U.S. Department of Energy Smart Grid Investment Grant Technical Advisory Group Guidance Document #2

Topic: Non-Rate Treatments in Consumer Behavior Study Designs

August 6, 2010

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TREATMENT: ***In the context of Consumer Behavior Studies, a treatment variable is something offered or provided to a customer whose effect will be measured as part of a study or experiment.***

A key goal of the Department of Energy's (DOE) Smart Grid Investment Grant (SGIG) consumer behavior studies is to provide experimental evidence that certain treatment variables are more or less effective in changing behavior than other options, including the status quo. At the same time, these studies will function to inform utility management, regulators, and policy makers of the economic and operational issues to be expected in a larger, system-wide implementation of those treatments tested.

One of the main objectives for each SGIG Consumer Behavior Study Plan is to outline and justify the treatment variables of interest. All of the consumer behavior studies incorporate treatments belonging to one or more of the following categories: rate design, customer education, in-home displays, control or automation technology, and customer recruitment strategy. The purpose of this guidance document is to consider all of these treatments but rate design, which will be considered in a separate guidance document,

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[*] The following individuals on the Lawrence Berkeley National Laboratory Technical Advisory Group (TAG) drafted and/or provided input and comments on one or more of the U.S. Department of Energy Smart Grid Investment Grant (SGIG) Technical Advisory Group Guidance Documents: Peter Cappers, Andrew Satchwell and Charles Goldman (LBNL), Karen Herter (Herter Energy Research Solutions, Inc.), Roger Levy (Levy Associates), Theresa Flaim (Energy Resource Economics, LLC), Rich Scheer (Scheer Ventures, LLC), Lisa Schwartz (Regulatory Assistance Project), Richard Feinberg (Purdue University), Catherine Wolfram, Lucas Davis and Meredith Fowlie (University of California at Berkeley), Miriam Goldberg, Curt Puckett and Roger Wright (KEMA), Ahmad Faruqui, Sanem Sergici, and Ryan Hledik (Brattle Group), Michael Sullivan, Matt Mercurio, Michael Perry, Josh Bode, and Stephen George (Freeman, Sullivan & Company). In addition to the TAG members listed above, Bernie Neenan and Chris Holmes of the Electric Power Research Institute also provided comments.

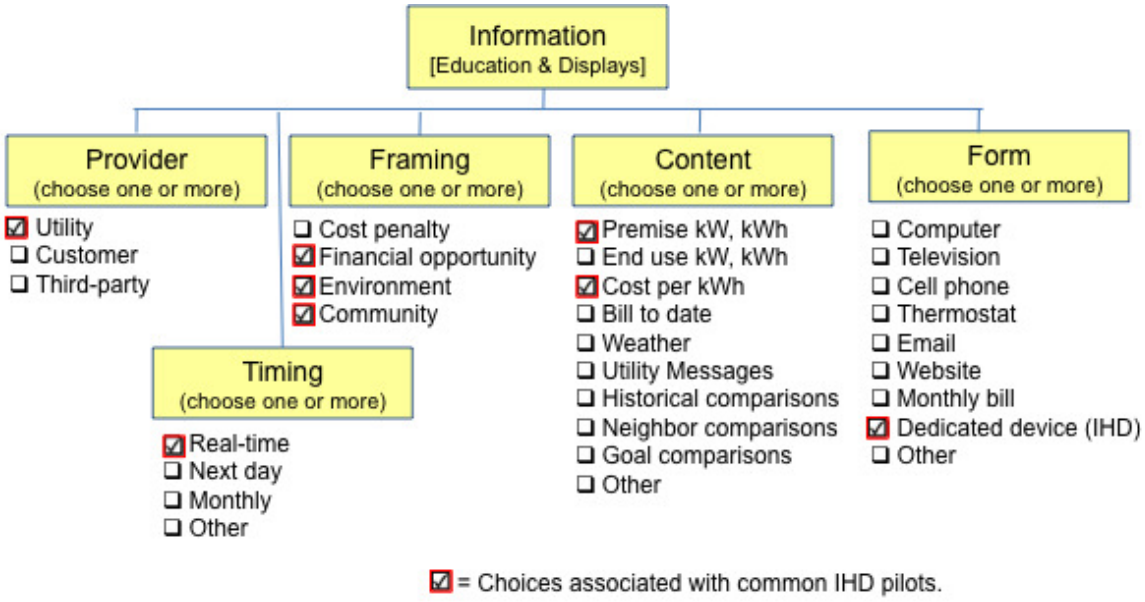
in order to highlight the problems and complexity they can introduce to an experimental design, and provide recommendations for keeping consumer behavior study designs manageable.

CUSTOMER EDUCATION AND IN-HOME DISPLAYS → INFORMATION

Education in its basic form is information, while in-home displays represent one means of providing access to that information. Consequently, education and in-home displays are not separable, but are better classified together as "information" treatments.

Information is a multi-faceted concept, defined by its source, content, framing, and physical attributes, among other things. Figure 1 provides a typology of information, depicting some of the many components that could be combined to make a single information treatment. Components commonly investigated in utility pilots are identified with checked boxes.

Figure 1. Information Options



Given that none of these options are mutually exclusive, it is immediately apparent from Figure 1 that the number of ways to combine information elements to make up a single "treatment"is enormous. Testing all possible combinations is clearly not practical. However, focusing on just a few elements must be done carefully to ensure the resulting treatment(s) are as representative of a full-scale implementation as possible.

Recommendations for Information Treatments

a. - **Minimize the number of information treatments in the SGIG behavior studies.** It is important to understand the marginal value of information, but given the number of different information treatments possible not all can be captured. Instead, the SGIG

consumer behavior studies should focus on a very limited subset of information treatment elements to vary and test in a highly rigorous fashion. However; there are other research methods (e.g., market research, surveys, focus groups) than a field study that may be more appropriate to test the efficacy and acceptance of a wider array of alternative information treatments of interest to the SGIG recipient. Such efforts should be pursued, but outside of the broader SGIG dynamic pricing and consumer behavior research effort.

b. - **Prefer studies to not focus exclusively on information device treatments (such as IHDs).** Several recent studies have shown minimal conservation effects for these devices[1], but more research may be needed to understand if these results are robust. Ideally, information-only devices would be compared against more multipurpose devices available to display information of any type (see Figure 1) in order to understand the differential effects, especially given the large and growing market for such comprehensive devices.

c. - **Take care when interpreting results.** Great care should be used in information experiments. While the selection of informational attributes/variables is easy (e.g., informational brochure, web content), the interpretation of those variables is complicated. It is easy to conclude that an informational technique does not work but in doing so an error in attribution is sometimes made for the informational attribute might actually be correct but the level of that attribute might be wrong. For example, a poorly written and designed glossy brochure may not elicit the desired acceptance of dynamic pricing resulting in the erroneous conclusion that customers are unwilling to accept dynamic pricing.

AUTOMATION AND CONTROL TECHNOLOGY

Automation and control technology can also involve a variety of options based on what device is used to exercise control, who controls it, what electricity-consuming devices are controlled, and how they are controlled. Figure 2 identifies some of the main elements of automation and control. The checked boxes indicate one of the best-understood automation options, air-conditioning direct load control. These elements are not mutually exclusive; in time, it is possible that all of these options will coexist.

[1] See for example, PEPCO PowerCents DC study (2008) or Energy Australia (2006).

Figure 2. Automation and Control Options

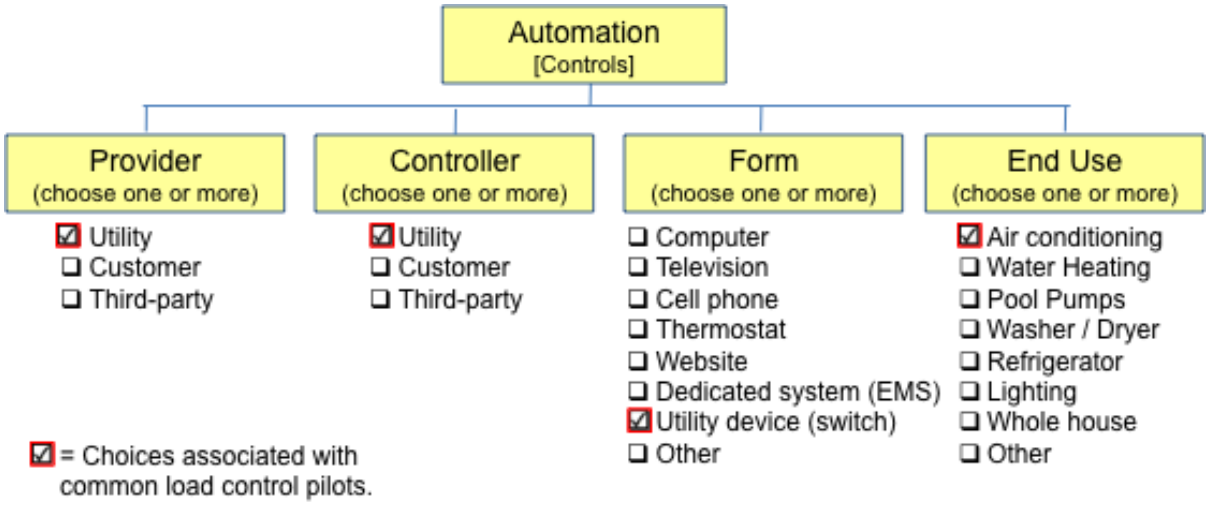


Figure 2 indicates that the possibilities for automation treatments, like information treatments, are nearly unlimited –thus the need to focus efforts on evaluating a very small subset of elements that will inform future decision making.

Recommendations for Automation

a. **Minimize the number of "automation" treatments.** It is important to understand the marginal value of automation or control technology, but given the number of different treatments possible not all can be captured. Instead, the SGIG consumer behavior studies should focus on a very limited subset of automation technology treatment elements to vary and test in a highly rigorous fashion. However; there are other research methods (e.g., market research, surveys, focus groups) than a field study that may be more appropriate to test the efficacy and acceptance of a wider array of alternative automation or control technology treatments of interest to the SGIG recipient. Such efforts should be pursued, but outside of the broader SGIG dynamic pricing and consumer behavior research effort.

b. **Prefer studies to include customer-programmed appliance controls.** Direct utility control of appliances will likely remain an important option; however, direct load control has been the mass-market demand response method of choice for decades, so there is little need for further research in this area. On the other hand, the area of customer-programmed appliance controls has not been nearly as well studied and has been talked about extensively as the future of the Smart Grid.

c. **Avoid treatment options that are not indicative of what might happen under full smart metering or dynamic pricing implementations.** Consider carefully whether a "no automation" treatment is realistic for your customers, given that automation technologies have consistently doubled or tripled response to critical peak events and the cost of a simple communicating thermostat is rapidly approaching the cost of a standard thermostat (~$30).

RECRUITMENT STRATEGIES: MANDATORY, OPT-IN, AND OPT-OUT

The SGIG consumer behavior studies are expected to provide utilities and the retail electricity industry with a better understanding of not only rate forms and prices, but also rate *recruitment strategies*, the methods by which customers are moved from one rate to another.

When rate recruitment is *mandatory*, customers are taken off their old rate, placed on a new rate, and are not given the option to switch to another rate. Use of mandatory recruitment in a study would allow an estimate of the effects of placing all customers on the same rate, but should not be used to estimate how customers would respond to a portfolio of voluntary rate offerings.

Voluntary rate recruitment can take one of two forms: (1) customers are left on their existing rate and provided the opportunity to "opt-in" to experimental rate options, or (2) customers are placed on a experimental rate and given the opportunity to "opt-out"— either to their old rate or to another experimental rate. It is interesting to note that in both cases, customers opt out of one rate and in to another. In the context of a study, however, the terms *opt-in* and *opt-out* are generally used in reference to the experimental rate, as in, customers are recruited to opt in to an experimental rate, or, customers are allowed to opt out of the experimental rate.

In all voluntary recruitment efforts, customers are given a choice. Some choose to switch to a different rate, some choose to stay on the default rate, and many (or perhaps most) choose not to choose, thus remaining on their existing default rate under opt-in and being placed on the new dynamic default rate under opt-out. Since customers historically do not opt out of default rates in large numbers, it is important for utilities to choose the best possible defaults for the full-scale implementation in terms of economics, customer acceptance, and load effects.

Recommendations for Recruitment

a. **Carefully consider how the chosen recruitment strategy will define the meaning of the study results.** Mandatory participation can be used effectively where the results of the study are to determine the one-and-only required option to be offered to customers in the future; however, where customer options are an important part of a utility's long term strategy, participation in treatment groups should be either opt-in or opt-out.
b. **The ideal consumer behavior study, as identified in the FOA, includes mandatory participation in the study to test dynamic pricing as default service.** DOE is especially interested in pilots that identify a mandatory dynamic rate offering, since that has not yet been tested to date. Clearly, though, there must be regulatory and political support for such a rate offering after the pilot is completed, or else alternative recruitment methods should be employed.
c. **The preferred alternative is an opt-out recruitment strategy for dynamic rate treatments.** Of particular interest are comparisons of treatment groups that have the same rate options but start out on different default rates.

GENERAL RECOMMENDATIONS

While there is no single approach that identifies what should and should not be included in the experimental design, there are several key principles that should be carefully considered when determining which treatments to include.

a. **Avoid the use of the term "technology" as a treatment.** Instead, define the technology using the terms in Figures 1 and 2, indicating the source of the information and hardware, the information available to customers and when, the appliances under control and by whom, access points, etc.

b. **Avoid pure technology trials where the intent is to perform "Consumer Reports" style evaluations.** The impacts attributed to a specific device relate only to that particular make and model at the time it was studied. Understanding the effects of one or two out of dozens of available options is of limited use, especially when the options available today will be gone or significantly changed in the coming months and years. Instead, the study should focus on the impact associated with the attributes of the information (e.g., real-time vs. next day delivery) or automation control technology (e.g., whole-house vs. appliance-level), instead of the specific technology itself.

c. **Avoid treatment variables that are unrealistic.** Instead, use a reasonable baseline scenario against which alternative treatments are compared. For example, an option like "no education" is not possible given regulatory requirements.

d. **Compare information and/or automation treatments only if there is a need for the utility to choose one over the other, or compare the efficacy/acceptance if it intends to offer both.** There is little need to compare electricity use in terms of dollars to electricity use in terms of kWh, since both can be provided at no extra cost. Similarly, there is no need to compare the effectiveness of information provided via website, email, text message, or phone: the cost of each is so small that they should probably all be offered simultaneously, letting customers decide which methods suit them best. A utility that wants to provide energy use information on a website and also offer dedicated devices to those who don't have Internet access need not necessarily compare the effectiveness of one versus the other: both will be offered, leaving the ultimate choice with the customer. The same could be true of automation treatments.

e. - **Carefully consider whether any given technology is likely to stand the test of time.** For example, studies have historically incorporated dedicated energy information displays; however, such devices may not successfully compete in the future against devices that integrate such information into multifunctional devices like cell phones, computers or some other yet-to-be-developed product. In each major category of elements, researchers should carefully consider whether the information treatment is likely to stand the test of time. If not, then the test is of limited value.

f. - **Consider using market research, rather than the field study, to answer some of the research questions of interest.** Information can be presented with different perspectives and levels of objectivity, thereby affecting the framing of messages. For example, characterizing the high critical peak price as a risk to be avoided will produce different results than if low off-peak rates are characterized as an opportunity for customers to save money. Framing is a critical issue that will be difficult if not impossible to control as a treatment variable. There are countless other examples

where other forms of research may be more appropriate than a field study to address the research question of interest.

TREATMENT PRIORITIES

In order to further the industry's understanding of what advanced metering infrastructure enables and how they can be realized; the DOE has identified a prioritized list of treatments recipients will ideally address with their studies. These are shown in Table 2. SGIG recipients should understand that Technical Advisory Groups have been tasked to make sure that at least some of the treatments being evaluated by SGIG projects will be of high priority interest to DOE.

Table 2. Research Priorities

	High Priority	Low Priority	No interest
Information	- premise vs. appliance - real-time vs. delayed	- historical comparisons - messages - benchmarks	- costly treatments that provide the same functionality as free treatments
Automation	-customer vs. utility control of end uses -customer control	-utility control	- controls without automated response to prices
Recruitment	-mandatory dynamic rates -opt-out dynamic rates	-opt-in dynamic rates -opt-out static rates	-opt-in static rates

THE IMPORTANCE OF MEASURING CUSTOMER SATISFACTION IN ADDITION TO BEHAVIORAL CHANGES

Some form of a customer satisfaction measurement should be part of any research plan.

Customer satisfaction is believed to be an index of many of the attitudinal and behavioral issues that utilities want to engender. Utilities are asking that customers see them as caring energy advisors. As utilities try to get consumers to engage in new behaviors, the level of "trust" consumers feel/perceive will be important. Research generally shows that high levels of customer satisfaction are determinant of trust and relationship building with customers. High levels of customer satisfaction results in greater customer retention, greater profitability, growth, and greater employee satisfaction.

The beauty of customer satisfaction is that it is easily measured and tracked.

There are two essential questions that need to be asked: -

a. "How satisfied are you with (name of program)?" using a scale of "very satisfied" to "very dissatisfied." The number of intervals between the very's is not important but 5 to 7 Likert scales are easy and work well.
b. "I would recommend (name of program) to my friends?" , again using a 5 to 7 point scale is typical.

Both questions sum to a satisfaction index and has been found to be a more valid measure of satisfaction that either one alone.