June 15, 2010

Mr. Lucas Adin
U.S. Department of Energy
Building Technologies Program
Mailstop EE-2J
1000 Independence Avenue, SW
Washington, DC 20585-0121

**Re: Docket No. EERE-2010-BT-CRT-0006: Survey of Field Energy Consumption of Residential Refrigerators, Refrigerator-Freezers, and Freezers**

Dear Mr. Adin,

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), Alliance to Save Energy (ASE), American Council for an Energy-Efficient Economy (ACEEE), National Consumer Law Center (NCLC), Natural Resources Defense Council (NRDC), and Northeast Energy Efficiency Partnerships (NEEP) in response to the Department of Energy (DOE) request for comment on a proposed survey of field energy consumption of residential refrigerators, refrigerator-freezers, and freezers. We strongly support the Department's initiative to gather field data to support the standards rulemaking process, and we appreciate the opportunity to provide input on the proposal. The docket is important in itself, but also as precedent and experience for field studies on many other products for which standards have been based on limited and/or obsolete data. In our comments below, we provide some recommendations regarding the field metering proposal, and we also suggest additional residential products for which field metering could provide useful information for the standards rulemakings.

**The proposed collection of information will provide data that will improve the analyses for the current and future energy conservation standards rulemakings.**

The data proposed to be collected through this field metering study would help the Department establish energy conservation standards for residential refrigerators, refrigerator-freezers, and freezers that result in the maximum level of energy savings that are technologically feasible and economically justified. The field energy use of these appliances is a key input to the life-cycle cost (LCC) and payback period (PBP) analyses as well as the national impacts analysis (NIA) conducted for the standards rulemakings. The energy savings for a given refrigerator or freezer due to a specific improvement in efficiency depend on the baseline energy consumption in the field. For the same percentage improvement in efficiency, greater energy savings will be realized for units with higher baseline energy consumption.

The actual energy savings in the field affect the LCC and PBP analyses since greater annual energy savings yield greater operating cost savings. The cost-effectiveness of efficiency improvements from the perspective of consumers therefore cannot be properly evaluated without good data on field energy consumption. This data is also essential for the analyses of national energy savings (NES) and net present value (NPV), which evaluate the national impacts of

standards, since national energy savings are calculated by aggregating the estimated energy savings in the field from individual units.

**Field-metered data will allow DOE to evaluate the use of field usage adjustment factors.**

In the preliminary Technical Support Document (TSD) for the current standards rulemaking for residential refrigerators, refrigerator-freezers, and freezers, DOE used data from the 2005 RECS combined with a regression analysis to calculate a usage adjustment factor (UAF), which relates the field energy use of a given unit to the its rated energy consumption. While conditional demand analysis is a powerful tool, there are significant uncertainties in RECS data, and regression analyses could produce a systematic bias for some products. Without metered data, there is no way to determine how well these energy use estimates based on RECS data reflect actual energy consumption in the field.

The test procedures for refrigerators and freezers attempt to produce annual energy consumption values for products that are representative of the energy consumption that consumers will see in the field. It is possible that the current test procedures do provide a good estimate of actual field energy use, which would mean that applying a UAF would be unnecessary. However, we cannot validate this assumption without comparing metered data to test procedure data. In addition, the test procedure conditions may not allow for the test procedure to produce an accurate estimate of field energy consumption. Rather than simulate door openings and food loadings, the test procedure is conducted with an ambient temperature of 90$^{o}$F under the assumption that the combination of factors will result in a tested energy consumption that will reasonably reflect field energy use. However, since the test procedure conditions are based on old models, it is necessary to have current field data to determine whether these conditions are still appropriate or whether test procedure conditions should be modified.

**We encourage DOE to review existing metering study results and to consider ways to collaborate with evaluation, measurement & verification efforts.**

DOE should review existing utility refrigerator and refrigerator recycling program metering results to the extent they exist around the country. Not only might useful monitoring data be available to inform or expand the effective sample size of the study, but it is possible that there are good opportunities to collaborate with forward-looking efficiency program evaluation, measurement & verification (EM&V) efforts.

**The proposed field metering study could yield additional information beyond the annual energy consumption of refrigerators and freezers that would be useful for the standards rulemaking process.**

We believe that the most important information that this study could provide is data on the field energy consumption of refrigerators, refrigerator-freezers, and freezers. However, we encourage the Department to take advantage of this opportunity to collect as much additional information as possible that could be useful for current and future standards rulemakings. The following is a list of specific suggestions for additional information to collect:

- The ratio of field consumption to test procedure consumption for each product class: Data for each product class would show whether the difference between field energy use and energy use as measured by the test procedure varies across product classes or whether a constant field adjustment factor for all product classes is appropriate.
- How the energy use of products changes over their lifetime and whether this change depends on the initial efficiency of the product: Data on performance degradation over time could help DOE better estimate lifetime energy consumption for the standards rulemaking analyses.
- The distribution of ages of products in the field: There is limited information available on product lifetimes, and product lifetime is a key input to the standards rulemaking analyses.
- Load profile data: Load profile data would provide information on the peak demand impacts of efficiency improvements and load-shifting.
- Information on door openings: Data on the number of door openings per day and the length of each door opening would allow for potentially incorporating door openings into the test procedures.
- The contribution of ice-maker energy use to total energy consumption: Ice-maker energy use is not captured by the current test procedure. In addition, in order to evaluate potential increases in energy efficiency for products with ice makers, it is necessary to know the relative contribution of ice-maker energy use to total energy consumption.

**To the extent possible, DOE should attempt to obtain a representative sample.**

We recognize that there are trade-offs between having a large sample size and obtaining a truly representative sample. However, we encourage DOE to strive for a representative sample that reflects variations in climate, household composition, income levels, and other factors to the greatest extent possible. A study conducted in a statistically-rigorous way will significantly increase the value of the data collected.

DOE's proposal to recruit volunteers nationally to perform metering on their own appliances has the potential to significantly increase the sample size at a relatively low cost. However, there will likely be selection bias, which means that solely relying on volunteers may not allow for obtaining a representative sample. We encourage the Department to supplement this approach by identifying which demographic groups, regions, etc. are missing from the sample and sending out workers to install meters and collect data from these households. DOE could also improve the representativeness of the sample by partnering with student groups, community groups, and other organizations across the country to conduct metering in households. By obtaining a representative sample, DOE will also be able to analyze the data collected to determine which factors actually do significantly affect field energy use. This information could then be used in the design of future metering studies.

**DOE should account for variations in energy use throughout the year when estimating annual energy use.**

Since refrigerators and freezers are almost always operating continuously, it is not necessary to conduct metering over a long period of time to capture variations in operating hours. However, there are at least two factors that should be accounted for when estimating annual energy use based on short-term metered data. First, energy use varies somewhat with climate and season, including ambient temperatures (and, to some extent, humidity). In certain regions or in houses without air conditioning, there may be significant variations in indoor ambient conditions between the summer and the winter. Second, ice-maker energy use is likely greater in the summer due to demand for larger quantities of ice.

**DOE should attempt to adequately capture all product classes of refrigerators, refrigerator-freezers, and freezers and to capture products used in non-residential settings.**

We encourage DOE to ensure that all refrigerator and freezer product classes including built-ins are represented in the sample. As mentioned previously, this will allow the Department to determine whether any difference between field energy consumption and test procedure consumption is consistent across product classes or whether there is greater variation for certain products. It is possible that the test procedures better represent field energy consumption for certain product classes than for others, and the purchase of certain product classes may be correlated with income, household size, and other factors. We also encourage DOE to ensure that the sample includes residential refrigerators used in non-residential settings (*e.g.*, office building lunchrooms) since the field energy use may vary between residential and non-residential applications.

**We encourage DOE at a later stage to conduct field metering for additional products.**

We support DOE's proposal to initially conduct metering on refrigerators and freezers. This will allow the Department to develop a robust study methodology by evaluating and improving the study at different phases. However, we believe that there are additional products for which field metering would provide important data for standards rulemakings. We encourage DOE to focus any additional metering efforts where there are data gaps. The following is a list of additional residential products that we believe would be good candidates for field metering. Field metering for some of these products (*e.g.*, computers) could likely be conducted using a similar methodology as that for refrigerators and freezers. For other products (*e.g.*, central heating and cooling equipment and systems), a field metering study would likely require longer-term measurements, the ability to measure natural gas consumption as well as electricity consumption, and skilled technicians to conduct the necessary measurements and tests.

- Clothes dryers: The current test procedure for clothes dryers involves stopping the cycle once the clothes reach a specified remaining moisture content (RMC), and it assumes that all automatic termination controls are equally effective. Therefore, the test procedure does not actually measure the energy use of a full cycle. In addition, there is not good information available about the cycle selections that consumers choose in the field and how the differences between field loads and test loads affect energy consumption. For a

field metering study for clothes dryers, it would be important to capture the energy use per cycle compared to the test procedure energy use and to collect data on the number of cycles run during the metering period. These two pieces of information would allow for estimating annual field energy use. It would also be useful to measure the volume of air removed from the house during a dryer cycle for a representative sample of house types, especially energy-efficient ones, to determine if HVAC interactions are important.

- Clothes washers: As with clothes dryers, there is limited information for clothes washers on the temperature and cycle selections used by consumers and the average number, size and composition of loads, which affect how field energy use compares to the test procedure.
- Room air conditioners: There are very few data available on operating hours for room air conditioners, and operating hours can vary significantly depending on climate, orientation of the window in which the unit is installed, household characteristics, temperature settings, and other factors. Operating hours have a considerable impact on the results of the analyses for standards rulemakings since they directly impact energy savings due to an increase in efficiency. In addition, there is limited information on load profiles, and room air conditioners can have a substantial impact on peak demand. It would also be useful to collect information on the number of units per home, usage patterns for units in different rooms of the house, and operating hours as a function of unit capacity. As with other "home" appliances, a significant number of room air conditioners are also found in non-residential buildings, and these should also be included in the sampling design for a field study.
- Computers and other residential electronics: Computers, routers, set-top boxes, and similar equipment are currently outside the scope of DOE's appliance standards rulemakings. However, the usage of these products is increasing and will likely continue to increase. There is very little information available on hours of usage and, for some equipment, "power management" settings when not in use. It would be relatively easy to meter residential electronics while metering refrigerators, for example, and this approach would mean that the "overhead" costs related to identifying households, installing and removing equipment, etc. would only occur once. In the case of office networked computers, some of this information on operating hours and settings might be available from central servers, rather than metering individual PCs. Field-metered data for these products could allow for estimating the potential energy savings from efficiency standards.
- Central Heating and Cooling Equipment and Systems: There are significant uncertainties regarding housing and system characteristics (*e.g.*, duct losses) that affect the performance of central heating and cooling equipment and systems. In addition to measuring the field energy consumption of these pieces of equipment and systems and closely related characteristics such as refrigerant charge, it would be useful for standards rulemakings to have data on system efficiency as a function of duct and equipment location (*i.e.*, attic, basement/crawl space), duct leakage, and the magnitude of the difference between equipment efficiency and system efficiency.

- Water Heaters: There are limited data on hot water usage, usage patterns, and distribution system losses, which significantly affect water heater energy consumption. Data on field usage could be used to modify the test procedures to better simulate field consumption.

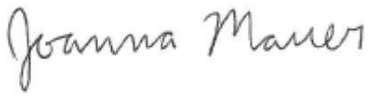
**To the extent possible, DOE should make the data collected publicly available.**

We encourage DOE to make all of the information gathered from this initial field study and subsequent field studies, including data sets, available to the public on the DOE website. These data should be useful for all stakeholders participating in the standards rulemakings, including manufacturers for the purpose of developing better product designs, and utilities for incentive program design.

In summary, we support DOE's proposal to conduct field metering for refrigerators and freezers, and we believe that the results will provide information to improve the analyses for current and future standards rulemakings. We encourage DOE to collect as much relevant information as possible from a representative sample of households and to consider expanding the scope of this study to additional products where there are data gaps.

Thank you for considering our comments. If you have any questions, please do not hesitate to contact Joanna Mauer at (202) 507-4034.

Sincerely,



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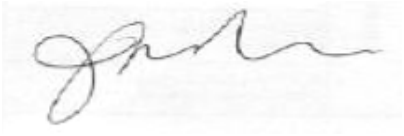

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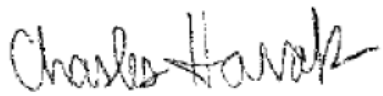

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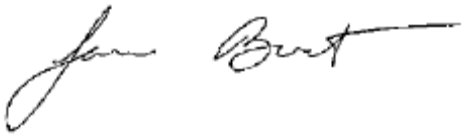

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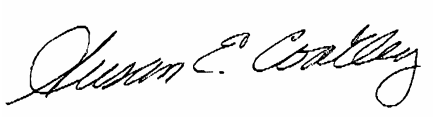

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