Final Report – Volume II

Assessment of **Energy and Capacity Savings Potential in Iowa**

Prepared for The Iowa Utility Association

February 15, 2008

In Collaboration with Summit Blue Consulting, Nexant, Inc., A-TEC Energy Corporation, and Britt/Makela Group

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Appendix G: Attribution of Energy Savings: An Assessment of the Net-to-Gross Ratio Issue

Introduction

In 2002, Global Energy Partners and Quantec provided the Iowa Utilities Board a report on the issue of free riders and spillover.[1] The report provided definitions of free riders and spillover, discussed the historical background issues, and provided examples of studies performed. The report concluded with a recommendation for dealing with these issues in Iowa's Energy Efficiency Plans. The recommendation was that Iowa's investor-owned utilities, along with the Iowa Utilities Board, assume a net-to-gross ratio of 1.0 across all utility programs for the 2004-2008 Energy Efficiency Plans.

The purpose of this paper is to assess whether the policy of having a 1.0 net-to-gross ratio remains appropriate. The paper begins by providing definitions of what makes up the net-to-gross ratio, then examines the treatment of free ridership and spillover, both historically and currently. Results of evaluation efforts across the country are examined, many conducted following the 2002 recommendation that address the issues of program free riders and spillover. Finally, based on this review, recommendations are provided for future net-to-gross research.

Definitions

The goal of the net-to-gross assessment is to measure all energy saving attributable to the program. This is called "net" program savings. The ratio of net program savings to gross program savings is the "net-to-gross" ratio.

Free ridership and spillover are two main adjustments to gross savings to arrive at net savings. The first adjustment is to subtract from gross savings the actions of participants unaffected by the program. That is, participants are considered free riders if they would have taken the same energy saving action at the same time, in the same quantity, and at the same level of efficiency regardless of the program's existence.

The second adjustment is to add energy savings from high-efficiency actions taken outside the program to gross impacts attributable to the program. These additional energy savings come from greater knowledge and awareness of energy-efficient options due directly to program availability but falling outside of attaining the savings through the program. These savings are referred to as spillover.

Spillover can occur within both participant and nonparticipant groups. For example, participants may be inspired to adopt high-efficiency measures beyond those available within a program.

[1] *Assessment of Energy and Capacity Savings Potential in Iowa Volume 2: Free Riders and Spillover – A Look Back, A Path Forward,* prepared for the Iowa Utility Association by Global Energy Partners and Quantec, July 25, 2002

Nonparticipants can gain knowledge and awareness of energy-efficient options due to program availability and apply that knowledge and awareness to implement high-efficiency actions. These actions would not have occurred without the program's existence through savings gained outside the program structure. For most programs, the number of eligible nonparticipants is far greater than the number of participants; thus the potential exists for large spillover impacts within this nonparticipant population.

A third potential adjustment is for market effects.[2] Market effect impacts can be measured by evaluating and estimating the impacts of any changes the program causes to the way markets operate. As the result of programs, manufacturers may change the efficiency of their products, or retailers and wholesalers may change the composition of their inventories to reflect the demand for more efficient goods created through a program or group of programs. Such market transformation activities are the ideal achievement of energy-efficiency programs, and the impact could be very significant. However, because multiple actors may be involved in causing positive market effects and the need to avoid double-counting when measuring spillover and market effects, it is often difficult to determine how these effects should be attributed among the different market actors. Because of these attribution issues, measurement of market effects becomes a significant measurement and evaluation challenge.

Treatment of Free Ridership and Spillover

The Iowa Chapter 35 rules outline the inputs for all cost-effectiveness tests, including the Societal Test. The rules are based on the 1987 California Public Utilities Commission Standard Practice Manual of Economic Analysis of Demand-Side Management Programs. In calculating benefits for the Utility Cost Test (UCT), the manual states "the avoided supply costs should be calculated using net program savings, savings net of changes in energy use that would have happened in the absence of the program." This definition of net savings says impacts of free riders should be subtracted from gross savings, reducing benefits while keeping costs constant.[3] Therefore, identification of free riders in a program reduces the UCT cost-effectiveness. From a societal perspective, the CPUC Standard Practice Manual states participant costs and utility and participant benefits should be calculated using a net approach. Since administrative costs tend to be fixed, higher free ridership means these costs are essentially spread over fewer participants, and may have a negative impact on the Societal Test benefit/cost test. Given that administrative costs normally represent only a small percentage of program expenditures, this impact is assumed to be minor.

Policy Treatment across the U.S.

A recent study conducted for the Nevada Power Company and Sierra Pacific Power Collaborative included an examination of the treatment of free ridership and spillover in 23 states

2 Note that some of the literature includes nonparticipant spillover as part of market effects.

3 Gross savings is typically total program savings adjusted for weather.

and/or utilities serving those states. The results, presented in Table G.1, found that 15 states (69%) have rejected the concept of free ridership in estimating net savings.[4]

A number of states, including Minnesota and Wisconsin, have publicly stated free ridership and spillover effects cancel each other and therefore do not need to be estimated.[5] The International Energy Agency has concurred with this opinion, even suggesting the assumption of offsets may be conservative:

> "These indirect effects (Free Riders and Spillover) work in opposite directions and both are difficult to quantify. Until better information is available, it may be practical to assume (as some regulatory jurisdictions in the case of traditional energy efficiency projects and programs) that these effects cancel each other out. As the literature search indicates, in many cases, when both effects are measured, spillover can actually be greater than free ridership, in which case the assumption that they cancel provides a conservative estimate of program energy savings.[6]

Other states feel that estimating free ridership and spillover is too costly and inherently biased. For example, Michael Sherman, Manager for Energy Efficiency Massachusetts Division of Electric Regulation stated that, ". . . because the issues (Free Ridership and Spillover) are very hard to quantify due to survey bias, we don't believe there is real value in requiring traditional NTGR quantification. We prefer that the utilities focus on market transformation programs and correct for factors affecting gross to net savings in program design."[7]

California, on the other hand, requires the use of deemed free ridership values. Table G.2 lists the California Public Utilities Commission's (CPUC) deemed net-to-gross ratios by program. Although spillover effects are not included in these net-to-gross values, the CPUC is allowing the evaluations of the 2006-2008 energy efficiency programs to include an examination and estimation of participant spillover. Should spillover be included it is likely that some of the net-to-gross ratios will be near or greater than 1.0.

The decision to include free ridership impacts without including spillover impacts is inherently an asymmetrical, biased view. The National Association of Regulatory Utility Commissioners (NARUC) Regulating DSM Evaluation Manual states that, " . . . as of 1994 virtually no regulators were requiring the measurement of spillover effects, yet, . . . most encourage or require Free Ridership assessments, resulting in potentially lopsided analyses, which could undervalue the benefits of utility DSM programs."[8]

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4 "A Study of Methodologies for Evaluating Free Ridership and Spillover throughout the United States." Draft Report to the Nevada Power/Sierra Pacific Power Collaborative Sub-Committee on Free Ridership and Spillover. Prepared by Paragon Consulting Services, Inc. November 20, 2006.

5 EnergyPulse article, "Energy Efficiency and the Spectre of Free Ridership, Is a Kilowatt Saved Really a Kilowatt Saved", Stephen Heins, Oct 2005

6 International Energy Agency papers, p. 7, July 2000

7 Paragon Consulting Services, November 26, 2006.

8 NARUC, 1994, p. 4-9; p. A-9

Table G.1. Treatment of Free Ridership and Spillover by State

State	Spillover:		Free-Ridership
	Participant	Non-participant	
Arizona*	No	No	No
California	Yes	No	Yes
Colorado*	No	No	No
Connecticut	Yes	Yes	Yes
Idaho	No	No	No
Iowa	No	No	No
Maine	No	No	No
Massachusetts	Yes	Yes	Yes
Minnesota	No	No	No
NE ISO	No	No	No
New Hampshire	Yes	Yes	No
New Jersey	No	No	No
New Mexico*	No	No	No
New York	Yes	Yes	Yes
North Carolina*	No	No	No
Ohio	No	No	No
Oregon*	Yes	Yes	Yes
Rhode Island	Yes	No	No
Texas	No	No	No
Utah	Yes	Yes	Yes
Vermont	Yes	Yes	Yes
Washington	No	No	No
Wisconsin	No	No	No

Table G.2. California Program Deemed Net-to-Gross Ratios

Program Area/Program	Net-to-Gross Ratios
Residential	
Appliance early retirement and replacement	0.80
California Home Energy Efficiency Rating System (CHEERS)	0.72
Residential Audits	0.72
Refrigerator Recycling/Freezer Recycling	0.35/0.54
Residential Contractor Program	0.89
Emerging Technologies	0.83
All other residential programs	0.80
Nonresidential	
Advanced water heating systems	1.0
Agricultural and Dairy Incentives	0.75
Coin Laundry and Dry Cleaner Education	0.7
Commercial and agricultural information, tools, or design assistance services	0.83
Comprehensive Space Conditioning	1.0
Lodging Education	0.7
Express Efficiency (rebates)	0.96
Energy Management Services, including audits (for small and medium customers)	0.83
Food Services Equipment Retrofit	1.0
Industrial Information and Services	0.74
Large Standard Performance Contract	0.70
All other nonresidential programs	0.80
New Construction	
Industrial and Agricultural Process	0.94
Industrial new construction incentives	0.62
Savings by Design	0.82
All other new construction programs	0.80

Source: "Energy Efficiency Policy Manual v2", Prepared by the California Public Utilities Commission, Energy Division, August, 2003

Measuring Free Ridership and Spillover

In addition to differing policies regarding the need to estimate free ridership and spillover, there remains no consensus on any one single approach to estimating net-to-gross among those that attempt to do so. The most widespread way to measure free riders and spillover is through surveys where respondents self-report the impact of the program on their actions. Methods of inquiry have become more sophisticated in recent years, with a string of questions and incremental answers to understand partial free riders. In general, free rider questions ask interviewees about actions they would have taken had the program not been in place. For spillover, recent survey-based studies have focused mainly on participant and non-participant spillover. Participant surveys elicit responses about whether or not customers have purchased additional energy-efficient measures of the same type without financial assistance. Non-participant free driver surveys ask customers if they purchased efficiency measures due to their awareness of the program.

While survey techniques are relatively straightforward, they contain inherent problems. In general, the problems related to the survey approach are referred to as "self-reporting bias." Specific to free riders, two problems include cognitive dissonance and hypothetical bias." [9] Cognitive dissonance occurs when the interviewees rationalize that they would have taken the correct action (e.g., installing environmentally friendly efficient technologies) without program inducement. This tends to increase free ridership estimates. Hypothetical bias occurs because the survey is asking a hypothetical question and getting a hypothetical answer. Because programs may impact the availability or relative prices of measures, the participants probably cannot know what they would have done faced with a landscape unaffected by the DSM program.

In terms of spillover, ideally, both participants and non-participants would report the efficiency measures they installed due to overall awareness created by the DSM program, regardless of the similarity to the actual program measure. Studies have found that interviewees have a difficult time self-reporting the details such as usage, size, and efficiency levels. These data are necessary to create reliable estimates of energy savings due to spillover.

The use of statistical models to estimate net impacts is viewed as a more sophisticated method. Generally, statistical models analyze participant and non-participant actions, characteristics and attitudes to predict free ridership and spillover. Therefore, these methods can avoid both hypothetical bias and cognitive dissonance. Interviewees are not asked hypothetical questions, nor are they asked questions that are perceived to have a "right" answer. Instead, they are asked about their recent purchase decisions, general awareness of energy efficient information, and attitude toward energy efficiency.

The disadvantage of statistical analysis is its inability to estimate all types of spillover. Specifically, the spillover upstream in the distribution channel cannot be estimated with this method. Further, very few studies have estimated both free riders and spillover. A robust statistical analysis includes surveys designed to minimize self-reporting bias while collecting data on other program and participant characteristics. This level of sophistication requires a relatively large expenditure on evaluation. This may be necessary for some projects, but for a marginally cost-effective program, large evaluation expenditures could burden the program to the extent it is no longer cost effective.

A number of studies have also found that, because of the inherent biases, net-to-gross results can vary sharply based on the method selected. For example, a study by Kenneth Train in 1995 found that self-reported estimates of free ridership can be over 50% higher than discrete choice approaches, presumably due to the cognitive dissonance effect of the self-reported approach (Table G.3).[10]

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9 Ozog, M. and D.M. Waldman, "Behavioral Models of Free Riders in DSM Programs", 1993

10 Train, K. and E. Paquette, "A Discrete Choice Method to Estimate Free ridership, Net-to-Gross Ratios, and the Effect of Program Advertising," Energy Services Journal, Vol. 1, No. 1, 1995.

Table G.3. Difference of Free Ridership Rates Based on Research Approach

	Free-Ridership Rates	
	Discrete Choice	Self-Reported
1995 Commercial Lighting Study	22%	32% to 38%
1994 PG&E Commercial Rebate	27%	42%

Cross-Program Research

An ongoing project sponsored by the California Public Utilities Commission called the National Energy Efficiency Best Practices Study provides some insight into how the net-to-gross issue has been handled in various programs across the country. [11] The objective of the Best Practices project is to identify best practices for 18 different program types and to communicate the findings to program planners to enhance the design of such programs in California and elsewhere. In-depth interviews were conducted with managers of over 100 programs. Based on the interviews, program profiles were developed, and best practices were identified from groups of programs. Information was also provided on whether a program included a net-to-gross adjustment and if this adjustment was based solely on free ridership or if it also included spillover. Table G.3 provides a summary listing of the net-to-gross values found in the programs included in the Best Practices project by program area. Most of the Best Practices reviews took place in 2004 and 2005.

Approximately half of the studies (49%) either assumed or calculated a net-to-gross value of 1.0, and 68% of the studies had net-to-gross values between 0.9 and 1.0 (most likely not statistically significantly different from 1.0 [assuming 10% precision]). In most cases, net-to-gross values, when used by a program, were only based on free ridership values or were on a deemed net-to-gross assumption. Free ridership values when identified varied significantly, even within program areas. There was very little reporting of spillover impacts. Also, some program areas, such as appliance recycling, were not included.

[11] This study is managed by Pacific Gas and Electric Company under the auspices of the California Public Utility Commission in association with the California Energy Commission, San Diego Gas and Electric, Southern California Edison, and Southern California Gas Company. The website address is: http://www.eebestpractices.com/index.asp

Table G.4. Net-to-Gross Values Identified through the Best Practices Project

Program Area	Net-to-Gross Values	Free Ridership Values	Spillover Values
Residential			
Lighting (six programs)	3 - N/A, 0.8, 1.27, 1.04	4 – N/A, 6%, 5.7%	4 – N/A, 6%, 5.7%
Air Conditioning (six programs)	5 – N/A, 0.8	6 – N/A	6 – N/A
Single Family Comprehensive (six programs)	1 – N/A, 0.89, 0.89, 0.97, 0.93, 0.94	4 – N/A, 3%, 4.4%	6 – N/A
Multi-Family Comprehensive (six programs)	4 – N/A 0.78, 0.89	5 – N/A, 3%	6 – N/A
New Construction (seven programs)	3 – N/A, 0.8, 1.0, 1.0, 1.16	4 – N/A, 20%, 0%, 0%	7 – N/A
Non-Residential			
Lighting (six programs)	1 – N/A, 0.96, 0.96, 0.96, 0.96, 1.0	6 – N/A	6 – N/A
HVAC (six programs)	3 – N/A, 0.85, 0.96, 1.0	4 – N/A, 15%, 0%	6 – N/A
Large Comprehensive (ten programs)	3 – N/A, 0.7, 0.8, 1.0, 0.7, 0.8, 1.06	10 – N/A	10 – N/A (1 inferred of at least 6%)
New Construction (six programs	1 – N/A, 0.65, 0.75, 0.81, 0.67, 0.93	3 – N/A, 40%, 33%, 7%	6 – N/A

See the Best Practices website for detailed reports: http://www.eebestpractices.com/index.asp

Another cross-program study reviewed the evaluation efforts of 54 resource acquisition programs and 31 information-only programs from the 2002–2003 portfolio of California energy efficiency programs.[12] The California Evaluation Framework, which helps guide the California evaluation efforts, provides three primary components for evaluating energy and demand savings:[13]

1. Quantify the number of measures/actions installed or adopted.
2. Identify the savings achieved by the measures/actions installed or adopted.
3. Identify the savings that would have occurred in the program's absence.

Fifty of the 2002–2003 Portfolio evaluations were included in the study since not all evaluation efforts had been concluded by the time the report was developed. Within the net-to-gross analysis section of the study, only 23 of the 50 evaluation efforts took free ridership into consideration. Far fewer included efforts to account for spillover effects; three measured participant spillover, and three measured nonparticipant spillover. Although the study stated free ridership and spillover were important considerations that should be included in evaluation research, it provided no guidelines as to which effects may have had a greater impact or if it was appropriate to believe free ridership and spillover effects essentially cancelled each other out.

[12] *California 2002-2003 Portfolio Energy Efficiency Program Effects and Evaluation Summary Report*, prepared for Southern Californ ia Edison and the Project Advisory Group by TecMarket Works, January 16, 2006

[13] *The California Evaluation Framework*, prepared for Southern California Edison by TecMarket Works, 2004

However, some specific program evaluation efforts were identified that will be reviewed in more detail in the next section of this report.

Specific Programs

Broad reviews of program results provided the first step to assess the need for detailed net-to-gross assessments by the Iowa Utility Board. In most cases, the assumed net-to-gross values were approximately 1.0, and those that were not 1.0 often did not consider the potential counterbalancing impacts to free ridership from spillover.

This section provides a second step for assessing the need for net-to-gross analysis by examining evaluation findings in more detail for specific program types, particularly examining studies that included both free ridership and spillover. A sample of program types were selected based on those considered to have high savings potential in Iowa, appearing to have low net-to-gross ratios, or being excluded from the previous meta-studies.

Lighting Programs

The net-to-gross values for both residential and nonresidential sector lighting programs are provided in Table G.2 and Table G.3. As shown in Table G.2, net-to-gross values for lighting programs range from 0.8 to 1.27. The 0.8 value represents the deemed net-to-gross value for the California residential lighting programs and does not include spillover effects. The net-to-gross values above 1.0 come from studies that include spillover effects.

Table G.5 lists results from three additional evaluation efforts that included lighting free ridership and spillover effects.[14] For each of these programs, the estimated net-to-gross value is 1.0 or higher, as spillover estimates are significantly higher than free ridership estimates. The spillover estimates for the Energy Trust program are very large and significantly higher than either Efficiency Vermont or NYSERDA.

Table G.5. Residential and Commercial Lighting Programs with Spillover Estimates

Sponsoring Organization	Net-to-Gross Values	Free Ridership Values	Spillover Values
Residential:			
Efficiency Vermont[15]	1.19	6%	25%
Energy Trust of Oregon[16]	capped at 1.0	15%	over 200%
Non-Residential:			
NYSERDA[17]	1.09	39%	79%

14 Note: the NYSERDA net-to-gross value does not equal (1 - free ridership + spillover), which is the formula used by most programs, but uses (1-free ridership) * (1 + spillover). Note also that the efficiency Vermont values represent a more recent study than that identified in Table G.2.

15 *Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs*, prepared for the Vermont Department of Public Service, prepared by KEMA, Inc, December 2005

16 *2003-2004 Home Energy Savings Program Residential Impact Evaluation,* prepared for the Energy Trust of Oregon, prepared by Itron, Inc., December 2006

Non-Residential Large Comprehensive Programs

Non-Residential Large Comprehensive Programs, such as the California Standard Performance Contract (SPC) Program, promote the procurement and installation of high-efficiency energy technologies by providing incentive payments and design/audit assistance, in some cases, to partially offset incremental equipment costs. Customers can receive incentives for customized projects based on calculating the amount of kWh saved or based on a measurement and verification procedure. Providing incentives to shorten payback periods and assistance to quantify equipment performance increases the adoption of new technologies. The SPC program in California, as identified in Table G.2, has a relatively low net-to gross value of 0.7. However, this net-to-gross estimate only includes adjustments for free riders and includes no spillover effects.

Evaluations from two similar type programs that included estimation of spillover effects were also reviewed. As shown in Table G.5, similar to the California SPC program, free ridership is large, with a value of 30% for NYSERDA and 44% for Wisconsin. However, these high free ridership values are nearly offset by large spillover estimates, with an adjusted net-to-gross of 0.91 for Wisconsin and 0.97 for NYSERDA. Assuming an estimated precision of approximately 10%, these values are not significantly different from a net-to-gross of 1.0.

Table G.6. Non-Residential Large Comprehensive Programs with Spillover Effects

Sponsoring Organization	Net-to-Gross Values	Free Ridership Values	Spillover Values
Wisconsin Power & Light[18]	0.91	44%	34%
NYSERDA[19]	0.97	30%	39%

Refrigerator and Freezer Recycling Programs

Table G.2 indicates very low deemed net-to-gross estimates of 0.35 for refrigerators and 0.54 for freezers in California. This type of program likely does not lend itself to having much if any spillover effects as it is unlikely many participants or nonparticipants would dispose of additional qualified refrigerators and freezers beyond the ones they dispose of within the program. Therefore, these low net-to-gross values may be appropriate.

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17 *New York Energy $mart Program Evaluation and Status Report for the Year Ending December 31, 2006*, New York State Energy Research and Development Authority, March 2007

18 *Shared Savings Decision-Making Process Evaluation Research Results*, prepared for Wisconsin Power & Light by Summit Blue Consulting, April 11 2006

19 *Commercial/Industrial Performance Program (CIPP) Market Characterization, Market Assessment and Causality Evaluation*, prepared for New York State Energy Research and Development Authority by Summit Blue Consulting and Quantec, April 2006

The only program evaluation examining net-to-gross for refrigerator and freezer recycling programs was the KEMA study, which was used to develop the 0.35 and 0.54 values found in Table G.2.[20] In this evaluation, gross savings were reduced for two reasons:

1. The attribution (free rider) factor
2. The part use factor

The attribution factor accounts for what the disposal of the recycled unit would have been in the program's absence. Options for the used refrigerators and freezers are: a) to be destroyed; b) kept by the owner as a second unit; or c) transferred to another owner. The KEMA evaluation estimated that the attribution factor for refrigerators was 41% and 73% for freezers.

The part use factor accounts for usage of the units if they are kept as second refrigerators/ freezers or transferred to a new owner. For example, savings due to removal of a unit used for only three months of the year is only one-quarter (3/12) the savings associated with full-year use. The KEMA evaluation estimated the part use factor 0.88 for refrigerators and 0.77 for freezers. Spillover issues were not addressed in the KEMA study, which was appropriate considering the program objectives.

Non-Residential New Construction Programs

Although information included in Table G.3 indicates a large number of nonresidential new construction programs have low net-to-gross estimates, none of the programs cited in Table G.3 included any estimates of spillover effects. Only one evaluation of a non-residential new construction program was found to include estimates of spillover effects. This was an evaluation of the NYSERDA new construction program,[21] with a 46% free ridership estimate. This is similar to two of the three free ridership estimates provided in Table G.3 for non-residential new construction programs.

Both participant and nonparticipant spillover were also estimated in the NYSERDA study. These combined spillover effects were estimated to be 54%, more than offsetting the 46% free ridership estimate.

Energy-Efficient Residential Clothes Washers

Many utilities offer programs that promote ENERGY STAR® residential appliances, including clothes washers. In recent years, however, evidence has appeared that the market for energy-efficient clothes washers is being transformed, with resulting low net-to-gross estimates. Attribution for this market transformation may lie with the ENERGY STAR program and not

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[20] Final Report: Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program, prepared for Southern California Edison by KEMA-XENERGY, February 13, 2004

[21] *New Construction Program (NCP) Market Characterization, Market Assessment and Causality Evaluation*, prepared for New York State Research and Development Authority, prepared by Summit Blue Consulting and Quantec, May 2006.

with local utility financial incentive programs. If so, this would mean there would be very little spillover (especially nonparticipant spillover) from this program.

Efficiency Vermont[22] has performed evaluations of the energy-efficient clothes washers as part of its portfolio of energy-efficient appliances offered under the efficient products portion of it residential program. In 2001, they estimated the net-to-gross ratio for this part of their program was only 0.38. In 2004, they re-estimated net-to-gross, and it fell even further to only 0.17. Spillover was not specifically addressed in these Efficiency Vermont studies. However, a statement was made in the evaluation report that the high saturation of ENERGY STAR clothes washers in the market place is not a local but rather a national phenomenon, with an inference that attribution for spillover would be to a national, not local effort.

Despite this very low net-to-gross value, Efficiency Vermont plans to continue to administer rebates for ENERGY STAR clothes washers. They are doing this to maintain good relationships with retailer channels built up over many years.

Conclusions and Recommendations

This study examined the treatment of free ridership and spillover throughout the United States. Key findings include:

- ***Net-to-gross estimates would have minor, if any, impacts on the societal benefit test.*** If the benefit cost tests were run with net impacts, programs with a net-to-gross ratio less than one would have their administrative costs spread over fewer participants. Given that administrative costs normally represent only a small percentage of program expenditures, this impact is assumed to be minor.
- ***Many states have assumed free ridership and spillover offset one another***. A recent study conducted for the Nevada Power Company and Sierra Pacific Power Collaborative found 15 states (69%) have rejected the concept of free ridership in estimating net saving.
- ***Estimating free ridership and spillover is difficult, with no consensus on an approach for how best to estimate these values***. There are inherent biases with both the self-report and statistical approaches, and the selection of one approach over another can give significantly different results.
- ***A study of best practice programs found over two-thirds of all identified programs had a net-to-gross value of approximately 1.0.*** Approximately half of the studies (49%) either assumed or calculated a net-to-gross value of 1.0, and 68% of the studies had net-to-gross values between 0.9 and 1.0. In most cases, net-to-gross values, when used by a program, were only based on free ridership values; so an even higher percentage of programs would have a net-to-gross ratio of approximately 1.0 if spillover was examined.
- ***Assuming a net-to-gross ratio of 1.0 may provide conservative estimates***. Research indicates some programs, particularly for lighting, routinely achieve net-to-gross ratios of

[22] *Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs*, prepared for the Vermont Department of Public Service, prepared by KEMA, Inc, December 2005

well over 1.0 when spillover is examined. Assuming a net-to-gross of 1.0, therefore, is likely a conservative estimate, underestimating true program impacts for some measures.

Given these findings, we recommend the Iowa Utilities Board and Iowa's investor-owned utilities continue the policy of assuming free ridership and spillover offset each other. However, findings from this study indicate that although an average, a net-to-gross ratio of 1.0 is a reasonable assumption, specific measures are likely to have net-to-gross values less than 1.0. Quantec therefore recommends utilities make efforts to design effective programs that minimize free ridership by:

- ***Reviewing studies that indicate certain measures are achieving high market shares and thus high free ridership rates***. For example, ENERGY STAR clothes washers continue to gain market share throughout the country, and results from Vermont indicate high free ridership and a net-to-gross ratio of less than 1.0.
- ***Carefully setting incentive levels to minimize free ridership.*** As programs mature and market share for efficiency measures increase, program administrators may be inclined to reduce incentive levels. Paradoxically, however, as incentives *drop*, free ridership *increases*. This occurs because lower incentives are less likely to motivate participants who would not have installed a measure in the incentive's absence (i.e., a low incentive is not enough to motivate a customer to do what he or she was not already planning). Incentive levels should thus be carefully reviewed and set so to make sure to motivate a substantial number of participants to install an efficiency measure they would likely not have installed in a program's absence.