

Bird's Eye View of Energy Efficiency Market Research: Time to Move Beyond the Forest

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ABSTRACT

Wisconsin's public benefits program conducted a gap analysis to broadly identify what already is known and what information gaps exist in market research concerning energy efficiency in the agricultural, commercial, industrial, and residential sectors. The gap analysis comprised a review of 336 past market research reports and other publications in each of these sectors from all over the United States, thereby providing an opportunity to take a bird's eye view of strengths and weaknesses of the current body of market research literature related to energy efficiency. Most of these reports were reviewed, classified by multiple content areas (sectors, subsectors, market actors, technologies, and type of information included), rated on multiple parameters, and included in a database for further analysis.

High-level analysis of these reports suggests that market researchers may have collectively exhausted some popular topics while leaving other issues devoid of research. One of the larger gaps may not be a specific topic, but depth of research. Much of the published market research identified by this effort approached market research with a narrow energy efficiency perspective, while largely ignoring or undervaluing the larger context in which energy-related decisions are made and the complex roles and dynamics at play in businesses.

This paper discusses these and other relatively unexplored areas of research that would help in the design of more effective energy efficiency programs that are intended to influence markets.

Introduction

The Wisconsin Department of Administration launched the state's public benefits program in 2001. This effort, dubbed Wisconsin Focus on Energy, comprises four parallel program efforts – one each for major markets (commercial, industrial, and agricultural sectors), the residential sector, renewable energy, and environmental research and development – and a comprehensive evaluation. To assist both the program implementers and evaluators, the Department of Administration also initiated a market research baseline. This baseline consisted of an extensive literature review and gap analysis, as well as some primary data collection in areas that were a high priority for program staff or evaluators, known to be poorly covered by prior research, and in which market conditions were most likely to change as program activities began. The gap analysis was completed in October 2001; the report for the entire project became public in March 2002.

Although the gap analysis was conducted with the Wisconsin Focus on Energy programs in mind, the literature review and resulting database were national in scope and

point to some findings that are likely to be interesting to the energy-efficiency research community as a whole. This paper summarizes the kinds of literature we found and highlights observations we made about the content and approaches of past research in the field.

Methodology

The market research baseline project's gap analysis consisted of four steps in roughly the following sequence, but with some overlap:

- identification of market research priorities of Wisconsin Focus on Energy program managers and evaluators;
- development of a database structure to facilitate cataloging of existing literature;
- literature search and review (not limited to the priorities identified above); and
- analysis and reporting of gaps.

Two of these steps – development of a matrix and the literature search and review – warrant further explanation.

We developed a database structure that allowed us to catalog and analyze the literature we identified in a logical manner and to rate each report's applicability to Wisconsin Focus on Energy. The database dictated the kind of information we would collect and keep about each report we reviewed. The database consists of two main tables. One lists the reports we reviewed as well as typical bibliographical information about each report and a brief description. The other table identifies the various combinations of sectors, subsectors, market actors, technologies or services, and types of information applicable to each report. This table also rates each report's applicability to Wisconsin, reliability, thoroughness, and freshness.

The literature search itself consisted of a broad search for market research that is relevant for the design and implementation of new energy-efficiency programs. We sought such research and evaluation reports from many of the "usual sources" of energy-efficiency research. These sources included:

- Energy Center of Wisconsin reports and library;
- Wisconsin Focus on Energy Pilot interim evaluation reports;
- Consortium for Energy Efficiency database of evaluation/market research reports;
- American Council for an Energy-Efficient Economy conference proceedings and reports;
- International Energy Program Evaluation Conference proceedings;
- Northwest Energy Efficiency Alliance publications;
- Northeast Energy Efficiency Partnerships publications;
- California DSM Measurement Advisory Committee database of reports;
- Department of Energy publications; and
- Environmental Protection Agency publications.

We followed up this broad search with more targeted searches for literature that addresses the research priorities identified by Wisconsin Focus on Energy program managers and evaluators. These targeted searches took us back to these same sources, references cited in relevant reports we had found, and other sources.

We reviewed a total of 336 reports, articles, and papers – all of which are included in the database. Of these, we examined 311 closely enough to categorize and rate. The market research baseline gap analysis and the analysis for this paper are based on this group of 311 publications. We did tend to examine those reports more closely that were likely to address a Wisconsin Focus on Energy research priority, but these priorities were so broadly stated that we believe our literature review to be representative of the kinds of market research information publicly available.

Classification of Existing Market Research

As noted, we categorized the content of 311 market research reports we examined in the following ways:

- by sector;
- by subsector;
- by market actor(s) studied;
- by technology or service studied; and
- by type(s) of information gathered.

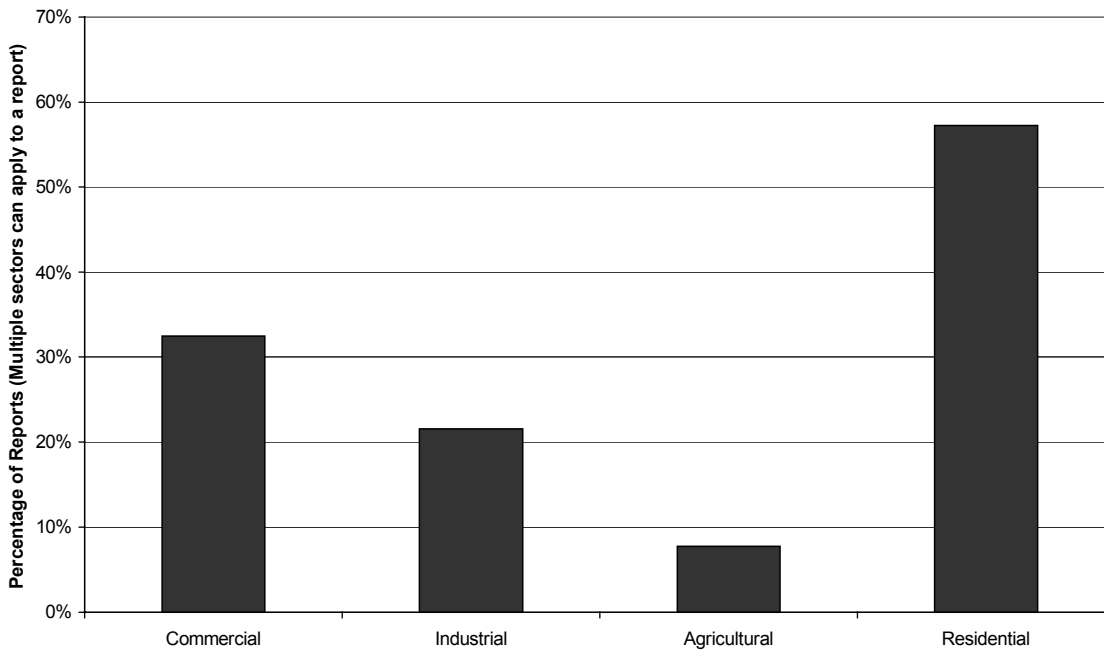
We present a brief overview below of our findings in each of these dimensions, but will focus the remainder of the paper on some more general observations about the market research we found.

Literature by Sector

The body of literature we identified was most prolific in the residential sector, followed by the commercial and industrial sectors. We found the least information about the agricultural sector. This mix of sectors was probably influenced by the way we conducted the literature review, so the proportions shown in Figure 1 are not necessarily representative of the full body of existing market research literature. Nevertheless, it does appear that the residential sector has been studied thoroughly (or, at least, frequently).

Our analysis of the literature by subsector expanded on these results by identifying the extent to which smaller segments of each sector have been addressed by existing market research. We defined subsectors based on the programmatic divisions within the Wisconsin Focus on Energy program. While interesting, these results are less likely to be useful to people not associated with the program, so we will not present them here.

Figure 1. Literature by Sector



Literature by Market Actor

The bulk of the literature addressed the end-user or customer, followed by literature that addressed a group of market actors we called “builders/contractors/designers” (sometimes in conjunction with research about end-users). This latter group varies by sector, but comprises those people directly involved in the design of an energy-using system, house, or building. Some reports did not address specific market actors at all, but rather focused on such items as a specific technology or a high-level description of a market. Figure 2 illustrates the market actors studied by sector.

Literature by Technology or Service

Some literature in all sectors addressed specific technologies or services, as shown in Figure 3. Market research in the residential sector was more likely to address specific technologies or services. Research of the residential sector, as a group, also covered a broader range of technologies. In contrast, research of the commercial sector tends to focus on overall building design, HVAC, and lighting, and research of the industrial sector concentrates heavily on motors. Table 1 shows the most common technologies studied for each sector.

Figure 2. Literature by Market Actors

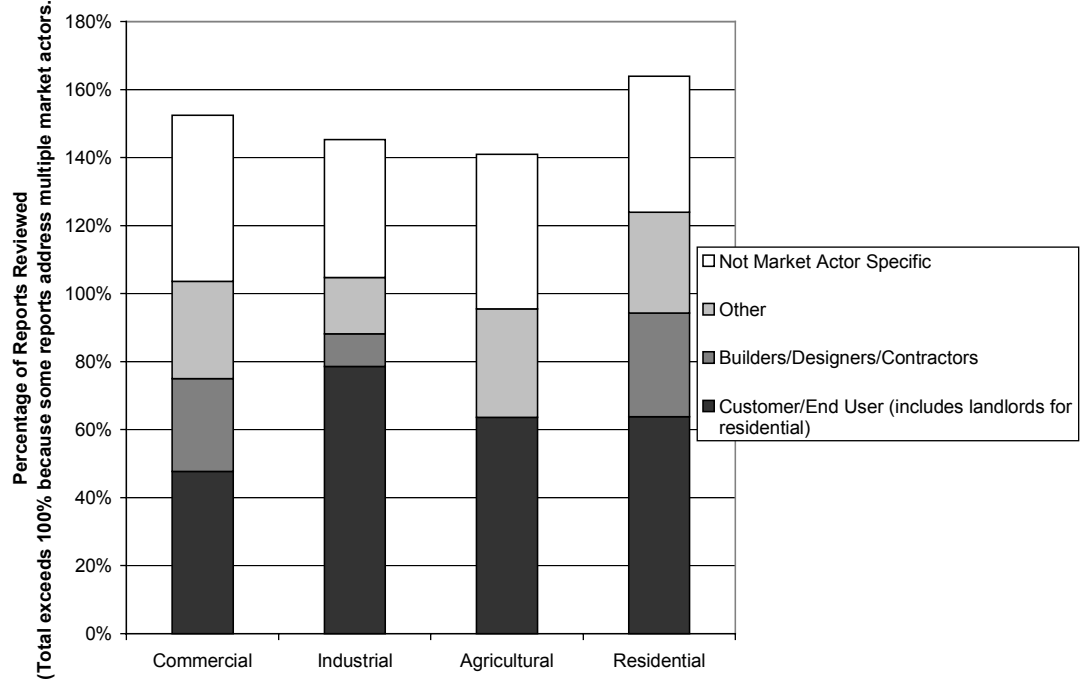


Figure 3. Technology- and Service-Specific Research

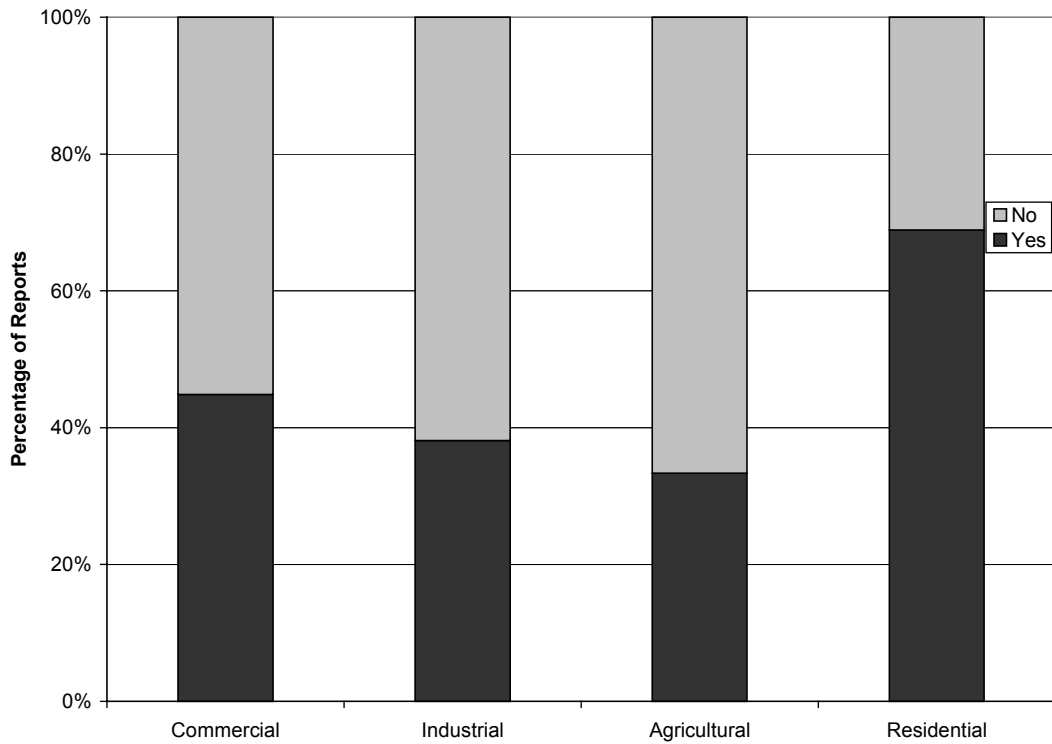


Table 1. Most Common Technologies Studied by Sector

Residential	% of reports	Commercial	% of reports	Industrial	% of reports
HVAC	39%	Building Design	38%	Industrial Motors	50%
Water Heating	28%	HVAC	38%	Renewable Energy	19%
Appliances	23%	Lighting	18%	Refrigeration	13%
Windows	22%				
Lighting	21%				

Agricultural sector not reported in the table because of the small number of reports we reviewed in that sector.

Literature by Type of Information

Probably the most informative aspect of our literature review was a categorization of the type of information each report provided. In this categorization, we sought to identify what each report tells us about the sector, subsector, market actor, and technology or service that was studied. That is, this variable describes the contents of the report, whereas the variables described earlier merely define the report's boundaries.

After reviewing a subset of the available literature, we established seven types of information that seemed to describe content of the existing body of literature:

- attitudes – comprising attitudes and awareness concerning an energy topic being studied among the target audience of the study;
- barriers – barriers to energy efficiency identified in the course of the research and possible solutions to address them;
- market description – a high-level description of how a market is structured, who the players are, and how they relate to one another;
- market interaction – a description of how market players interact with one another, including decision-making processes and criteria;
- market tracking indicators – quantitative measures that might serve as indicators of change in the market;
- physical characteristics/energy use – a description of the physical features of buildings, the equipment installed, and/or energy consumption by the population being studied; and
- other – a catch-all for other types of information not defined above.

As shown in Table 2, the existing body of literature is well-balanced across all of these types of information.

Table 2. Type of Information by Sector

Type of Information	Commercial	Industrial	Agricultural	Residential
Market Interactions	36%	28%	21%	33%
Market Description	44%	24%	17%	29%
Attitudes	33%	24%	17%	39%
Barriers	29%	28%	17%	24%
Physical Char. / Energy Use	15%	25%	38%	15%
Market Tracking Indicators	20%	12%	13%	17%
Other	10%	3%	17%	2%

Columns may exceed 100% because each report could address more than one type of information.

Gaps and Weaknesses in Existing Market Research

In our work for Wisconsin Focus on Energy, we used this classification of existing market research to identify gaps in the market information that would be required to design, refine, and evaluate the programs that were being initiated as part of Wisconsin Focus on Energy. While many of the gaps we identified are specific to Wisconsin's programs and needs, we observed some general themes that warrant some attention at the national level.

Shallowness in Information about Decision-Making

Because customer decision-making processes and criteria were among the market research priorities of the Wisconsin Focus on Energy program staff, we paid particular attention to the existing information about market interactions. Here, we found that many past market research projects have addressed decision-making in some form, but most of these provide only a glimpse of how decisions are made. Though social scientists in the energy field have long advocated that energy use and energy-related decisions be viewed in a broader social context (e.g., Wilhite and Shove, 1998), few of the applied studies we reviewed provide the kind of depth and context that allow researchers, evaluators, and program staff to get to know the market actors they are trying to influence.

Cursory exploration of decision-making is common. Many of the reports we reviewed attempted to address multiples types of information. Typically, the projects described in these reports use a combination of one or two data collection strategies to describe a market, describe the interactions and decision-making processes by market players, measure attitudes, identify barriers, and suggest new or improved program approaches. Necessarily, inquiries into any one topic are limited. Often the decision-related information is based on survey questions, such as the following (with response options provided or pre-determined categories established for coding):

- Why did you purchase a new (name of equipment here)?
- What types of (name of equipment) did you consider?
- Why did you not purchase a (name for energy-efficient version of the piece of equipment being discussed)?

Other projects have asked respondents to agree or disagree with statements about certain previously identified barriers, such as:

- The lack of available capital is a major barrier to energy management investment in this company.
- We are willing to pay a higher price for new equipment which will lower operating costs.

While these projects may serve their intended purpose – to provide a complete overview for a specific audience, such as the managers or sponsors of a particular energy efficiency program – they do not add much to the overall pool of knowledge about the decision-makers that energy-efficiency programs are attempting to influence. In fact, as discussed below, many of these studies cover similar ground. (Market Research Department, 1986, and Wisconsin Energy Conservation Corporation, 1992)

A few reports shed light on decision-maker perspectives. Some reports we reviewed do address decision-making in-depth. These projects generally used in-depth interviews – by themselves or in conjunction with other qualitative data collection – to provide a true introduction to the decision-makers. Together, these studies provide a window to the decision-making process and the world of the market actors that energy-efficiency programs have been trying to influence—particularly when they address the perspectives of multiple market actors in the context of a specific product or service (e.g., Banks, 2000).

Even among these projects there are two gradations – the projects that address decision-making from the energy-efficiency point of view and those that manage to provide the perspective of the market actors involved. The latter type of exploration is more difficult, time-consuming, and costly, but we found the information this line of inquiry provides to be the most helpful in getting to know the market actors involved and ensuring that energy-efficiency programs meet their needs.

Examples of these projects include:

- a qualitative assessment of market transformation potential among new commercial office buildings that sought first to address the question “Why do buildings turn out the way they do?” By studying building decisions from the perspective of the market actors, the researchers for this project laid the groundwork for additional work to understand the complex decision-making practices that underlie the perception in the energy-efficiency field that “first cost is all that matters.” Similarly, by exploring the ways that change – not just energy-efficient practices, but any kind of change – occurs in the buildings market, the researchers provide greater opportunities for themselves and readers to identify new ways that energy-efficiency programs could address this market. (Kunkle, 2001)
- an article in a financial journal that describes the capital budgeting practices of twelve large manufacturers. The article includes a hypothetical example based on the author’s interviews that describes in detail how one energy-related investment might be considered by a manufacturer and what considerations (project-related or otherwise) cause the project to be advanced to the next level in the decision-making

process or shelved. Although based on only a handful of companies' practices, the depth with which this article describes decision-making among large manufacturers allows the reader to begin to become truly acquainted with the target audience for any energy-efficiency programs for large industrial firms. (Ross, 1986)

- a European study that explored in great depth what caused a small number of industrial firms to voluntarily implement energy efficiency measures. The researchers devoted 33 interviews to the study of nine companies, thereby obtaining a rich understanding of the companies being studied and the various factors that led to the energy efficiency measures taken. Although potentially expensive, such depth provides insights that are almost certainly missed in studies that feature a more shallow exploration of a larger sample of firms. (Togoby, 1997)

Diamond and Moezzi (2000) note that “in understanding energy consumption processes in the real world and trying to guide practices, energy analysts often need to observe rather than to assume.” Indeed, the studies identified above are notable for being relatively free of implicit assumptions that lead to a narrow exploration of market barriers. This feature enables these studies to provide a depth of understanding that helps the reader get to know the market actors. Such studies can be difficult to do, but they are more lasting and geographically applicable than most market research we reviewed. They lay the groundwork for others to build upon, thereby providing opportunities for a collective advancement in knowledge.

It is interesting to note that one of the examples we singled out – the article in a financial journal – was published outside the “usual sources” of energy-efficiency market research information that many of us rely upon. That is not to say that market research outside the energy-efficiency research community is necessarily deeper or better. However, new or atypical sources of secondary data should not be ignored. This point is corroborated by the fact that we found useful information from trade associations and two European studies even though we concentrated our literature search on the “usual sources.” There may be more available from other non-traditional sources than we realize.

Repetition

Numerous projects seemed to overlap with work already done by others. Common examples of this kind of repetition included:

- multiple reports that identify similar barriers to the same energy-efficient choices (in all sectors);
- multiple studies of motors and adjustable speed drives in the industrial sector;
- multiple studies of HVAC systems in commercial buildings;
- multiple studies of building design in commercial buildings (especially for barriers to energy-efficient approaches to building design); and
- identical evaluations of similar programs.

We sought to demonstrate this observation quantitatively by showing the number of reports that addressed various combinations of sector, market actor, technology/service,

and/or type of information. However, the number of reports addressing the same issues – when measured this way – tended to be in the single digits (1-9). Our sample of reports reviewed may not be large enough to prove quantitatively the observation we made qualitatively.

Nevertheless, it makes sense that reports are somewhat redundant when one considers that the projects on which they report were often not written to further our common understanding, but to provide the most complete picture possible for a particular audience or to comply with local regulatory requirements. To a certain extent, however, repetition of research can result in lost opportunity to learn something new.

Evaluation projects seemed to stand out as most repetitive, as each evaluation project seeks to base its findings on data collection linked to the program being evaluated. In one case, we found two identical evaluation projects of very similar programs. In such cases, learning could have been enhanced if one project had built on the findings of the other.

Conclusions

An extensive pool of market information exists from over two decades of evaluation and market research efforts related to energy efficiency. Together, the hundreds – and probably thousands – of reports that have been written cover all sectors and many dimensions of each sector. However, a review of a subset of these reports suggests that some of the past work has been repetitive and not provided the depth of information that would allow program designers and implementers to fully get to know the targeted market actors.

To be fair, we acknowledge that most of the studies we reviewed were designed for specific purposes, such as the evaluation or design of a specific local energy-efficiency program. They may have served those purposes very well even if they contributed modestly or not at all to the greater knowledge base within the energy-efficiency community.

Nevertheless, an extensive literature review provides an opportunity to assess how well this patchwork of individual research projects is serving the energy-efficiency community and whether opportunities for improvement exist. Overall, the individual projects seem to provide a wealth of information, but they have left some holes, particularly in in-depth understanding of key market actors. Our literature review suggests that, while such research may exist, it does not appear to be commonly identified as relevant for energy market research and program design. Casting a broader net in secondary research and more in-depth exploration of how market actors see the world would help us become more acquainted with the people we have been studying and targeting through energy-efficiency programs.

In a world of finite resources, we see the issues of repetition and lack of depth as related to each other. When we conduct research that follows in the footsteps of past projects, we forgo the opportunity to blaze new trails that may lead to new understanding. We believe that, increasingly, those new trails ought to take us toward a deeper understanding of the perspective of the market actors.

Reducing repetition may require at least two adjustments in how we researchers do our work. The first adjustment is an increase in our use of secondary research. Some projects include an extensive literature review, while others do not. The latter group of projects risks duplicating work already done elsewhere that might also apply to the issues

being studied. Efforts to identify and catalog relevant research reports – such as a database developed by the Consortium for Energy Efficiency and one created by the Wisconsin Focus on Energy program (described above) – provide good tools for secondary research, and the availability of regional reports for the Pacific Northwest, the northeastern states, and California on the respective regional organizations' web sites also facilitates secondary research. In addition, however, we believe researchers might do well to explore literature outside the “usual sources.”

The second adjustment is increased coordination of research and sharing of results. Some such efforts are underway, with coordinated efforts to evaluate ENERGY STAR®, in various parts of the country, for example. More coordination in other areas, where feasible, would help ensure an efficient use of limited resources for market research. Similarly, making research results publicly available – even after a period of time following the conclusion of the project – would allow privately held information to have a second life and serve to enhance our common knowledge.

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