GUIDE TO Regional Energy Efficiency Standards

BY HARVEY SACHS

On October 13, 2009, the Air-Conditioning, Heating and Refrigeration Institute (AHRI) signed an agreement with environmental advocates and other groups, notably the California Energy Commission and leading utilities. This agreement on regional standards for furnaces, central air conditioners, and heat pumps establishes several precedents.

First, the consensus agreement calls for DOE to adopt regional standards for furnaces, central air conditioners, and heat pumps, replacing the national standards approach that has long been in effect. These regional standards are summarized in Table 1. Second, the agreement calls on Congress to adopt language that would allow states to establish somewhat higher performance expectations in their state energy codes for residences. Third, the agreement calls for manufacturers to improve the information that they make available to distributors and contractors, making it easier for them to identify the best product for each customer.

However, the full meaning of the regional efficiency standards won't be known until DOE carries out a rule making on implementation of regional standards. In the meantime, I'll give a little background on the standards, and make some guesses as to how implementation might work. I'll also try to explain why all of us involved in creating the consensus worked for so long to develop an agreement on regional standards.

National minimum-efficiency standards for furnaces, air conditioners, and heat pumps took effect in 1992, eliminating the threat that each state would set its own standards. Standard setting by DOE has been acrimonious. This is partly because federal law mandates that standards should be set at the "maximum level that is technologically feasible and economically justified." Environmental advocates (and some utilities) have pushed for more-stringent standards, while manufacturers have resisted for economic reasons. Both sides make a good case. Environmental advocates argue for maximum efficiency as a benefit to consumers and the environment. Manufacturers, distributors, and contractors all worry that higher minimum standards will make it harder to realize cost-effective savings from premium products, and will risk collapsing the industry into commodity vendors. As standards get more stringent, the incremental savings realized with each step in the standards-setting process grow smaller. And with the huge, well-documented savings that come from better installation—the Air Conditioning Contractor's Association of America's Quality Installation (ACCA QI) program is a case in point—we all have a stake in avoiding selections based on Low Bid instead of Best Value. So we're working as hard as we can on helping the industry establish value in addition to efficiency.

Table 1. Recommended Standards Levels

SYSTEM TYPE	≥ 5,000 HDD	< 5,000 HDD	CA/AZ/NM/NV
Split A/C	13-SEER	14-SEER	14-SEER/12.2 EER <45,000 Btu/h 14-SEER /11.7 EER ≥45,000 Btu/h
Split HP	14-SEER/8.2 HSPF*	14-SEER/8.2 HSPF	14 SEER /8.2 HSPF
Package A/C	14-SEER	14-SEER	14-SEER/11 EER
Package HP	14-SEER/8 HSPF	14-SEER/8 HSPF	14-SEER/8 HSPF
Gas-Pack (weatherized)	14-SEER/81% AFUE	14-SEER/81% AFUE	14-SEER/81% AFUE
Gas furnaces (nonweatherized)	90% AFUE	80% AFUE	80% AFUE
Oil furnaces (nonweatherized)	83% AFUE	83% AFUE	83% AFUE

** heating seasonal performance factor*

The other problem with efficiency standards has been that the current rating methods aren't very good, and they get worse as the equipment gets better. They don't do a very good job of helping consumers arrive at good choices for their houses, and they don't help contractors sell homeowners the products that best meet their needs. One reason—in the case of air conditioners—is that the laboratory tests don't approximate field conditions very well. For example, defects in duct design generally lead to the use of much more fan power than the test assumes, which affects air flow, dehumidification, and energy use. (see, "ECM Efficiency—Better (and Worse) Than You Think," p. 34.

But the most important reason that rating methods aren't very good is that the United States has a lot of very different climates. The right furnaces in Michigan and Minnesota are certainly condensing ones, with an annual fuel utilization efficiency (AFUE) of at least 90. The same furnaces might not be cost-effective in Mississippi, but the federal process has required a one-size-fits-all approach.

Similarly, contrast what we need from air conditioners in Arizona and in Alabama. In the hot-dry West, about the only thing that matters economically is performance at high outdoor temperatures. For example, one-third of the cost of air conditioning in Sacramento is for energy used when outside temperatures are above 90°F. This gets only 7% of the weighting in SEER, which serves as the federal score for air conditioners. For California, Arizona, and similar states, energy efficiency ratio at 95°F (EER95) is a better predictor of air conditioner energy cost than SEER. The Southwest doesn't worry about humidity. Conversely, in hot-humid climates, what matters most is how well the air conditioner removes humidity at part load, when the outside temperatures are in the upper 70s and 80s. Enhancing dehumidification—lowering the sensible heat ratio (SHR)—tends to reduce SEER, at least for low-end equipment. We think manufacturers resist cutting corners to improve SEER at the expense of dehumidification because they fear callbacks associated with mold.

These considerations led the American Council for an Energy Efficient Economy (ACEEE), where I work, to start work on the potential gains from regional standards early in this decade. With our research partners, and with guidance from an industry advisory committee, we published our recommendation that regional standards be considered. In the 2007 Energy Independence and Security Act (EISA), DOE was so instructed. Since then, we at ACEEE have been engaged with the HVAC equipment manufacturers and others on finding ways to make this recommendation work to save energy and help industry. The 2009 agreement is one step in a process to reduce uncertainty for business and improve the business case for efficiency.

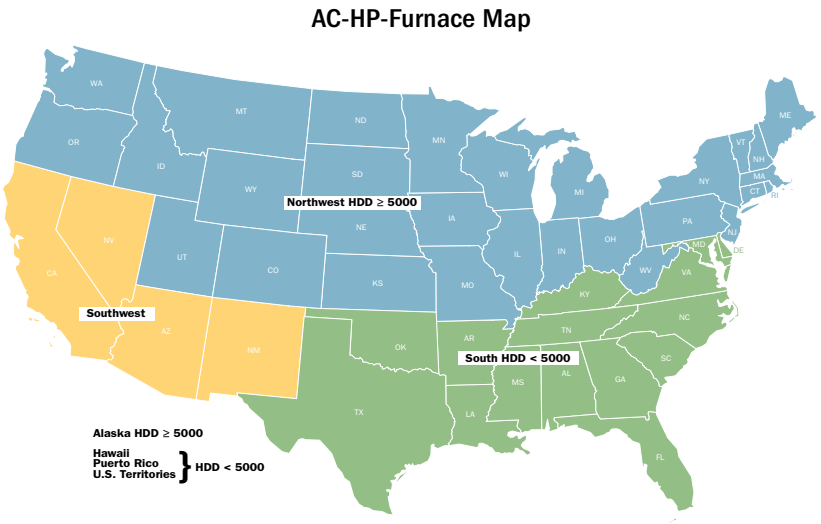

Figure 1. The new agreement will establish two regions for furnaces and three for air conditioners. The regional air conditioner agreement differs from the furnace agreement only in that there is a separate four-state region with minimum EER as well as SEER requirements.

WHAT THE AGREEMENT DOES

The 2009 agreement will establish two regions for furnaces and three for air conditioners (see Figure 1). The boundary between North-HDD and South-HDD is the boundary between states with average winter intensity above 5,000 heating degree-days (HDD) and states with warmer winters. Above that boundary, we recommend condensing furnaces (AFUE ≥ 90); below that boundary, we recommend an 80 AFUE limit. The regional air conditioner agreement differs only in that there is a separate four-state hot-dry region with minimum EER as well as SEER requirements, to ensure minimum high-temperature performance levels. Otherwise, the boundaries are the same as those for furnaces.

The 5,000 HDD boundary was a compromise. Climate mattered most, but we also tried to minimize the number and size of metropolitan areas that straddle a boundary, to reduce the number of affected contractors and distributors as much as possible.

There's one key area that the agreement does not address: enforcement of the minimum-efficiency standards. Current law is clear: No one can manufacture or import for sale in the United States any product that does not meet the federal minimum-efficiency specification. The new law (EISA) requires DOE to carry out separate rule making to develop enforcement mechanisms for regional standards, if these standards are adopted. This separate rule making is not yet scheduled. Enforcement may become the responsibility of state and local code officials, which might fit in with their increasing responsibilities under the American Recovery and Reinvestment Act, the federal stimulus act of 2009. In this scenario, contractors would be liable if nonconforming

equipment was installed in any state. Better approaches may be developed, and all of us look forward to broad industry participation in developing the least onerous system, and one that will help deliver efficiency by ensuring excellent installation of the right equipment by real professionals.

WHY DOES THIS MATTER?

ACEEE has projected the direct savings from this agreement as about $13 billion in today's dollars between 2013, when the new standards begin to take effect, and 2030—taking into account the incremental cost of the more-efficient equipment. Between now and 2030, the agreement also hopes to save 3.7 quadrillion Btu of energy nationwide. These are huge savings in themselves; and they can also be thought of as an annual greenhouse gas emission reduction of 23 million metric tons of CO_2 in 2030—an amount equal to the CO_2 produced by about four million cars every year.

But wait! There's more! The agreement contains several provisions that are themselves precedent setting. First, industry and advocates have agreed to ask Congress to direct building energy code officials to make changes that will better prepare new houses for a future of more-expensive energy. For the first time, industry and advocates together are asking energy code officials to allow the use of somewhat more-efficient equipment in baselines for performance paths, as long as there is a way to meet code with minimum-legal equipment. This will encourage contractors to specify equipment that is better than the old "builders' specials."

Further, the manufacturers have agreed to share much more engineering data for their units with their customers, and we're working toward establishing standard formats for these data. The data will include EER at multiple points, as well as the SHR at 82°F. This information will allow software developers like WrightSoft and Elite to develop much better energy use estimators in their load calculation programs, adding to the climate data they already incorporate. We expect that smart specifiers (and manufacturers) will use this information to support much better and much more credible proposals for customers. It will be easy to pick good-better-best options, and to present the benefits of, and the savings to be realized by, each option in a compact form to help customers make an intelligent choice.

Furthermore, the best contractors can use the engineering data to look at trade-offs among options and features, at the effects of oversizing, at the benefits of better air handlers, and at many other factors. Ultimately, showing that some trade-offs don't really decrease energy bills may help to reduce stocking requirements, at least for most contractors and distributors.

We expect that better information will lead to more finely tuned incentive programs on the part of utilities, and of the government, too. We already see EER requirements in Energy Star, for example. Southeastern programs might well seek low SHR values to ensure comfort and protect against mold—for their protection and for yours.

The point I'm making is that regional standards can offer an information-rich environment that rewards speedy, intelligent logistics, from manufacturers through distributors to contractors. In this sense, they complement the increasing role of software in the equipment itself, as we see advanced components, features, and controls taking market share away from the older electromechanical devices.

In this context, it's interesting to think about possible changes in the wholesale-retail model that dominates the market now. I'm just guessing, of course, but in an information-rich logistics environment, distributors and contractors might wind up working more closely and effectively to minimize "windshield time" (work time spend in a car!), optimize inventory, and speed up delivery (why not from distributor to job site, instead of distributor to contractor to job site?). They might generally partner more effectively to see that what each customer needs is available when that customer needs it. So those who master their information systems will rule their world. Of course, as one who has always struggled just to program a thermostat, I can see the downsides, too.

WILL THERE BE LOSERS?

I'm often asked whether consumer choice will suffer in a regional standards world. On November 23, 2009, the AHRI directory included over 200,000 single- phase A/C systems (original equipment manufacturer, not mix-and-match) at 14-SEER and higher, the level proposed for the South and Southwest. The directory also included 2,540 condensing furnaces (AFUE ≥ 90, the level proposed for the North). In general, this sounds like excellent availability already. We're confident that in the years before the new rules take effect, the original equipment manufacturers (OEMs) will fill any gaps they feel might be profitable. Indeed, the effective dates were staggered to help them allocate resources effectively.

Some involved in the discussions about the new standards have expressed concern that the North-South boundaries established in the agreement are too crude, because there are huge climate variations within many states. For example, California recognizes 16 different climate zones for energy purposes. Some wanted finer-scale regulation, but in the end the agreement reflects the parties' best judgment on what is achievable now. Where there are anomalies, such as cold areas in a hot state, rebate programs may encourage better equipment in those areas, but states cannot require equipment efficiencies beyond the federal minimum for the state. Surely this approach will do less harm to consumers than the prior one, which left the South with relatively inefficient air conditioners and the North with no requirements for condensing furnaces.

There's another compromise, too—one that was a big deal for me. After all the research on the value of different rating methods for the different regions, we compromised for the 2015 round. For that one, we will not have true regional ratings, but just dif-

ferent stringency levels in the different regions. For example, we won't establish a maximum SHR for the southern climates, something that would have helped ensure good dehumidification. The manufacturers felt strongly that multiple ratings were problematic now. But they will provide engineering data, so the software developers can help specifiers make the best possible recommendations to customers.

DISCUSSION

At ACEEE, we believe that much greater energy efficiency is necessary for America's future—and can be a key to profitability for those who leverage the opportunity. In part, that's because the regional standards are just one piece, although a critical one, in a broader set of changes that are coming to the buildings industries. As noted above, regional standards are likely to require local compliance responsibility. This goes along with separate efforts to ensure that building codes are actually enforceable, and are enforced. Initially, this will have an impact primarily on new construction, but we think the impact will be extended in ways that help professionalize the contracting industry. We expect much more use of building energy use labels, particularly when real estate changes hands. If we're right, this automatically boosts the value of efficiency investments, because it helps ensure that customers will receive a return on their investment if they sell before equipment life is over.

We don't know if this kind of labeling will be based on energy audits or on utility bill analysis—or on both, in some jurisdictions. We are certain, though, that this kind of labeling will make it easier for contractors and their suppliers to differentiate high-quality products and services, and to make more money by selling better products and service. I hope this works for you.

The attention getter in this agreement is the set of regional standards, but other sections of the agreement may have comparable long-term benefits. It's the first agreement we've struck that reaches beyond equipment standards to request provisions in the building energy codes that will benefit communities. And it may be the first time that manufacturers have agreed to provide bin-level engineering data to develop better equipment selection methods for contractors and others. We think the 2009 agreement is a good start toward common efforts for improved efficiency. Stay tuned!

Harvey Sachs, *Ph.D., is ACEEE's director of buildings programs. He works on emerging technologies, market transformation, and standards for the residential and commercial sectors.*