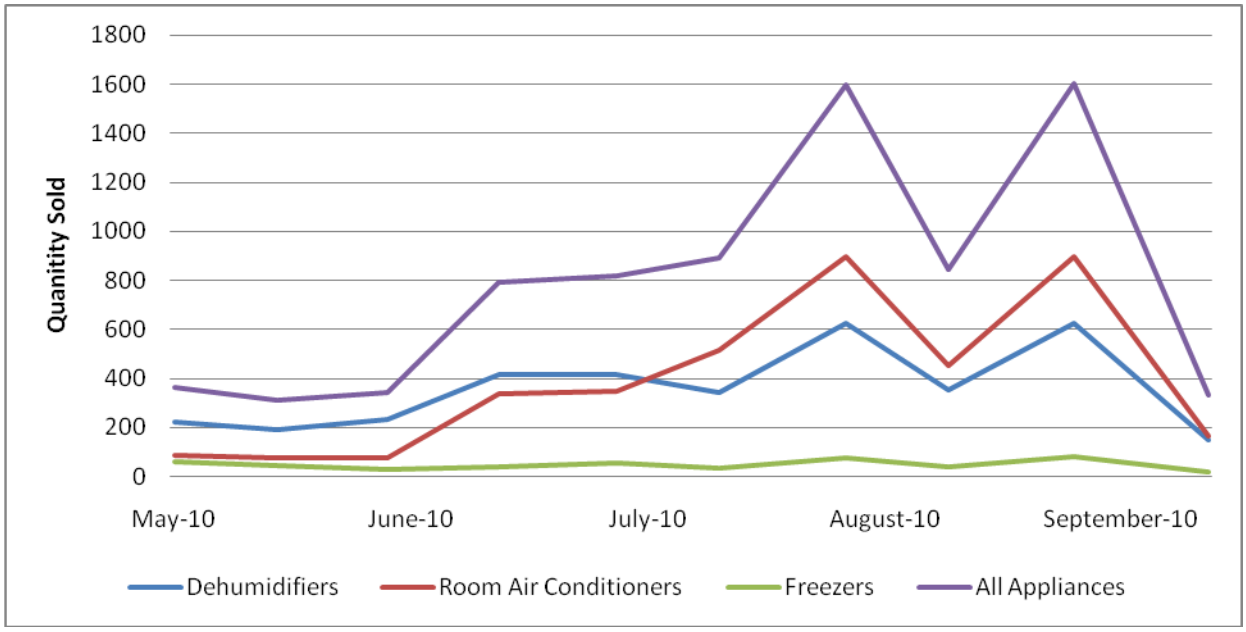
A total of 7,889 program appliances were sold in PY2. Table 21 summarizes the number of appliances sold and the amount of incentives paid by appliance type. Room air conditioners were the highest selling appliance.

**Table 21. Appliances Sold and Incentives Paid**

| Appliance | Incentive Amount | Qty Sold | Total Incentives Paid $ |
|---|---|---|---|
| Dehumidifiers | $25.00 | 3,545 | $88,625.00 |
| Freezers | $50.00 | 490 | $24,500.00 |
| Room Air Conditioners | $50.00 | 3,853 | $192,650.00 |
| **Grand Total** | | **7,888** | **$305,795.00** |

Figure 7 shows appliance sales by program month.

**Figure 7. Appliance Sales by Program Month**




Overall, sales increased from June through July 2010. In August, sales noticeably decreased for all appliances, then peaked again at the beginning of September and declined again quickly. These sales patterns follow expectations, as sales of these appliances are largely weather-driven.

# Determination of Gross Savings

## Lighting – Upstream Program

We determined gross savings for lighting based on the following inputs:

- Average per-unit energy and demand savings;
- Number of product sales;
- Installation rate; and
- Leakage.

### Installation Rate

Per-unit energy and demand savings, as well as product sales, were discussed in the previous two sections. Theoretically, installation rates should also be applied to the results. However, carrying over program sales from previous year's evaluation into future years requires continuous tracking and follow-up, which can be challenging if regulatory requirements and policies change over time. Therefore, Cadmus developed an installation rate adjustment to account for the difference in the present value of savings over the assumed approximate nine-year life of a CFL. We developed the installation rate adjustment based on specific site visit data over a three year

period in California,[12] which showed that within three years, 98 percent of CFLs are installed, and the remaining 2 percent do not get installed. Cadmus applied this same logic to Ameren Missouri's results by developing an algorithm to apply the rate at which installation occurs based on the initial year one installation rates.

According to this algorithm, 55 percent of CFLs that were put into storage in year one are installed in year two, and 41 percent of CFLs that were put into storage from year one are installed in year three. Applying this algorithm to Ameren Missouri, where the installation rate was 82 percent in PY2, 55 percent of 278,543 are installed in year two, and 41 percent of 278,543 are installed in year three. Table 22 and Table 23 illustrate this approach and compare the net present value (NPV) of the CFLs savings (simplified by assuming that savings equals the number of CFLs) over a nine year period. As shown, the difference is 2.7 percent. Therefore, Cadmus applied a 2.7 percent installation rate adjustment to gross savings.

**Table 22. Expected CFL Installations from PY2 Program Bulbs**

| | Installation Rate | Total Bulbs |
|---|---|---|
| PY2 Bulbs Sold | | **1,547,459** |
| PY2 Installation | 82% of Bulbs Sold | 1,268,916 |
| Remaining Bulbs After PY2 | | 278,543 |
| PY3 Installation | 55% of Remaining Bulbs After PY2 | 153,198 |
| Remaining Bulbs After PY3 | | 125,344 |
| PY4 Installation | 41% of Remaining Bulbs After PY2 | 114,202 |
| Bulbs Never Installed | | 81,826 |
| **Total Installed** | **0.99** | **1,536,317** |

[12] KEMA, Inc., The Cadmus Group Inc., Itron, Inc., PA Consulting Group, and Jai J. Mitchell Analytics. Draft Evaluation Report: Upstream Lighting Program. Prepared for the California Public Utilities Commission, Energy Division, December 10, 2009.

**Table 23. Comparison of Actual Installation Impacts to Assumed First Year Installation**

| Scenario 1, Installation Over Three Years | | | | | Scenario 2, Installation Assumed in Year One | Difference |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Total | | |
| NPV | | | | 9,026,368 | 9,277,399 | 2.71% |
| 1 | 1,268,916 | | | 1,268,916 | 1,547,459 | |
| 2 | 1,268,916 | 153,198 | | 1,422,115 | 1,547,459 | |
| 3 | 1,268,916 | 153,198 | 114,202 | 1,536,317 | 1,547,459 | |
| 4 | 1,268,916 | 153,198 | 114,202 | 1,536,317 | 1,547,459 | |
| 5 | 1,268,916 | 153,198 | 114,202 | 1,536,317 | 1,547,459 | |
| 6 | 1,268,916 | 153,198 | 114,202 | 1,536,317 | 1,547,459 | |
| 7 | 1,268,916 | 153,198 | 114,202 | 1,536,317 | 1,547,459 | |
| 8 | 1,268,916 | 153,198 | 114,202 | 1,536,317 | 1,547,459 | |
| 9 | 1,268,916 | 153,198 | 114,202 | 1,536,317 | 1,547,459 | |
| 10 | | 153,198 | 114,202 | 267,401 | 0 | |
| 11 | | | 114,202 | 114,202 | 0 | |

*Calculated at 9% discount rate.

## Leakage

Leakage is defined as CFLs sold to non-Ameren Missouri customers purchasing CFLs at program stores. To calculate program leakage, Cadmus and its subcontractor ICC/Decision Services conducted 611 customer intercept surveys in 24 stores across seven distribution channels in the Ameren Missouri territory. Customers were intercepted in participating stores after they had selected at least one light bulb to purchase (either a program or non-program bulb). As an incentive for participating, each intercept customer was offered a $5 gift card to the store where the intercepts took place, and the study consisted of taking a three to five minute survey in the store. Retail markdown stores were stratified and sampled to allow higher precision on stores assumed to be most vulnerable. Results were then weighted to calculate overall leakage.

***Sampling Plan.*** To create the intercept sampling plan, we started with a list of retailers participating in the markdown program and not the coupon program. The coupon program requires customers to identify their zip code and utility which minimizes leakage. Cadmus stratified the list of 289 participating markdown retailers by the following strata:

- Urban vs. rural –urban in the St. Louis metropolitan area and rural outside of St. Louis.
- Vulnerable vs. non-vulnerable –using Ameren Missouri customer meter accounts compared to census population estimates, we allocated stores in areas with 50 percent or less of the household population in the area being in the Ameren Missouri service territory to the vulnerable category, as well as specific locations identified by Ameren Missouri staff as being located close to other utility areas.
- Targeted vs. non-targeted – targeted stores were identified by APT as potential high CFL sellers.

- Store distribution channel – warehouse, mass merchandise, home improvement, grocery, hardware, and bargain.

Table 24 shows the number of intercepted stores according to the sample stratifications listed above. Due to the limited number of rural retail stores in the sample and challenges of retail stores allowing the intercept visits, Cadmus was only able to complete intercepts in three rural stores, all of which were Wal-Marts.

**Table 24. Stores Visited By Stratification (n = 24)**

| Leakage Vulnerability | Rural Sample Size | | Urban Sample Size | |
|---|---|---|---|---|
| | Targeted | Non-Targeted | Targeted | Non-Targeted |
| Non-Vulnerable | 0 | 0 | 7 | 1 |
| Vulnerable | 3 | 0 | 5 | 8 |

Table 25 presents the sample plan and completed surveys by store distribution channel, while

Table 26 shows the actual number of completed intercepts by store name. The team conducted the most intercepts at home improvement stores (with over 200 intercepts at Home Depot stores), grocery stores (with 180 surveys at Schnuck's and Dierberg's combined), and mass merchandise stores (with 131 surveys at Wal-Mart stores).

**Table 25. Stores Visited by Distribution Channel and Completed Surveys**

| Distribution Channel | Stores Visited | Surveys Completed |
|---|---|---|
| Home Improvement | 8 | 207 |
| Grocery | 5 | 180 |
| Mass Merch or Discount Store | 5 | 131 |
| Bargain | 4 | 39 |
| Hardware | 1 | 30 |
| Warehouse | 1 | 24 |
| **Total** | **24** | **611** |

**Table 26. Stores Visited and Completed Surveys by Store Name (n = 611)**

| Store Name | Stores Visited | Surveys Completed By Store |
|---|---|---|
| Wal-Mart | 5 | 131 |
| Home Depot | 8 | 207 |
| Family Dollar Store | 3 | 23 |
| Dierberg's | 2 | 90 |
| Schnuck's | 3 | 90 |
| Sam's Club | 1 | 24 |
| Ace Hardware | 1 | 30 |
| Dollar Tree Store | 1 | 16 |
| **Total** | **24** | **611** |

Table 27 presents the distribution of stores with and without Ameren Missouri program lighting demonstrations that occurred at the same time as the intercepts. As noted, due to difficulty in

gaining store approval for the surveys when demonstrations are not happening, we conducted the majority of the intercepts when demonstrations were taking place.

**Table 27. Demonstration Stores by Distribution Channel (n = 24)**

| Distribution Channel | Demo Store | Non-Demo Store |
|---|---|---|
| Mass Merch or Discount Store | 5 | 0 |
| Home Improvement | 6 | 2 |
| Bargain Store | 0 | 4 |
| Grocery | 5 | 0 |
| Warehouse | 1 | 0 |
| Hardware | 1 | 0 |
| **Total** | **18** | **6** |

***Weighting.*** After cleaning and preparing the raw survey data, Cadmus analysts weighted the program bulb data based on store population proportions relative to store sample proportions by distribution channel, targeted/non-targeted and vulnerability status. Walmart stores received an additional weight to account for location. The sample included three rural locations (all of which are Walmart stores) which is not an accurate representation of all rural stores in the population. To mitigate the possibility of overstating leakage from these rural Walmart stores, Cadmus analysts calculated separate urban and rural Wal-Mart weights to represent the store population. Table 28 illustrates the proportions used and the calculated weights for each store type. The population included 289 stores across seven retail distribution channels. Cadmus and ICC conducted intercepts in 24 stores across all distribution channels except specialty lighting stores. The specialty lighting stores were not included because they represent only a small proportion of program bulb sales. Since our rural sample contained only Wal-Mart stores, we only weight those types of stores by the urban and rural designation.

**Table 28. Design Weight Inputs and Calculations**

| Weighting Variable | Observation | Store Population (n = 289) | | Store Sample (n = 24) | | Weight* |
|---|---|---|---|---|---|---|
| | | Population Stores | Population Distribution | Sample Stores | Sample Distribution | |
| Leakage Risk | Non-Vulnerable | 130 | 45% | 8 | 33% | 134.95% |
| | Vulnerable | 159 | 55% | 16 | 67% | 82.53% |
| Wal-Mart | Rural | 12 | 36 | 3 | 60% | 60.61% |
| | Urban | 21 | 64 | 2 | 40% | 159.09% |
| Distribution Channel | Bargain | 70 | 25% | 4 | 17% | 150.00% |
| | Grocery | 75 | 27% | 5 | 21% | 128.57% |
| | Hardware | 35 | 12% | 1 | 4% | 300.00% |
| | Home Improvement | 53 | 19% | 8 | 33% | 56.79% |
| | Mass Merch / Discount Store | 36 | 13% | 5 | 21% | 61.71% |
| | Warehouse | 11 | 3.9% | 1 | 4.2% | 94.29% |
| | Specialty Lighting** | 9 | 3% | - | | - |

* We calculated each weight as the population proportion divided by the sample proportion.
** The intercept store sample did not include specialty lighting stores. To account for specialty lighting store population distribution, analysts redistributed the specialty lighting store weight to the other distribution channels.

We applied all weights applicable to a specific store; for instance, a program CFL purchased in a vulnerable, urban grocery store received a weight of 0.8253 x 1[13] x 1.2857 = 1.0588.

***Results.*** CFL leakage in mass merchandise rural store locations is expected to be higher than in urban locations because rural store locations typically serve larger geographic areas. There are usually fewer store locations in rural areas, and these stores may attract customers from other cities, states, and utility service areas. In urban areas, however; stores like Wal-Mart are more prevalent and may primarily serve small neighborhoods or other housing developments. In many cases, urban customers may not have to travel very far to shop at these types of stores. In rural locations, there may only be one or two big-box retailers within a given area. Fewer big-box retailers may attract customers from various locations and longer distances.

CFL leakage at vulnerable stores is also expected to be higher than at non-vulnerable stores. By definition, analysts suspect higher program bulb leakage since these stores may be closer to state lines, bridge crossings to other states, or within zip codes with higher percentages of non-Ameren Missouri electric meters (households).

CFL leakage at implementer demonstration stores may be higher than leakage at non-demonstration stores, because these atypical in-store events naturally pique customer interest and may potentially influence purchasing decisions.

During the intercept surveys, the interviewers first asked customers what types of lighting products they intended to purchase when entering the store. Table 29 shows that 40 percent of lighting customers intended to purchase incandescent light bulbs. Thirty-six percent intended to purchase CFLs only, and four percent intended to purchase a combination of CFLs and non-CFLs. The remaining customers intended to purchase halogens and other non-CFLs. Eight percent did not decide what types of lighting products they intended to buy prior to visiting the store. The customers who intended to purchase only CFLs purchased roughly 66 percent of the 1,303 Ameren Missouri program bulbs identified during the intercepts. We do not believe this estimate suggests evidence of freeridership since there is not enough information to know whether the customers' intention to purchase CFLs was due to earlier program exposure.

**Table 29. Customer Intent to Purchase Lighting Products (n = 611)**

| Intent to Purchase | Customers | Percent of Total Customers |
|---|---|---|
| CFLs only | 223 | 36% |
| CFLs + other bulbs | 23 | 4% |
| Incandescent | 247 | 40% |
| Halogens | 29 | 5% |
| Other non-CFL | 39 | 6% |
| None | 4 | 1% |
| Don't Know | 46 | 8% |
| **Total** | **611** | **100%** |

[13] All non-Wal-Mart stores received a weight of 1 for the Wal-Mart rural/urban weight. This was used as a placeholder when calculating the final weight but multiplying by 1 has no effect on the final weight.

As can be seen in Table 30, 29 percent of customers who initially intended to purchase only non-CFLs ultimately purchased 27 percent of weighted program CFLs. A number of factors may explain this conversion to CFLs from non-CFLs, including the influence of the Ameren Missouri program, the incentive to participate in the intercept surveys, or the in-store implementer demonstrations. Customers who intended to purchase either CFLs only or CFLs and other bulbs purchased 78 percent of the weighted program CFLs.

**Table 30. Actual Program CFL Purchases by Initial Intent**

| Purchase Category | Initial Intent to Purchase | Percent of Customers | Weighted Percent of Program CFLs Purchased | Weighted Percent of Bulbs by Purchase Category |
|---|---|---|---|---|
| CFLs | CFLs Only | 65% | 70% | 78% |
| | CFLs and other bulbs | 7% | 8% | |
| Non-CFLs | Incandescent bulbs | 9% | 7% | 27% |
| | Halogen bulbs | 2% | 1% | |
| | Other Non-CFLs | 6% | 5% | |
| | None/Don't Know | 12% | 14% | |
| **Totals** | | **308** | **1,103.63** | |

When asked about program knowledge, the majority of survey respondents did not have prior knowledge of Ameren Missouri's CFL program. Since a significant portion of program marketing occurs at the point of purchase through signs advertising the discounts, it is expected that most consumers do not have prior knowledge of the program. Also, customers influenced by the program may not recall the program being sponsored by Ameren Missouri. See Figures 10 through 12 for pictures of the promotional displays at the stores. The 8 percent (48 respondents) who did have prior knowledge of the program included 47 Ameren Missouri customers and one customer from Kansas City Power & Light (shown in Table 31). These customers purchased 10.5 percent of weighted program CFLs.

**Table 31. Customer Awareness of Ameren Missouri CFL Program (n = 611)**

| Actual Purchases | Customers | Percent of Total Customers |
|---|---|---|
| Customers Aware of Program | 48 | 8% |
| Customers Not Aware of Program | 563 | 92% |
| **Total** | **611** | **100%** |

The team reviewed lighting products in each survey respondents' shopping cart to determine actual lighting purchases. Just under half of respondents purchased CFLs only, 44 percent purchased non-CFLs only, and nine percent purchased both CFLs and non-CFLs. Customers purchasing only CFLs accounted for 86 percent of the weighted program CFLs.

The team also asked respondents to indicate where they intended to install the CFLs they purchased. Customers planned to install 97 percent of weighted program CFLs in residential applications, the remaining three percent were to be installed in non-residential locations within Ameren Missouri territory. Of the residential purchases, 91.3 percent were intended to be installed in homes serviced by Ameren Missouri and the remaining 8.7 percent outside the area.

On a total program CFL-based level, weighted[14] CFL leakage is 8.7 percent. We used the following equation to calculate program CFL leakage:

$$Leakage = \left[1 - \left(\frac{\sum Program\ CFLs\ Sold\ to\ Ameren\ Missouri\ Customers}{\sum Program\ CFLs\ Sold}\right)\right] \times 100$$

Table 32 shows the inputs we used in this calculation.

**Table 32. Weighted Bulb-Based CFL Leakage Inputs and Calculations**

| Weighted Program CFLs Purchased By AUE Customers [A] | Weighted Total Program CFLs Sold [B] | Leakage [1 – (A/B)] |
|---|---|---|
| 1,007.72 | 1,103.63 | 8.7% |

Analysts also estimated leakage based on general store location, vulnerability, and program demonstrations coinciding with intercept surveys. These results are included in Appendix C.

## Total Gross Energy Savings

We calculated total realized gross energy savings using the following formula:

$$Per\ unit\ energy\ savings\ x\ bulbs\ sold\ x\ (1 - leakage\ rate)x\ (1 - installation\ rate\ adjustment).$$

As discussed above, approximately 8.7 percent of program bulbs sold were installed outside of Ameren Missouri's service territory, and all of these were intended to be installed in residential homes. Further, the intercept surveys indicated that approximately three percent of the program purchased upstream markdown CFLs were installed in non-residential facilities. Our installation rate adjustment accounting for bulbs initially put in storage is 2.71 percent. Demand savings were similarly calculated.

Table 33 shows the results for the upstream program. Leakage rates for bulbs purchased using coupons are assumed to be zero, since purchasers are required to provide their zip code and the name of their utility.

**Table 33. PY2 Upstream Gross *Ex Ante* and *Ex Post* CFL Savings**

| Type | Number Sold** | *Ex Post* Per Unit Gross Energy Savings | *Ex Post* Per Unit Gross Demand Reduction | *Ex Ante* Gross Program Energy Savings (MWh) | *Ex Post* Gross Program Energy Saving(MWh)* | *Ex Post* Gross Program Demand Reduction (kW) | Realization Rate |
|---|---|---|---|---|---|---|---|
| Residential | 1,496,118 | 48.4 | 0.0075 | 54,593 | 64,366 | 9,967 | 1.18 |
| Non-Residential | 46,272 | 166.4 | 0.054 | 1,688 | 7,493 | 2,431 | 4.44 |
| Coupons | 5,069 | 48.4 | 0.0075 | 185.0 | 239 | 36.99 | 1.29 |
| **Total** | **1,547,459** | | | **56,467** | **72,097** | **12,435** | **1.28** |

* Ex Post Gross Savings= Number Sold X Ex Post Per Unit Energy Savings X (1-leakage) X (installation rate)

** On-line purchases are assumed to be allocated among residential and non-residential similar to the store markdowns

[14] All leakage calculations are weighted by the design weights shown in Table 28.

Table 34 shows the results for the upstream program split by rural and urban areas of Ameren Missouri service territory.

**Table 34. Upstream Program Results by Rural and Urban Areas**

| Product | Total Program Sales* | *Installation Rate* | *Leakage Rate* | *Total Ex Post Gross Energy Savings (MWh)* | *Total Ex Post Gross Demand Savings (kW)* | NTG Ratio | Net Energy Savings* (MWh) | Net Demand Savings* (kW) |
|---|---|---|---|---|---|---|---|---|
| Urban | 1,402,367 | 0.9729 | 0.034 | 63,868 | 9,890 | 0.96 | 61,313 | 9,494 |
| Rural | 144,231 | 0.9729 | 0.403 | 4,057 | 628 | 0.96 | 3,895 | 603 |
| **Total-PY2** | **1,546,598** | **0.9729** | **0.087** | **67,925** | **10,518** | | **68,998** | **10,097** |

*** Excludes on-line and SMD bulbs.**

## Fixtures

We determined gross savings for lighting fixtures based on the following inputs:

- Average per-unit energy and demand savings, and
- Number of product sales.

Cadmus assumed the installation rate to be 100 percent, leakage to be zero, and that all fixtures are installed in residential homes. Table 35 shows *ex ante* and *ex post* savings for lighting fixtures.

**Table 35. PY2 Gross *Ex Ante* and *Ex Post* Lighting Fixture Savings**

| Number Sold | *E x Post* Gross Per Unit Energy Savings (kWh) | *Ex Post* Gross Per Unit Demand Savings (kW) | *Ex Ante* Gross Energy Saved (MWh) | Ex Post Gross Energy Saved (MWh) | Ex Post Gross Demand Saved (kW) | Realization Rate |
|---|---|---|---|---|---|---|
| 591 | 124 | .014 | 52.9 | 73.3 | 8.3 | 1.385 |

## Appliances

We determined gross savings for appliances based on the following inputs:

- Average per-unit energy and demand savings, and
- Number of product sales.

Table 36 illustrates the results for each of the appliances.

**Table 36. Gross Energy and Demand Savings for Appliances**

| Appliance | Number Sold | *Ex Ante* Gross Per Unit Energy Savings (kWh) | *Ex Ante* Gross Energy Saved (MWh) | Realized Gross Per Unit Energy Savings (kWh) | Gross Per Unit Demand Savings (kW) | *Ex Post* Gross Energy Saved (MWh) | *Ex Post* Gross Demand Saved (kW) | Realization Rate |
|---|---|---|---|---|---|---|---|---|
| Freezers | 490 | 247.1 | 121.1 | 61 | 0.004 | 29.9 | 1.96 | 0.25 |
| Room AC | 3,853 | 95.7 | 368.7 | 115 | 0.06 | 443.1 | 231.18 | 1.20 |
| Dehumidifier | 3,545 | 249.8 | 885.5 | 213 | 0.08 | 755 | 283.6 | 0.85 |
| **Total** | **7,888** | | **1,375** | | | **1,228** | **516.74** | **0.89** |

# Determination of Net Savings

## Lighting - Upstream

Cadmus' lighting NTG analysis utilizes a multistate regression model. The multistate modeling effort relies on data from telephone and on-site surveys, conducted in areas with longstanding compact fluorescent lamp (CFL) programs, newer or smaller programs, and no CFL programs, through June 2010. Site visit data were collected from1,533 households across 15 different areas. The primary purpose of the effort was to produce NTG ratios for the ten CFL programs taking part in the effort.

The evaluation team of The NMR Group Inc. (NMR) and The Cadmus Group (Cadmus) chose a zero-inflated negative binomial (ZINB) model for predicting CFL purchases.

Appendix E provides more detail about the model and a discussion of three alternative scenarios; however, numerous models, testing a large number of plausible independent variables, were analyzed for goodness of fit. The final base case predicts that:

1) Households with higher education levels have a greater probability of purchasing any CFLs.
2) Households who received a previous on-site survey (in New York and Houston) were also more likely to purchase CFLs.
3) Households with a greater CFL saturation at the beginning of 2010 were less likely to buy any CFLs.
4) Those who do like to experiment with new technology were more likely to buy at least one CFL.

Other factors influencing the number of CFLs purchased included:

1) Whether or not participants own their own homes (with owners showing propensity to purchase a greater number of CFLs in 2010).
2) The larger the participant's home the more CFLs he or she purchased in 2010.

3) Even though they were less likely to have zero purchases overall, participants who responded that they do like to experiment with the latest technology (measured on a four-point scale ranging from strongly agree to strongly disagree) purchased fewer CFLs in 2010 than those who responded that they do not seek the latest technology.

4) Households with a higher saturation of CFLs at the beginning of 2010 also were likely to buy fewer CFLs.

5) Those in areas with longer running programs were less likely to buy more CFLs.

6) Households who purchased CFLs at big box stores were more likely to buy more CFLs.

7) Finally, households visited in both 2009 and 2010 purchased fewer CFLs in 2010 than households visited only in 2010. Also, those areas where site inspectors did not require residents to guess their purchase period when they responded "don't know" to the question of "was the bulb purchased in the first half of 2010, the last half of 2009, first half of 2009, or 2008 and earlier" were likely to have lower CFL purchases. This could be because those asked to "guess" when bulbs were purchased, tended to guess more recently (a common memory bias); those allowed to "not know" were eliminated from the model if greater than 25 percent were unknown, and set to zero for unknown bulbs if the unknowns were less than 25 percent.

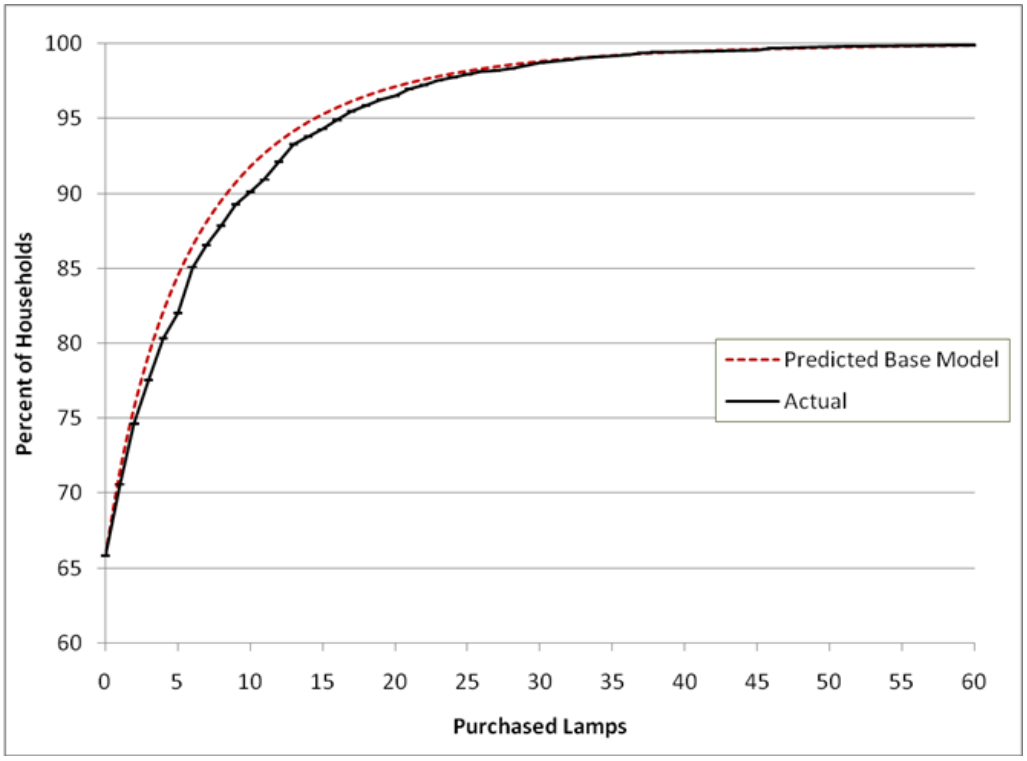
Various model specifications were tested, and quality of fit was evaluated through a variety of techniques:

- Maximum likelihood $R^2$ of the model;[15]
- Predicted compared to actual values for purchases (P/A) in the program scenario; and
- The probability of significance test for each variable.

We also looked at the coefficient sign and variables to make sure they made logical sense. Figure 8 compares the CFL purchase distributions from the predicted base model to actual reported site visit results; these represent the distribution of purchases across all 15 areas.

[15] Because the ZINB is a nonlinear model, the maximum likelihood $R^2$ is not directly comparable with those reported for ordinary least squares—regular—regression models. It is normal to have lower $R^2$ for nonlinear models.

**Figure 8. Predicted vs. Actual CFL Purchase Distributions**




The following equation was used to estimate the NTG ratios for each program service territory. The model *predicted* each Ameren Missouri household purchased an average 2.54 CFLs in the first half of 2010. The model also predicted that these households would have purchased 2.045 CFLs had the program not existed. Subtracting the without-program estimates from the predicted program scenario yields an estimated "lift" in CFL purchases of 0.499 CFLs per household. Dividing the net program purchase estimates by the 0.52 incented CFLs[16] per household yields a NTG of 0.96.

$$NTG = \frac{Predicted\ CFL\ Purchased\ with\ Pgm - Predicted\ CFL\ Purchased\ without\ Pgm}{Average\ Number\ of\ Incented\ CFL\ per\ Household}$$

$$Ameren\ Missouri\ NTG = \frac{2.544 - 2.045}{0.52} = 0.96$$

## Fixtures

As ENERGY STAR lighting fixtures are newer to market and even with the program promotion tend to have low market shares,[17] an NTG of 1.0 is assumed for this measure.

[16] Calculated from the program tracking database.

[17] New York ENERGY STAR® Products and Marketing Program, Market Characterization, Market Assessment, and Market Causality Evaluation, Final Report for New York State Energy Research and Development Authority. Quantec LLC and Summit Blue Consulting, May 2006.

## Appliances

Cadmus used self-reported freeridership information from the participant survey to estimate measure-specific NTG ratios. This method of estimating net savings, while inappropriate for the lighting component of the program(due to the fact that lighting participants may be unaware of a program), is the industry standard for appliance rebate programs. The self-reported method does not, however, account for any market effects the program may have, as it does not quantify spillover or consider that the program influences retail store stocking to include more energy efficient appliances in retail stores. In order to account for the market transformation activities that this program includes, Cadmus created a customized analysis matrix to score each participant's freeridership.

The survey asked participants a battery of five questions to assess freeridership:

- F2. Before you knew about the rebate, were you already planning to purchase a new [MEASURE NAME]?
- F3. If the rebate had not been available, would you still have purchased the exact same make and model of [MEASURE NAME] for your home?
- F4. Without the rebate, would the [MEASURE NAME] have had the same level of efficiency, be more efficient, or less efficient?
- F5. And without the rebate, would you have purchased the [MEASURE NAME] at the same time, later [specify when], or not at all?

While these questions imply that anyone responding "yes" to all of these questions is a "free-rider", it doesn't account for the influence of the rebate advertising, prominently displayed on the store's display shelves and influence of the program in the mix of products stocked by retailers.

Additional adjustments were made based on participant responses to the open-ended question:

- C3. Please think back to the time when you were deciding to buy the energy saving [MEASURE NAME]. What factors motivated you to purchase the [MEASURE NAME]?

The freeridership scoring analysis began with development of a score for each participating customer based on his or her individual responses to the specific battery of FR questions.[18]. Each participant's freerider score was derived by translating responses into a matrix value and then using a rules-based calculation to obtain the value. The complete set of participant responses rarely reflect each potential matrix combination but tend to group around a subset of common patterns. The freeridership decision tree shown in **Error! Reference source not found.** epresents the rules-based approach used in the Ameren Missouri appliance freeridership scoring matrix.

[18] Khawaja, S. The NAPEE Handbook on DSM Evaluation, 2007 edition, page 5-10

**Figure 9. PY2 Appliance Rebate Freeridership Decision Tree**

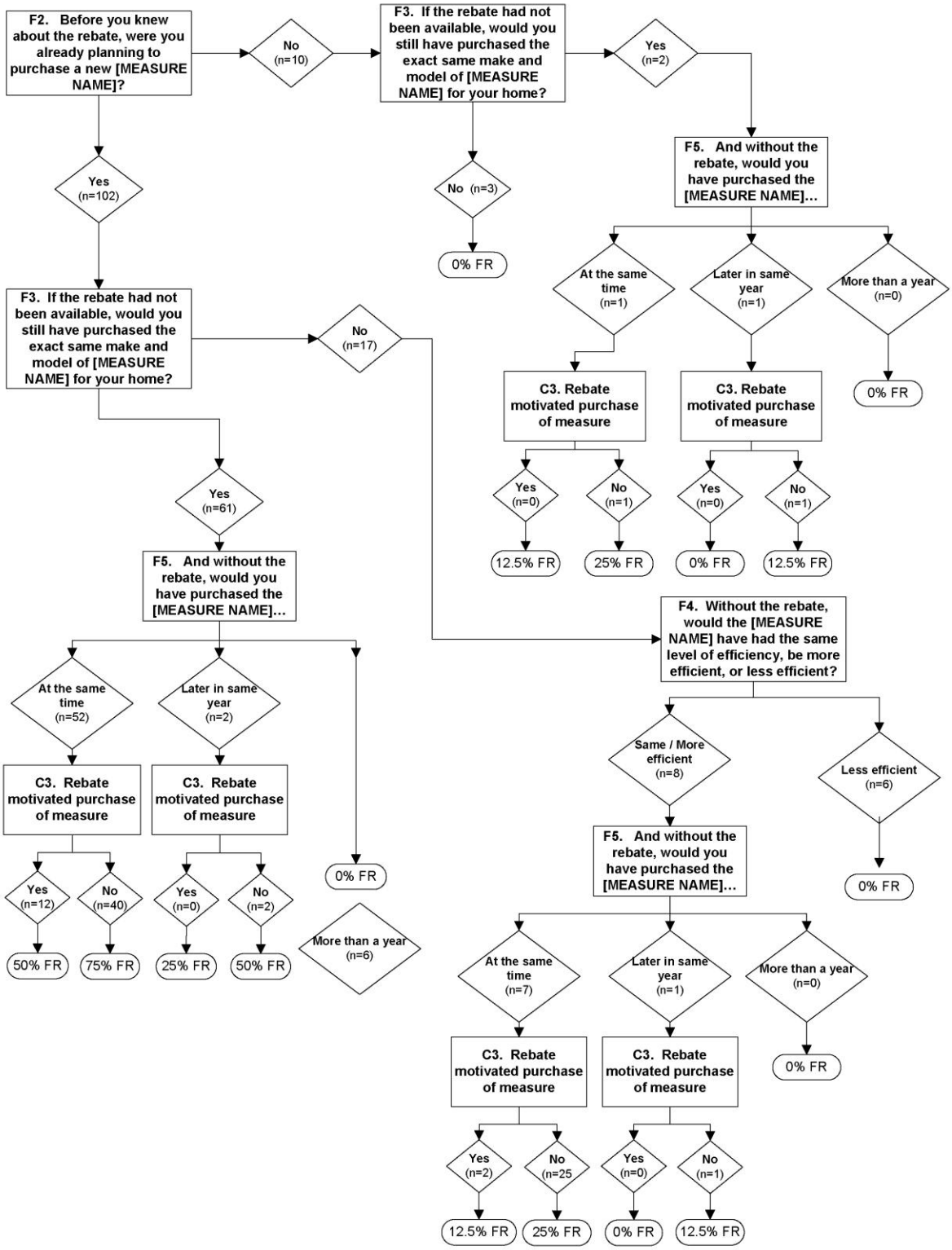


**Table 37. PY2 Appliance Freeridership**

| Stream | FR | N | Precision |
|---|---|---|---|
| Dehumidifier | 0.48 | 34 | ± .170 @ 90% C.I. |
| Freezer | 0.42 | 41 | ± .167 @ 90% C.I. |
| Room AC | 0.38 | 38 | ± .224 @ 90% C.I. |
| **Total-PY2** | **0.42** | **113** | **± .107 @ 90% C.I.** |

One key permutation influencing the freeridership calculations significantly was the group of 41 respondents that answered *"Yes"* to *F2*, *"Yes"* to F3, skipped for F4, and *"At the Same"* time for *F5*. These respondents were initially scored as 75 percent freeriders. Essentially these respondents said that without the Ameren Missouri rebate, they would have installed the same equipment to the same level of efficiency and at the same time. Rather than score these respondents as 100 percent freeriders, Cadmus allowed for the fact that the program has influenced stocking and the POP materials were in view as they were shopping for products.

The additional open-ended question asking about influential factors counterbalanced the freeridership indicated by the responses to the questions above. As shown in the decision tree, freeridership scores were adjusted downward for participants who directly stated that the rebate motivated them to purchase the energy-efficient appliance.

**Table 38. PY2 Appliance Overall Freeridership Distribution**

| Freeridership % | 0% | 12.5% | 25% | 50% | 75% | Total |
|---|---|---|---|---|---|---|
| # of Respondents | 21 | 10 | 18 | 23 | 41 | 113 |

This analysis shows levels of freeridership consistent with data compiled by D&R International that tracks regional ENERGY STAR market shares. According to D&R International, ENERGY STAR room air conditioners account for approximately 38 percent of all room air conditioners sold in Missouri in 2009, which is the same as the freeridership estimated by the survey.[19] This study did not examine the regional values for freezers or dehumidifiers.

## Impact Evaluation Summary

A summary of PY2 per-unit gross energy savings, along with program participation and total program gross and net energy (kWh) and demand (kW)savings, is provided in Table 39.

[19] http://www.energystar.gov/ia/partners/manuf_res/2009FinalSalesData.xls

**Table 39. PY2 Evaluated Participation, Gross and Net Savings**

| Product | Total Program Sales | *Ex Post* Energy Savings (MWh) | *Ex Post* Demand Savings (kW) | NTG Ratio* | Net Energy Savings (MWh) | Net Demand Saving* (kW) |
|---|---|---|---|---|---|---|
| Upstream CFLs | 1,547,459 | 72,097 | 12,435 | 0.96 | 69,214 | 11,938 |
| Fixtures | 591 | 73.3 | 8.3 | 1 | 73.3 | 8.3 |
| Room Air Conditioner | 3,853 | 443.1 | 231.18 | 0.62 | 274.7 | 143.3 |
| Dehumidifier | 3,545 | 347 | 283.6 | 0.52 | 180.4 | 147.5 |
| Freezers | 490 | 29.9 | 2.0 | 0.58 | 17.3 | 1.1 |
| Total-PY2 | | **72,991** | **12,960** | **0.96** | **69,759** | **12,238** |

* Appliance NTG estimates are based on free-ridership only.

Table 40 compares overall results to program goals for the year. Ameren Missouri is ahead of its cumulative PY2 savings goals, compensating for lower than planned results in PY1.

**Table 40. PY2 Sales and Participation Targets and Results**

| ENERGY STAR Lighting or Appliance Type | Program Targets | Results |
|---|---|---|
| CFLs | 1,177,537 | 1,547,459 |
| Dehumidifiers | 1,500 | 3,545 |
| Freezers | 2,600 | 490 |
| Room Air Conditioner | 8,000 | 3,853 |
| CFL Fixtures | 2,500 | 591 |
| **Total Net Energy Saving (kWh)** | **64,928** | **69,759** |
| **Total Net Peak Demand Savings (kW)** | **5,600** | **12,238** |

# 5. Process Evaluation

Informing the process evaluation are the stakeholder interviews, retailer interviews, appliance participant surveys, and the social distribution surveys.

## Stakeholder Interview Findings

The stakeholder interviews revealed detailed information about program processes and progress. Stakeholders reported that they were pleased with the program's second year, and that PY2 ran very smoothly. This section reports the findings from all stakeholder interviews.

### Program Design and Administration

APT's program design for PY2 shifted the focus away from marketing and manufacturer buy downs, and instead focused on markdown relationships with manufacturers and retailers. APT leveraged existing corporate relationships to expand retailer participation—in particular to large big-box chain stores such as Home Depot and Costco, and scaled up field activity in participating stores. Additionally, the online store was put in place.

The appliance component also expanded in PY2. Again, the focus was shifted away from cooperative advertising, and mail-in rebates were put in place for customers. APT also performed retailer education, placed rebate forms and in-store advertisements, and initiated relationships with appliance retailers.

Program administration also changed: Ameren Missouri addeda new program manager of residential energy efficiency at the same time it transitioned to the new program design. The new program manager was involved in hiring and contracting with APT and the existing program manager stayed involved at a higher level. This level of early involvement likely contributed to the smooth transition from one implementer to the other.

### Implementation and Delivery

Ameren Missouri staff perceived APT's approach to program implementation and delivery more favorably than the PY1 implementation strategy. Program staff expressed high satisfaction with all aspects of APT's implementation, including recordkeeping and data management, interactions with participant retailers, budgeting and invoicing, and the quality of in-store POP materials, and all stakeholders felt the program design was executed according to plan. APT focused its field representatives on helping PY1 participating retailers transition from receiving manufacturer buydowns (where bulbs were reserved and purchased in advance)to the simpler mark down approach, where manufacturers receive the incentives and offer lower upfront prices on lighting products to retailers.

### Lighting

The retail markdown component is the program's largest generator of energy savings. During PY2, APT expanded the program into many large retailers including big-box stores, which greatly increased program sales. Program staff reported that this expansion was largely attributable to APT's existing corporate relationships with many of the large retailers. Because APT has administered similar CFL programs for a number of utilities around the country, they

were able to leverage their relationships with national chain retailers for the Ameren Missouri program.

Another improvement that aided in expanding the program was the introduction of three-party Memoranda of Understandings (MOUs) with retailers. These agreements laid out the terms of the program and the processes for participation, and reportedly made it easier for retailers to participate. Improved tracking, invoicing, and payment processes, as well as increased presence in retail stores, also contributed to creating an easy participation experience for retailers. Ameren Missouri staff noted that the new systems have reduced the amount of paperwork required of participant retailers.

Retailers with electronic POS data collection are able to use this capability to report program sales to APT. However, a coupon system is also available for smaller retailers without POS data collection capabilities. Small retailers have coupons in the store, which Ameren Missouri customers can use to receive an instant discount on CFLs. The coupons are then returned to the implementer with an invoice for the associated markdown rebate. This system was introduced in PY1, but stakeholders reported that APT streamlined the process, making it simpler for retailers to participate using coupons.

## Appliances

While some cooperative advertising was conducted in PY1 to promote ENERGY STAR appliances, only 114 appliances were sold as a result of the program. PY2 saw the introduction of customer incentives in the form of mail-in rebates, and this drove an increase in sales volume. This component is also implemented through relationships with retailers. The APT field representatives went to retail stores and hung rebate forms on appliances, and also conducted training of store personnel. This interactive method aims to promote market transformation at the retail level by encouraging retailers to stock and promote efficient appliances. Appliance rebates are processed and paid by EFI.

## Products

The range of products offered through the program is limited by the original tariff filed during PY1. The tariff listed eligible measures, some of which are no longer being promoted through the program. Ameren Missouri staff reported that although they considered filing a revised tariff to allow for additional measures, some staff members felt that this would be too time-consuming to be worthwhile given the short implementation period.

Instead, program staff picked the measures from the tariff that were most cost-effective and made the most sense for the Ameren Missouri market, and focused the program on those measures. For example, the tariff lists dishwashers as an eligible measure, but dishwasher rebates do not tend to be cost-effective, so Ameren Missouri opted not to include them in their rebate offerings. The same applies to lighting products – although fixtures and ceiling fans are included in the tariff, they comprise only a small portion of the program because they are not as prevalent in the market as other lighting products.

Despite the limitations of the tariff, Ameren Missouri staff reported satisfaction with the range of products offered. Expansions to the rebated appliances are planned for PY3, and additional lighting products may be included in future program years. Given the cost-effective appliance opportunities, program stakeholders believe that PY2 offerings were sufficient. Two additional

measures have been added for PY3, water coolers and air purifiers. As noted by one stakeholder, "*having five products on top of lighting is a nice suite of measures to offer*."

## General Marketing

The lighting and appliance program made major gains in saturation during PY2. Rather than focusing on media advertising, Ameren's PY2 approach focused on in-store advertising, with an emphasis on eye-catching POP materials, and product placement in prominent locations such as end-caps. Program staff remarked that a customer "*can't walk into a store without seeing program materials*," and that expansion into more retail channels also increased awareness among area retailers. Examples of POP marketing are shown below**Error! Reference source ot found.**. Ameren Missouri also sponsored store education events where APT field staff set up a table in the store and talked directly to customers about CFLs.

**Figure 10. Example of In-Store CFL Signage**


**Figure 11. Example of POP Appliance Rebate Marketing**

**Figure 12. Example of CFL Demonstration and Signage**


## Marketing to Retailers

As noted, retailer recruitment is conducted by APT and relies largely on the strong corporate relationships that the implementer has with many large retailers. The retailers who joined the program in its first year were transitioned into the new program, and additional new stores were added to the program. The most notable change was the addition of a few major big-box retailers.

In addition to recruitment, APT maintains strong relationships with its retail participants. Field representatives are assigned to retail stores and build professional relationships with store managers, conducting weekly, bi-weekly, or monthly visits to each store. This personal point of contact reportedly helps keep the retailers satisfied with the program, and also benefits the program by gaining the trust and support of the store managers. Ameren Missouri program staff reported that while monitoring ride-alongs with field representatives, they observed that store managers were familiar with the field representatives and seemed to have a strong relationship with the program.

## Marketing to Customers

Program staff reported that APT has seven field representatives, and each of them perform at least one retail in-store lighting demonstration per month. These demonstrations reinforce retailer education and increase the program's visibility to customers. The in-store marketing also includes POP displays and materials that clearly demonstrate Ameren Missouri's role in sponsoring the discounted lighting products, as well as product placement in prominent store locations such as ends of display aisles.

In addition to in-store marketing, Ameren Missouri advertises the program in their annual Personal Energy Report, which is sent to 900,000 customers every year. The program also gets promoted through the Ameren Missouri website and through emails to customers that have signed up for e-billing. Although no television or newspaper advertising promotes the program,

press releases are sent out for every major program event, and a local green reporter has highlighted Ameren Missouri's energy-efficiency programs in a number of TV news features.

Cooperative advertising, which was a major feature of PY1 implementation, was very limited in PY2. Ameren Missouri staff reported that the budget for cooperative advertising was greatly reduced, because of the desire to focus on markdowns and rebates.

## Data, Communication, and Reporting

APT's data tracking system is quite sophisticated, linking into the capabilities of larger retailers that use electronic POS systems, while also incorporating data from small retailers using the coupon system. These data are processed into monthly reports to Ameren Missouri, and program staff reported that APT has comprehensive data reporting. In addition to the monthly report, APT holds weekly meetings with Ameren Missouri program and implementation staff to discuss program status and needs. Additionally, Ameren Missouri staff members reportedly communicate with APT by phone or email about four to five times per day on average. There seems to be open communication regarding program design, strategy, and day-to-day processes and implementation decisions.

## Payments and Invoicing

EFI administers all payments to both residential customers (for appliance rebates) and retailers (for markdown and coupon incentives). These rebates are paid from a pre-paid account held by Ameren Missouri, which according to the program staff is a somewhat novel process for implementers at Ameren Missouri. This process has worked well, and allows for advance planning of payments. Rather than submitting an invoice, EFI submits a reconciliation that documents any differences between planned and actual rebate payments. Separately, APT submits invoices to Ameren Missouri for administrative costs, and these are paid from a different account.

Program staff reported that since the PY2 sales goals were higher to compensate for lower results in PY1, budget limitations have not yet been an issue. However, when funding availability shifts, APT is able to reduce or increase spending as needed. For example, when limited funds were available for lighting rebates, APT shut off the supply of 60W equivalent bulbs in some stores to reduce rebate costs temporarily. Then when funding became available again, those bulbs were restocked.

## Achievements, Challenges, and Changes

Program staff is proud of the successful transition to the new program design. Staff reported that the transition to subcontract implementation tasks to APT was smooth and that APT was diligent about collecting information to determine appropriate changes. The program staff was extremely happy with the processes and results of PY2, and one staff member noted that their job had become much more fun in the process. Staff reported on the excellent communication among the implementation team, and their very high opinion of APT's ability to implement the program effectively.

While there were no reports of major program shortcomings, stakeholders mentioned that the coincident timing of Ameren Missouri changing its brand name from AmerenUE was challenging because it required a complete overhaul of all POP materials. However, one

stakeholder noted that the change enabled them to create a "*new look*" and get more attention with the new in-store advertising materials. This transition also contributed to the shift away from cooperative advertising, because it was difficult to produce timely advertising with the correct branding. Despite the challenge, staff reported that they successfully made the change to the new brand, and that APT was instrumental in implementing those changes.

### Future Trends

Stakeholders plan to expand the program even more in PY3, signing on more retailers and increasing the diversity of retailers involved. PY3 will be responsible for achieving nearly half of the three-year savings target in just one year. Program staff hopes that the high sales volume continues in the next program year. The program has added new appliance rebates in PY3 for air purifiers and water coolers.

One of the changes that program staff seemed enthusiastic about was the effort to expand in urban areas, and in more grocery and drugstores. This effort, in concert with the SMD program, would help make CFLs available to low-income and urban customers. Another part of that effort is the push to offer multipacks of bulbs at dollar stores and discount stores. Multipacks allow for a lower per-bulb price to the customer, and staff hopes this would help make CFLs competitive with incandescent bulbs in low-income markets.

With the upcoming introduction of Energy Independence and Security Act (EISA) regulations, which will eliminate certain types of incandescent bulbs from the market, program staff is looking into ways to alter the program for future implementation years. For example, LED bulbs are being discussed as a potential core program offering in future years.

## Retailer Interviews

### Lighting

Telephone interviews with upstream market actors such as retailers provide key insight into the program and also identify how the program affected the target market. Cadmus interviewed 64 participating lighting retailers across six retail distribution channels. Table 41 presents these results by retail distribution channel.

**Table 41. Interviews Completed by Retail Distribution Channel (n = 64)**

| Distribution Channel | Stores | Percent of Total |
|---|---|---|
| Bargain | 12 | 19% |
| Grocery | 7 | 11% |
| Hardware | 1 | 2% |
| Home Improvement | 17 | 27% |
| Mass Merchandise | 17 | 27% |
| Warehouse | 10 | 16% |
| **Totals** | **64** | **100%** |

## Reasons for Participating in the Ameren Missouri Lighting Program

All respondents discussed their primary reason for participating in the Ameren Missouri lighting program. Corporate-level decision-making was the most cited reason for program participation, as reported by 34 percent of participating retailers. Twenty-two percent also said that the opportunity to save customers money was a key reason for participating in the program. One of these respondents said:

> *"We wanted to participate in the program because we knew it would be a good deal for our customers."*

Another 14 percent indicated that they want to encourage/promote energy savings, and 9 percent said that they participate in the program in order to expose customers to CFLs. Two respondents said the following regarding energy savings and introducing customers to CFLs:

> *"To save energy, help customers by reducing the price of CFLs, and transitioning them towards CFL bulbs."*

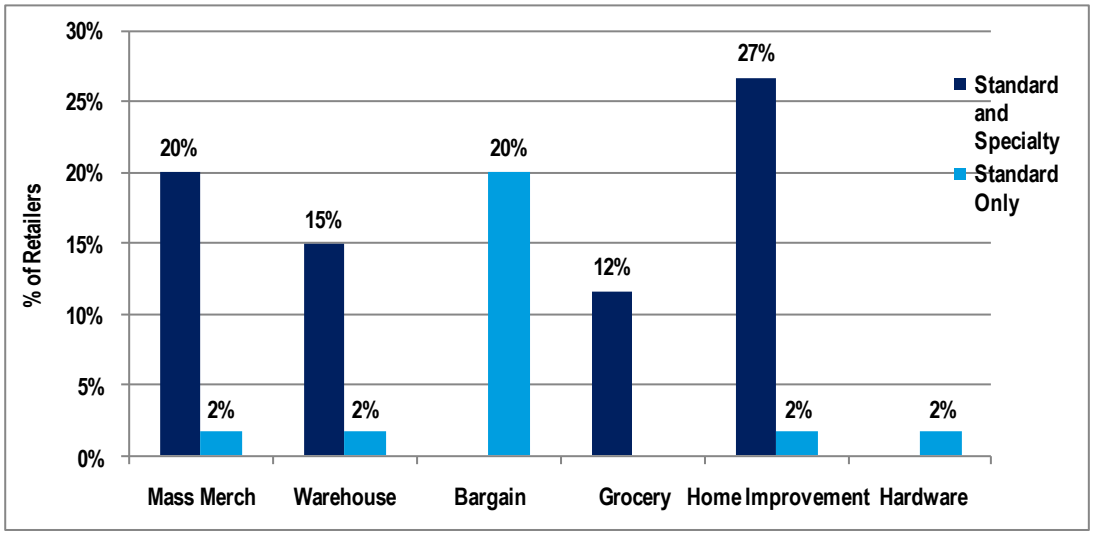
> *"To convert people to the newer energy-saving bulbs."*

Some retailers also discussed that they want to expose customers to CFLs because incandescent bulbs and other inefficient lighting products will be slowly phased out beginning in 2012 per EISA legislation.

## Retailer Stocking Patterns

Lighting retailers were asked to describe their stocking practices for standard and specialty ENERGY STAR CFLs. Just under three-fourths of retailers stock both standard and specialty CFLs that are sponsored by the Ameren Missouri program. As shown in Figure 13, most home improvement stores and mass merchandise stores stock both types of CFLs. The bargain stores interviewed in this study stock only standard program-sponsored CFLs.

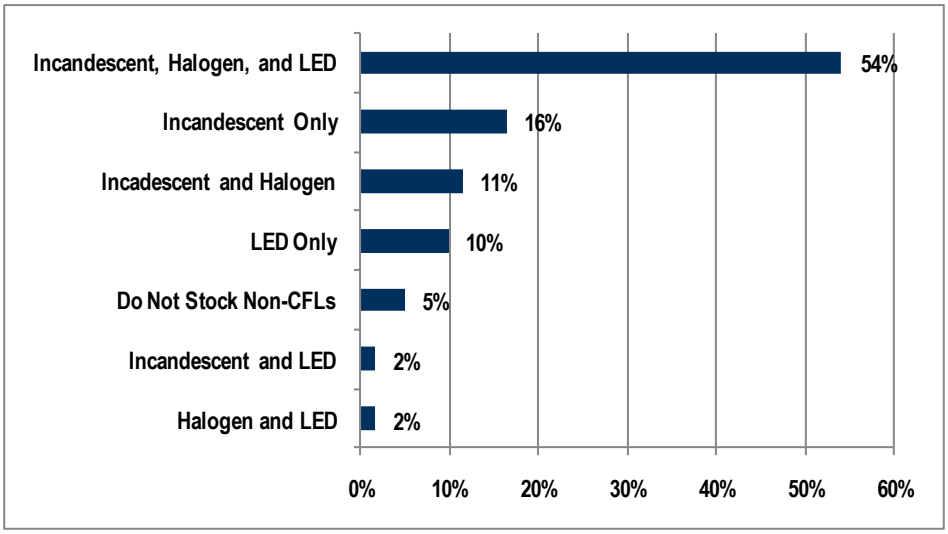
**Figure 13. CFL Stocking Patterns of Program-Sponsored Bulbs (n = 60)**




Retailers also discussed their stocking patterns for non-sponsored CFLs. Interestingly, 27 percent of participating retailers do not stock non-sponsored CFLs. These include three bargain stores, three grocery stores, two home improvement stores, and eight warehouse retailers. About half of participating retailers stock non-sponsored standard and specialty CFLs.

Non-CFL stocking practices vary across retailers and distribution channels as shown below. Fifty-four percent of participating retailers stock incandescent, halogen, and LED bulbs; with home improvement retailers accounting for 25 percent of stores that stock these bulbs. Interestingly, 5 percent of participating retailers (representing three warehouse stores) do not stock incandescent, halogen, or LED bulbs at all. This is indicative of strong program effects in these stores and distribution channels. Sixteen percent of retailers (representing nine bargain stores and one home improvement store) offer only incandescent bulbs as non-CFL lighting options.

**Figure 14. Non-CFL Stocking Practices by Distribution Channel (n = 61)**




On average, retailers attribute 53 percent of lighting sales to CFLs and 41 percent of sales to incandescent bulbs, as shown in Table 42. LEDs and other bulb types make up the remaining 6 percent of sales. One bargain retailer indicated that only five percent of his lighting sales can be attributed to CFLs.

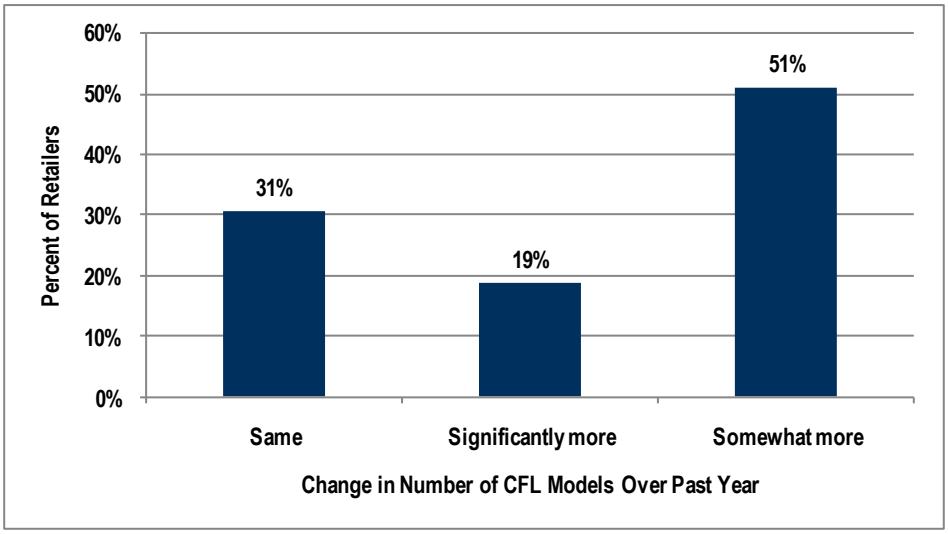
**Table 42. Percent of Annual Sales by Bulb Type**

| Min, Max, and Average Sales | CFL Sales | LED Sales | Incandescent Sales | Other Lighting Sales |
|---|---|---|---|---|
| Minimum Reported Sales | 5% | 0% | 0% | 0% |
| Maximum Reported Sales | 100% | 20% | 95% | 30% |
| **Average Reported Sales** | **53%** | **4%** | **41%** | **2%** |

Retailers then discussed how their stocking of CFL products has changed over the past year. Fifty-one percent of retailers reported that they stocked somewhat more models of CFLs than they did a year earlier. Nineteen percent indicated that they stock significantly more CFL models and 31 percent said that they stock the same number of CFL models. Figure 15 presents these findings.

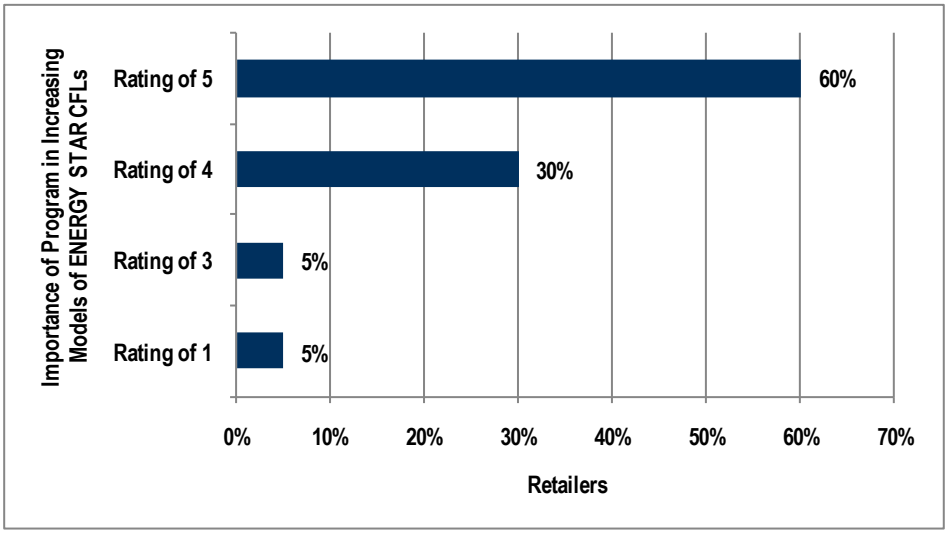
Positive program effects are also apparent across distribution channels. Most home improvement and mass merchandise retailers stock somewhat more CFL models than they did the previous year. Additionally, six home improvement retailers, two grocery stores, one hardware store, one bargain store, and one mass merchandise retailer reported stocking significantly more models of CFLs than in the previous year. Overall, the program had a positive influence on CFL stocking. One retailer in PY2 also sold ENERGY STAR fixtures, promoted by the program. This retailer indicated that his stock of light fixtures has not changed at all over the past year.

**Figure 15. Changes in Stock of CFL Models Over Past Year (n = 59)**




The 40 retailers who reported that they stock somewhat or significantly more CFL models than in the previous year rated the importance of the Ameren Missouri lighting program in helping bring about these increases. Sixty percent of these retailers believe that the program has been very effective in bringing about increases in the models of CFLs they carry and gave the program a rating of five. Thirty percent rated the program as a four. Only two retailers (representing 5 percent) gave the program a low rating. Figure 16 presents these findings.

**Figure 16. Importance of Ameren Missouri Lighting Program in Bringing About Increases in CFL Models (n = 40)**

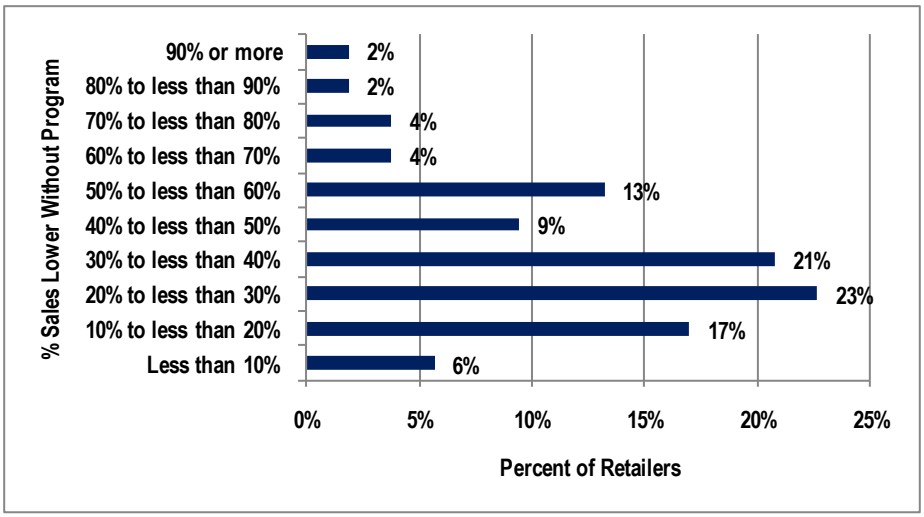


## Sales Trends

Ninety percent of retailers said that they would sell ENERGY STAR CFLs without the support of the Ameren Missouri lighting program. The 10 percent of retailers who would not stock ENERGY STAR CFLs in the absence of the program included two mass merchandise retailers and three bargain retailers. Ninety-one percent said that sales of standard ENERGY STAR CFLs would be lower in absence of the program, with the remaining seven percent indicating that standard CFL sales would remain the same in absence of the program.

Figure 17 shows that 23 percent of retailers estimated that standard CFL sales would be 20–30 percent lower without the support of the program[20]. Another 21 percent of retailers estimated that CFL sales would be 30–40 percent lower without the program. When weighted by the number of retailers for each category, CFL sales would be 35 percent lower in absence of the program. On the whole, retailers reported that without the program CFLs would be more expensive for customers, and therefore retailers would sell fewer CFLs at higher prices.

**Figure 17. Retailers Reporting Lower CFL Sales in Absence of the Ameren Missouri Program (n = 53)**




Nearly all of the retailers who said that CFL sales would be lower without the program also said that they expected CFL sales to increase as a result of participation in the Ameren Missouri lighting program. All but two retailers (one grocery and home improvement store) indicated that their expectations of increased sales through the program were met.

The two warehouse retailers who sell ENERGY STAR light fixtures answered additional questions in this part of the survey. Both of these retailers said that they would continue stocking ENERGY STAR light fixtures without the support of Ameren Missouri. Both stores also said that sales of ENERGY STAR light fixtures would be lower without the program. One warehouse retailer estimated that sales would be 20 percent to 30 percent lower and the other estimated that

[20] All retailers provided the same response for specialty CFLs except for one mass merchandise retailer.

sales would be 70 percent to 80 percent lower without the program. These retailers also expected that sales of ENERGY STAR light fixtures would increase through program participation and indicated that these expectations have been met. Neither of these retailers offered additional discounts on program-sponsored ENERGY STAR light fixtures.

## Pricing Trends

Twelve retailers indicated that among their non-program CFL selection they only sell standard ENERGY STAR CFLs. Of these 12, eight (66 percent) said the Ameren Missouri program CFLs are typically priced lower than non-program CFLs. Two retailers (a bargain store and mass merchandise retailer) indicated that program and non-program CFLs are priced the same. One grocery store reported program CFLs are priced higher than non-program CFLs. On average, program CFLs are priced $1.79 lower per bulb than non-program CFLs. The grocery retailer who said that program CFLs are priced higher than non-program CFLs explained that this is the case because "[We have] a name-brand CFL bulb." In other words, the name brand seems to add a premium to the price even when discounted by the Ameren Missouri lighting program.

Retailers were also asked to assess the impact of program-sponsored CFLs (standard and specialty) on the sales of other non-program CFLs. Twenty-seven retailers indicated that the Ameren Missouri lighting program did have an impact on the sale of other CFLs. Of these, 22 retailers (about 81 percent) believe that the program negatively impacted the sale of other CFLs. These retailers largely cited the lower price of program CFLs as the key reason for this negative impact. Five retailers (19 percent) believe that the program positively impacted sales of other CFLs. These retailers indicated that customers have more choices among CFL lighting products when the store sells program-sponsored CFLs.

Six retailers discussed additional discounts their stores applied to the program-sponsored CFLs. One retailer offered $3–$4 discounts on multi-packs, and others offered similar discounts (e.g. $1 off, 50 percent off, etc).

## Program Satisfaction

All retailers were asked to rate various aspects of the program, including the program itself, using a standard 0 – 10 rating scale where 0 is very dissatisfied and 10 is very satisfied.

Retailers gave high ratings to the quantity of products discounted by the program. Ninety percent of retailers rated the quantity of products at least a 7; with 39 percent of retailers giving a rating of 10. Two retailers who gave this aspect of the program low ratings reported that they did not receive enough program CFLs or that they could not sell them.

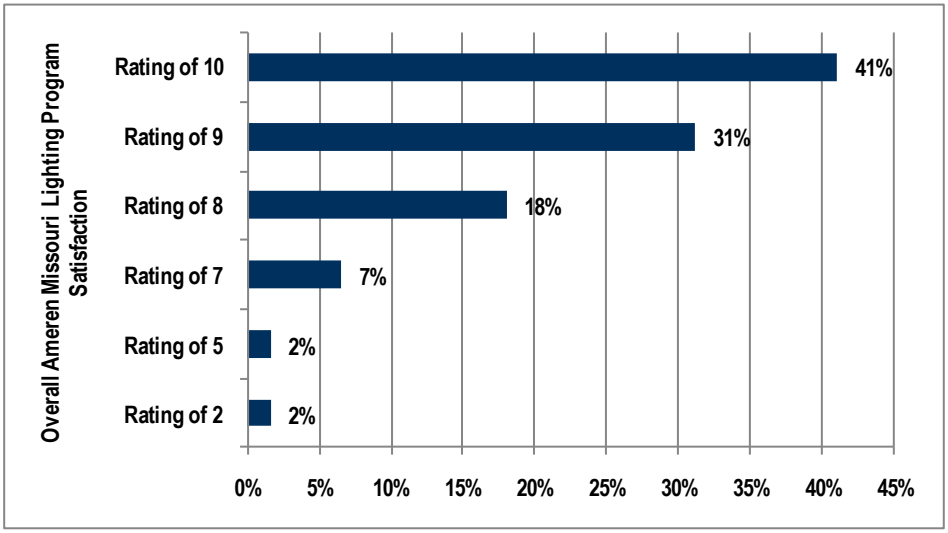
Ameren Missouri's mass marketing efforts also received high ratings, as 85 percent of retailers rated marketing materials as a 7 or above; with 38 percent of retailers giving a rating of 10. Retailers who were not as satisfied with the marketing materials said that they did not receive enough marketing materials. One retailer also indicated that he had received too much marketing material.

Retailers were also very satisfied overall with the coordination of product placement and product promotions. Fifty percent of retailers rated coordination efforts a 10; with 92 percent of retailers giving this aspect of the program a rating of 7 or higher. Four stores who gave this aspect of the program a low rating said that there was not enough promotion of program-sponsored CFLs.

Ameren Missouri program managers and staff also received high marks from retailers. Ninety-six percent of retailers rated program staff 7 or higher; with 55 percent rating program staff 10. One retailer who gave very low ratings to Ameren Missouri program staff said that there was no communication between program staff and his store.

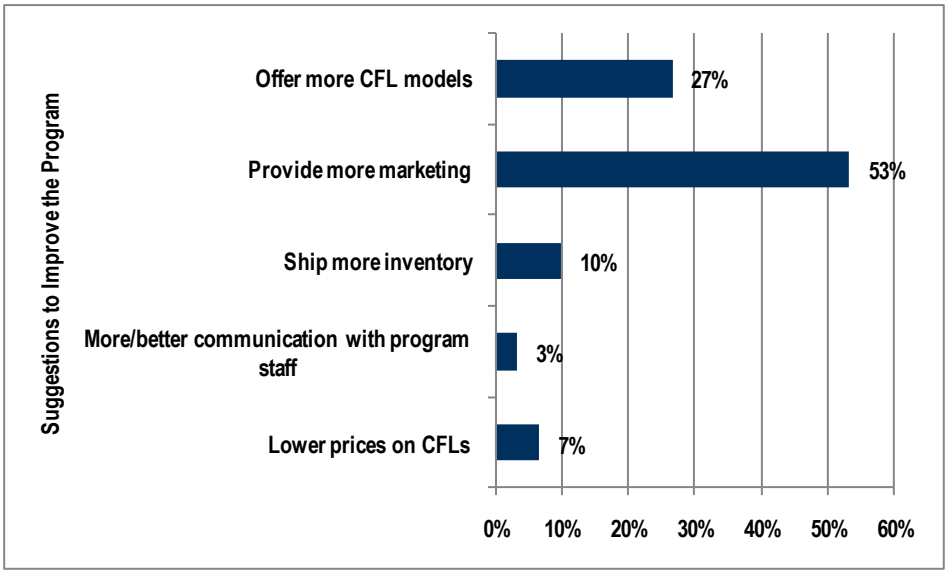
Lastly, retailers rated their overall satisfaction with the Ameren Missouri lighting program. Figure 18 shows that retailers were satisfied overall with the program. Forty-one percent of retailers rated the program overall as a 10; with about 97 percent of retailers rating the program a 7 or higher. Two retailers gave the program very low ratings. One retailer said that the program did not result in higher sales and the other retailer said that he was indifferent about the program.

**Figure 18. Overall Ameren Missouri Lighting Program Satisfaction (n = 61)**




Thirty retailers provided various responses when asked how the program could be improved. Figure 19 shows that more than half of retailers suggested that Ameren Missouri provide additional marketing materials. Twenty-seven percent suggested that Ameren Missouri discount more CFL models.

**Figure 19. Suggestions to Improve Ameren Missouri Lighting Program (n = 30)**




Seventy percent of retailers indicated that they were planning to participate in the Ameren Missouri lighting program going forward. Only one retailer said that he was not planning to participate in the future because of an interaction with a program representative earlier this year. The program representative apparently told this retailer that Ameren Missouri was going to discontinue the program at his store but the representative never visited the store to confirm. The retailer thinks that he will not receive program CFLs next year. Twenty-eight percent of retailers were unsure about future participation but did not provide any indication as to why.

## Appliances

Interviews with appliance retailers provide program insights and also identify how the program affected the target market. Cadmus interviewed 15 participating appliance retailers across five retail distribution channels. These interviews asked questions about ENERGY STAR dehumidifiers, freezers, and window AC units. The table below presents these interview completions by retail distribution channel.

**Table 43. Appliance Retailer Interviews Completed by Retail Distribution Channel (n = 15)**

| Distribution Channel | Stores | Percent of Total |
|---|---|---|
| Hardware | 1 | 7% |
| Home Furnishings | 2 | 13% |
| Home Improvement | 5 | 33% |
| Mass Merchandise | 5 | 33% |
| Warehouse | 2 | 13% |
| **Totals** | **15** | **100%** |

All retailers indicated which of the three measures their stores sold, and survey administrators then asked questions for each measure that retailers sell. Table 44 shows the number of retailers

who sell each of the three measures. This analysis discusses stocking patterns, sales trends, and pricing for each measure independently of the others.

**Table 44. Measures Sold by Appliance Retailers (n = 15)**

| ENERGY STAR Measure | Stores (n = 15) |
|---|---|
| Dehumidifiers | 14 |
| Freezers | 11 |
| Window ACs | 12 |

## Reasons for Participating

All respondents discussed their primary reasons for participating in the Ameren Missouri appliance program. Five retailers (33 percent) said that they participated in the program in order to provide money-saving appliance options for customers. Four retailers (27 percent) indicated that program participation was decided at the corporate level. Three retailers (20 percent) said that they decided to participate in the program after Ameren Missouri representatives visited their store and asked them to participate. One of these respondents said:

*"Ameren presented the program to the store and [it] seemed like a good idea."*

One retailer (7 percent) said that his store participated in the program to encourage/promote energy savings.

## Retailer Stocking Patterns

Appliance retailers were asked to describe their stocking practices for ENERGY STAR dehumidifiers, freezers, and window AC units. The appliance rebate program positively affected stocking patterns across all three measures.

The 14 retailers who sell dehumidifiers said that 79 percent (average of responses) of dehumidifiers on their sales floor qualified for Ameren Missouri's rebate program as of January1, 2010. Four of these retailers indicated that the percentage of rebate-qualified dehumidifiers on the sales floor had increased since last year. According to these four retailers, 90 percent of dehumidifiers for sale in their stores qualify for the Ameren Missouri appliance rebate. The program appears to have had positive effects on these four retailers.

The 11 retailers who sell freezers said that 50 percent (average of responses) of freezers on their sales floors qualified for the program rebate in January 2010. Three retailers reported that their current stock of freezers on the sales floor is greater than the stock one year ago. According to these three retailers, 68 percent (weighted average) of their freezers now qualify for the Ameren Missouri program rebate. The program has also had positive effects on the stocking of freezers.

The 12 retailers who sell window AC units also discussed changes in their stock of rebate-qualified units. In the summer of 2009, seven retailers stated that of the window AC units on their sales floors, an average of 63 percent were rebate-qualified. For the summer of 2010, all 12 retailers reported that 70 percent of their window AC units qualified for the Ameren Missouri program rebate. The program seems to be most effective in increasing the stocking patterns of window AC units among retailers.

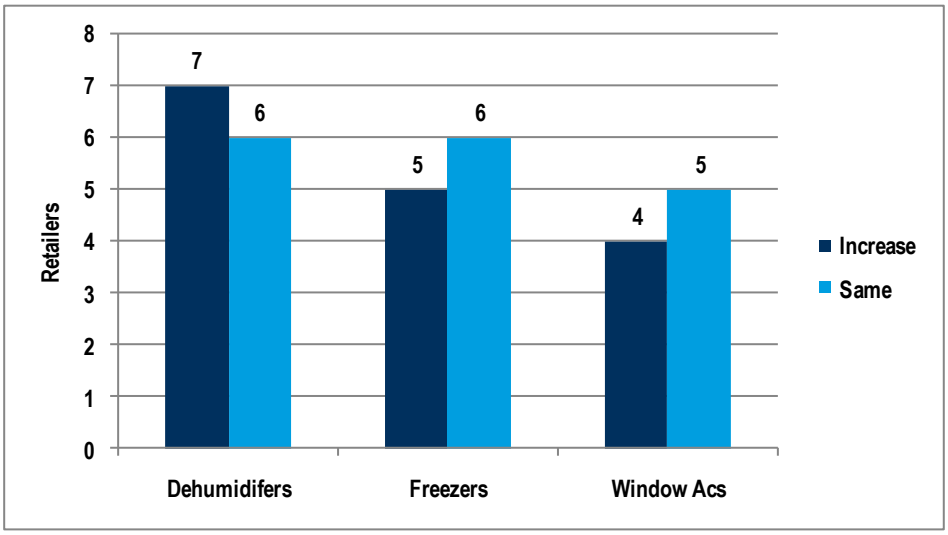
## Sales Trends

In absence of the Ameren Missouri appliance rebate incentives, 13 of the 14 retailers who sell ENERGY STAR dehumidifiers (97 percent) said they would still advertise and sell these products. All 11 retailers who sell ENERGY STAR freezers and all 12 retailers who sell ENERGY STAR window AC units would still advertise and sell these measures in absence of the program.

Seven of the 14 retailers (50 percent) who sell ENERGY STAR dehumidifiers estimated that sales of dehumidifiers would be 20 percent lower without support of the program. Just over half of the 11 retailers who sell ENERGY STAR freezers estimated that sales of these measures would decrease by an average of 18 percent without the Ameren Missouri appliance program. One fourth of window AC retailers estimated that their sales would also be lower by 18 percent if the Ameren Missouri rebates were not available.

Cadmus asked retailers if their sales of each ENERGY STAR measure changed from January 2010 to January 2011. Seven retailers said that their sales of ENERGY STAR dehumidifiers increased from the previous year, and six reported that sales were unchanged. For freezers and window ACs, more retailers reported no change in sales in the past year than those who reported an increase. Figure 20 presents these findings.

**Figure 20. Retailers Reporting Changes in Sales of ENERGY STAR Measures from Jan. 2010 to Jan. 2011**




Retailers also discussed perceived changes in consumer demand for each ENERGY STAR measure. More than half (57 percent) of retailers who sell dehumidifiers believed that there has been no change in demand for this measure over the past year. Three retailers (21 percent) reported a significant increase in demand for dehumidifiers over the past year. Two of these rated the importance of the program as 5; indicating that the Ameren Missouri appliance rebate program was very important in helping bring about increases in consumer demand. Three other retailers (21 percent) reported a slight increase in demand over the past year.

For retailers who sell ENERGY STAR freezers, five retailers of the 11 (45 percent) reported that consumer demand for the measure had increased significantly over the past year. Two of them also rated the importance of the program in bringing about this increase as a 5 on a scale of 1 to 5. Two retailers (18 percent) said that demand for ENERGY STAR freezers had increased somewhat, and four retailers (36 percent) said that demand had not changed at all over the past year.

Twenty-five percent of window AC retailers (three of 12) reported that consumer demand for ENERGY STAR window AC units had increased significantly this past year. One of these retailers rated the program's importance in bringing about this increase as a 5 on a scale of 1 to 5. Fifty percent (six retailers) indicated that demand for ENERGY STAR window ACs had increased somewhat, and another 25 percent (3 retailers) said that demand had not changed at all over the past year.

Retailers also provided estimates of the percentage of total sales for each measure that could be attributed to the program over the past 12 months. Twelve of the 14 retailers (86 percent) who sell ENERGY STAR dehumidifiers estimated that they sell, on average, 25 percent of their dehumidifiers through the program. The other 75 percent of dehumidifier sales are not through the program. Ten of the 11 retailers (91 percent) who sell ENERGY STAR freezers estimated that they sell, on average 24 percent of their freezers through the program. Lastly, nine of the 12 retailers (75 percent) who sell ENERGY STAR window ACs estimated the program accounts for 29 percent of their window AC sales.

## Program Satisfaction

All appliance retailers were asked to rate various aspects of the program, including the program itself, using a standard 0–10 rating scale where 0 is very dissatisfied and 10 is very satisfied. Across all aspects of the program, retailers are generally satisfied.

Fifty-three percent of retailers were very satisfied with Ameren Missouri's approach to incenting energy-efficient appliances. Most retailers rated this aspect of the program at least a 7. One retailer was indifferent (giving a rating of 5), and one retailer was very dissatisfied with this aspect of the program, indicating that customers did not know about the program because of a lack of promotional activities.

The dollar amounts for ENERGY STAR appliance rebates also received high ratings. The lowest rating was 7 (representing one retailer) and 40 percent (6 retailers) gave the program a rating of 10.

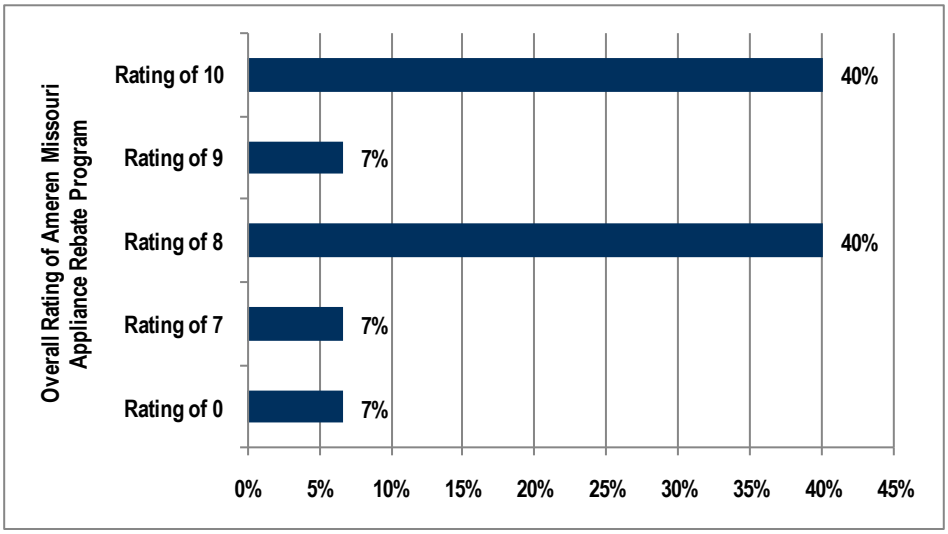
Ameren Missouri's mass marketing efforts received mixed ratings among retailers. Thirteen retailers rated this aspect of the program, as two retailers said they were not familiar with Ameren Missouri's marketing efforts. While 23 percent (three retailers) rated Ameren Missouri's mass marketing a 10, 38 percent (five retailers) of retailers rated this aspect of the program a 5. Three of these retailers all commented that they were mostly unaware of the mass marketing as they hardly ever saw it in their stores. Another retailer quipped that she "wouldn't call it mass marketing." One retailer rated the program's marketing efforts as a 0 and indicated that no one ever sees the advertising, as no one promotes it in his store.

Program coordination and product placement received generally good ratings. Fifty percent (of 12 retailers contributing) rated this aspect of the program a 10. One retailer was neither satisfied nor dissatisfied; rating product placement and program coordination a 5.

Ameren Missouri program managers also received good ratings from retailers. Fifty-eight percent of the 12 retailers responding to this question rated program managers a 10. The lowest rating was 7; given by one retailer.

Lastly, retailers rated their overall satisfaction with the Ameren Missouri appliance rebate program. Forty percent of retailers rated the program a 10 and another 40 percent rated the program an 8. Seven percent of retailers (represented by 1 retailer) expressed his dissatisfaction with the program by giving the program a rating of 0. He said that he was very dissatisfied with the program as there was "no promotion or customer support".

**Figure 21. Overall Satisfaction with Ameren Missouri's Appliance Rebate Program (n = 15)**




Ten retailers offered suggestions for improving the program in the future. Sixty percent (six retailers) suggested increasing marketing efforts by providing more marketing materials or conducting promotions more frequently. Two retailers suggested that Ameren Missouri should adjust marketing materials by reducing the size of pamphlets so that they fit better into boxes. Two other retailers suggested the Ameren Missouri should expand the program to other measures such as dishwashers, clothes washers, and refrigerators because the dehumidifiers market is very small.

Lastly, 60 percent (nine retailers) indicated that they plan to participate in the Ameren Missouri appliance rebate program going forward. While none other retailers said that they would not participate going forward, the remaining 40 percent of retailers had not yet made a decision about future participation.

# Appliance Participant Survey

Cadmus surveyed a sample of appliance rebate participants to assess freeridership and process efficacy from the participant perspective. The sample was stratified by appliance type in order to achieve accurate results for questions specific to each of the three main appliances rebated through the program: dehumidifiers, freezers, and room air conditioners. Table 45 below shows sample stratification by appliance type and precision levels at the 90 percent confidence level for each stratum and for the population as a whole. When responses are reported for the total population, they are weighted to represent each appliance's share of the population.

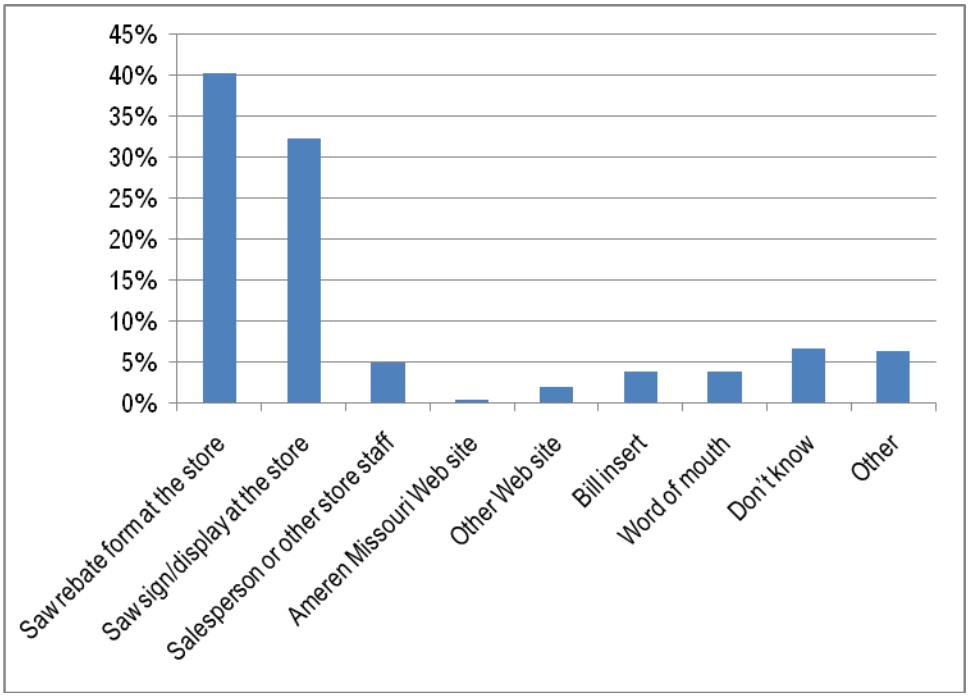
**Table 45. Appliance Rebate Participant Survey Sample Stratification**

| Appliance | Total Number of Participants | Proportion of Population (Weight) | Number of Participants Surveyed | Precision at 90% Confidence Level |
|---|---|---|---|---|
| Dehumidifiers | 3,454 | 45% | 50 | 11.6% |
| Freezers | 490 | 6% | 53 | 10.7% |
| Room Air Conditioners | 3,853 | 49% | 50 | 11.6% |
| **Grand Total** | **7,888** | **100%** | **153** | **6.6%** |

## Program Awareness and Satisfaction

The survey asked participants how they first learned about the program. As shown in Figure 22, where results have been weighted by appliance type to represent the total population, a large majority of participants (77 percent) learned about the rebates in the store – either via the rebate form itself, signage, or from a salesperson.

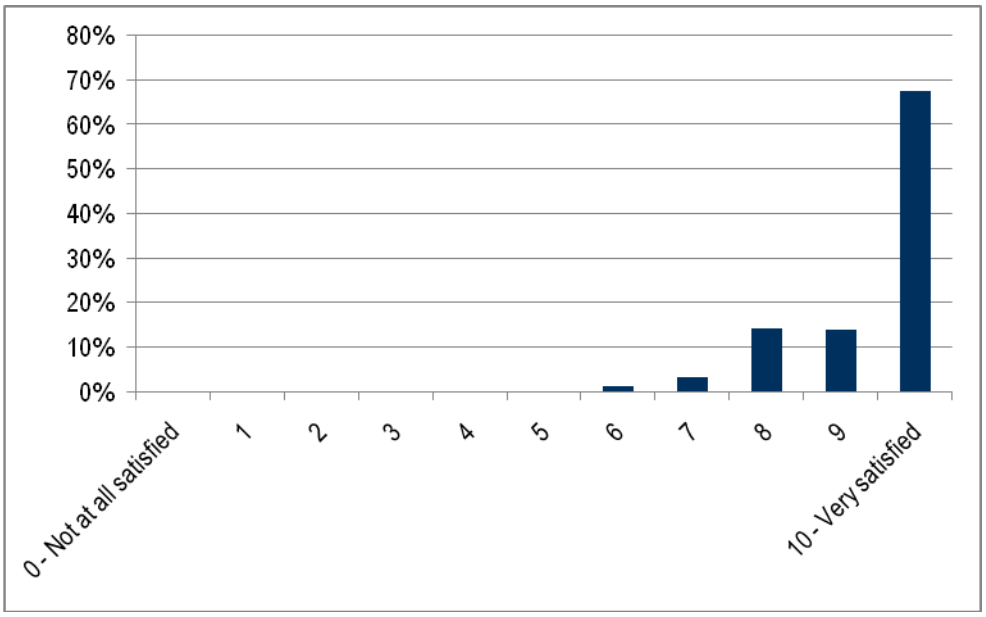
**Figure 22. Method of Learning About the Appliance Rebate Program (n=153, weighted by appliance type)**




While very few people (less than 1 percent) reported learning about the program from Ameren Missouri's website, 29 percent of participants report having visited the Ameren Missouri website. This could represent an opportunity to increase online marketing of the program.

Program participants were very satisfied with the program overall. On a scale of 0 to 10, where 0 is not at all satisfied and 10 and very satisfied, 68 percent rated the program a 10. Furthermore, no respondents gave a score lower than six. Participant satisfaction results are shown in Figure 23.

**Figure 23. Participants' Satisfaction with the Appliance Rebate Program (n=153, weighted by appliance type)**




When asked whether they had any suggestions for potential improvements to the program, the most common suggestions offered were:

- Offer rebates on additional appliances (mentioned by 15 respondents)
  - Specific appliances mentioned were furnaces, ovens, and ground-source heat pumps
- Increase advertising and promotion of program (mentioned by 13)
- Increase the dollar amount of the incentives (mentioned by 4)

A number of commenters stated that they were pleased with the program and looked forward to seeing it expand.

## Measure-Specific Results

The survey asked a number of questions about the specific measure for which the respondent received a rebate. The results of these questions are reported in this section. Here, no weighting is applied, because the measure-level samples were random.

### Dehumidifier

A total of 3,545 ENERGY STAR dehumidifiers were rebated through the program in PY2, accounting for over $88,000 in customer incentives paid. The survey asked recipients of the dehumidifier rebate about their motivation for purchasing the ENERGY STAR unit. Responses are summarized in Table 46. Nearly half of respondents were simply in need of a new unit, citing problems with humidity, dampness, or mold in their homes. The demand for dehumidifiers in Missouri is high, due to the humid summer climate and the housing stock in which basements are common. Therefore it is logical that many people cited this need as the primary motivator for

purchasing the unit. 24 percent mentioned the incentive as one of the factors that motivated them to purchase the unit.

**Table 46. Motivation for Purchasing Dehumidifier (Multiple Responses Allowed, n=50)**

| Reason | Number of Respondents | Percent of Respondents |
|---|---|---|
| Needed or wanted a dehumidifier due to humidity, dampness, or mold | 24 | 48% |
| The incentive or rebate | 12 | 24% |
| Old equipment didn't work | 9 | 18% |
| Cost of the dehumidifier | 9 | 18% |
| Wanted to save energy | 3 | 6% |
| Features or size of the dehumidifier | 3 | 6% |
| Wanted to reduce energy costs | 2 | 4% |
| Brand of dehumidifier | 2 | 4% |
| Old equipment working poorly | 1 | 2% |
| Past experience with another Ameren program | 1 | 2% |
| Recommendation of retailer | 1 | 2% |
| Liked the appearance of the ENERGY STAR dehumidifier more than the old one | 1 | 2% |

Respondents were asked to specify whether they purchased the dehumidifier as a new addition to their home, or as a replacement of an existing unit. As shown in Table 47, a majority (54 percent) were adding a new unit to their homes.

**Table 47. Dehumidifiers: Replacement or Additional?**

| | Number of Respondents | Percent of Respondents |
|---|---|---|
| Replacement | 23 | 46% |
| Additional | 27 | 54% |

The participants who reported replacing an existing unit were asked about the old equipment they replaced. A majority (52 percent) reported that the old unit was between five and 10 years old. Table 48 shows the reported condition of the replaced dehumidifiers, and Table 49 shows the method of disposal.

**Table 48. Condition of Replaced Dehumidifiers**

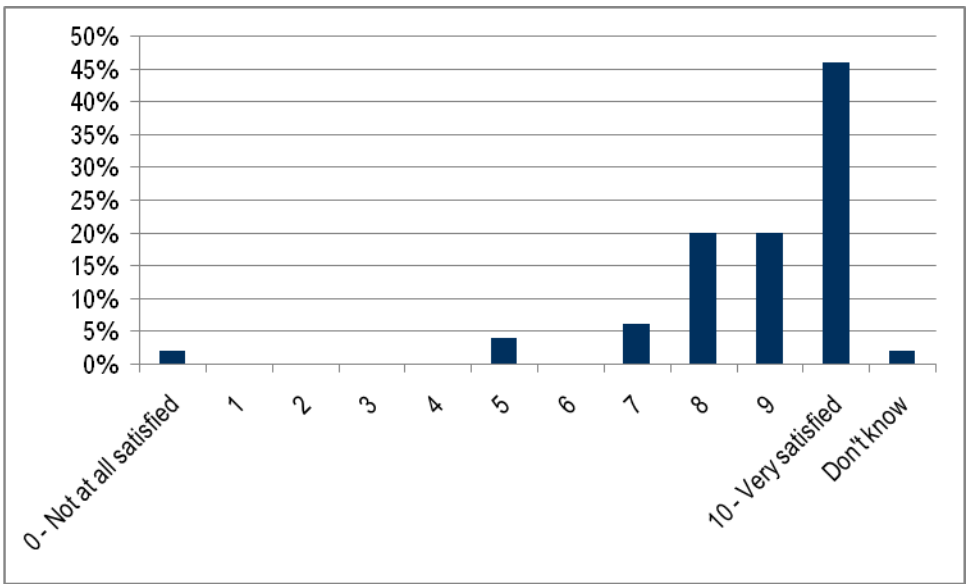
| Condition of Unit | Number of Respondents | Percent of Respondents (n=23) |
|---|---|---|
| Good | 2 | 9% |
| Poor | 7 | 30% |
| Not working | 14 | 61% |

**Table 49. Disposal of Replaced Dehumidifiers**

| Disposal Method | Number of Respondents | Percent of Respondents (n=23) |
|---|---|---|
| Sold or gave away | 1 | 4% |
| Still in home but permanently removed | 3 | 13% |
| Recycled | 7 | 30% |
| Threw away or took to dump | 12 | 52% |

Respondents were highly satisfied with their new ENERGY STAR dehumidifiers, with 66 percent reporting a score of 9 or 10 on a satisfaction scale, as shown in Figure 24.

**Figure 24. Participant Satisfaction with Dehumidifier**




Participants were also quite satisfied with the incentive payments. Ninety-six percent of respondents were satisfied with the dollar amount of incentive they received for their dehumidifier, and 96 percent were satisfied with how quickly they received the incentive.

## Freezer

A total of 490 ENERGY STAR freezers were rebated through the program in PY2, accounting for $24,500 in customer incentives paid. The survey asked recipients of the freezer rebate about their motivation for purchasing the ENERGY STAR unit. Responses are summarized in Table 50. The most frequently mentioned reason for purchasing the new freezer was a desire to save energy (mentioned by 17 respondents).

**Table 50. Motivation for Purchasing Freezer (Multiple Responses Allowed, n=53)**

| Reason | Number of Respondents | Percent of Respondents |
|---|---|---|
| Wanted to save energy | 17 | 32% |
| Old equipment didn't work | 13 | 25% |
| The incentive or rebate | 13 | 25% |
| Features or size of freezer | 12 | 23% |
| Needed or wanted a new freezer | 8 | 15% |
| Cost of freezer | 8 | 15% |
| Old equipment working poorly or too old | 7 | 13% |
| Wanted to reduce energy costs | 6 | 11% |
| Because of past experience with another Ameren program | 1 | 2% |
| Saw advertisement for rebate program | 1 | 2% |
| Liked the appearance of the ENERGY STAR freezer more than the old one | 1 | 2% |
| Brand of freezer | 1 | 2% |

Respondents were asked to specify whether they purchased the unit as a new addition to their home appliances, or as a replacement of an existing unit. As shown in Table 51, a majority (68 percent) purchased the unit as a replacement.

**Table 51. Freezers: Replacement or Additional?**

| | Number of Respondents | Percent of Respondents (n=53) |
|---|---|---|
| Replacement | 36 | 68% |
| Additional | 17 | 32% |

The participants who reported replacing an existing unit were asked about the old freezer they replaced. As shown in Table 52, most (56 percent) of the replaced freezers were between 10 and 30 years old, and another 19 percent were over 30 years old.

**Table 52. Age of Replaced Freezers**

| Age Category | Number of Respondents | Percent of Respondents (n=36) |
|---|---|---|
| Less than 5 years old | 4 | 11% |
| 5 to less than 10 years old | 5 | 14% |
| 10 to less than 20 years old | 10 | 28% |
| 20 years to less than 30 years old | 10 | 28% |
| 30 or more years old | 7 | 19% |

Table 53 shows the reported condition of the replaced freezers, and Table 54 shows the method of disposal. A fairly large number of replaced freezers (16, or 44 percent) were reportedly not working, which is in line with the finding that many replaced freezers were quite old. The

disposal methods reported show than a small number of the replaced freezers stayed on the grid – two units (6 percent) were sold or given away.

**Table 53. Condition of Replaced Freezers**

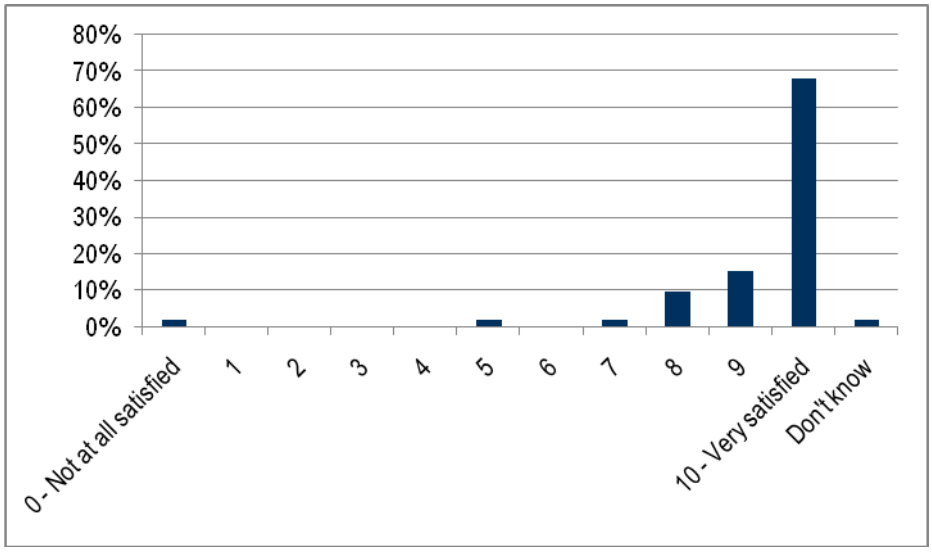
| Condition of Unit | Number of Respondents | Percent of Respondents (n=36) |
|---|---|---|
| Good | 10 | 28% |
| Fair | 4 | 11% |
| Poor | 5 | 14% |
| Not working | 16 | 44% |
| Don't know | 1 | 3% |

**Table 54. Disposal of Replaced Freezers**

| Disposal Method | Number of Respondents | Percent of Respondents (n=36) |
|---|---|---|
| Sold or gave away | 2 | 6% |
| Still in home but permanently removed | 10 | 28% |
| Recycled | 3 | 8% |
| Threw away or took to dump | 18 | 50% |
| Don't know | 2 | 6% |

Participants reported high levels of satisfaction with their new ENERGY STAR freezers: this measure showed the highest satisfaction ratings out of the three rebated measures. 68 percent of respondents rated the new appliance a 10 on a satisfaction scale, as shown in Figure 25.

**Figure 25. Participant Satisfaction with Freezer**



Freezer purchasers were also fairly satisfied with the rebate they received, although the level of satisfaction here is slightly lower than for the other two appliances. 89 percent were satisfied with the dollar amount of the incentive they received for the freezer, and 89 percent were satisfied with how quickly they received the incentive. The slightly lower level of satisfaction is likely due to the fact that the incentive amount likely accounts for a lower percentage of the total appliance cost, as compared to the other two incentives offered.

## Room Air Conditioners

A total of 3,853 ENERGY STAR room air conditioners were rebated through the program in PY2, accounting for nearly $200,000 in customer incentives paid. The survey asked recipients of the room air conditioner rebate about their motivation for purchasing the ENERGY STAR unit. Responses are summarized in Table 55. Over a third of respondents were simply in need of a new unit, and nearly a quarter were concerned with saving energy. 20 percent mentioned the incentive as one of the factors that motivated them to purchase the unit.

**Table 55. Motivation for Purchasing Room Air Conditioner (Multiple responses allowed, n=50)**

| Reason | Number of Respondents | Percent of Respondents |
|---|---|---|
| Needed or wanted a new air conditioner | 18 | 36% |
| Wanted to save energy | 12 | 24% |
| The incentive or rebate | 10 | 20% |
| Cost of air conditioner | 9 | 18% |
| Features or size of air conditioner | 8 | 16% |
| Old equipment didn't work | 5 | 10% |
| Wanted to reduce energy costs | 5 | 10% |
| Old equipment working poorly | 2 | 4% |
| Brand of air conditioner | 2 | 4% |
| Environmental concerns | 1 | 2% |
| Liked the appearance of the ENERGY STAR air conditioner more than the old one | 1 | 2% |
| Keeping up with the latest technology or trends | 1 | 2% |

Respondents were asked to specify whether they purchased the unit as a new addition to their home appliances, or as a replacement of an existing unit. As shown in Table 56, a majority (52 percent) purchased the unit as a replacement.

**Table 56. Room Air Conditioners: Replacement or Additional?**

| | Number of Respondents | Percent of Respondents (n=50) |
|---|---|---|
| Replacement | 26 | 52% |
| Additional | 24 | 48% |

The participants who reported replacing an existing unit were asked about the old equipment they replaced. A majority (65 percent) reported that the old unit was over five years old, and nearly a third of the units (27 percent) were over 10 years old. Table 57 shows the reported

condition of the replaced room air conditioners, and Table 58 shows the method of disposal. It is notable that while nearly a third of the old units (31 percent) remained in the home, 19 percent disposed the old unit responsibly by recycling it.

**Table 57. Condition of Replaced Room Air Conditioners**

| Condition of Unit | Number of Respondents | Percent of Respondents (n=26) |
|---|---|---|
| Good | 6 | 23% |
| Fair | 6 | 23% |
| Poor | 6 | 23% |
| Not working | 8 | 31% |

**Table 58. Disposal of Replaced Room Air Conditioners**

| Disposal Method | Number of Respondents | Percent of Respondents (n=26) |
|---|---|---|
| Sold or gave away | 4 | 15% |
| Still in home but permanently removed | 8 | 31% |
| Recycled | 5 | 19% |
| Threw away or took to dump | 7 | 27% |
| Don't know | 2 | 8% |

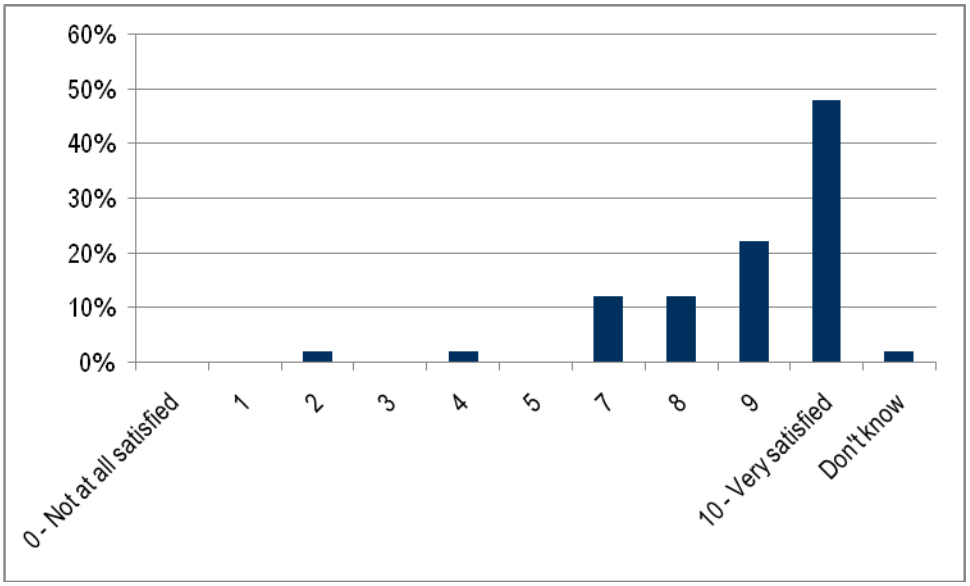
The survey also asked about unit installation. Since room air conditioners are sometimes installed only seasonally, the results (shown in Table 59) are in line with what was expected: only 60 percent of units were installed at the time the survey was conducted, which was during the winter months. An additional 30 percent of units were in storage for the winter.

**Table 59. Room Air Conditioners: Installed in Participant Home?**

| | Number of Respondents | Percent of Respondents (n=50) |
|---|---|---|
| It is currently installed in my home | 30 | 60% |
| It is installed at some other location | 3 | 6% |
| It was installed and used over the summer but is currently in storage | 15 | 30% |
| It is not installed or in use | 2 | 4% |

As shown in Figure 26, participants reported high levels of satisfaction with their new ENERGY STAR room air conditioners, with 70 percent of respondents rating the appliance a 9 or 10 on a satisfaction scale.

**Figure 26. Participant Satisfaction with Room Air Conditioner**




Room air conditioner participants were even more satisfied with their rebate than participants purchasing the other two appliances. 100 percent of respondents were satisfied with the dollar amount they received for the room air conditioner, and 98 percent of respondents were satisfied with how quickly they received their incentive payment. The room air conditioner rebate of $50 is likely to account for a higher percentage of the cost of the appliance, as compared to the dehumidifier and freezer rebates.

## Spillover

The results of the participant survey indicate that a noteworthy amount of spillover occurred among program participants. This is a positive outcome in line with the program's market transformation goals. While this evaluation does not quantify savings associated with spillover measures, these findings demonstrate the depth of the impact the appliance rebate program has on its participants.

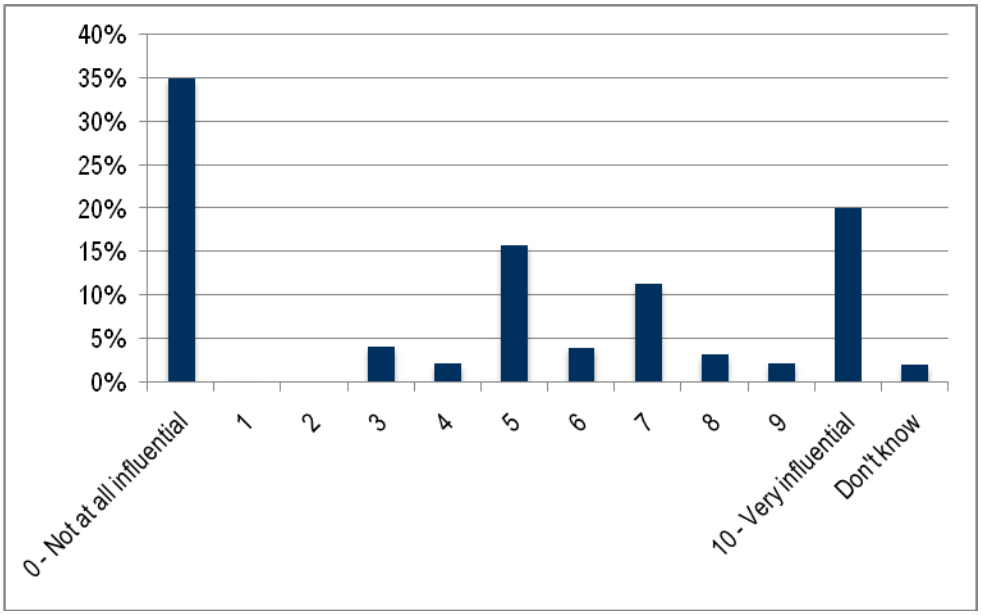
25 percent of respondents (weighted by appliance type) reported that since participating in the program, they added other energy-efficient products in their home that were not rebated by Ameren Missouri. Of those, 95 percent reported that the additional energy-efficient products added were ENERGY STAR rated. Furthermore, an additional 27 percent of participants reported that they took energy-efficient actions aside from installing new products. Examples given of energy-efficient products and actions included the following:

- Replacing incandescent light bulbs with CFLs (mentioned by 14 respondents)
- Infiltration control such as weather-stripping (mentioned by 10)
- Adding insulation (mentioned by 8)
- Replacing doors and/or windows (mentioned by 7)
- Turning off lights (mentioned by 2)

- Unplugging unused appliances (mentioned by 1)

The survey asked all respondents who had either installed energy-efficient products or taken energy-efficient actions (a total of 72 out of 153) to rate how influential the appliance rebate program was in their decision to take these additional steps. Responses to this question are summarized in Figure 27.

**Figure 27. Influence of Program on Additional Energy-Efficient Actions (n=72, Weighted by Appliance Type)**




While it is clear that a number of rebate recipients (35 percent) did not consider the program influential in their decision to take further energy-efficient actions, just over 20 percent rated the program's influence a 10 out of 10. This shows that a small but significant number of people are being strongly affected by their participation, which is the desired outcome of a market transformation program in terms of spillover.

# 6. Social Marketing Distribution

Ameren Missouri's Social Marketing Distribution (SMD) Program provides not-for-profit organizations with energy-efficient compact fluorescent light bulbs (CFLs), which the organizations can then distribute to Ameren Missouri customers in the communities they serve. The goal of the program is to reduce energy use in residential areas and therefore lower household energy expenses.

Through this program, Ameren Missouri has been able to reach customers who may not have qualified for other energy assistance programs and lacked the resources to make the initial purchase of CFLs. Organizations that have benefited from this program include those that help serve the needs of elderly and lower income groups. However, the program is available to any organization that meets the following requirements.

- Must be a not-for-profit organization that represents residential customers served by Ameren Missouri;
- Must be able to distribute a minimum of 5,000 CFLs or directly install a minimum of 500 CFLs;
- CFL distribution must be limited to residential customers residing in the Ameren Missouri service territory;
- Must provide sufficient performance data to allow evaluation, measurement, and verification of the project;
- Must also distribute consumer educational materials on CFL lighting, which are provided by Ameren Missouri;
- Must have a total cost per CFL less than Ameren Missouri's current maximum incentive for CFL lamps.[21]

The first SMD took place in December 2009. In this program, APT coordinated with local service providers, including Operation Food Search and Agape, among others, to deliver free 13W and 23W CFLs to Ameren Missouri customers who take advantage of those organizations' services. This section presents process and impact findings on the SMD Program.

## Evaluation Methodology

Cadmus conducted staff interviews and a participant survey to gather information about the SMD component of the L&A program.

Staff interviews, conducted in conjunction with the L&A Program interviews, gathered feedback from five key staff members, as outlined in Table 60, below.

[21] Since CFLs for the SMD are purchased in bulk, the cost per CFL is typically less than Ameren Missouri's upstream CFL incentives.

**Table 60. SMD Stakeholder Interviewees**

| Title | Organization |
|---|---|
| Residential Program Manager | Ameren Missouri |
| Senior Program Manager | Ameren Missouri |
| Community Relations Director | Operation Food Search |
| Regional Director of Operations | APT |
| Program Manager | APT |

Cadmus also designed and analyzed a survey, implemented by Tetra Tech Inc., of a random sample of 71 participants who received free CFLs subsidized by Ameren Missouri at local food pantries. The survey was designed to provide an understanding of installation rates and possible spillover associated with the distributions. The sample size was designed to produce a sampling error of ±10 percent at the 90 percent confidence level.

## SMD Process Interview Findings

Ameren Missouri staff reported that the distributions were introduced in response to a challenge from Ameren Missouri management to introduce energy-efficiency programming in urban areas, in order to help those customers most in need. To address this challenge, L&A program staff developed the SMD component in conjunction with APT and local low-income service providers.

The implementation process begins when partner organizations submit information about their customers and APT verifies that at least 80 percent of the organization's customers live in Ameren Missouri's service territory.[22] SMD can consist of either direct-install campaigns or event distributions where bulbs are given to customers. Direct-install campaigns are more difficult to achieve and reportedly accounted for approximately 10 to 12 percent of the SMD volume in PY2.

Operation Food Search, one of the partner organizations that deliver the program, reported that the number of CFLs distributed to each client is determined by the size of the participant's family. Each family is to receive a minimum of two bulbs (one each of the 13-watt and 23-watt bulbs).

Ameren Missouri staff reported that the SMD component has very low overhead costs and is very efficiently implemented, because APT relies on the operational capacities of the organizations with which it partners. Therefore, the cost of the light bulbs themselves is the primary expense associated with this program component. The partner organizations are reportedly very happy with the program, and there is high demand for participation.

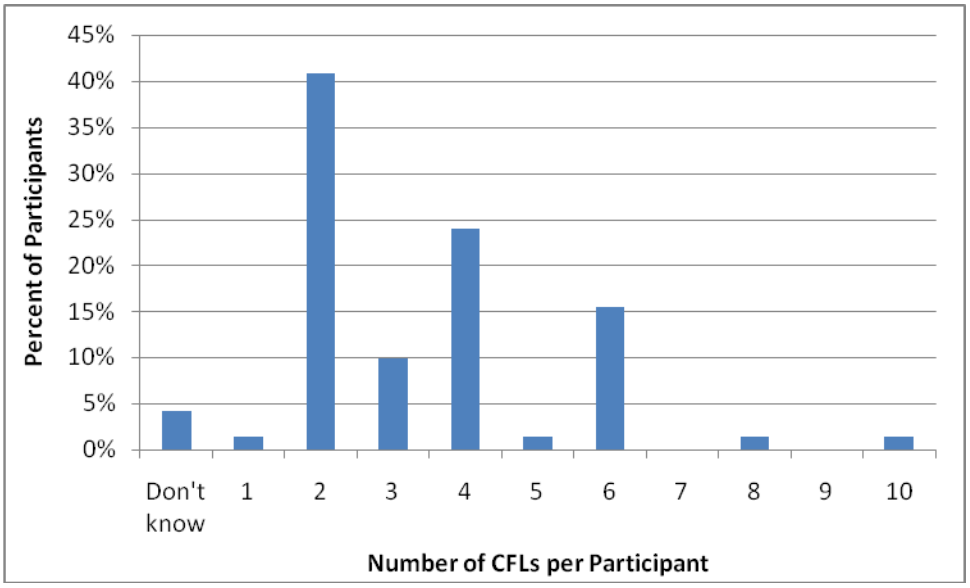
[22] While only 80 percent of the organization's constituents must live in Ameren Missouri's service territory, 100 percent of program bulbs are required to go to Ameren Missouri customers.

## SMD Participant Survey Findings

Cadmus surveyed 71 Ameren Missouri customers who had received CFLs at one of three food pantry locations. The survey was conducted by telephone, and survey operators asked participants questions about their satisfaction with the CFLs they received, their prior and future buying patterns for both CFLs and incandescent bulbs, and demographics and housing characteristics. The survey also included questions about bulb installation for the purpose of assessing impact; the results of are discussed in the following section.

Surveyed participants reported receiving an average of 3.5 CFLs each. As shown in Figure 28, most participants received bulbs in multiples of two, which may indicate that the 13-W and 23-W bulbs are being distributed in pairs. The most common number of bulbs received was two, and the highest number received was 10.

**Figure 28. Number of CFLs Received in SMD**



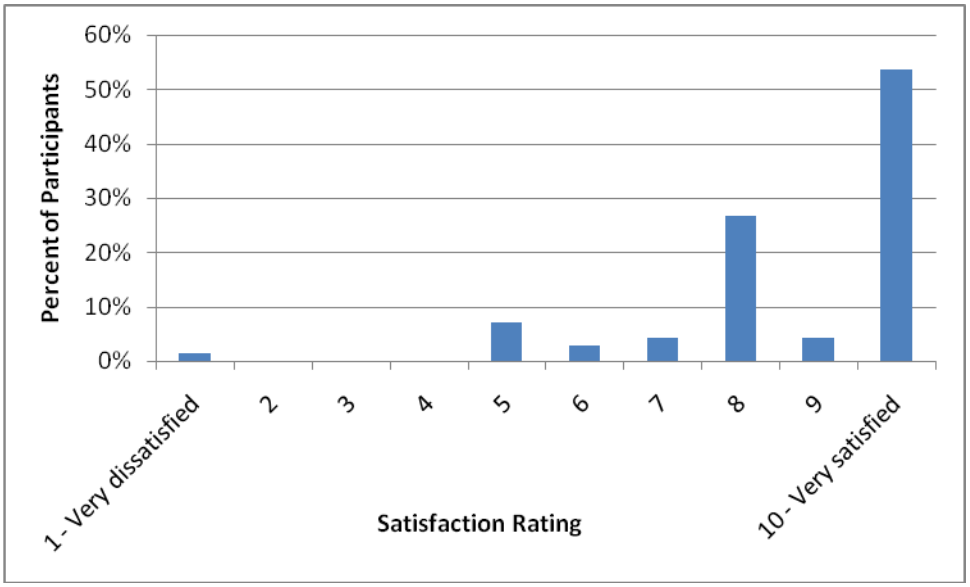

Seventy-seven percent of respondents reported installing all the bulbs they received, with an average of 3 CFLs installed. Only four respondents (6 percent) reported not installing any of the light bulbs they received. Of the 20 respondents who did not install all their bulbs, 16 (80 percent) reportedly stored the CFLs in their homes, with the remaining 20 percent reporting that they were not sure what they did with the bulbs. Based on these survey responses, Cadmus calculated the weighted average installation rate to be 88 percent.

Respondents who installed any light bulbs were asked whether those bulbs were still in use, and 97 percent responded affirmatively. Only two respondents (3 percent) said the bulbs were no longer in use, and both stated that the CFLs had burned out. Both of these participants reported replacing the burned-out CFLs with incandescent light bulbs.

When asked about their satisfaction with the CFLs in their home, respondents gave predominately positive feedback. As shown in Figure 29, only one participant gave a satisfaction

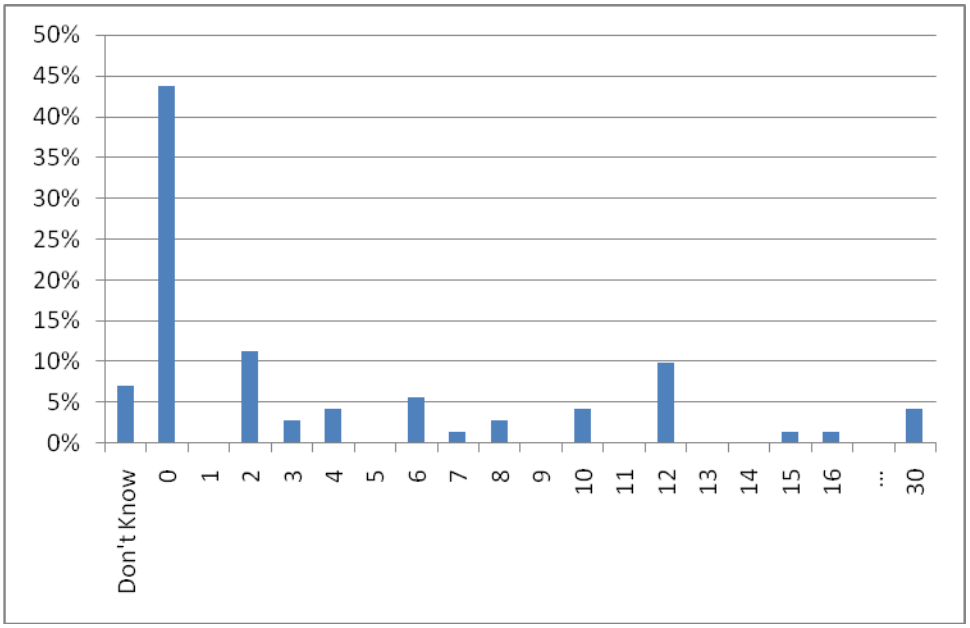
score below 5. That outlier gave a score of 1, indicating major dissatisfaction. However, a large majority (85 percent) gave the CFLs a score of 8 or higher.

**Figure 29. Participant Satisfaction with CFLs**
**(1 to 10 scale, 1 is very dissatisfied and 10 is very satisfied)**




Participants were asked whether they had used CFLs in their home prior to receiving these free light bulbs, and they were evenly split between those who had (49 percent) and those who had not (49 percent). Among participants who had used CFLs in the past, the number purchased in the last year, as shown in Figure 30, ranged from two to 30, with an average of 4.8 bulbs per household.

**Figure 30. Number of CFLs Purchased in the Past Year**



The respondents who had purchased CFLs in the past year were asked from what kind of store or stores they had purchased their bulbs. These results, shown in Table 61, clearly indicate that mass merchandise or discount department stores were the most common place to purchase CFLs among this participant population. This category includes stores such as Target, Wal-Mart, and Kmart. Many types of stores were not mentioned by any participants, including drugstores, which are one of the targets for expansion of the upstream component of the L&A program.

**Table 61. Type of Store from Which Participants Had Previously Purchased CFLs (Multiple Responses Allowed, n=35)**

| Type of Store | Number of Respondents | Percent of Respondents (n=35) |
|---|---|---|
| Grocery store | 1 | 3% |
| Membership/warehouse store | 0 | 0% |
| Home improvement store | 11 | 31% |
| Hardware store | 2 | 6% |
| Mass merchandise/discount department store | 29 | 83% |
| Drugstore | 0 | 0% |
| Convenience store | 0 | 0% |
| Specialty lighting/electrical store | 0 | 0% |
| Home furnishing store | 0 | 0% |
| Mail order | 0 | 0% |
| Online | 0 | 0% |
| Bargain/dollar store | 3 | 9% |
| Office supply store | 0 | 0% |

Participants were also asked about purchasing patterns for incandescent light bulbs. The responses, shown in Table 62 demonstrate that there is much similarity between CFL and incandescent purchasing patterns, with the primary difference being purchases from bargain/dollar stores. Nearly one-third (32 percent) of respondents reported having purchased incandescent bulbs at bargain or dollar stores, compared with only 9 percent reporting having purchased CFLs there.

**Table 62. Type of Store from Which Participants Had Purchased Incandescents (Multiple Responses Allowed, n=71)**

| Type of Store | Number of Respondents | Percent of Respondents (n=71) |
|---|---|---|
| Grocery store | 6 | 8% |
| Membership/warehouse store | 0 | 0% |
| Home improvement store | 10 | 14% |
| Hardware store | 1 | 1% |
| Mass merchandise/discount department store | 51 | 72% |
| Drugstore | 1 | 1% |
| Convenience store | 0 | 0% |
| Specialty lighting/electrical store | 0 | 0% |
| Home furnishing store | 0 | 0% |
| Mail order | 0 | 0% |
| Online | 0 | 0% |
| Bargain/dollar store | 23 | 32% |
| Office supply store | 0 | 0% |
| Other | 3 | 4% |

The survey asked participants whether they had purchased additional CFLs since receiving the free CFLs from the program. Fifteen (21 percent) reported that they had, and reported purchasing an average of 4.6 CFLs each since receiving the free bulbs. A majority (76 percent) had not purchased any additional bulbs since receiving the program CFLs. Nevertheless, most participants (87 percent) reported that they planned to purchase additional CFLs in the future. Of those who said they would not purchase CFLs in the future, the most common reason cited was that the CFLs were too expensive.

Participants were asked a short battery of demographic and home characteristic questions to determine participant age, type of dwelling, and home tenure. These results are summarized in Table 63, Table 64, and Table 65.

**Table 63. SMD Participant Age**

| Age Cohort | Number of Respondents | Percent of Respondents (n=71) |
|---|---|---|
| 60+ | 14 | 20% |
| 50-59 | 15 | 21% |
| 40-49 | 21 | 30% |
| 30-39 | 15 | 21% |
| 20-29 | 5 | 7% |
| Refused | 1 | 1% |

**Table 64. SMD Participant Dwelling Type**

| Dwelling Type | Number of Respondents | Percent of Respondents (n=71) |
|---|---|---|
| One-family home detached from any other house | 32 | 45% |
| One-family home attached to one or more houses | 2 | 3% |
| Building with 3 or 4 apartments | 4 | 6% |
| Building with 5 or more apartments | 10 | 14% |
| Mobile home | 23 | 32% |

**Table 65. SMD Participant Home Tenure**

| Tenure Type | Number of Respondents | Percent of Respondents (n=71) |
|---|---|---|
| Owner | 28 | 39% |
| Renter | 42 | 59% |
| Landlord | 1 | 1% |

At the conclusion of the phone survey, customers were asked whether they had any additional comments to share. In a finding that did not appear elsewhere in the survey, five participants (representing 7 percent of the total) noted that the bulbs supplied were not bright enough. Nonetheless, of the 25 customers who shared comments, 10 expressed their gratitude to Ameren Missouri for providing the free CFLs.

## SMD Impact Findings

In order to assess the savings impact of the SMD component of the program, Cadmus followed a methodology similar to that used to determine gross savings for the upstream lighting component, which is described beginning on page 15. The preliminary inputs to the analysis, shown in Table 66, were drawn from the program tracking database and from the analysis performed for upstream lighting.

**Table 66. SMD Summary of Participation**

| Bulb Type | Incandescent Equivalent Wattage | Bulbs Distributed |
|---|---|---|
| 13-watt CFL | 60 | 57,470 |
| 23-watt CFL | 100 | 57,220 |

These inputs were used to calculate weighted average CFL and equivalent incandescent wattage. Since CFLs purchased may not replace equivalent wattage incandescents, we use the same ratio of equivalent incandescent-to-CFL wattage, 4.0, used in the upstream lighting evaluation, also referred to as delta watts.

Per-unit gross energy savings are determined using the watt ratio and assuming 2.91 daily hours of use (HOU, as determined in the upstream lighting evaluation) according to the following formula.

$$\frac{CFL\ Watts\ X\ Watt\ Ratio - CFL\ Watts\ \ X\ HOU\ X\ 365}{1000}$$

$$\frac{18\ Watts\ X\ 4 - 18\ \ X\ 2.91\ hours\ X\ 365}{1000} = 57.36\ kWh$$

In order to determine total program savings, per-bulb savings are multiplied by the 88 percent installation rate determined in the participant survey and by the number of bulbs distributed, as shown below. Since CFLs are distributed at no charge through this program component, the traditional definition of freeridership (participants still would have purchased the same product at the same time without the program) does not apply. Therefore, the NTG ratio estimate is 1.0.

**Table 67. SMD Total Energy Savings**

| Product | Total Bulbs Distributed | *Ex Post* Gross Energy Savings Per CFL (kWh) | *Ex Post* Total Gross Energy Savings (MWh) | NTG Ratio | Net Energy Savings (MWh) |
|---|---|---|---|---|---|
| Social Marketing Distribution CFLs | 114,690 | 57.36 | 5,789 | 1 | 5,789 |

As determined in the metering study discussed earlier in this report, Cadmus calculated that 12.2 percent of metered CFLs were in operation at the time of Ameren Missouri's system peak. Using this information, Cadmus calculated the peak coincident demand savings per bulb using the following formula:

$$\frac{CFL\ Watts\ X\ Watt\ Ratio\ X\ Peak\ Use\ Coincidence}{1000} = \frac{18\ X\ 4\ X\ 0.122}{1000} = .0089\ kW$$

Table 68 shows per unit and total program peak demand reduction, which was calculated by multiplying per unit demand reduction by number of bulbs distributed and by the 88 percent installation rate. Once again the NTG ratio is 1.0, and no adjustment is made for freeridership, since the bulbs were distributed free of charge.

**Table 68. SMD Total Demand Reduction**

| Product | Total Bulbs Distributed | *Ex Post* Per Unit Gross Demand Reduction (kW) | *Ex Post* Total Gross Demand Reduction (kW) | NTG Ratio | Net Demand Reduction (kW) |
|---|---|---|---|---|---|
| Social Marketing Distribution CFLs | 114,690 | .0089 | 898 | 1.0 | 898 |

# 7. Conclusions and Recommendations

The following conclusions and recommendations are offered based on findings presented in the previous chapters.

## Conclusions

The program exceeded its goals for CFL sales and savings during PY2; Table 69 and

Table 70 show overall participation and gross and net savings as well as the result compared to Ameren Missouri's goals.

**Table 69. PY2 Evaluated Participation, Gross and Net Savings**

| Product | Total Program Sales | *Ex Post* Energy Savings (MWh) | *Ex Post* Demand Savings (kW) | NTG Ratio* | Net Energy Savings (MWh) | Net Demand Saving* (kW) |
|---|---|---|---|---|---|---|
| Upstream CFLs | 1,547,459 | 72,097 | 12,435 | 0.96 | 69,214 | 11,938 |
| Fixtures | 591 | 73.3 | 8.3 | 1 | 73.3 | 8.3 |
| Room Air Conditioner | 3,853 | 443.1 | 231.18 | 0.62 | 274.7 | 143.3 |
| Dehumidifier | 3,545 | 347 | 283.6 | 0.52 | 180.4 | 147.5 |
| Freezers | 490 | 29.9 | 2.0 | 0.58 | 17.3 | 1.1 |
| Total-PY2 | | **72,991** | **12,960** | **0.96** | **69,759** | **12,238** |

* Appliance NTG ratios are based on free-ridership estimates and do not include spillover.

**Table 70. PY2 Sales and Participation Targets and Results**

| ENERGY STAR Lighting or Appliance Type | Program Targets | Results |
|---|---|---|
| CFLs (units) | 1,177,537 | 1,547,459 |
| Dehumidifiers (units) | 1,500 | 3,545 |
| Freezers (units) | 2,600 | 490 |
| Room Air Conditioner (units) | 8,000 | 3,853 |
| CFL Fixtures (units) | 2,500 | 591 |
| Total Net Energy Saving (MWh) | 64,928 | **69,759** |
| Total Net Peak Demand Savings (kW) | 5,600 | **12,238** |

As shown in Table 71, the SMD program distributed 114, 690 bulbs saving a total of 5,789 MWh.

**Table 71. SMD Results**

| | Total Bulbs Distributed | *Ex Post* Total Gross Energy Savings (MWh) | *Ex Post* Gross Demand Savings (kW) | NTG Ratio | Net Energy Savings (MWh) | Net Demand Savings (kW) |
|---|---|---|---|---|---|---|
| Social Marketing Distribution CFLs | 114,690 | 5,789 | 898 | 1.0 | 5,789 | 898 |

Combining the totals from the upstream lighting and appliance programs (Table ES2) with the SMD CFL program (Table ES5) yields an overall portfolio PY2 savings of 78,780 gross MWh and 13,858 gross kW. Net savings are slightly lower with 74,549 net MWh and 13,136 net kW. These savings do not include possible additional spillover which may occur when program participants purchase and install additional types of energy efficient measures outside of the program. This type of spillover is difficult to verify and quantify without detailed surveys and site verifications.

The evaluation found evidence that market transformation is occurring, as the multistate site visits indicated that Ameren Missouri's CFL market penetration (number of homes with at least one CFL) is 93 percent, which is higher than that in all the non-program areas, the newer program areas, and even all long-running program areas (based on the average in the long-running program areas). This may be evidence that Ameren's unique SMD program is broadening the reach of CFLs. A high market penetration indicates the program is wide-reaching; however, Ameren Missouri's low average saturation compared to long-running programs (16.3 percent vs. 23 percent, respectively) indicates significant opportunities for increased CFL purchases within customers' homes.

Ameren Missouri's program and incentive costs were lower than in most other participating program areas in the multistate study, yet CFL sales (both program bulbs and non-program bulbs) were higher, perhaps indicating an effective program delivery strategy.

Intercept surveys indicated some significant leakage in certain rural locations. The overall leakage rate for the program was 8.7 percent; however, this number doesn't consider possible leakage into the area (for instance, from the neighboring utility Ameren Illinois). Leakage rates in the St. Louis area are estimated to be lower, at roughly 3.4 percent.

As reported by retailers, the program has been successful in increasing the supply of energy-efficient CFLs and appliances in the market, and most retailers report significant increases in their sales due to the program. Program staff also reported success in product placement in end-caps and other visible store locations, which are likely to induce more sales.

Program stakeholders reported being pleased with the program, and plan to continue adding more retail outlets in the coming year. An additional two appliance types are planned as well.

## Recommendations

- ***Incorporate evaluation requirements into corporate retailer/manufacturer MOUs:*** Retailers are not always cooperative in responding to interview requests, allowing store intercepts, providing opinions on program processes, and providing information on their CFL sales levels; information that is needed to perform an evaluation. In some cases

during PY2, Cadmus was unable to collect data from all the retailers in our planned sample. The current memorandum of understanding (MOU) does not require specific cooperation with interviews or in-store customer surveys. Cadmus recommends modifying retailer and manufacturer MOU's to require cooperation with evaluation approaches.

- ***Continue focusing on consumer education*.** As reported by APT, store events and trainings have been effective in increasing consumer awareness and education about CFLs. The high level of market penetration is indicative of this effort. Cadmus recommends having education efforts on proper disposal of CFLs and proper application of specialty CFLs in specialty fixtures.
- ***Consider switching to the coupon approach in stores vulnerable to leakage.*** Evidence of leakage rates as high as 49 percent was found in some rural big-box stores. The coupon approach, which requires customers to complete an instant rebate form and ensures bulbs are purchased by Ameren Missouri customers, could alleviate this problem without eliminating the rural stores from the program.
- ***Update appliance savings estimates in the tracking database.*** Cadmus independently calculated the estimated savings for freezers, dehumidifiers, and room air conditioners. The *ex ante* estimates for freezers, in particular, were higher than our estimates, which may have been caused by an assumption of early replacement rather than new purchases. New savings estimates for freezers were approximately 25 percent of *ex ante* savings. *Ex ante* and realized savings estimates for dehumidifiers and room air conditioners were close to our estimates, and are dependent on particular sizes installed.
- ***Perform additional mass marketing.*** Based on a small level of dissatisfaction among retailers and the fact that many intercepted customers were unaware of Ameren Missouri's program, Cadmus recommends Ameren Missouri perform broader program marketing or advertising. General advertising can increase program spillover and hasten the market transformation as consumers will think more about their choices wherever they shop. Participating retailers will also feel they are benefiting more from the program.
- ***Perform general marketing regarding appliance rebates***: While appliance rebate freeridership was not unnecessarily high, Ameren Missouri may be able to achieve greater savings by broadly marketing the program. The current approach attempts to convert customers already shopping for appliances from purchasing standard efficiency to higher efficiency products. Adding general marketing could encourage some customers to replace older, inefficient appliances early, which would result in greater energy savings and fewer free riders.

# Appendix A. CFL User Survey and Site Visits

## Sampling Plan

A total of 451 surveys were conducted in July 2010 by Tetra Tech Inc., a subcontractor to Cadmus, with randomly selected Ameren Missouri residential customers. The sample of survey respondents included both CFL purchasers and non-purchasers. Of the 451 households surveyed, 69 percent reported they had purchased CFLs during the previous six months (January – June 2010).

The sample was designed to achieve a precision level of at least ±5 percent with 95 percent confidence for Ameren Missouri's service territory overall. The other goal of the survey was recruiting a minimum of 100 households for site visits. All 451 of those surveyed were asked to participate in site visits and were offered a $50 incentive to allow a site inspector to inventory lighting in their home. Of those asked, 87 accepted, were scheduled, and completed site visits during the June and July of 2010.

Of the 1,450 customers initially contacted, 306 had non-working numbers. The remaining were contacted an average of 8.4 times to complete the 451 surveys, resulting in a cooperation rate of 39.4 percent. Table 72 summarizes the final distribution of telephone surveys.

**Table 72. Final Distribution of Telephone Surveys**

| CFL Disposition | Completes | Recruited for Site Visit | Scheduled for Site Visit | Hard Refusal | Non Working Number |
|---|---|---|---|---|---|
| Unaware | 8 | 136 | 87 | 84 | 306 |
| Non Purchaser | 185 | | | | |
| Non User | 21 | | | | |
| 6-month Purchaser | 266 | | | | |
| **All** | **451** | | | | |

## Results

Respondents reported total CFL bulbs installed and in storage at the time of the telephone surveys. The majority of respondent households reported having between six and 10 CFLs installed. Respondents also reported having between one and five CFL bulbs in storage at the time of the telephone surveys. It is worth noting that self-reported CFL purchase data are often difficult for respondents to recall, and therefore are often unreliable. Individual home lighting audits are typically more accurate for assessing CFL penetration and saturation. The next section reports results from the site visits.

Table 73 summarizes reported CFL purchases, installations, and stored bulbs per household based on the survey results.

**Table 73. Summary of CFL Purchases by Installation and Storage**

| Survey Question | Average |
|---|---|
| CFLs installed at time of survey | 10.4 |
| CFLs in storage at time of survey | 5.1 |
| CFLs purchased six months prior | 5.2 |

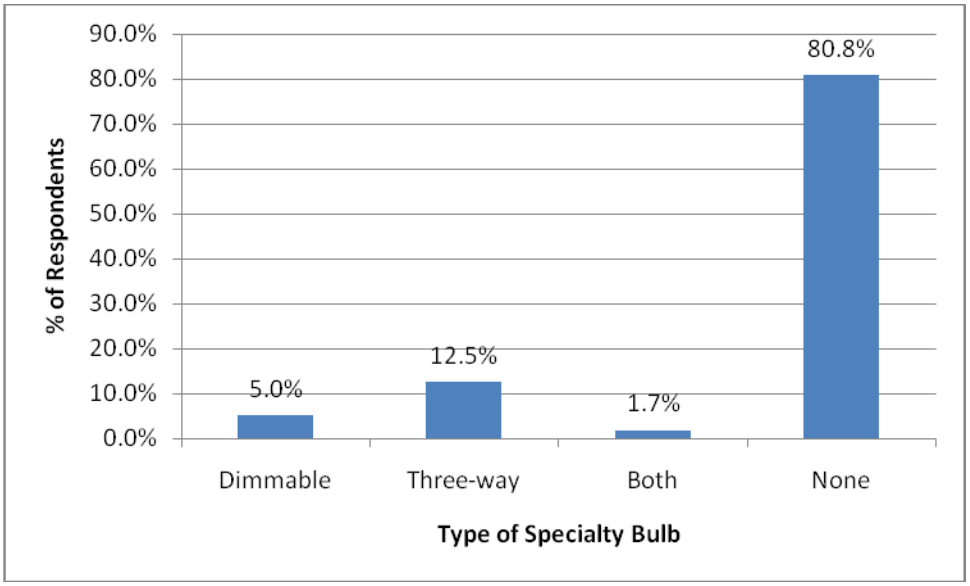
Respondents also were asked to discuss their CFL purchases in the six months prior to the Ameren Missouri telephone survey. These results are shown in Table 74.

**Table 74. CFLs Purchased During Six Months Prior to Ameren Missouri Telephone Surveys (n = 272)**

| Number of CFLs Purchased in Six Months Prior to Survey | Percent of Respondents |
|---|---|
| 0 | 31% |
| 1-5 | 27% |
| 6-10 | 30% |
| 11-20 | 11% |
| 21 or more | 1% |

Respondents also discussed their use of CFLs in specialty fixtures, such as dimmable and 3-way fixtures. As can be seen in Figure 31, almost 81 percent of respondents did not have CFLs installed in specialty light fixtures. This may indicate poor awareness of specialty CFL bulbs, and may be an opportunity for increased education and marketing of these bulbs types.

**Figure 31. Use of CFLs on Dimmable and 3-Way Fixtures (n = 308)**




Seventy-one percent of respondents with CFLs in specialty fixtures reported correctly using dimmable CFLs in dimmable fixtures. Similarly, 69 percent of respondents reported using

correct 3-way CFLs in 3-way lighting fixtures. These results, presented in Table 75 and Table 76, indicate more opportunity for education on the correct use of specialty CFLs.

**Table 75. Correct Use of CFLs in Dimmable Fixtures**

| Correct Use of CFLs in Dimmable Fixtures | Percent of Respondents (n=19) |
|---|---|
| Use of Dimmable CFLs | 71.6% |
| Use of Regular CFLs | 28.4% |

**Table 76. Correct Use of CFLs in 3-Way Fixtures**

| Correct Use of CFLs in 3-Way Fixtures | Percent of Respondents (n=37) |
|---|---|
| Use of 3-way CFLs | 69% |
| Use of Regular CFLs | 31% |

Respondents discussed their satisfaction with using CFLs in dimmable and 3-way light fixtures. Overall, respondents were satisfied with using CFLs in dimmable fixtures. Figure 32 shows that 59 percent of respondents are "*very satisfied*" using CFLs in dimmable fixtures. Just 51 percent of respondents indicated that they are "*very satisfied*" using CFLs in 3-way fixtures. Figure 33 presents overall satisfaction findings for 3-way CFLs.

**Figure 32. Satisfaction with CFLs in Dimmable Fixtures (n = 21)**

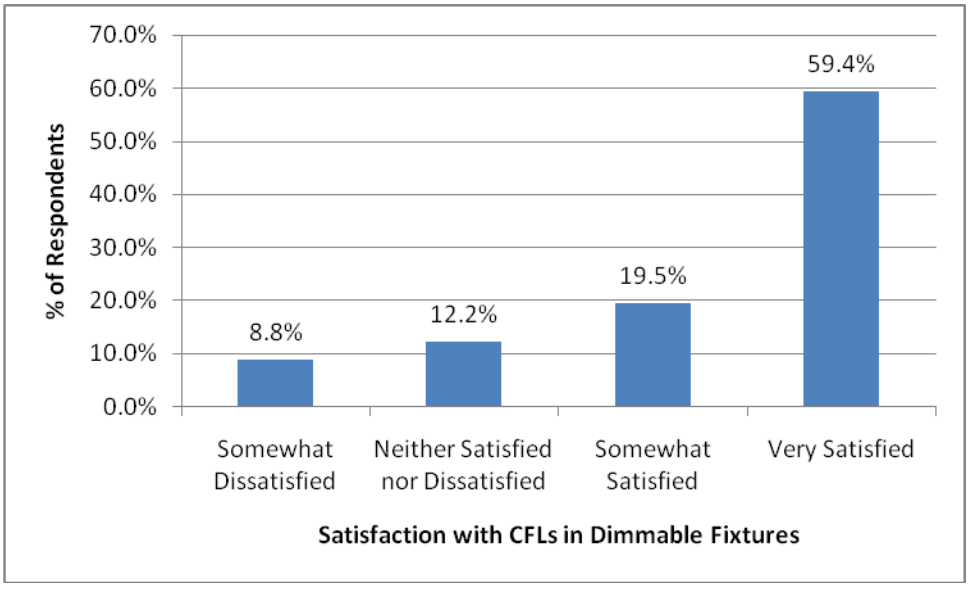
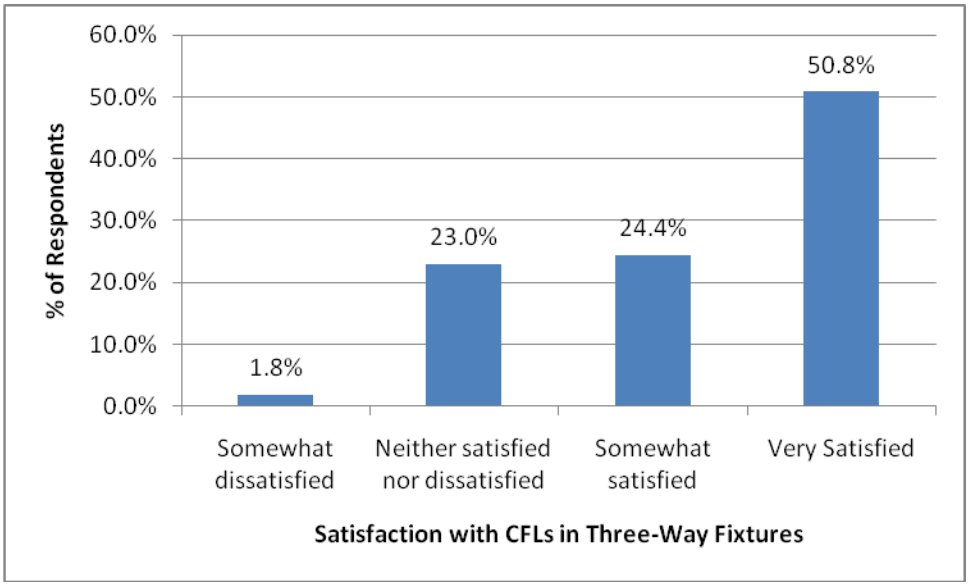


**Figure 33. Satisfaction with CFLs in 3-Way Fixtures (n = 44)**




The Ameren Missouri telephone survey elicited feedback about respondents' concerns with CFLs in general. Respondents overwhelmingly indicated that they do not have any particular concerns with CFLs (81.7 percent); however, disposal of CFLs is the number one concern respondents mentioned at 8.2 percent, and mercury was a concern for 3.5 percent of respondents. For non-safety concerns, respondents cited brightness, delayed full brightness of bulb, and shorter than anticipated life span as CFL concerns. Respondents also provided verbatim responses not included in the survey; of these respondents, many were related to personal safety and environmental concerns, including that CFLs easily shatter and that they add to pollution, while others cited concerns about the noise that the bulbs emit. Table 77 illustrates the results of this question.

**Table 77. Concerns with CFLs* (n = 314)**

| CFL Concerns | % of Respondents |
|---|---|
| None | 81.7% |
| Mercury | 3.5% |
| Requires Special Disposal | 8.2% |
| Light Color | 0.5% |
| Not Bright Enough | 2.9% |
| Delayed Full Brightness | 0.8% |
| Short Life | 0.8% |
| Expensive | 0.3% |
| Other | 6.8% |

* Multiple responses were allowed.

As shown in Figure 34, a high percentage of respondents (48 percent) reported that they had disposed of CFLs that were broken, burned out, or otherwise no longer useful. Respondents were then asked to describe their disposal methods. As shown in Figure 35, the majority of respondents disposed of CFLs by throwing them out with the trash. Overall, very few

respondents disposed of CFLs through environmentally-safe means. This indicates a significant opportunity for educating consumers about the proper disposal of CFLs.

**Figure 34. Percent of Respondents Who Have Disposed of CFLs (n = 309)**

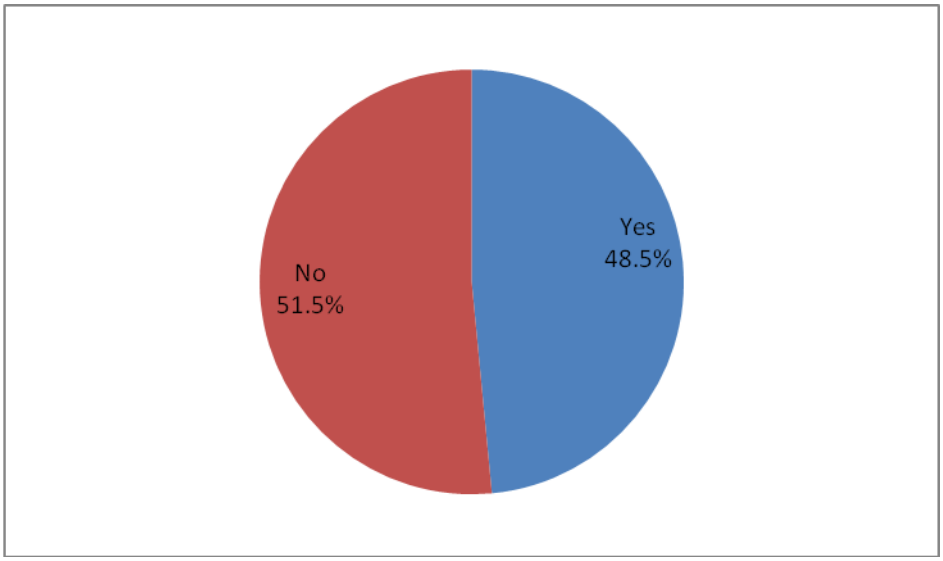
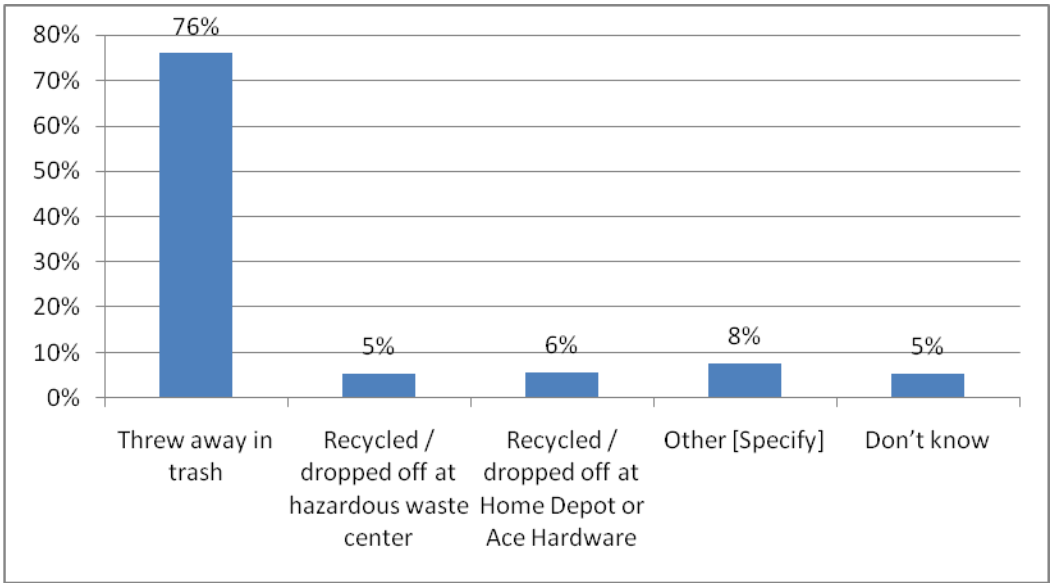


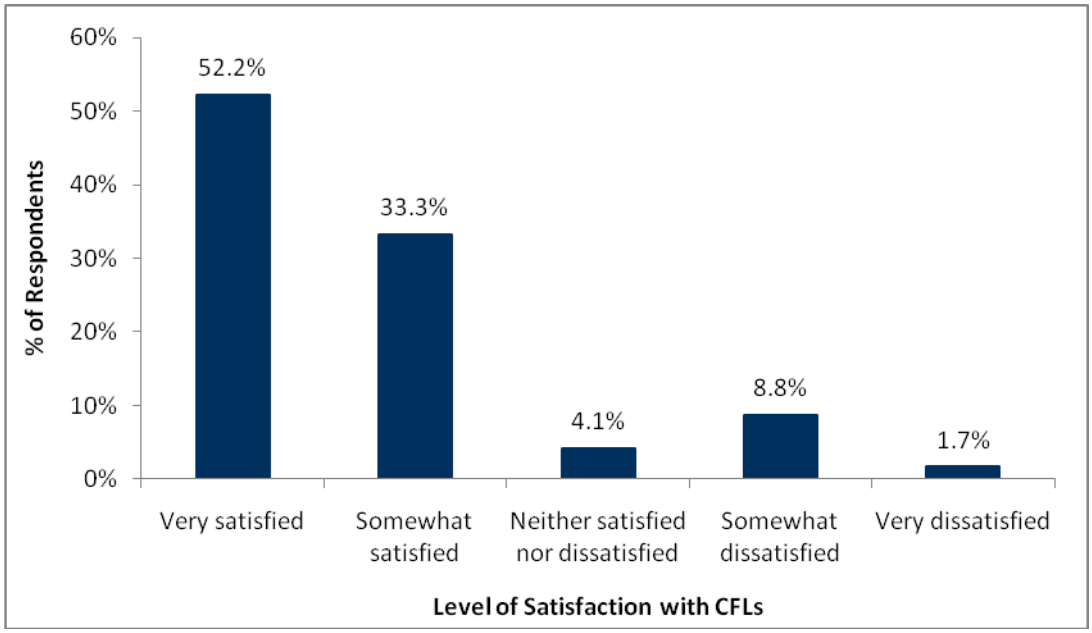

**Figure 35. Disposal Methods (n = 148)**




Ameren Missouri respondents also discussed their overall satisfaction with CFLs. Fifty-two percent of respondents reported being "*very satisfied*" with CFLs, while 1.7 percent of respondents reported being "*very dissatisfied*." Figure 36 presents these results. Respondents who were generally dissatisfied provided additional feedback regarding their dissatisfaction. Of these 25 responses, eight indicated that they are concerned about the mercury that CFLs contain, three respondents do not like the requirements for proper CFL disposal, and three participants

discussed lack of education about CFLs. Other concerns included: price, color of light, and short bulb life.

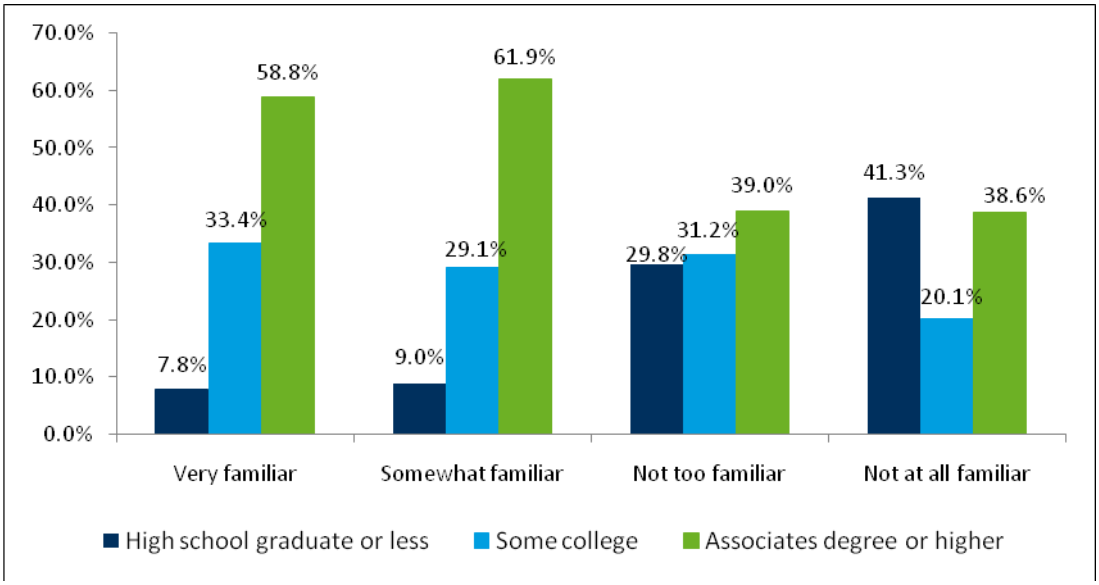
**Figure 36. Satisfaction with CFLs (n = 307)**




## CFL Awareness and Familiarity

Cadmus analyzed familiarity with CFLs based on respondents' education level, income, and ethnicity. More than half (58.8 percent) of respondents who reported that they are "*very familiar*" with CFLs earned at least an associate's degree, while only 7.8 percent of these respondents were a high school graduate or did not graduate high school. Overall, respondents who claimed to be "*not at all familiar*" with CFLs were less educated than those with some college education or an associate's degree or higher. These findings are presented in Figure 37.

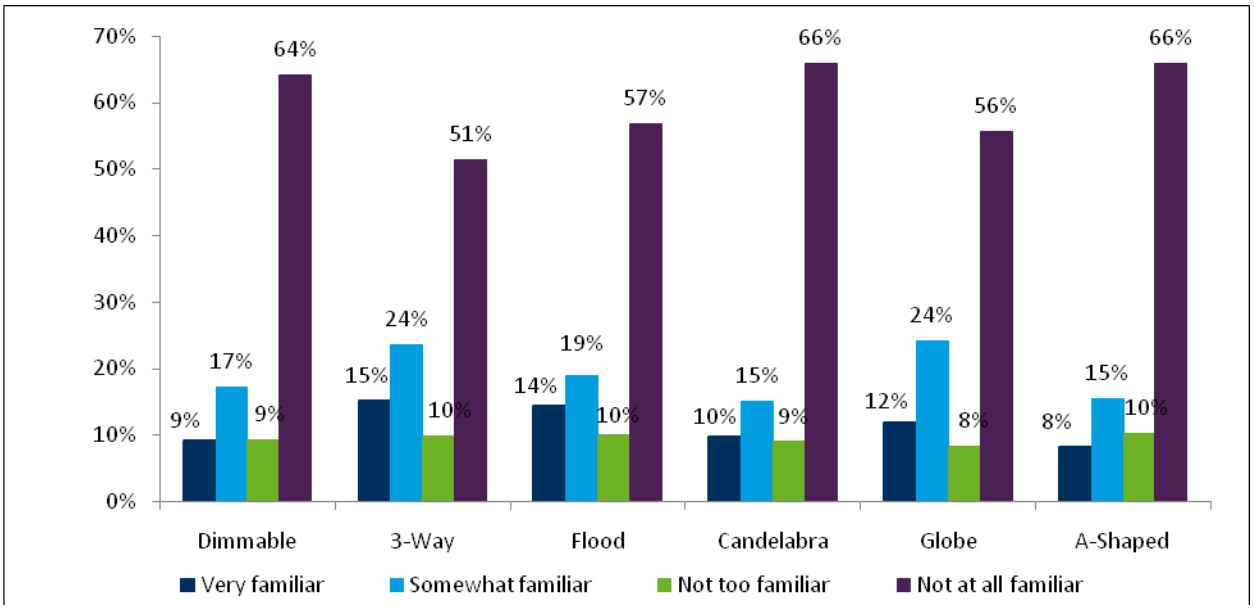
**Figure 37. CFL Familiarity by Educational Attainment***




* High school graduate or lower n = 36; Some college n = 95, Associates degree or higher n = 175.

We then asked participants about their familiarity with a variety of specialty CFL bulbs. Across all bulb varieties mentioned in the telephone survey, at least half of the 394 respondents were not at all familiar with specialty CFL bulbs. As presented in Figure 38, roughly 20 percent of respondents reported being at least somewhat familiar with all specialty CFL bulbs mentioned in the telephone survey except candelabra and A-shaped CFLs. The lower levels of familiarity with specialty CFL bulbs indicate that stronger marketing and customer education may be necessary to increase saturation and penetration of these bulbs.

**Figure 38. Familiarity with Specialty CFL Bulbs (n = 394)**



## CFL Usage

It is logical to find lower use of CFLs among lower income, lower educated, and minority residences. Cadmus found this to be the case when analyzing telephone survey data. The survey data show that CFL usage varied somewhat by educational attainment, ethnicity, and income.

Analysis of education distribution among respondents showed that almost two-thirds (64.4 percent) had at least some college education or a degree. Seven percent had less than a ninth grade education, and the remaining respondents had at least some high school education. Among respondents with at least an associate's degree, 84 percent have used CFLs, compared with 74 percent with some college education. Over 34 percent of respondents who are high school graduates or less have used CFLs. Table 78 presents these findings.

**Table 78. CFL Usage by Educational Attainment (n = 304)**

| High School Grad or Lower | Some College | Associates Degree or Higher |
|---|---|---|
| 34.2% | 73.6% | 84.4% |

Ethnicity also seems to be a contributing factor to CFL usage. Table 79 shows that among respondents, 80 percent of Caucasians and 61 percent of black people reported using CFLs. Of those respondents who described themselves as "*other*" ethnicity, 64.5 percent reported having used CFLs in the interior or exterior of their home.

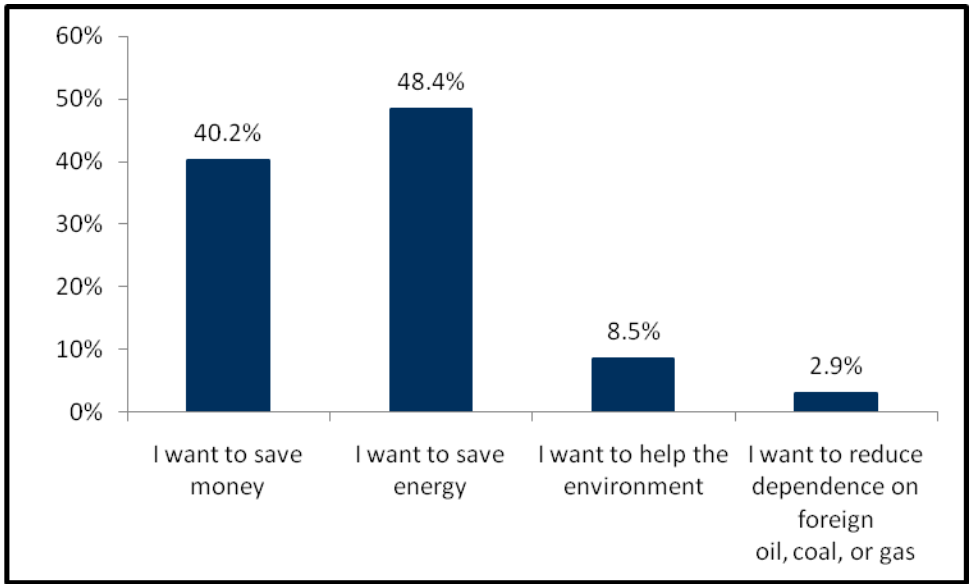
**Table 79. CFL Usage by Ethnicity***

| White | Black | Other Ethnicity |
|---|---|---|
| 80.3% | 61% | 64.5% |

* White n = 336, Black n = 45, Other n = 15.

Telephone survey respondents also discussed why they are currently using CFLs. Around half (48 percent) indicated that they installed CFLs to save energy. Another 40 percent installed CFLs to save money. Only a handful of participants reported that they installed CFLs to either help the environment or reduce dependence on foreign fossil fuel sources. These findings are presented in Figure 39.

**Figure 39. Reasons for Using CFLs (n = 295)**




## CFL Purchases

Telephone survey participants were asked to identify the types of stores where they typically purchase CFL bulbs. These participants most often cited mass merchandise stores, such as Wal-Mart or Target. The second most cited store type was home improvement stores such as Home Depot or Lowe's. Participants also discussed their proximity to large discount stores or home improvement stores. Most participants (93.4 percent) live within 30 minutes from the nearest store. Specifically, more than half (64.6 percent) are within a 14-minute drive to the nearest store.

Survey respondents discussed how they first heard about CFLs. Survey administrators did not prompt respondents; therefore, respondents discussed multiple ways that they first heard about CFLs. Forty-one percent of respondents cited traditional media marketing such as television, radio, newspaper, and magazine advertisements. Roughly 17 percent of respondents also heard about CFLs through retail store displays or advertisements. Respondents also discussed a variety of other ways they heard about CFLs that were not included in the telephone survey. These responses included internet research or indirect marketing by associates at lighting or home improvement stores.

To conclude the CFL purchases section of the survey, respondents discussed their bulb storage habits and their bulb removal habits. Three-fourths of respondents indicated that they typically keep a supply of bulbs in storage. The remaining respondents typically purchase bulbs as needed when installed bulbs burn out.

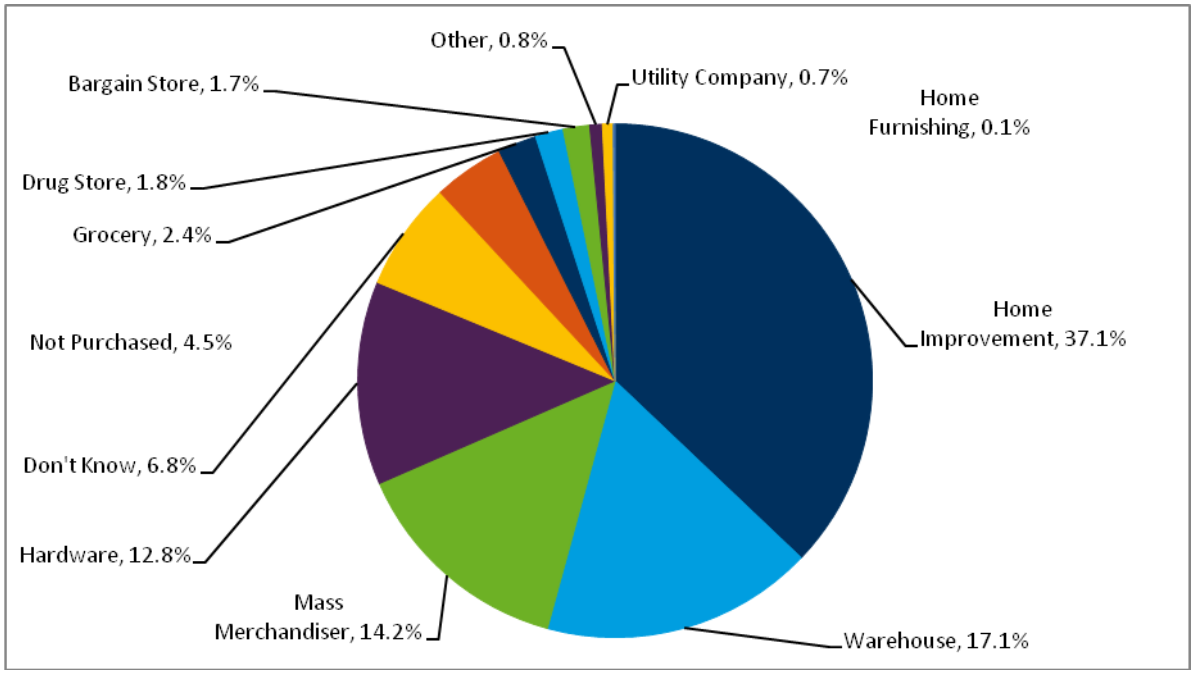
# Appendix B. Site Visits

This section describes information collected from 87 Ameren Missouri customers during site visits occurring during the summer of 2010. Site visits were performed by a combination of Cadmus and Mad Dash, Inc.

## Where Purchased

Site inspectors asked for each CFL found in a home, where that particular bulb was purchased (Figure 40). Home improvement stores (such as Lowes or Home Depot) and warehouse stores (such as Sam's Club or Costco) were the most common, followed by mass merchandise stores (such as Target or Wal-Mart) and hardware stores (such as ACE Hardware). Most respondents had little difficulty telling inspectors where specific bulbs were purchased since they commonly shopped at the same store, however 6.8 percent didn't know and 4.5 percent had bulbs given to them.

**Figure 40. Stores Where Each CFL Found Was Purchased**




## Environmental and Early Adopter Tendencies

Participants were asked their opinions on several environmental questions. A majority of respondents (65 percent) stated that they believe the earth's average temperature is rising most likely due to human activity (Figure 41). Sixty percent also thought that "*protection of the environment should be given priority, even at the risk of curbing economic growth*" (Figure 42).

**Figure 41. Opinion on Whether the Earth's Average Temperature Is Rising Due to Human Activity (n = 80)**

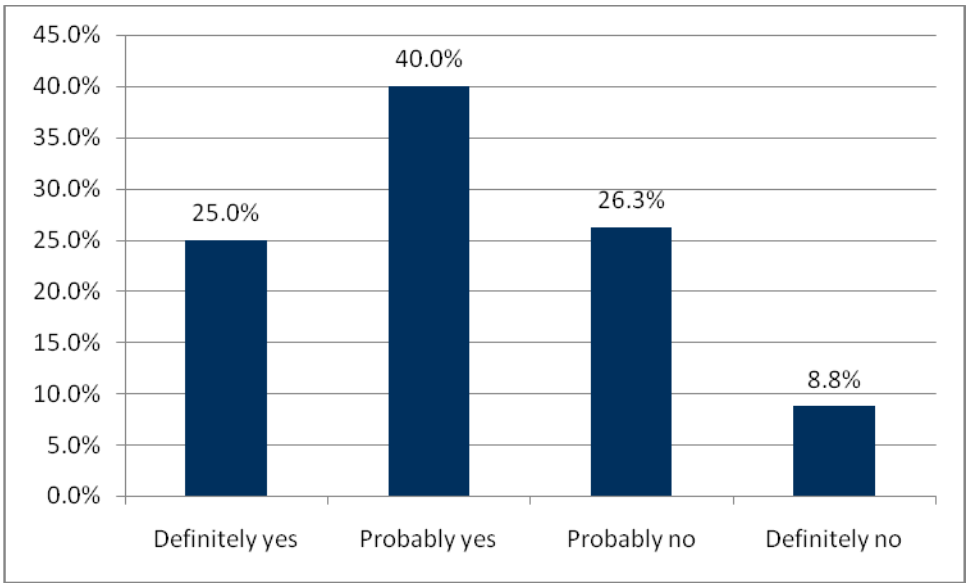
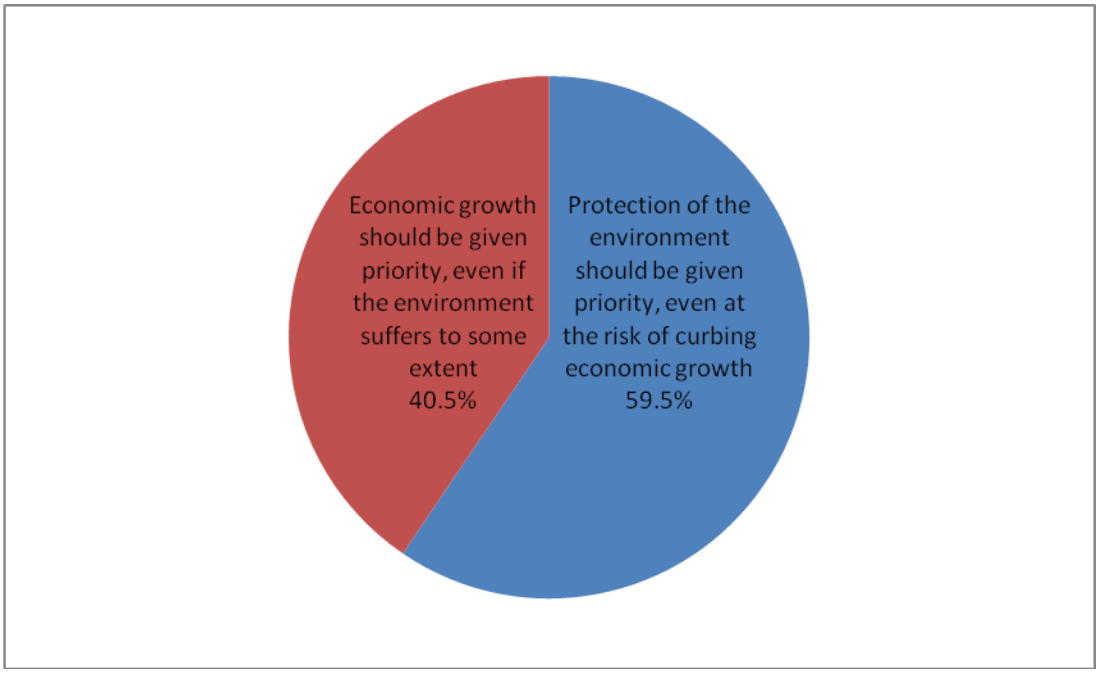



**Figure 42. Respondents' Opinions on Economic Growth vs. Environment (n = 79)**




When asked about comfort with new technologies, over two-thirds of all respondents (71.8 percent) agreed "*I am skeptical of new technology. I like to wait until a new technology is proven before I buy it.*" Twenty-seven percent, however, agreed with the statement "*I always like to have the latest gadget*." Eighty-seven percent agreed "*I am comfortable learning about how new technologies work*" (Table 80). Thus, while there was healthy skepticism about new

technologies, the majority are comfortable learning about new technologies—a positive response when trying to get households to adopt new, energy-efficient technologies.

**Table 80. Level to Which Respondents Are Comfortable with New Technology**

| Level of Agreement | I am skeptical of new technology. I like to wait until a new technology is proven before I buy it | I always like to have the latest gadget | I am comfortable learning about how new technologies work |
|---|---|---|---|
| Strongly Agree | 15.3% | 2.4% | 25.9% |
| Agree | 56.5% | 24.7% | 61.2% |
| Disagree | 18.8% | 61.2% | 10.6% |
| Strongly Disagree | 9.4% | 11.8% | 2.4% |
| **Total Respondents** | **85** | **85** | **85** |

## Inventory Results

While the most common type of room in homes were bedrooms (2.8 on average), basements, followed by outdoor spaces, had the most sockets per room (10.8 and 8.1, on average). Table 81 shows the average number of rooms in Ameren Missouri customer homes and the average number of sockets per room.

**Table 81. Number of Rooms and Sockets in a Typical Home (Total Homes Visited n = 87, Total Number of Sockets n = 6,049)**

| Room Type | Average Number of Rooms with Sockets per Home* | Average Sockets per Room |
|---|---|---|
| Bedroom | 2.8 | 3.9 |
| Bathroom | 2.2 | 4.1 |
| Living Space | 1.3 | 7.0 |
| Closet | 1.3 | 1.5 |
| Kitchen | 1.1 | 6.9 |
| Hallway | 1.1 | 2.5 |
| Outdoor | 0.9 | 8.1 |
| Basement | 0.6 | 10.8 |
| Utility | 0.6 | 2.5 |
| Dining | 0.6 | 6.6 |
| Office/Den | 0.6 | 5.3 |
| Garage | 0.5 | 6.0 |
| Other | 0.4 | 2.5 |
| Foyer | 0.4 | 4.6 |
| **Total** | **14.3** | **4.9** |

* Any room with sockets was included in that particular category. If there were no sockets, such as a closet without a light, the room was not recorded.

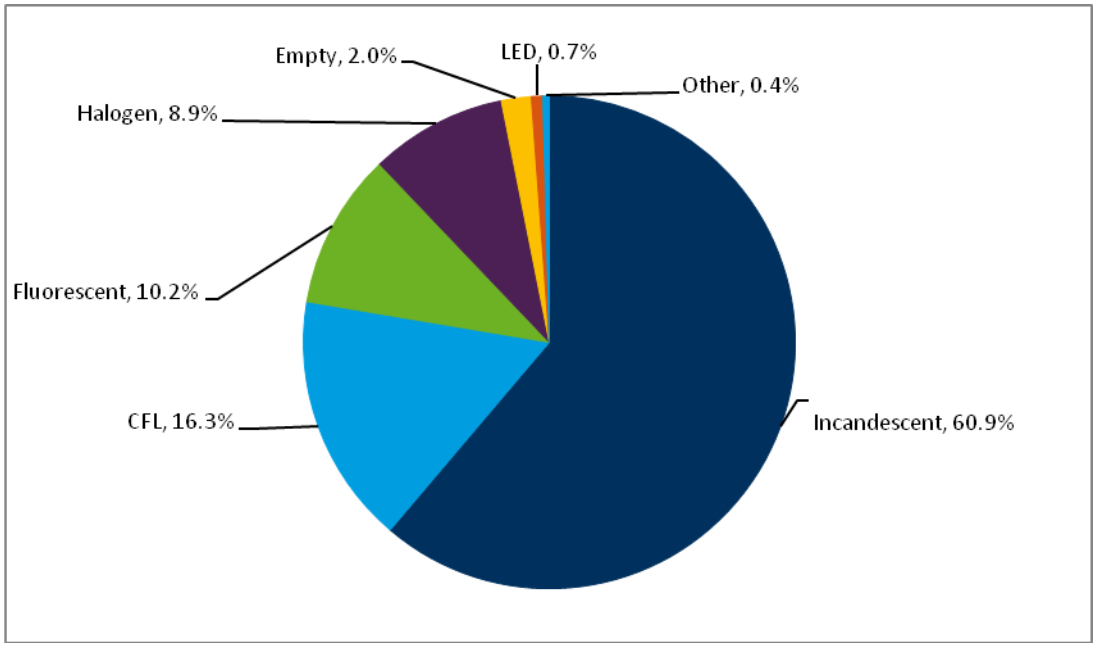
The on-site survey identified 6,049 sockets.[23] As shown in Table **82**, the majority of these sockets (76.2 percent) were medium screw-based, followed by pin-based sockets, and then small screw-based sockets. Of all sockets catalogued, 16.3 percent had CFLs installed in them. The majority of installed CFLs were medium, screw-based. Two percent of all sockets did not have a bulb installed. Figure 43 shows the saturation for each bulb type. At 60.9 percent, incandescent bulbs made up the largest percentage, followed by CFLs at 16.3 percent, and fluorescent bulbs at 10.2 percent. There were 220 CFLs found in storage, yielding an average of 2.5 uninstalled CFLs per home.

**Table** 82**. Bulbs per Socket Type**

| Socket Type | Total | | CFLs | | Empty Sockets | |
|---|---|---|---|---|---|---|
| | # | % | # | % | # | % |
| Medium Screw Base | 4,612 | 76.2% | 958 | 20.8% | 115 | 2.5% |
| Pin Base | 903 | 14.9% | 0 | 0% | 0 | 0% |
| Small Screw Base | 480 | 7.9% | 25 | 5.2% | 4 | 0.8% |
| Other* | 54 | 0.9% | 4 | 7.4% | 0 | 0.0% |
| **Total Sockets** | **6,049** | **100.0%** | **988** | **16.3%** | **119** | **2%** |

*Other includes GU-based bulbs.

**Figure 43. Percent of Bulb Type (Site Visits n = 87, Total Sockets n = 6,049)**

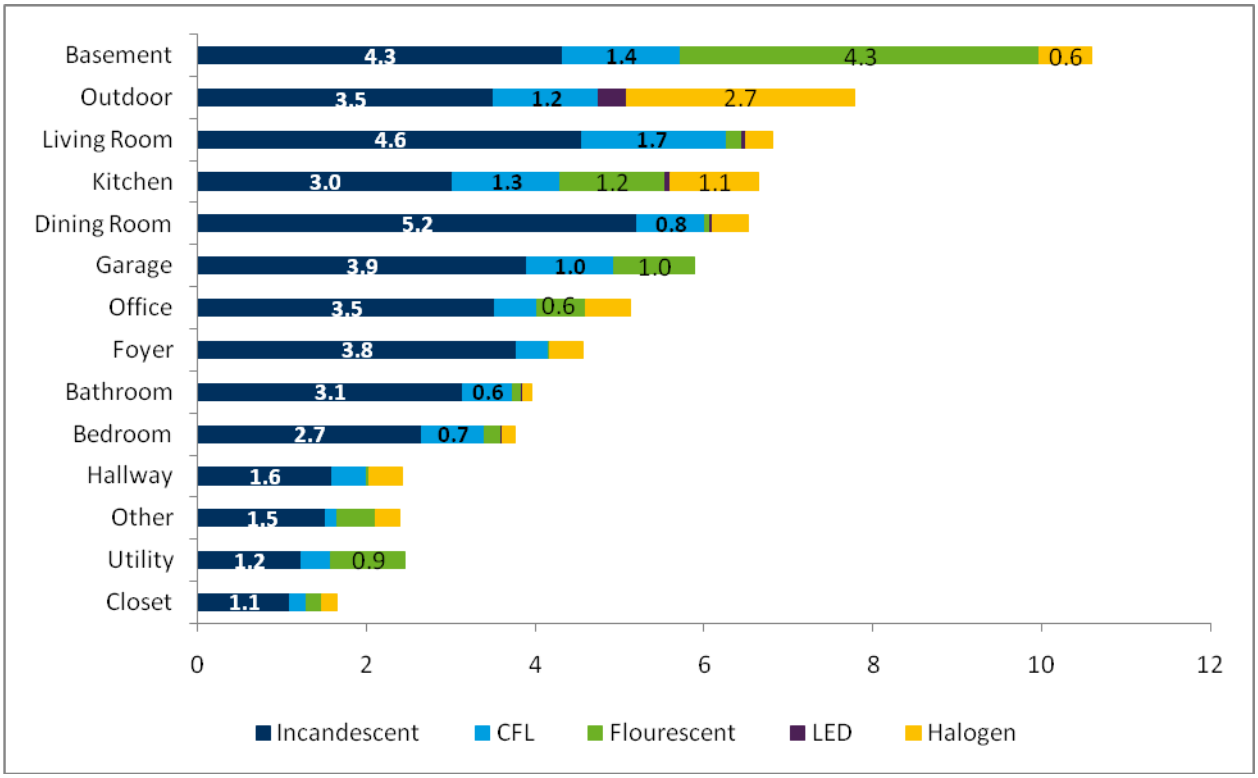



Among room types, basements had the greatest average number of installed bulbs, followed by outdoor areas, and then living rooms. Dining rooms had the highest average number of incandescent bulbs (5.2), followed by living rooms (4.6).

[23] This included empty sockets and sockets that had an installed, burnt out bulb.

Living rooms had the highest average number of CFLs (1.7), followed by basements (1.4), and then kitchens (1.3). While LEDs and halogens were not as common, on average 0.3 LEDs were installed in outdoor areas, 2.7 halogens were found outdoors, and 1.1 halogens were found in kitchens (Figure 44).

**Figure 44. Average Number of Bulbs per Room Type (Total Installed Bulbs n = 5,931)**




Of 1,208 CFLs on-site, 41.3 percent were reportedly purchased before 2009; 35.5 percent were purchased in 2009; and 16.5 percent were purchased during the first seven months of 2010 (Table 83).

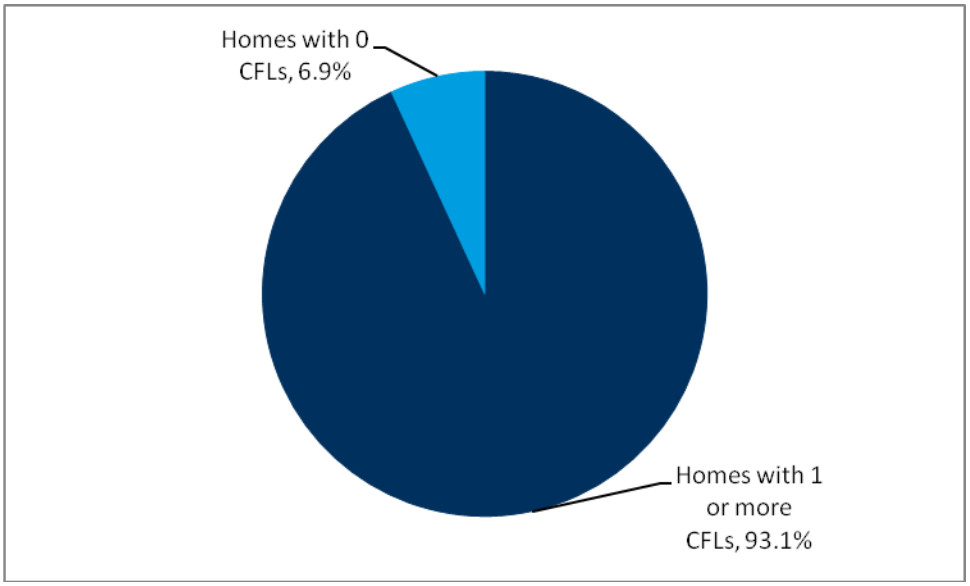
**Table 83. CFLs by Purchase Date**

| Purchased | Before 2009 | First Half of 2009 | Second Half of 2009 | 2010* | Don't Know |
|---|---|---|---|---|---|
| Total CFLs Purchased (1,208) | 41.3% | 16.1% | 19.4% | 16.5% | 6.7% |
| Average CFLs Purchased per Home | 5.73 | 2.23 | 2.70 | 2.29 | 0.93 |

* Site visits occurred in July and August 2010; this category only represents purchases through the beginning of August 2010.

CFL penetration was 93.1 percent (Figure 45).

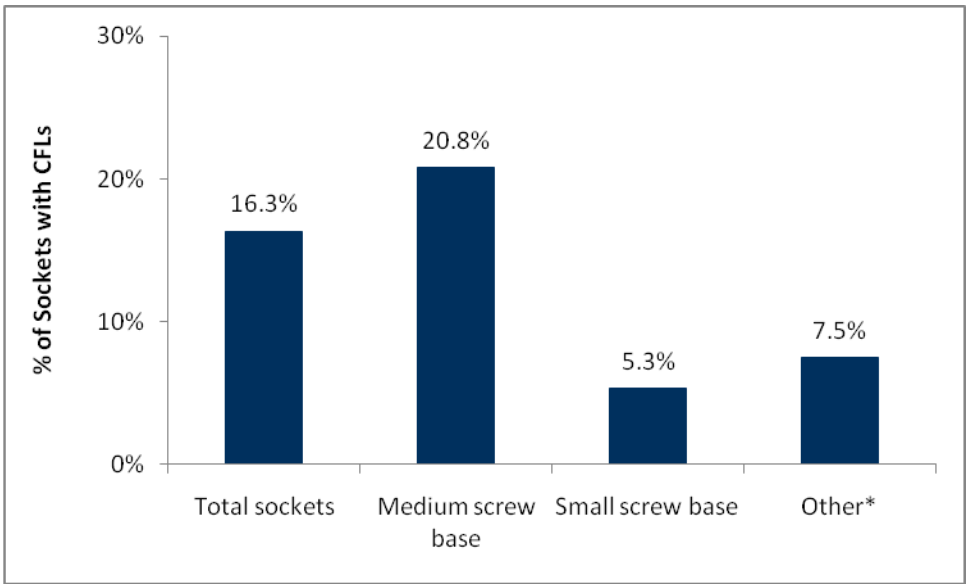
**Figure 45. CFL Penetration (Site Visits n = 87)**




The following figures display CFL saturation from several different approaches. Figure 46 shows CFL saturation by socket type. Among all sockets, CFL saturation was 16.3 percent. Among all medium, screw-based sockets, CFL saturation increased to 20.8 percent and dropped to 5.3 percent for small screw-based sockets. Although saturation among small screw-based sockets was lower than for medium screw-based sockets, the number of sockets without CFLs was highest among medium, screw-based sockets, as these were the majority of sockets found on-site.

Of 87 site visits and 5,931 total bulbs, 45 of them were installed LEDs. The installation rate among all CFLs purchased and on-site was 82 percent.

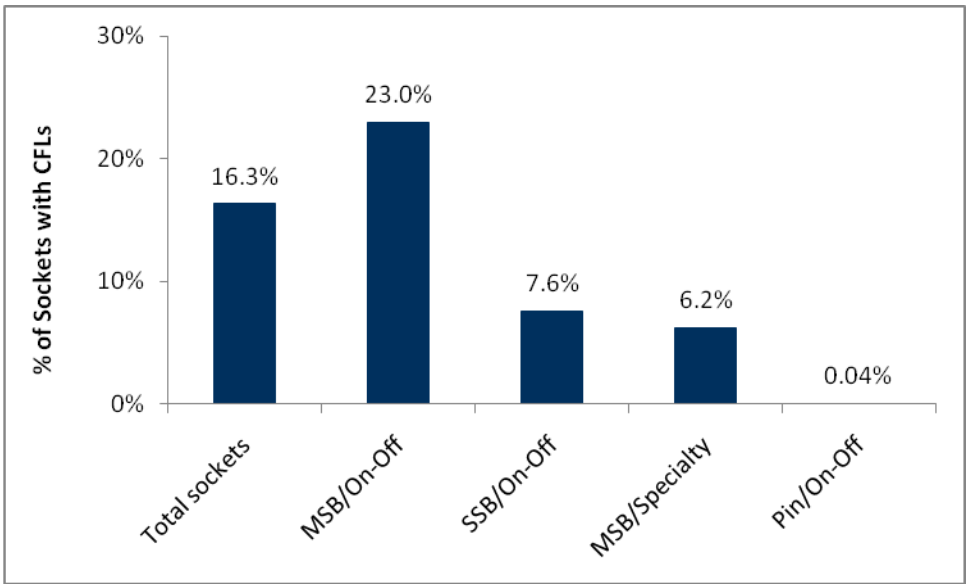
**Figure 46. CFL Saturation by Socket Type (Total Sockets n = 6,049)**




* Other includes the pin-based GU bulbs.

The graph below adds another layer of data, showing CFL saturation by base and control types. Saturation was 23 percent for medium, screw-based sockets with an on/off control type.

**Figure 47. CFL Saturation by Socket/Control Type (Total Sockets n = 6,049)**




As shown in Figure 48, CFL saturation by room type was greatest in living spaces and bedrooms (24 percent and 19 percent), followed by kitchens (18 percent) and garages (17 percent). Figure 49 shows that among fixture types, CFL saturation was highest for lamps (both table lamps and floor lamps at 32.6 percent), followed by torchieres (18.3 percent) and ceiling fans (17.7 percent). As these results indicate, residents have the highest percentage of CFLs in their highest use areas.

**Figure 48. CFL Saturation by Room Type (Total Sockets n = 6,049)**

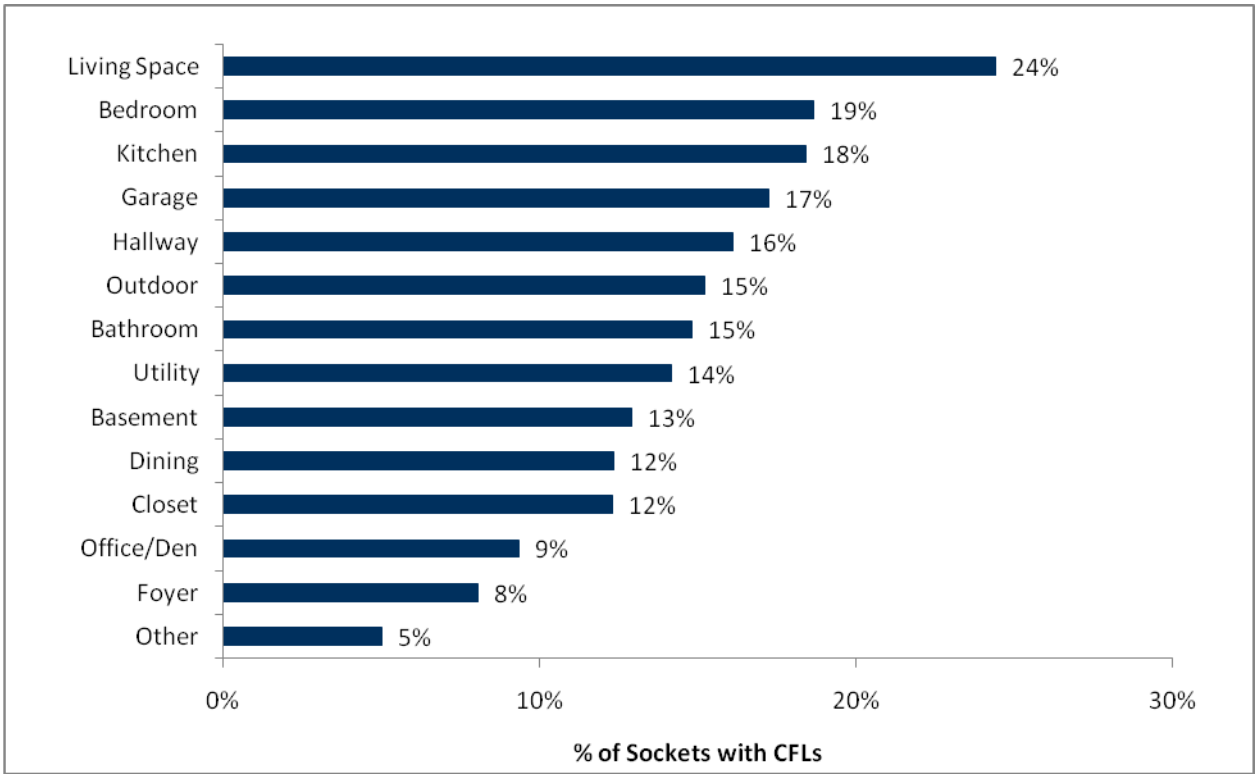
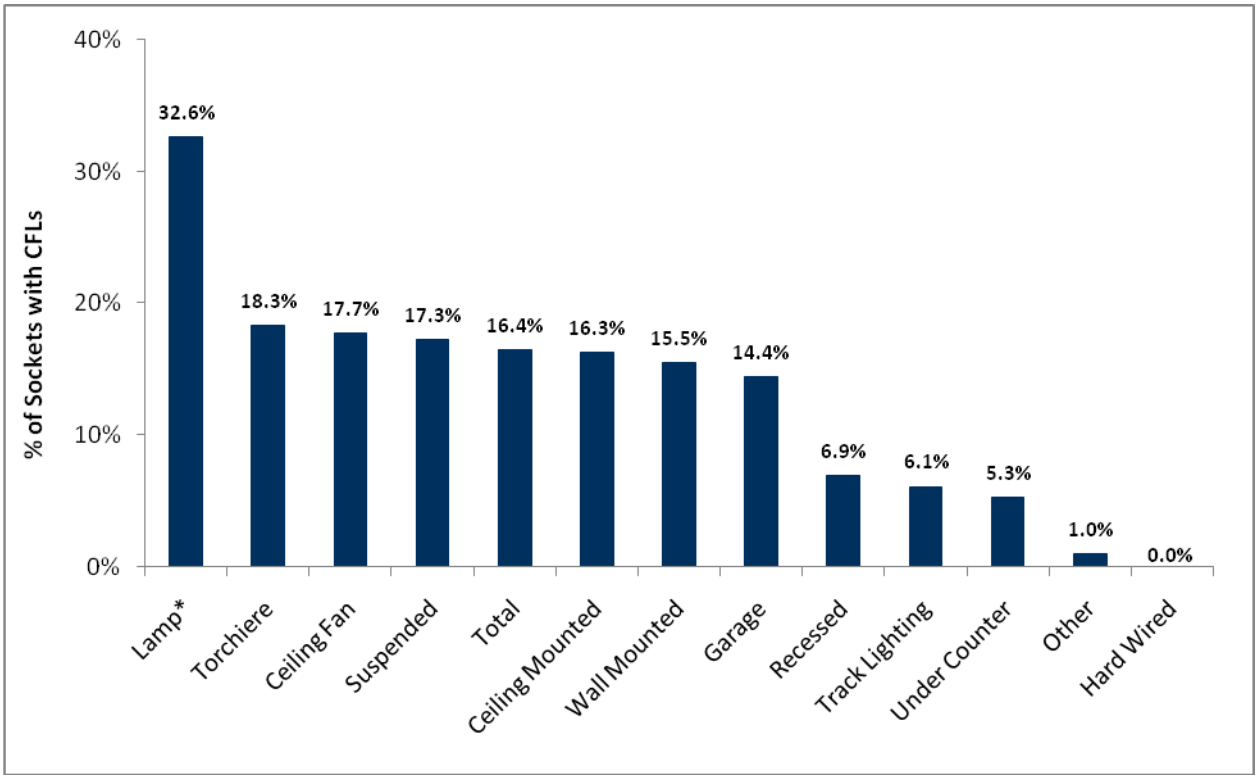



**Figure 49. CFL Saturation by Fixture Type (Total Sockets n = 6,049)**



# Appendix C. Store Intercepts – Detailed Results

CFL intercept surveys, while useful and valuable in identifying factors that influence purchasing decisions, do have some potential drawbacks. First, customers are not randomly selected, so we are not able to ensure accuracy at the planned 90 percent confidence level with 15 percent precision. Also, retail stores are reticent to allow intercepts, as many stores prohibit outside solicitation of their customers. After several requests, the evaluation team was allowed to conduct intercepts in many stores, but only in conjunction with Ameren Missouri program in-store demonstration events (see Table 84), which were marketing and education events that APT had already planned. Ideally, the intercepts would be conducted independently of these events, so that customer purchasing decisions would not be influenced. Cadmus staff interviewed customers in the lighting aisle in most cases, when allowed by store management; however, sometimes we were only allowed to talk to customers at the demonstration table.

In addition to providing an estimate of overall program leakage, the research provides guidance on where program bulb leakage is the most problematic so that Ameren Missouri can assess the need to revise its list of program partners.

Overall, the majority of survey respondents did not have prior knowledge of Ameren Missouri's CFL program. The eight percent (48 respondents) who did have prior knowledge of the program included 47 Ameren Missouri customers and one customer from Kansas City Power & Light (shown in Table 84). These customers purchased 10.5 percent of weighted program CFLs.

**Table 84. Customer Awareness of Ameren Missouri CFL Program (n = 611)**

| Actual Purchases | Customers | Percent of Total Customers |
|---|---|---|
| Customers Aware of Program | 48 | 8% |
| Customers Not Aware of Program | 563 | 92% |
| **Total** | **611** | **100%** |

This CFL-based store leakage analysis identified four Home Depot stores as potentially vulnerable to leakage that were initially categorized as non-vulnerable. These four stores (shown in Table 85) have high CFL-based leakage, and Cadmus recommends that Ameren Missouri carefully assess continuing the program in these stores.

**Table 85. Potentially Vulnerable Stores Initially Categorized as Non-Vulnerable (n = 4)**

| Store Name | Store City | Percent of Non-Ameren Missouri Customers Purchasing Program CFLs | Percent of Program CFLs Sold to Non-Ameren Missouri Customers (weighted) |
|---|---|---|---|
| Home Depot | O'Fallon | 8% | 8% |
| | Wentzville | 37% | 29% |
| | Festus | 17% | 14% |
| | St. Charles | 21% | 27% |

As mentioned in the assumptions, rural stores are expected to be more susceptible to program CFL leakage than urban stores because they serve a larger geographic area. Table 86 shows that

non-Ameren Missouri customers purchased roughly 40.3 percent of program CFLs in rural store locations. In urban store locations, non-Ameren Missouri customers purchased 3.4 percent of program CFLs. These findings are consistent with our assumptions regarding rural and urban store locations. Table 86 shows the weighted number of bulbs purchased in rural and urban stores and illustrates the resulting leakage rate, defined as 1 minus the percentage of bulbs purchased by Ameren Missouri Customers.

**Table 86. Weighted Program CFL Leakage by Rural and Urban Store Locations**

| Program CFL Purchase Designations | Weighted Total Program CFLs Sold By: | |
|---|---|---|
| | Rural | Urban |
| Program Bulbs Purchased by Ameren Missouri Customers | 187.30 | 1,204.54 |
| Total Program Bulbs Purchased | 313.66 | 1,246.32 |
| **Leakage** | **40.30%** | **3.40%** |

Program CFL leakage was very high at stores initially categorized as vulnerable (Table 87). On a weighted-bulb basis, non-Ameren Missouri customers purchased 9.41 percent of program CFLs. As described in the sample plan for customer intercepts, Cadmus analysts identified vulnerable stores based on their proximity to other utility service territories and based on non-Ameren Missouri meters (households) as a percentage of total meters in the same zip code as the store.

**Table 87. Weighted Program CFL Leakage by Vulnerable and Non-Vulnerable Store Locations**

| Program CFL Purchase Designations | Weighted Total Program CFLs Sold By: | |
|---|---|---|
| | Vulnerable | Non-Vulnerable |
| Program Bulbs Purchased by Ameren Missouri Customers | 443.824 | 563.90 |
| Total Program Bulbs Purchased | 489.92 | 613.72 |
| **Leakage** | **9.41%** | **8.12%** |

As discussed in the leakage assumptions, program bulb leakage may be higher in stores where implementer demonstrations occur because implementers actively promote and otherwise draw customer attention to the program bulbs on sale. Table 88 shows that demonstration stores sold 9.13 percent of program CFLs to non-Ameren customers. Non-demonstration stores sold significantly fewer program CFLs (5.12 percent) to non-Ameren customers.

**Table 88. Weighted Program CFL Leakage by Demonstration and Non-Demonstration Store Locations**

| Program CFL Purchase Designations | Weighted Total Program CFLs Sold By: | |
|---|---|---|
| | Demo Store | Non-Demo Store |
| Program Bulbs Purchased by Ameren Missouri Customers | 865.40 | 103.95 |
| Total Program Bulbs Purchased | 994.47 | 109.55 |
| **Leakage** | **9.13%** | **5.12%** |

This research demonstrates that overall, program CFL leakage is the highest in rural stores that hosted demonstrations and that were initially categorized as vulnerable. This research also identified four Home Depot stores that were initially categorized as non-vulnerable. Cadmus

recommends that Ameren Missouri carefully consider the advantages and disadvantages of continuing the program in high leakage stores. Discontinuing the program at highly vulnerable stores may stem leakage, but may also reduce overall purchases of program CFLs as well as reduce the store diversity across the service territory.

Table 89 summarizes completed intercept surveys by store, location, distribution channel, whether an Ameren Missouri demonstration occurred in conjunction with the intercepts, and by the leakage risk of that particular store. Even though the team reached our targets for the overall distribution channel for warehouses and mass merchandise stores, we were unable to reach 30 people in four of the stores, and added four additional stores to the original 20.

**Table 89. Completed Stores (n = 24)**

| Store Name | Location | Distribution Channel | Leakage Risk | General Location | Dates | Demo Store | Completed Surveys |
|---|---|---|---|---|---|---|---|
| Ace Hardware | Chesterfield | Hardware | Non-Vulnerable | Urban | 12/11/2010 | Y | 30 |
| Dierberg's | St. Louis - Watson | Grocery | Vulnerable | Urban | 1/28/2011 – 1/30/2011 | Y | 45 |
| | St. Louis – Tesson Ferry | Grocery | Vulnerable | Urban | 1/28/2011 – 1/30/2011 | Y | 45 |
| Dollar Tree | Overland | Bargain | Vulnerable | Urban | 11/14/2010; 11/15/2010 | N | 16 |
| Family Dollar | St. Louis - MacCausland | Bargain | Vulnerable | Urban | 11/11/2010; 11/12/2010 | N | 5 |
| | St. Louis – Natural Bridge | Bargain | Vulnerable | Urban | 11/12/2010; 11/15/2010 | N | 16 |
| | St. Louis - Wells | Bargain | Vulnerable | Urban | 11/11/2010 | N | 2 |
| Home Depot | Festus | Home Improvement | Non-Vulnerable | Urban | 12/12/2010 | N | 18 |
| | O'Fallon | Home Improvement | Non-Vulnerable | Urban | 12/4/2010 | Y | 30 |
| | Overland | Home Improvement | Vulnerable | Urban | 12/12/2010 | N | 12 |
| | St. Charles | Home Improvement | Non-Vulnerable | Urban | 12/11/2010 | Y | 30 |
| | St. Louis - Brentwood | Home Improvement | Vulnerable | Urban | 11/13/2010 | Y | 30 |
| | St. Louis – S. Kingshighway | Home Improvement | Non-Vulnerable | Urban | 11/21/2010 | Y | 30 |
| | St. Louis – Sunset Hills | Home Improvement | Vulnerable | Urban | 11/20/2010 | Y | 30 |
| | Wentzville | Home Improvement | Non-Vulnerable | Urban | 11/21/2010 | Y | 27 |
| Sam's Club | St. Louis – Lemay Ferry | Warehouse | Vulnerable | Urban | 1/29/2011 | Y | 24 |
| Schnuck's | Florissant | Grocery | Non-Vulnerable | Urban | 1/21/2011 | Y | 29 |
| | St. Louis – Butler Hill | Grocery | Vulnerable | Urban | 1/21/2011 | Y | 30 |
| | St. Louis – Big Bend | Grocery | Vulnerable | Urban | 1/29/2011 | Y | 31 |
| Wal-Mart | Boonville | Mass Merch/ Discount | Vulnerable | Rural | 11/20/2010 | Y | 23 |
| | Desloge | Mass Merch/ Discount | Non-Vulnerable | Urban | 11/14/2010 | Y | 18 |
| | Maplewood | Mass Merch/ Discount | Vulnerable | Urban | 12/4/2010 | Y | 30 |
| | Moberly | Mass Merch/ Discount | Vulnerable | Rural | 11/13/2010 | Y | 30 |
| | Kirksville | Mass Merch/ Discount | Vulnerable | Rural | 1/15/2011 | Y | 30 |
| **Total Survey Participants** | | | | | | | **611** |

Table 90 provides the leakage risk for the stores where we completed intercepts. Two-thirds (67%) of the stores were considered vulnerable to leakage.

**Table 90. Stores Completed by Leakage Risk (n = 24)**

| Leakage Risk | Non-Vulnerable | Vulnerable | Total Stores |
|---|---|---|---|
| Stores | 8 | 16 | 24 |
| Distribution | 33.3% | 66.67% | 100% |

Table 91 provides the distribution of stores by general location.

**Table 91. Stores Completed by General Location (n = 24)**

| General Location | Rural | Urban | Total Stores |
|---|---|---|---|
| Stores | 3 | 21 | 24 |
| Distribution | 12.5% | 87.5% | 100% |

Table 92 shows the breakdown of customers and program bulb sales by store and location. The Wal-Mart stores in Kirksville and Moberly and the Home Depot in Wentzville had the highest frequencies of non-Ameren Missouri customers purchasing program CFLs. We initially categorized these two Wal-Mart stores as high-risk or vulnerable to CFL leakage; however, we categorized the Home Depot in Wentzville as non-vulnerable. Many stores, such as the Ace Hardware in Chesterfield and the Home Depot in St. Louis – Brentwood, only sold program CFLs to Ameren Missouri customers. The last column of Table 92 shows the distribution of non-Ameren Missouri customers by store. These percentages represent customer-based leakage and provide guidance on each stores' degree of vulnerability. On average, 8.6 percent of all customers who purchased program CFLs are non-Ameren Missouri customers.

**Table 92. Customers Purchasing Program CFLs by Store**

| Store Name | Store City | Program CFL Customers | Customers Purchasing Program CFLs | | |
|---|---|---|---|---|---|
| | | | Ameren Missouri Customers | Non-Ameren Missouri Customers | Percent of Non-Ameren Missouri Customers by Store |
| Ace Hardware | Chesterfield | 25 | 25 | 0 | 0% |
| Dierberg's | St. Louis - Watson | 16 | 16 | 0 | 0% |
| | St. Louis - Tesson | 5 | 5 | 0 | 0% |
| Dollar Tree Store | Overland | 8 | 8 | 0 | 0% |
| Family Dollar Store | St. Louis - McCausland | 3 | 3 | 0 | 0% |
| | St. Louis - Wells | 1 | 1 | 0 | 0% |
| | St. Louis - Natural Bridge | 9 | 9 | 0 | 0% |
| Home Depot | O'Fallon | 13 | 12 | 1 | 8% |
| | St. Louis - S. Kingshighway | 23 | 22 | 1 | 4% |
| | St. Louis - Sunset Hills | 17 | 15 | 2 | 12% |
| | Wentzville | 19 | 12 | 7 | 37% |
| | St. Louis - Brentwood | 16 | 16 | 0 | 0% |
| | Festus | 12 | 10 | 2 | 17% |
| | Overland | 7 | 7 | 0 | 0% |
| | St. Charles | 14 | 11 | 3 | 21% |
| Sam's Club | St. Louis - Lemay | 24 | 22 | 2 | 8% |
| Schnuck's | St. Louis - Butler | 2 | 2 | 0 | 0% |
| | Florissant | 17 | 17 | 0 | 0% |
| | St. Louis - Big Bend | 21 | 21 | 0 | 0% |
| Wal-Mart | Maplewood | 13 | 12 | 1 | 8% |
| | Boonville | 8 | 7 | 1 | 13% |
| | Moberly | 14 | 9 | 5 | 36% |
| | Desloge | 3 | 3 | 0 | 0% |
| | Kirksville | 18 | 10 | 8 | 44% |
| **Total** | **24** | **308** | **275** | **33** | **Average 8.6%** |

Table 93 shows actual program CFL purchases by Ameren Missouri and non-Ameren Missouri customers. Again, the last column in Table 93 shows the percentage of program CFLs sold to non-Ameren Missouri customers by store.[24] These percentages represent CFL-based leakage by store and provide further guidance for store vulnerability.

[24] We weighted these percentages by the design weights described above.

**Table 93. Program CFL Purchases by Store**

| Store Name | Store City | Weighted Program CFLs Sold | Weighted Program CFL Purchases by | | |
|---|---|---|---|---|---|
| | | | Ameren Missouri Customers | Non-Ameren Missouri Customers | Percent of Program CFLs Sold to Non-Ameren Missouri Customers (weighted) |
| Ace Hardware | Chesterfield | 230.76 | 230.76 | 0.00 | 0% |
| Dierberg's | St. Louis - Watson | 33.880768 | 33.880768 | 0.00 | 0% |
| | St. Louis - Tesson | 9.53 | 9.53 | 0.00 | 0% |
| Dollar Tree Store | Overland | 13.59 | 13.59 | 0.00 | 0% |
| Family Dollar Store | St. Louis - McCausland | 6.18 | 6.18 | 0.00 | 0% |
| | St. Louis - Wells | 2.47 | 2.47 | 0.00 | 0% |
| | St. Louis - Natural Bridge | 38.29 | 38.29 | 0.00 | 0% |
| Home Depot | O'Fallon | 75.11 | 68.97 | 6.13 | 8% |
| | St. Louis - S. Kingshighway | 86.60 | 85.83 | 0.77 | 1% |
| | St. Louis - Sunset Hills | 33.20 | 28.53 | 4.68 | 14% |
| | Wentzville | 90.43 | 64.38 | 26.06 | 29% |
| | St. Louis - Brentwood | 43.96 | 43.96 | 0.00 | 0% |
| | Festus | 42.92 | 36.79 | 6.13 | 14% |
| | Overland | 16.37 | 16.37 | 0.00 | 0% |
| | St. Charles | 39.85 | 29.12 | 10.73 | 27% |
| Sam's Club | St. Louis - Lemay | 133.55 | 125.01 | 8.54 | 6% |
| Schnuck's | St. Louis - Butler | 5.29 | 5.29 | 0.00 | 0% |
| | Florissant | 29.50 | 29.50 | 0.00 | 0% |
| | St. Louis - Big Bend | 45.53 | 45.53 | 0.00 | 0% |
| Wal-Mart | Maplewood | 41.23 | 36.38 | 4.85 | 12% |
| | Boonville | 10.47 | 10.16 | 0.31 | 3% |
| | Moberly | 24.95 | 15.71 | 9.24 | 37% |
| | Desloge | 18.55 | 18.55 | 0.00 | 0% |
| | Kirksville | 31.42 | 12.94 | 18.48 | 59% |
| **Total** | **24** | **1,103.63** | **1,007.72** | **95.91** | **Average 8.69%** |

Further analysis reveals that on average, three rural Wal-Mart stores (Moberly, Boonville, and Kirksville) sold 40 percent of their program CFLs to 14 non-Ameren Missouri customers. The Kirksville Wal-Mart appears to be a particularly high-risk rural store, and sold the most program CFLs to non-Ameren Missouri customers[25] (shown in Table 94). The Boonville store, however, had a leakage rate of only 3 percent. Table 94 also presents customer utilities as reported at the time of the intercept surveys. Four customers from the Wal-Mart in Kirksville reported Tricounty Electric Cooperative as their electricity provider. Another customer did not provide his utility to the researcher, but did indicate that he is from Iowa. Kirksville is approximately 48 miles from

[25] We weighted these program CFLs by the design weights described above.

the city of Bloomfield, Iowa, and roughly 30 miles from the border. Given Kirksville's proximity to Iowa, it is probable that this Wal-Mart regularly attracts customers from Iowa.

**Table 94. Rural Store Locations – Non-Ameren Customers and Weighted Program CFL Sales**

| Store Name | Store City | Weighted Program CFLs Sold to Non-Ameren Customers | Non-Ameren Missouri Customers | Customer Reported Utilities |
|---|---|---|---|---|
| Wal-Mart | Moberly | 9.24 | 5 | • Howard Electric<br>• Kansas City Power & Light<br>• Rural Electric Cooperative<br>• TXU Electric* |
| | Boonville | .31 | 1 | • Kansas City Power & Light |
| | Kirksville | 18.48 | 8 | • City of Unionville<br>• Anonymous Iowa utility<br>• North Central Rural Electric<br>• Tricounty Electric Cooperative |
| **Total** | | **28.03** | **14** | **-** |

* TXU Electric is a utility based in Texas. This customer does not live in Missouri.

Nineteen non-Ameren Missouri customers purchased 89.21 of the leaked program CFLs from vulnerable store locations. These stores and locations are presented in Table 95. The Wal-Mart in Kirksville sold the most Program CFLs to non-Ameren Missouri customers of all vulnerable store locations. As discussed above, the remote and rural location of this particular Wal-Mart makes it highly susceptible to Program bulb leakage.

**Table 95. Vulnerable Store Locations – Non-Ameren Customers and Weighted Program CFL Sales**

| Store Name | Store City | Weighted Program CFLs Sold to Non-Ameren Customers | Non-Ameren Missouri Customers | Customer Reported Utilities |
|---|---|---|---|---|
| Wal-Mart | Moberly | 9.24 | 5 | • Howard Electric<br>• Kansas City Power & Light<br>• Rural Electric Cooperative<br>• TXU Electric* |
| | Boonville | .31 | 1 | • Kansas City Power & Light |
| | Kirksville | 18.48 | 8 | • City of Unionville<br>• Anonymous Iowa Utility<br>• North Central Rural Electric<br>• Tricounty Electric Cooperative |
| | Maplewood | 4.85 | 1 | • Ameren Illinois |
| Home Depot | St. Louis – Sunset Hills | 4.68 | 2 | • Ameren Illinois<br>• Kirkwood Electric |
| Sam's Club | St. Louis – Lemay Ferry | 8.85 | 2 | • Crawford County Cooperative<br>• Sullivan Municipal Utilities |
| **Totals** | | **46.10** | **19** | |

* TXU Electric is a utility based in Texas. This customer does not live in Missouri.

Thirty-one non-Ameren Missouri customers purchased 89.79 program CFLs in ten stores where a program demonstration took place. The Wal-Mart stores in Kirksville and Moberly sold the most program CFLs to non-Ameren Missouri customers. The Home Depot in Wentzville also greatly contributed to program bulb leakage, as seven non-Ameren Missouri customers purchased 26.06program CFLs. All seven of these customers reported that their utility is Cuivre River Electric Cooperative. Table 96 presents these findings.

**Table 96. Program Demonstration Store Locations – Non-Ameren Customers and Weighted Program CFL Sales**

| Store Name | Store City | Weighted Program CFLs Sold to Non-Ameren Customers | Non-Ameren Missouri Customers | Customer Reported Utilities |
|---|---|---|---|---|
| Wal-Mart | Moberly | 9.24 | 5 | • Howard Electric<br>• Kansas City Power & Light<br>• Rural Electric Cooperative<br>• TXU Electric* |
| | Boonville | .31 | 1 | • Kansas City Power & Light |
| | Kirksville | 18.48 | 8 | • City of Unionville<br>• Anonymous Iowa Utility<br>• North Central Rural Electric<br>• Tricounty Electric Cooperative |
| | Maplewood | 4.85 | 1 | • Ameren Illinois |
| Home Depot | St. Louis – Sunset Hills | 4.68 | 2 | • Ameren Illinois<br>• Kirkwood Electric |
| | O'Fallon | 6.13 | 1 | • Cuivre River Electric Cooperative |
| | St. Charles | 10.73 | 3 | • Cuivre River Electric Cooperative |
| | St. Louis – S. Kingshighway | 0.77 | 1 | • Duke Power |
| | Wentzville | 26.06 | 7 | • Cuivre River Electric Cooperative |
| Sam's Club | St. Louis – Lemay Ferry | 8.54 | 2 | • Crawford County Cooperative<br>• Sullivan Municipal Utilities |
| **Total** | | **89.79** | **31** | **-** |

* TXU Electric is a utility based in Texas. This customer does not live in Missouri.

# Appendix D. Metering Data Preparation

## Logger Data Preparation

Cadmus analysts performed spreadsheet analysis, site documentation review, and SAS analysis to perform quality control on the data. Specific tasks are noted as follows:

- Cadmus reviewed *insitu* removal notes which identified loggers with potentially bad or questionable data. In some cases, analysts easily determined which loggers should be excluded from the HOU analysis based on field notes or a data review.
- We reviewed all raw logger data in Microsoft Excel® and then imported the data into SAS. Analysts reviewed counts of all events per logger. Loggers with very low or very high counts were carefully reviewed, as the former could indicate improper launching of the logger and the latter could indicate flickering problems.
- Cadmus carefully reviewed loggers that were flagged as questionable by removal technicians (e.g., participant removed, logger fell off fixture, poor installation) to ensure that the data represented *in situ* observations. Poor or improper logger installation did not always result in bad data, and therefore some data were included in the analysis even though the installation job may have been less than ideal.
- We reviewed logger data to identify extreme usage or non-usage, as well as usage that did not seem likely based on room type. For example, if a logger indicated a CFL fixture perpetually remained on throughout the metering period, analysts flagged the logger and contacted the homeowner to determine the data's accuracy.
- As a general quality control check, Cadmus removed data points that occur before the install date/time or after the removal date/time. This check prevents the analysis from including events that occurred prior to installation in the event that a technician did not reset the logger at the time of installation. This check also prevents the analysis from including events that occurred after the removal date in the event that logger data were downloaded on a different day than the removal date.
- Cadmus formatted time stamps on data points to show exact hours, minutes, and seconds of an event. This enabled analysts to obtain precise HOU estimates.
- Light flicker, which results from damaged bulbs, electrical work in need of repair, or ambient light such as that from televisions, computer monitors, sunlight, or passing car lights can be problematic when metering CFLs. Cadmus wrote the SAS program to eliminate on/off events that were less than three seconds apart. Once a light is switched on or off, it takes approximately three seconds for the logger to change its event status. Events recorded as less than three seconds apart were likely due to a flickering bulb. We deleted all records with repeated on/off events of less than three seconds from the analysis.[26]

[26] Note that the removal of records representing flicker had an insignificant impact on the HOU estimate.

- The SAS program includes a check to ensure that the total daily HOU do not exceed 24 hours. This checks the calculations and date formats in the SAS program.
- Cadmus converted all time 'on' data to seconds.
- We reduced the bulbs per fixture, a key element of the weighting scheme discussed below, using mean reversion, from five bulbs to two bulbs for one light logger. This logger was installed in the basement, and was left on 24 hours a day, 7 days a week.

Examples of light logger data are presented in Table 97.

**Table 97. Logger Data Example**

| Cadmus ID | Logger Serial Number | Date | Time | Status | Status Code |
|---|---|---|---|---|---|
| 145ACFA | LC09050020 | 6/11/2010 | 11:33:27 | Was OFF | 0 |
| 145ACFA | LC09050020 | 6/11/2010 | 19:13:49 | Turned ON | 1 |
| 145ACFA | LC09050020 | 6/11/2010 | 19:55:09 | Turned OFF | 0 |

Analysts identified 29 of the total 180 installed light loggers as having potentially bad data. After further review of data from these loggers and notes provided by removal technicians, analysts determined that 16 of these loggers should be removed from the analysis. Table 98 shows loggers installed by room, loggers removed, and the final quantity of loggers used in the HOU analysis. In most cases, participant removal and interference was the main reason for excluding loggers from the analysis. Logger installation error was more problematic for outdoor fixtures. Even when using a fiber-optic eye to control for exterior ambient light (i.e., sunlight), installation technicians did not always adequately angle the eyes to reduce exposure to sunlight. Table 99 shows loggers excluded by room and the reason for exclusion. Even after removing 16 loggers from the analysis, all 44 participating households remained in the final data set for the analysis.

**Table 98. Loggers Installed By Room Type (n = 180)**

| Room Type | Loggers Installed | Loggers Removed | Final Logger Quantity for HOU Analysis |
|---|---|---|---|
| Basement | 12 | 0 | 12 |
| Bathroom | 14 | 2 | 12 |
| Bedroom | 40 | 1 | 39 |
| Closet | 6 | 1 | 5 |
| Dining | 4 | 0 | 4 |
| Foyer | 5 | 1 | 4 |
| Garage | 5 | 0 | 5 |
| Hallway | 5 | 0 | 5 |
| Kitchen | 21 | 1 | 20 |
| Living Space | 46 | 4 | 42 |
| Office/Den | 7 | 1 | 6 |
| Other | 1 | 0 | 1 |
| Outdoor | 11 | 5 | 7 |
| Utility | 3 | 0 | 3 |
| **Totals** | **180** | **16** | **164** |

**Table 99. Loggers Excluded from Analysis by Room and Reason (n = 16)**

| Room Type | Logger Serial | Reason for Exclusion from Analysis |
|---|---|---|
| Bathroom | LC09050390 | Logger fell off fixture |
| | LC09050457 | Dead battery/internal malfunction |
| Bedroom | LC09050349 | Installation error |
| Closet | LC09050398 | Logger fell off fixture |
| Foyer | LC09050583 | Installation error |
| Kitchen | LC09050453 | Logger malfunction/dead battery |
| Living Space | LC09050482 | Logger removed and destroyed by participant* |
| | LC09050388 | Dead battery/internal malfunction |
| | LC09050431 | Logger removed by participant |
| | LC09050387 | Logger removed and destroyed by participant** |
| Office/Den | LC09050390 | Logger malfunction/dead battery |
| Outdoor | LC09050392 | Installation error |
| | LC09050135 | Installation error |
| | LC09050486 | Installation error |
| | LC09050500 | Logger malfunction/dead battery |
| | LC09050349 | Bad logger data |

* Logger was initially installed in ceiling-mounted dome fixture. While cleaning, the participant removed the glass dome and ran it through the dishwasher with the logger still attached. No data could be collected from this logger.
** Logger was initially installed on a table lamp. The participant removed the logger shortly after the installation and placed it in the dome of a torchiere floor lamp. The torchiere contained a 150 W incandescent bulb which severely burned the logger, destroyed it.

# Appendix E. Detailed Multistate Results and Comparative Statistics

The multistate modeling effort relies on data from telephone and on-site surveys conducted through June 2010 in areas with longstanding CFL programs, newer or smaller programs, and no CFL programs. Site visit data was collected from 1,533 households across 15 different areas.

### Areas Included in the Analyses

Sponsors of the Multistate Model Study include:

- Ameren Missouri;
- Ameren Illinois;
- ComEd;
- Consumers Energy in Michigan;
- Dayton Power and Light;
- EmPOWER Maryland;
- The five program administrators of the Massachusetts ENERGY STAR® Lighting Program (the Cape Light Compact, NSTAR, National Grid, Unitil, and Western Massachusetts Electric);
- National Grid in Rhode Island;
- The New York State Energy Research and Development Authority (NYSERDA); and
- The Salt River Project.

The various parties supporting this effort are referred to as program administrators (PAs):

- Electric utilities,
- Energy service organizations,
- Public service commissions, and
- State agencies.

NMR Group and Cadmus performed the modeling and analysis. The 10 PAs funded data collection in 11 program areas and four non-program areas, shown in the table below. PAs and evaluators chose these four non-program areas to complement the 11 program areas' demographic, social, and economic characteristics.

**Table 100. Participating Areas**

| Area | Abbreviation | Years Supporting CFLs* | On-Site Sample Size |
|---|---|---|---|
| *Program Areas* | | | |
| Ameren Illinois (part Illinois) | AIU | 1.5 | 92 |
| Ameren Missouri (part Missouri) | AUE | 0.5 | 87 |
| ComEd (part Illinois) | ComEd | 5.0 | 98 |
| Consumers Energy (part Michigan) | Consumers | 0.5 | 99 |
| Dayton Power and Light (part Ohio) | DPL | 1.0 | 72 |
| EmPOWER Maryland (most Maryland) | EmPOWER | 2.0 | 79 |
| Massachusetts (entire state)** | MA | 12.0 | 150 |
| New York City*** | NYC | 11.0 | 100 |
| New York State**** | NYS | 11.0 | 200 |
| Rhode Island (entire state)* | RI | 12.0 | 100 |
| Salt River Project (part Arizona) | SRP | 2.0 | 101 |
| *Non-program Areas* | | | |
| Houston, Texas (Harris County) | Houston | N/A | 100 |
| Indiana (central portion) | IN | N/A | 67 |
| Kansas (entire state) | KS | N/A | 95 |
| Pennington County, SD (portion) | SD | N/A | 93 |
| **Total** | | | **1,533** |

* As of the beginning of 2010.
** Surveyed the entire state, even though some portions may be served by municipal utilities not taking part in the ENERGY STAR Lighting Program.
*** Surveyed separately from the remainder of the state due to its unique demographic and economic characteristics.
**** State minus New York City and Nassau and Suffolk Counties.

## Development of Program Variables

Program variables were the statistical models' key components guiding calculation of NTG ratios. The team began developing these variables by reviewing CFL program plans and documents, prior evaluation reports, and program summaries, compiled by the Consortium for Energy Efficiency, the U.S. Department of Energy, and ENERGY STAR to locate CFL programs in each state and to gather information on CFL program activity through 2010 in each area.

Specifically, are database included:

- Data on program budgets;
- Numbers of CFLs incented;
- The percentage of budget allocated to incentives, marketing and advertising, and overhead;
- The percentage of CFLs with specialty features; and

- The method of support (e.g., retail coupons, catalog, and/or upstream approaches).[27]

The team successfully collected this information for all programs for 2009 and 2010, and verified data with the PAs. We tested these program variables in the model individually and in combination, but the only program variable found to be statistically significant in the 2010 CFL purchase model presented below was the number of bulbs supported by the program per household in the state.

The team also collected information on when the current program and any of its predecessor programs had been launched, then entered these data into the models. However, we did not consider these data to be current program variables, as they captured the *cumulative impact of prior program activity* on current purchases, not the impacts of the 2010 program on purchases.

## Modeling Procedures

Drawing on experiences with earlier modeling attempts, the team chose to use the zero-inflated negative binomial regression (ZINB) to model CFL purchases.[28] The ZINB method analyzes count data (e.g.,the number of CFLs), with many cases falling at zero and with a fair degree of variability in the data. Compared to a related model (a negative binomial regression model), ZINB has the added benefit of not treating all zeros the same.

The procedure simultaneously runs a logistic model, sorting out differences in why someone may have zero purchases during a time period and a negative binomial regression to predict the number of CFLs purchased. The analysis led the modeling team to conclude two separate populations are represented by the observed zeros in the data. Those are:

1. CFL users who happened to not have made purchases during the observation time (i.e., the not-always zero group); and

2. Households likely to never purchase CFLs (i.e., the always zero group).

When using logistic regression to sort out reasons for zero purchases, the model also uses a negative binomial regression to estimate the probability of each count (including zeros) for participants in the not-always zero group. ZINB is a nonlinear procedure, and its interpretation differs from ordinary least squares models.

The team developed model specifications to include the program variables described above with additional variables for:

- Demographic, economic, and social characteristics;
- History of CFL use;
- Various measures of environmental opinions and early adoption behavior; and

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[27] Specialty features primarily included dimmable and three-way capabilities, colored bulbs, small screw bases, and shapes other than the usual spiral.

[28] Prior efforts clearly showed that ordinary least squares regression did not accurately reflect data distribution, with many people reporting "zero" purchases. Likewise, earlier attempts at using the negative binomial regression model—which is similar to, but simpler than, the ZINB—suffered from poor model fit.

- Binary variables to denote:
  - Variations in data collection (e.g., revisit to homes that had taken part in the 2009 modeling effort).
  - Program design (e.g., NYSERDA's program focuses more on marketing than incentives).
  - Variations in data collection approaches (e.g., how site technicians address "*don't know*" responses to on-site survey questions) and outlying CFL purchase behavior (e.g., unusually high purchase rates in Houston and Pennington County, SD).

The team excluded variables found to be excessively collinear with other model variables or that had little statistical effect on CFL purchases.[29] The models presented are parsimonious in that their every variable has a statistically significant net effect on CFL purchases (at the five percent level of significance); removing any variables would reduce the model's predictive capability. In short, they represent the best models yielded by the analyses.

## Model Results

The model's logistic portion indicates which households will likely never purchase CFLs versus those more likely to be purchasers. A positive coefficient implies higher likelihood of being a non-purchaser of CFLs.

The model's negative binomial portion is limited to those likely purchasing CFLs. It estimates how many CFLs these households purchased in 2010. Table 101 shows the base case model variables and their coefficients. This model was chosen as the base case because it provided the best predictability across all areas modeled and made intuitive and theoretical sense, considering the logic of CFLs programs and household purchasing behaviors.

[29] Co-linearity was determined by the tolerance statistic and the variance inflation factor.

**Table 101. Base Case Model**

| Logistic (Inflated) | Coefficient | P>\|z\| |
|---|---|---|
| Intercept | -0.254 | -0.842 |
| Some college or higher education | -0.494 | 0.0015 |
| Revisit (yes coded '1' to account for potential impact of our first visit as evidenced in some MA, NY, and Houston data) | -0.494 | 0.0015 |
| CFL saturation at beginning of 2010 | 0.015 | <.0001 |
| Like to have new technology (1 to 5, descending scale) | 0.306 | 0.004 |
| **Negative Binomial** | **Coefficient** | **P>\|z\|** |
| Intercept | 0.941 | 0.0002 |
| 2010 bulbs supported/household | 0.39 | <.0001 |
| CFL saturation at the beginning of 2010 | -0.014 | <.0001 |
| Purchase bulbs at big-box store | 0.405 | 0.0026 |
| Years supporting CFLs through buy downs | -0.034 | 0.001 |
| Data collection protocol treatment of 'don't know' | -0.77 | <.0001 |
| Homeowner | 0.36 | 0.0029 |
| Size of home (by 2,000 sq. ft., ascending scale) | 0.387 | <.0001 |
| Likes to have new technology (1 to 5, descending scale) | 0.174 | 0.0052 |
| Revisit household | -0.347 | 0.0171 |

The base case model's logistic portion predicts that:

1) Households with higher education levels have a greater probability of purchasing CFLs.
2) Households that received the revisit site inventories were more likely to purchase CFLs.
3) Households with a greater CFL saturation at the beginning of 2010were less likely to buy any CFLs, presumably because they had already purchased CFLs and did not need them when asked (until their current CFLs burn out or they exhaust their stock of stored CFLs).
4) Households that do like to have new technology were more likely to purchase at least one CFL.

The model's negative binomial portion predicts the number of bulbs a household is likely to purchase. As expected, the number of bulbs the program incented per household had a significant and positive effect on CFL purchases. Other factors influencing the number of CFL purchased included:

1) Participants who own their home had a propensity to purchase a greater number of CFLs in 2010.
2) Participants with larger homes purchased more CFLs in 2010.
3) Even though these households are more likely to purchase at least one CFL, participants who do seek the latest technology (measured on a four point scale ranging from strongly agree to strong disagree) purchased fewer CFLs in 2010 than those who do not seek the newest technology.
4) Households with a higher saturation of CFLs were likely to buyfewer CFLs.Similar to the model's logistic portion, this implies that those with higher levels of saturation simply did not need to buy as many CFLs.

5) Those in areas with longer running programs were less likely to buy more CFLs; this variable indicates the cumulative impact of older programs. Households in those areas have more CFLs because of the long program history.

6) Households who purchased CFLs at big-box stores were more likely to buy more CFLs, presumably due to the larger package size typically sold at these stores versus grocery or lighting specialty stores.

7) Finally, households visited in both 2009 and 2010 purchased fewer CFLs in 2010 than households visited only in 2010. Also, those areas where site inspectors did not require residents to guess when they purchased CFLs were likely to have lower CFL purchases. This could be because those asked to guess when bulbs were purchased tended to guess more recently (a common memory bias); when those allowed to not know were 25 percent or greater, they were eliminated from the model, and when less than 25 percent, unknown bulbs were set to zero.

## Model Diagnostics

We tested various model specifications, and evaluated quality of fit through a variety of techniques:

- Maximum likelihood $R^2$;
- Predicted compared to actual values for purchases (P/A); and
- The probability level of significance for each explanatory variable.

We also examined the coefficient signs to make sure they made logical sense.[30] Figure 50 compares the CFL purchase distributions from the predicted base model to actual reported site visit results; these represent the distribution of purchases within the Ameren Missouri territory. The subsequent figure presents a similar graph, showing results for the entire 15 areas combined.

[30] For instance, the variable "area electricity rate"—defined as the average cents per kWh for the residential customer class of each program area—was found to be significant in an alternative model specification, and the resulting model showed that it was a good fit according to the tested diagnostics. However, the coefficient sign was negative, counter-intuitively indicating that higher electricity prices were associated with lower bulb purchases. When we replaced this variable with an "east coast" variable, the model fit was even better, indicating that the electricity price variable acted as a proxy for the country's region. The region in question—the east coast—has the highest rates in the model, but also has the model's oldest CFL programs. This relationship was eventually replaced with the "years supporting programs" variable, which provided yet a better model fit, and showed a more theoretically sound relationship than electricity price or a regional variable.

**Figure 50. Ameren Missouri Cumulative Predicted vs. Actual CFL Purchases**

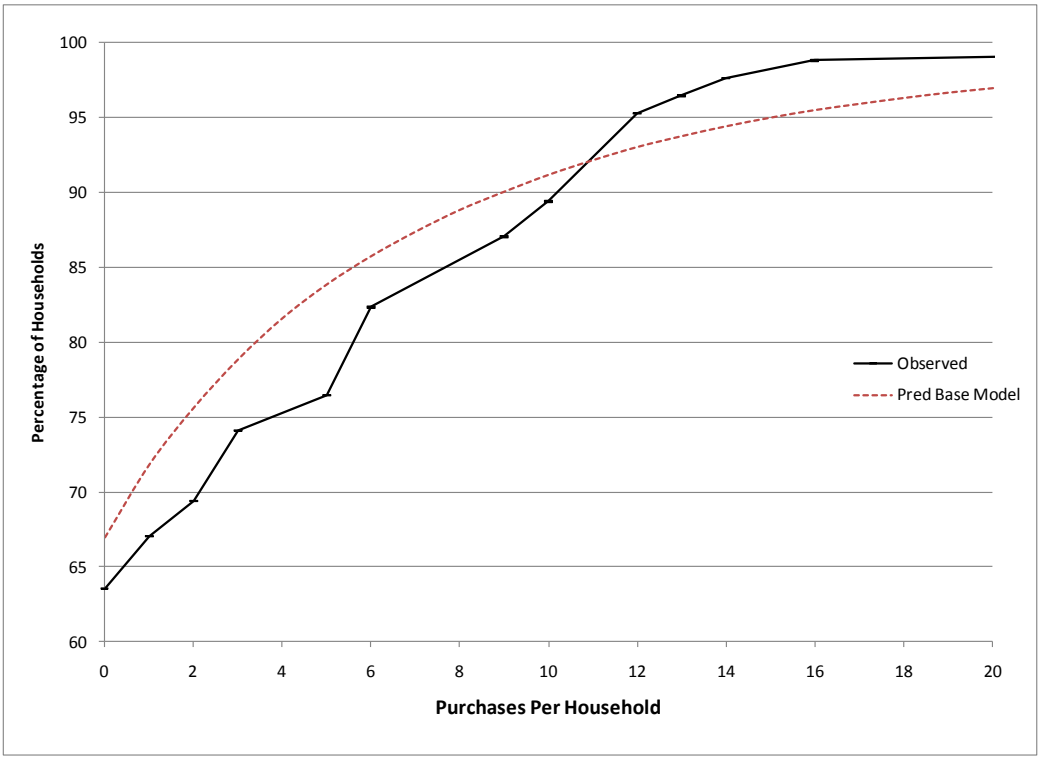
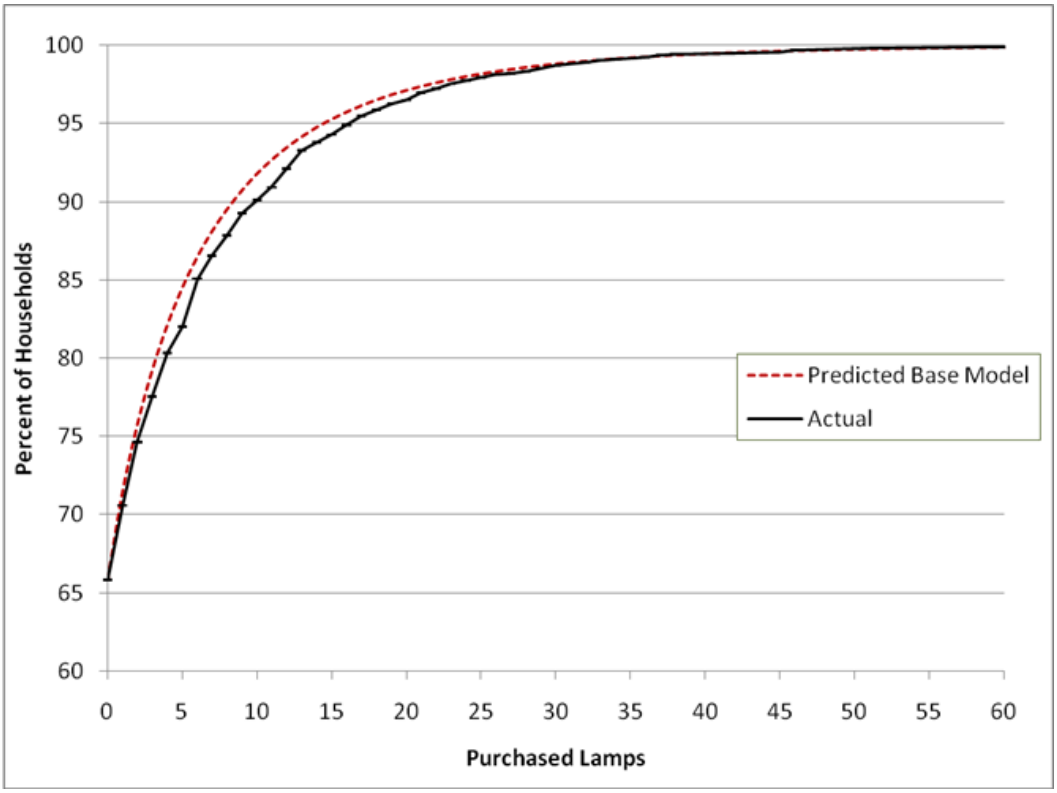



**Figure 51. Cumulative Predicted vs. Actual for All Areas**



## NTG Calculations

To develop actual NTG estimates, we used a fitted model to predict purchases per household in the program's presence: that is, using actual bulb purchases supported per household by program in 2010 (see row A of the table below). We then used the same fitted model to predict purchases, assuming the program had not supported any bulbs in 2010 (row B). The "without program" scenario was estimated by setting the incented number of light bulbs per household to zero. Since the program encourages market transformation, the number of incented light bulbs per household cannot fully capture all program effects since the program also works to increase CFL availability and consumer awareness of CFLs over time. We believe these effects are captured in the "years of support" variable which varies across program areas. Programs running for longer periods of time are likely to have made more progress in achieving widespread CFL availability and increased consumer awareness than newer programs.

These calculations predicted that each Ameren Missouri household purchased an average of 2.544 CFLs in the first half of 2010. The predicted non-program scenario suggested that 2.045 CFLs would have been purchased in the program's absence. Subtracting without-program estimates from the predicted program scenario yielded an estimate of net predicted program purchases of 0.499 (row C). Dividing the net program purchase estimates by the incented CFLs per household of 0.52 (row D) yielded an NTG of 0.96 (shown in row E).

**Table 102. NTG Calculation**

| Input | Value |
|---|---|
| A. Per-household purchases with program predicted | 2.544 |
| B. Per-household purchases without program | 2.045 |
| C. Net program purchases per household predicted | 0.499 |
| D. Incented CFLs per household | 0.52 |
| **E. Total NTG** | **0.96** |

## Sensitivity Analysis

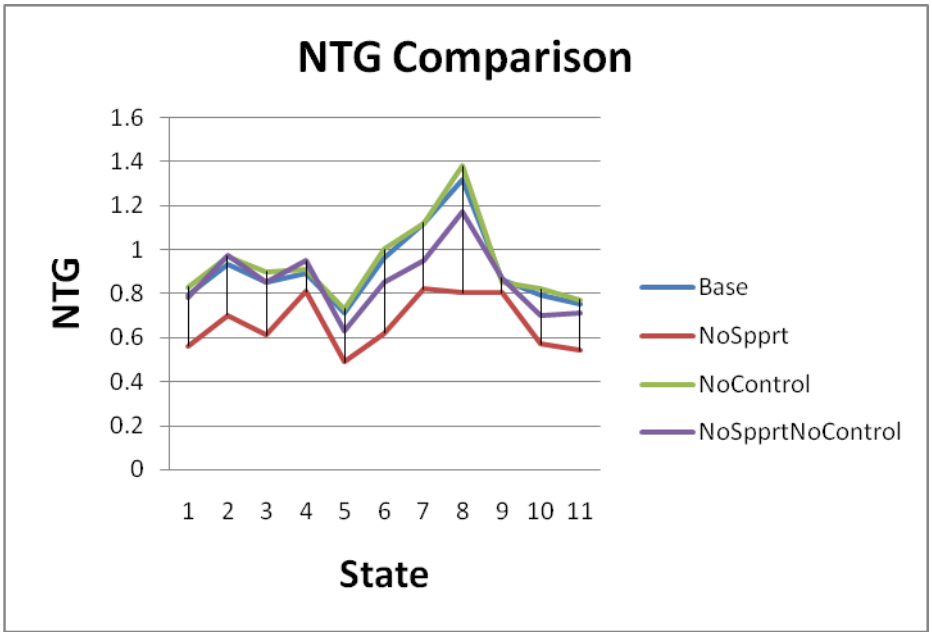
We calculated a 0.96 NTG estimate for Ameren Missouri, which is higher than the *ex ante* estimate of 0.8. This model yielded the best fit across all areas with a P/A value of 1.025. The evaluation team also analyzed many other variable combinations, and chose to report three additional modeled scenarios testing possible model limitations:

- **No Control States**. In this scenario, we completely removed all four control states from the model (testing the impact if we assumed control states were all contaminated by program spillover). In this case, the Ameren Missouri NTG ratio increased to 1.0, along with slight increases in other areas, and the average P/A for all areas was 1.07, higher than in our base case model.
- **No Years of Support Variable**. In this case, we removed the variable of years the P/A supported a CFL program in the model's logistic portion, indicating the number of years the program had been offered in that area. In this case, the P/A averaged 1.07, higher than in our base case model. The Ameren Missouri NTG ratio decreased to 0.62, and NTG ratios of all areas dropped similarly.

- **Combination No Control States and No Years of Support**. We removed both the control states and years of support variables from the model for this scenario. Overall, P/A averaged 1.06, and the NTG ratio for Ameren Missouri was 0.85.

In most scenarios, we found that the relative NTG ratios between different program areas remained fairly constant. Figure 52 shows NTG ratios across the 11 areas for the base case and the first two sensitivity analyses discussed above. (Ameren Missouri is State number 6)

**Figure 52. NTG Ratios—Base Case and Sensitivities**




The table below shows the NTG ratio and average P/A for each sensitivity analysis in each area.

**Table 103. Base Case and Sensitivity NTG Ratios and P/A**

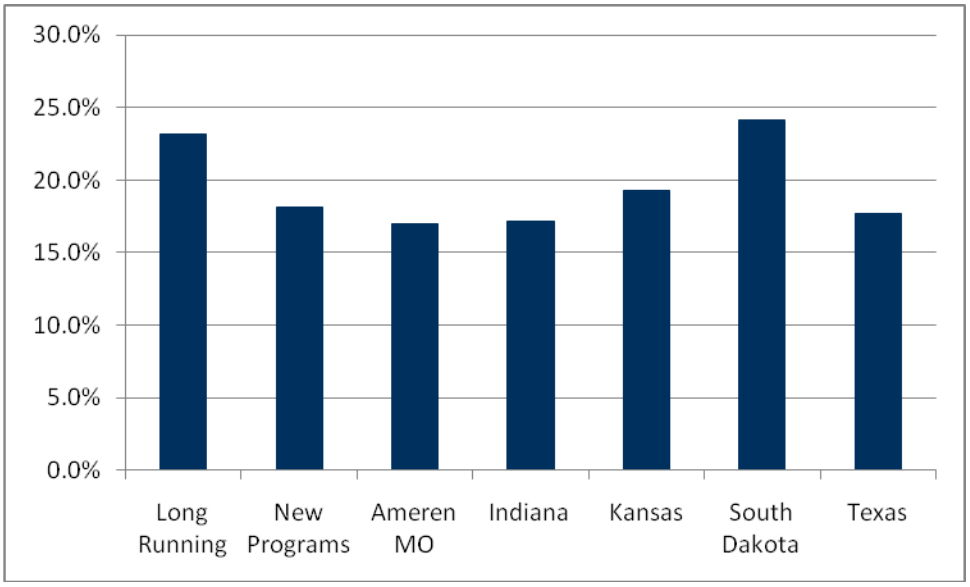
| Area | Base Case | No Years of Support | No Control State States | No Years of Support / No Control States |
|---|---|---|---|---|
| 1 | 0.79 | 0.56 | 0.83 | 0.78 |
| 2 | 0.93 | 0.7 | 0.97 | 0.97 |
| 3 | 0.85 | 0.61 | 0.9 | 0.85 |
| 4 | 0.89 | 0.81 | 0.91 | 0.95 |
| 5 | 0.71 | 0.49 | 0.73 | 0.63 |
| **Ameren Missouri** | **0.96** | **0.62** | **1** | **0.85** |
| 7 | 1.12 | 0.82 | 1.12 | 0.95 |
| 8 | 1.32 | 0.8 | 1.38 | 1.17 |
| 9 | 0.86 | 0.8 | 0.85 | 0.87 |
| 10 | 0.79 | 0.57 | 0.82 | 0.7 |
| 11 | 0.75 | 0.54 | 0.77 | 0.71 |
| Average P/A | 1.025 | 1.074 | 1.06 | 1.06 |

Additional analysis of multistate data yielded interesting comparisons among the program areas. For instance Ameren Missouri had higher levels of market penetration (homes with at least one CFL) than most other PAs, yet lower levels of CFL saturation (percentage of sockets in the home with CFLs). CFL saturation is higher in areas with longer running programs. Ameren Missouri's program costs per CFL purchased were lower than most areas and the CFL purchase rate was higher than most areas. Specifics on these results and others are included in Appendix E.

## Comparative Statistics

We used a total of 15 areas in the multistate analysis, with close to 100 site visits performed in each area. Four areas in the states of Kansas, Indiana, South Dakota, and Texas did not have programs.[31] To preserve confidentiality, we grouped multistate sponsors into those with newer programs (less than five years) and those with longer running programs. Figure 53 shows the average saturation of CFLs in new program areas, in long running program areas, in Ameren Missouri, and in each of the comparison areas; this is the total number of CFLs installed in all homes divided by the total number of installed bulbs. Interestingly, while non-program areas tended to have lower average saturations, they did not have the lowest. Only Indiana had lower average saturation than the new program areas (Texas and new progam areas were equal). South Dakota's saturation was higher than the average of the long running program areas. Ameren Missouri's service area had average saturation among the newer program areas.

**Figure 53. Average CFL Saturation**




We also compared market penetration among the program and non-program areas, shown in Figure 54. Market penetration is the percentage of homes visited with at least one CFL installed.

[31] Except for Kansas, the non-program areas did not cover the entire state. For instance, Texas site visit participants were only in the Houston area and South Dakota only included Pennington County.

Ameren Missouri's market penetration is the highest among all new programs, and has a higher level of penetration than among most long runnning programs.

**Figure 54. Market Penetration**

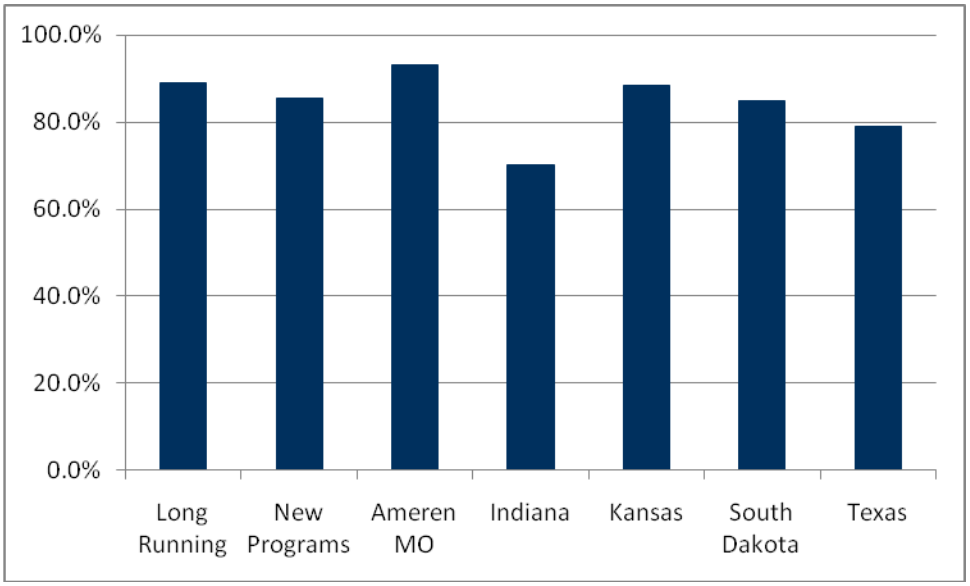
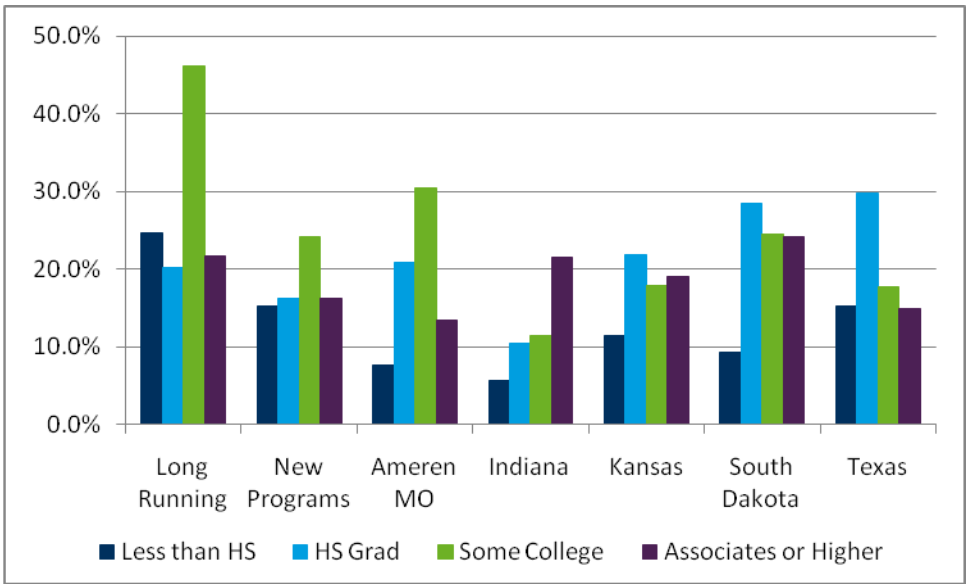



Figure 55 shows our analysis of saturation levels in each area by education level. Ameren Missouri residents who have completed some college have a higher CFL saturation than similar education levels in most other areas.

**Figure 55. Saturation Levels by Education**



Prior to the site visit, we asked participants whether they were familiar with CFLs. Lower familiarity is typically associated with lower CFL saturations; however, Ameren Missouri participants who reported being "*not familiar*" with CFL technology had higher CFL saturations those who were familiar (Figure 56). This could be due to a different family member answering the survey than who typically purchases light bulbs, or that those familiar had smaller homes with fewer sockets, or, in the situation of renters, landlords may have installing the bulbs.

**Figure 56. Average Saturation by CFL Familiarity**

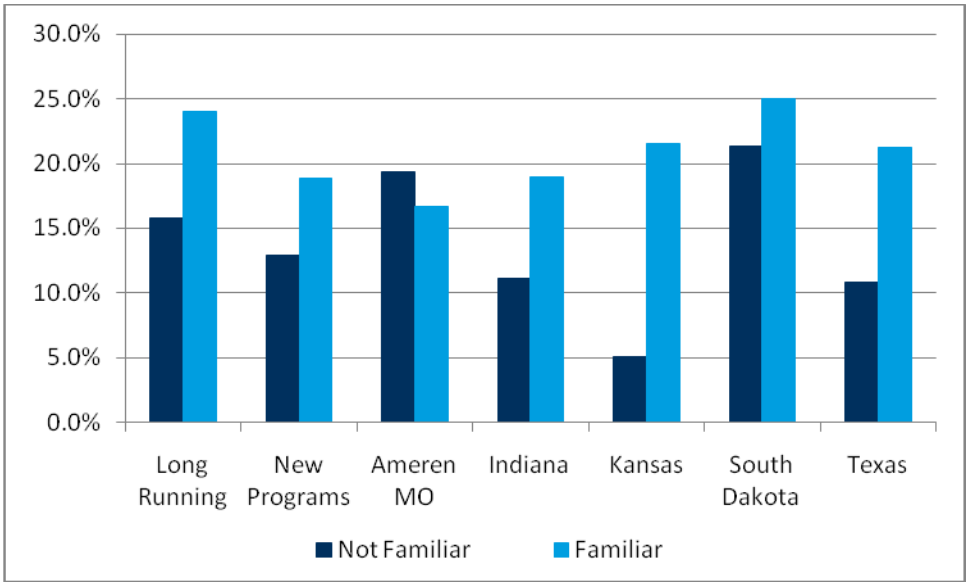



Figure 57 shows the average saturation for each area according to homeownership status. While it may be expected that CFL saturation is higher for those who own their home, rental homes are smaller on average, and thus may have a higher saturation but fewer actual numbers of installed CFLs.

**Figure 57. Average Saturation by Homeownership Status**

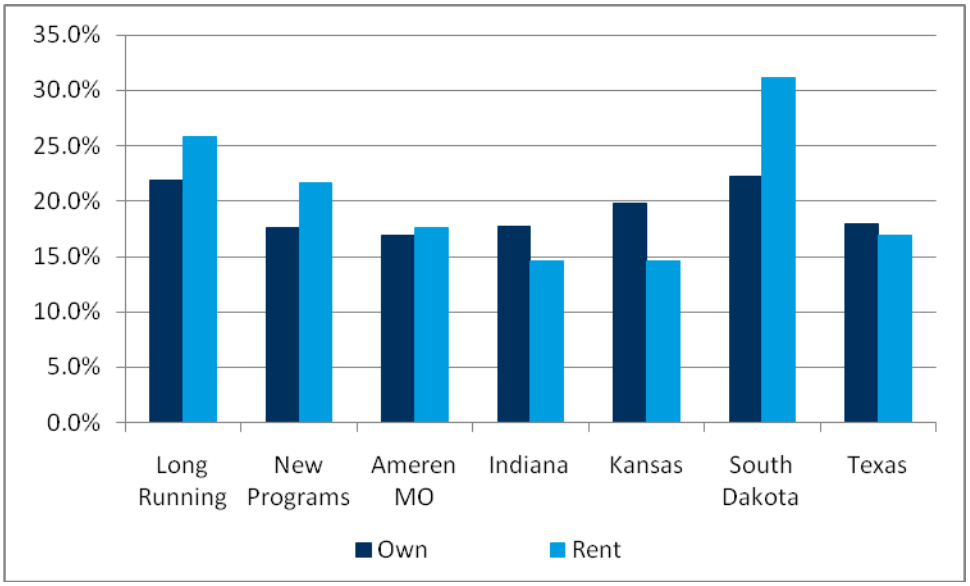



Figure 58 shows CFL saturations according to how residents answered the question "*Based on your understanding of the facts, is the earth's average temperature currently rising as a result of human activity?*" According to this analysis, there are no overall patterns of CFL saturation related to question response, although in many areas those who responded "*probably no*" or "*definitely no*" had lower saturations. Ameren Missouri customers who responded "*definitely no*" to this question had the highest saturation among Ameren Missouri customers.

**Figure 58. Average Saturation of Climate Change Attitudes**

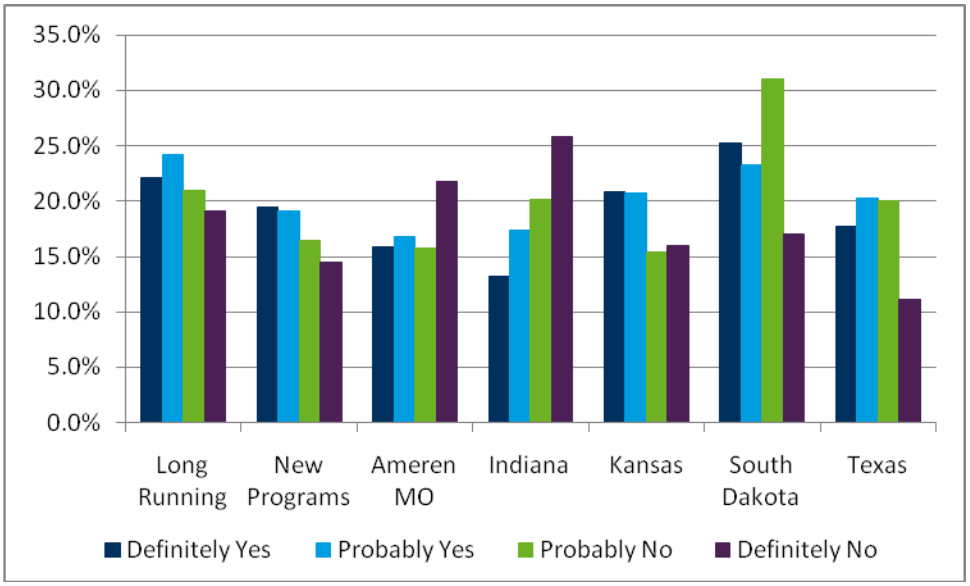


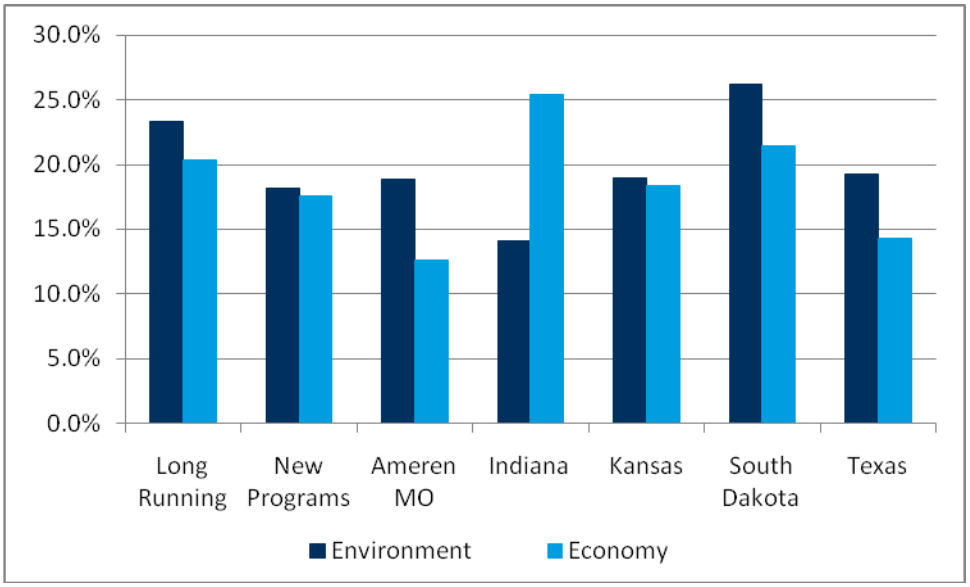
Figure 59 shows the results comparing CFL saturation to residents' answers to the following question: "*With which one of these statements about the environment and the economy do you most agree:*

1 *Protection of the environment should be given priority, even at the risk of curbing economic growth, OR*

2 *Economic growth should be given priority, even if the environment suffers to some extent?*"

For all areas except Indiana, those choosing the environment have a higher average CFL saturation than those choosing the economy.

**Figure 59. CFL Saturation by Economy vs. Environment Choice**




Our next comparisons describe how program activity related to CFL purchases, saturations, and NTG results for each program area. To preserve confidentiality, the areas compared in this analysis are referred to as A, B, C, etc.

Figure 60 compares the overall program budget and incentives-only budget per total incented CFLs of Ameren Missouri to other areas during the period of January through June 2010. Ameren Missouri program spending per incented CFL is below average among the compared programs. It should be noted that utilities may include different costs in the overhead budgets, for instance regulatory or management costs may be allocated differently among other programs.

**Figure 60. Total Program and Incentives Budget per Incented CFL**

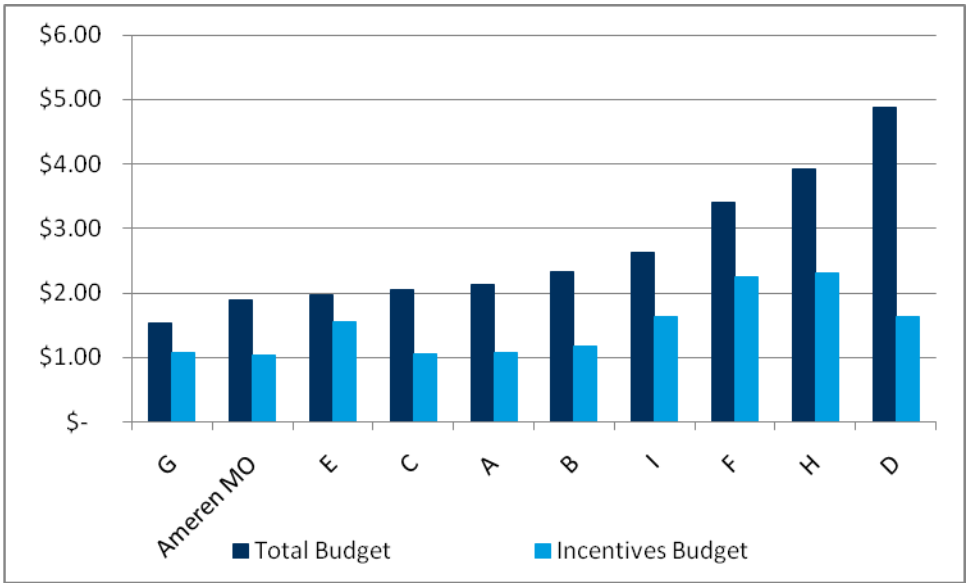



Figure 61 shows the total program budget and incentives budget per CFL purchased. CFL purchases include both incented CFLs and any CFLs purchased outside of the program (i.e., total number of CFL purchases identified during the site visits during the program period). Again, Ameren Missouri has one of the lowest budgets per CFL purchased inside and outside the program.

**Figure 61. Total Program Budget and Incentives Budget per Total CFL Purchased**

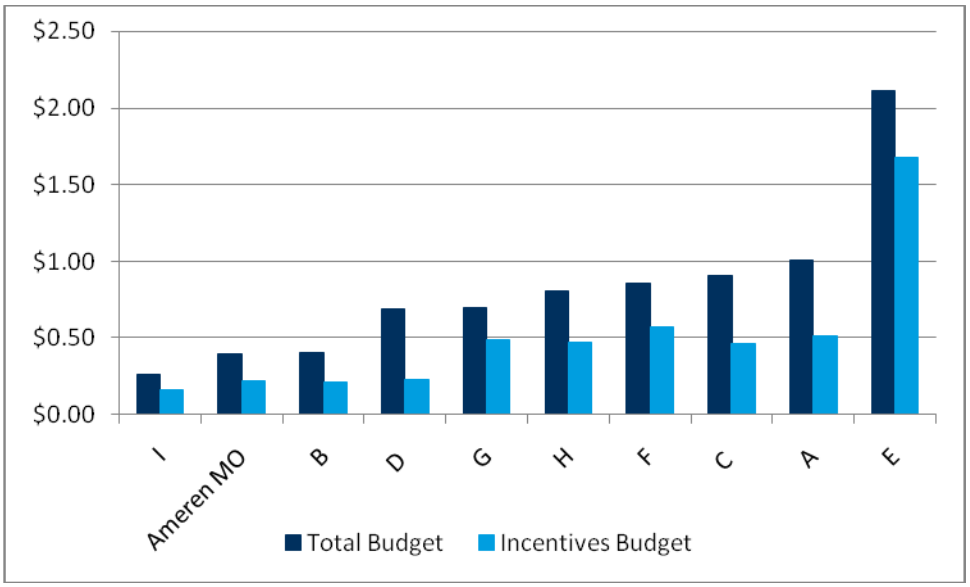



Figure 62 and Figure 63 show the total CFLs purchased in each area on a per household basis and the final NTG ratios for each area. In comparing the two figures, it is apparent that NTG

ratios tend to be higher among program areas with higher total CFLs purchased. Ameren Missouri was among the highest in CFL purchases per houshold and had among the highest NTG ratios.

**Figure 62. PY2 CFL Purchases per Household**

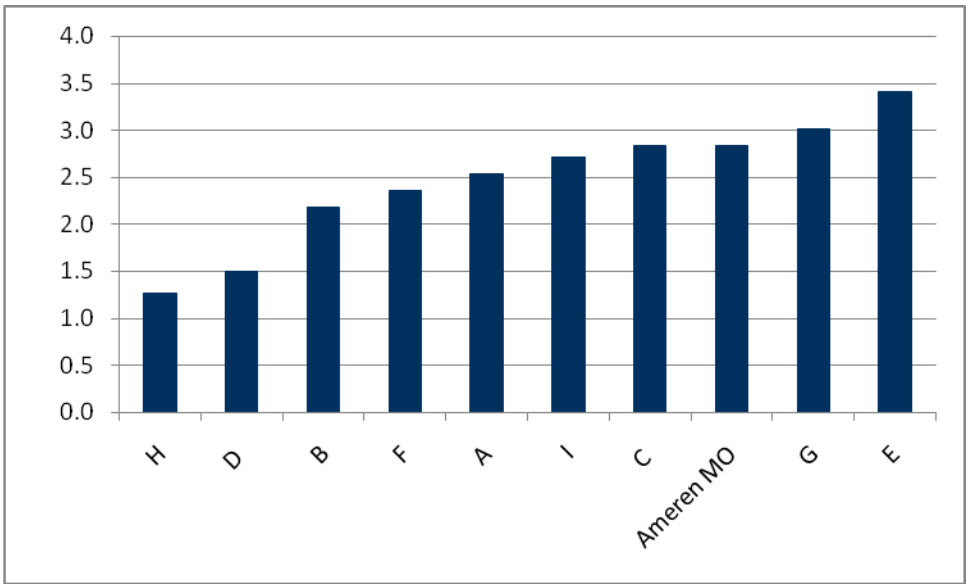
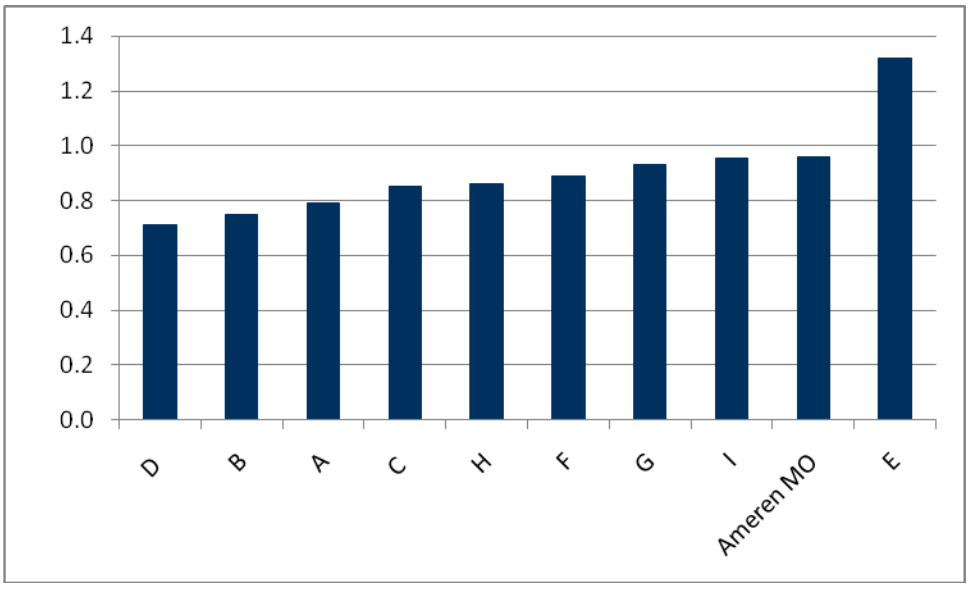



**Figure 63. NTG Ratios***




* The NTG ratio calculated for NYSERDA is the average of the NTG ratios for New York City and New York State (New York State does not include New York City).