



**American Council for an Energy-Efficient Economy**  
WASHINGTON, DC

October 27, 2004

Rachel Schmeltz  
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Dear Ms. Schmeltz:

The American Council for an Energy-Efficient Economy (ACEEE) supports the *thrust* of the Consortium for Energy Efficiency letter attached with respect to the design of the 2006 Energy Star program for residential central air conditioners and heat pumps. We have chosen to write this letter to elaborate on some critical details. Please find attached CEE's letter, and an earlier note from ACEEE proposing some ideas for the 2006 program.

*Equipment Performance Specification:* Because the market will go through a profound change when the SEER 13 standard takes effect in early 2006, we believe that studies of incremental cost and model availability now will be of limited value, although they may serve as a lower bound on equipment availability. We support CEE's call for studies of energy savings and peak demand reduction with advanced equipment, but stress that such studies must be informed by understanding the differences among rated performance, field performance with customary installation practices, and field performance with proper installation. We believe that such studies will suggest that the CEE Advanced Tier (SEER 15, EER 12.5, and HSPF 8.5) is the *highest* that warrants evaluation. Nationwide, it is hard to see large savings for increases beyond that point; the alternative would be a big step: regional performance levels, as for Energy Star Windows. We strongly endorse CEE's emphasis on high EER requirements, because of the ramifications of high temperature performance on so many issues, including emissions of marginal generating units dispatched to meet peak loads, and potential need for additional transmission lines.

Because we believe that proper installation is so important, we could be comfortable with a slightly lower SEER level if a strong installation component is included. Because of the limitations of the present rating method for predicting energy savings, the national field savings from further feasible increments to the rating metrics are not as large as those from improved installation, and thus the performance rating (SEER 14 or 15) will serve in large part to help assure consumers that the equipment is actually different. Recent research strongly suggests that proper installation is even more important for heat

pumps than for air conditioners, because the installer can easily modify the control sequence to use more resistance heat and less heat pump energy.

*Other Equipment Requirements:* (A) ACEEE expects TXVs or equivalent feedback controlled metering devices to be pervasive in SEER 13 and higher equipment in 2006, based on DOE analyses in the latest TSD. If a prescriptive requirement is used, it should focus on the broader class of feedback controlled metering devices rather than the narrow choice of one device. (B) The “straw man” uses the term “airtight.” We request that Energy Star consider a “box” leakage maximum requirement, separate from any access requirements that might be included.

ACEEE earlier suggested that Energy Star consider a requirement that all components of an Energy Star system be sourced from a single supplier (not necessarily an OEM, but someone who had taken responsibility for lab certification (not just simulation). We hear reports of shortfalls when condenser and evaporator are not matched. In addition, the increasing sophistication of control algorithms for 2-speed and modulating equipment may warrant requiring that, for units with these feature, the thermostat be from the equipment manufacturer, as well as being an Energy Star unit. Finally, some equipment on the market will not reach its certified rating unless installed with a modulating air handler fan. This is not an issue for heat pumps, but in practice means that many Energy Star air conditioners will require furnaces with ECM-equipped fans. The air conditioner specification should require use of such a fan when such fans were included as part of certification tests.

Thank you for all the effort to manage this exemplary program, and we hope these comments in support of the CEE letter will be helpful to you.

Sincerely,

Harvey M. Sachs  
Director, Buildings Program.  
October 27, 2004

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Dear Ms. Schmeltz:

The CEE Residential HVAC Committee (Committee) appreciates the opportunity to provide input on options for revising the ENERGY STAR Central Air Conditioner and Air Source Heat Pump Specification (Specification). Because the scope of the Specification is unclear at this point, it is difficult to provide precise comments as the Committee's position will depend on the specific program contents selected by EPA. The Committee looks forward to the opportunity to provide specific comments on a future specification revision proposal when determination of the scope of the Specification is made. The comments and recommendations contained in this letter are supported by the organizations listed at the end of the letter.

The Committee strongly supports maintaining an ENERGY STAR specification for central air conditioners and air-source heat pumps that is differentiated and meaningful. Both "Nameplate" efficiency requirements (SEER, EER, and HSPF) and installation requirements are critical for achieving worthwhile energy savings on a large scale. The ENERGY STAR brand has proven to be a valuable marketing platform for high-efficiency HVAC equipment, as demonstrated by the high level of resources dedicated to promoting the brand by multiple stakeholders. Based on the large number of efficiency rebates paid for equipment with ratings greater than 13 SEER and the number of systems with ratings greater than 13 SEER listed in the CEE Directory of ARI-Verified Equipment, there is ample equipment available today that could be promoted as high-efficiency after the new federal standard becomes effective. An ENERGY STAR specification would enable consumers to easily identify and purchase this equipment.

HVAC energy efficiency programs dedicated resources to promote the ENERGY STAR brand with an expectation that it would remain a platform for transforming the HVAC market. Suspending the CAC/ASHP program would lead to a conspicuous void in the marketplace, and would be detrimental to current and future efforts by EPA and its partners to encourage the production, installation, and maintenance of equipment in a manner that will save energy.

<b>Comments and Recommendations</b>
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*SEER, EER, and HSPF should remain equipment performance requirements within the Specification and reflect the most-efficient systems available at a range of capacities.* For the ENERGY STAR brand to continue to represent superior performance, EPA should set performance requirements that differentiate the most-efficient products available. When drafting a specification revision proposal, the Committee requests that in addition to the performance levels contained in the straw man (CEE Tier 2), EPA also evaluate the incremental cost, energy savings, peak demand reduction, and model availability at various capacities of the CEE Advanced Tier. While the Advanced Tier was set as a stretch target, programs have issued a large number of rebates at this level in some parts of the country.

*The Committee supports efforts to improve HVAC installation practices, and commends EPA for evaluating options for doing so within the Specification.* Taking steps to improve the installation of ENERGY STAR equipment will increase the health, comfort, safety provided to the consumer while increasing the energy efficiency of the system, and help to ensure consumers continue to associate value and quality with the ENERGY STAR brand. Available field studies indicate that proper installation yields a 20-30% gain relative to current practice. A stakeholder-supported definition of “quality installation” and the ability to identify a “quality installation” in the market place are necessary for ENERGY STAR to address installation. The Committee believes this can be achieved and that the Specification should contribute to enhanced system performance by addressing installation.

*The Committee supports cost-effective equipment requirements that will lead to improved in-field performance, such as TXVs.* Many field studies referenced in the ENERGY STAR straw man indicate TXVs lessen the efficiency losses that result from improper refrigerant charge or air flow. While the Committee would prefer that the Specification be performance-based, the lack of an accepted in-field performance metric requires consideration of prescriptive requirements. These may include the items presented in the straw man (e.g. airtight access, on-board diagnostic indicators, and automated metering devices) if proven to offer energy savings in addition to those already accounted for by the “Nameplate” efficiency requirements. The Committee is not aware of any studies demonstrating the energy saving potential of these other equipment requirements and encourages EPA to provide evidence of the energy savings potential of any prescriptive requirement included in the Specification.

*The Committee supports the intent of a technician certification requirement (e.g. NATE or BPI), but is uncertain whether the number of certified technicians that will exist in 2006 will be sufficient, or whether the practices of certified technicians will be significantly better than non-certified technicians due to existing market forces.* The Committee is committed to establishing a skilled technician work force that is capable of performing a quality installation. Certification programs are an important part of achieving that objective. The Committee recognizes an ENERGY STAR technician certification requirement would help to build an infrastructure of certified technicians; however, the Committee is not yet convinced an acceptable number of technicians will exist in the service territories of the Committee members to enable high levels of program participation. The Committee is very interested in continuing to work with manufacturers and other stakeholders to increase the number of certified technicians, with the goal of achieving an infrastructure that could support a future technician certification requirement.

*The Committee believes that ENERGY STAR should implement a verification requirement within the Specification by the proposed effective date, but only if several issues are resolved.* The Committee recognizes that some element of quality control in the form of in-field verifications will be necessary to significantly improve installation practices, and many of the Committee members include a verification component in their efficiency program. However, consensus on a nationally-viable process for verifying installations including the methods, tools, sampling tolerances, reporting of verification results, and performance requirements would need to exist. The Committee is currently working to address many of these issues and is eager to work with EPA and other ENERGY STAR partners to determine an agreed upon process for verifying installations in the upcoming months.

If EPA determines these issues will not be resolved in time for the proposed effective date, then the Committee recommends inclusion of a verification component requirement for 2007, or a phased-in verification requirement to be initiated in 2006 and strengthened in 2007, but again

only once the aforementioned issues have been addressed. The Committee does not believe that “self-certification” by contractors is a viable option for improving installation practices or ensuring quality because of the potential for abuse and lack of an enforcement mechanism.

*A consumer education component regarding installation should be built into the Specification.*

The Committee believes that EPA could play an important role in empowering consumers to ask informed questions about an HVAC installation by developing literature templates describing the benefits and definition of a quality installation that could be distributed by all ENERGY STAR partners. This definition should optimally include some form of commissioning report that would enable a technician to demonstrate that equipment has been installed in accordance with manufacturers’ requirements for system charge and air flow. This effort could involve:

1) manufacturers shipping the literature with equipment and including it with equipment specification sheets, 2) quality contractors distributing it to their customers with a bid, and 3) efficiency program administrators including it with rebate information. This literature would provide a necessary common bond among ENERGY STAR partners, to ensure their respective efforts will empower customers to know when they have a quality installation as well as provide further credibility to contractors dedicated to providing a quality installation.

Voluntary CAC/HP Efficiency Programs:  
A Straw-Man for 2006 and beyond.

Draft 2

Harvey M. Sachs

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September 2004

## **Introduction**

On January 23, 2006, the SEER 13 rule will take effect, and it promises very large, cost-effective, savings. However, it poses challenges that require changes in present voluntary incentive programs.

- Most of these, such as CEE and ENERGY STAR, are set at SEER 13, so they will either change or be eliminated.
- If SEER is our only yardstick, there are diminishing returns to just increasing SEER levels at which incentives are offered. 13/11 (today's sales-weighted average) is an 18% nominal improvement; 15/13 is only 15% better, and the sales-weighted average is not expected to rise quickly to levels much above 13.
- Newer equipment with 2-speed compressors offers the potential for very high SEER without improved EER, so it offers limited benefits to utilities with demand constraints. A SEER-only program will be hard for many sponsors to justify; EER must continue to be included.
- The remaining low-hanging fruit today are on the system side: proper sizing, proper installation, and good controls/diagnostics.

The Straw-Man we offer is designed to begin exploiting these opportunities. It is based on our analyses for a "robust" equipment program, the extensive field experience of groups including Proctor Engineering, FSEC, and AE/NC, and successful programs in California, New Jersey and elsewhere. It combines modest increments in performance requirements with additional system requirements. We believe that this combination will offer savings in the 30% range in field-measured performance and customer bills.

## **Straw-Man Specifications**

For conciseness, we first present a list of suggested requirements, and then a brief discussion of each.

### ***Equipment***

1. SEER/EER levels of 14/12 or possibly 15/13 (or 15/12.5).
2. Thermostatic Expansion Valve (TXV) or performance equivalent.
3. Limited fault diagnostics signals on ENERGY STAR thermostat.
4. Matched evaporator, condensing unit, and "thermostat" (controller) from single branded source.

## ***Installation***

5. Load calculation report required, design temperatures and indoor specified temperature by sponsor.
6. Air filter MERV and pressure drop specification.
7. Approved diagnostic tests at installation (CheckMe, RCA/Mowris, Honeywell Diagnostician, etc)
8. Installation report with pre-charge vacuum achieved, refrigerant level test, air flow test.

## ***Rationale (by numbered specification)***

1. **Higher SEER levels** by themselves might encourage designs that may offer poor latent heat (humidity) control, by using 2-speed compressors with high air flow and low refrigerant flow under most conditions. This leads to a warmer evaporator and less moisture condensed. Other SEER-improving strategies would include running the blower longer after the compressor shuts down, which succeeds in re-evaporating all the moisture remaining on the coil.
2. **Refrigerant charge.** Most standard efficiency units in the field have refrigerant charge that is far enough out of specification that it significantly affects performance. “A TXV or equivalent” requirement means little performance drop-off if the charge is within 20% of recommended levels. An alternative route would require that equipment remain within 5% of capacity and efficiency (EER) when tested with 20% more and 20% less than specified charge. This requirement may be quite modest: The TSD states that 60% of SEER 13 and 14 already has TXVs.
3. **Thermostat features.** We propose requiring an ENERGY STAR programmable thermostat to maximize potential savings, recognizing that not all owners will fully exploit the potential. The fault diagnostics feature gives the consumer the information required for ongoing performance assurance. We suggest two signals: (a) air flow/air filter warning. Indication that air flow has dropped since reset when new filter installed. (b) “call for service” when the system senses that it is operating outside its design performance boundary (Conditions might include high head pressure, improper suction pressure, etc). The goal is to give manufacturers maximum flexibility, but this might lead to permanent, non-invasive, pressure sensors that would eliminate the need to tap refrigerant lines to check pressures.
4. **Single source responsibility for all equipment..** The goal is to eliminate or minimize finger-pointing and substitution of lower quality components. The matched components “system” could be supplied by a traditional manufacturer, a specialty provider such as an independent coil manufacturer, or even a controls firm.
5. **Load calculations.** New Jersey and others require load calculations now, and have had acceptance by leading contractors. This must be “ACCA Manual J or better,” and must not allow gaming to oversize by adjusting indoor temperatures downward or design temperatures upward. The calculation conditions must be sponsor-specified for his/her region.

6. **The air filter** requirements are to preclude use of filters whose pressure drop is so great that air flow, humidity control, and air distribution may suffer, while requiring filters that remove a large fraction of particulate air pollutants, for indoor environmental quality.
7. **Diagnostics at time of installation.** Equipment and protocols commercially available include CheckMe, Honeywell Diagnostician, and Mowris's RCA. All are designed to assure that the installer does the job right. Extension may be required to assure distribution system performance (low leakage, low pressure drop). These lead into the customer report (Item 8) to justify distribution system repairs where required for efficiency.
8. **The installation report** for the customer and the program sponsor is designed to assure that the work has been done correctly, and that optional equipment settings enhance rather than degrade efficiency. One example is the heat pump "back-up" or "strip heat" control sequence, to be sure that it is only used for low-temperature capacity control instead of as the priority heat source. As another example, it may be important to verify lock-out of continuous ventilation in A/C mode in all but dry climates (for humidity control).
9. **What about duct balance between supply & return?**

## Discussion.

The underlying assertion of this straw-man is that there are large remaining savings opportunities for central air conditioning (and heat pump) equipment after SEER 13 takes effect. 30% improvement should be achievable. However, the greatest savings – and the greatest market transformation – will come from voluntary programs that define, encourage, and incentivize better air-conditioning *systems*. This may lead to greater involvement of manufacturers and contractor groups (ACCA, SMACNA, PHCC) in training and certification activities like NATE.

We are aware of one significant implication for branding programs (such as ENERGY STAR), if this is carried to the logical conclusion. To support such a shift, ENERGY STAR might want to label equipment under the new program as "ENERGY STAR eligible," meaning that the ENERGY STAR *system* combines this equipment with proper installation. There would be no difference for consumers in regions without market support programs, but it would strengthen program sponsors by giving them additional leverage to assure that exemplary equipment actually delivers efficiency, comfort, and some measure of indoor environmental quality.