However, achieving these savings would require actions by many people. The alternative is either continued reliability problems, or the higher costs and greater environmental problems associated with supply-side-only solutions.

RECOMMENDATIONS

In order to capture the peak demand savings possible from energy efficiency, we recommend the following actions:

- Policy-makers should consider efficiency programs as an essential complement to supply-side programs and load management in efforts to assure system reliability. Efficiency can be effective, low in cost, and provide economic savings directly to ratepayers.

- Utilities (or other appropriate program administrators) should begin developing and implementing major peak reduction programs as soon as possible so that programs would start by the end of 2000, and also should undertake sufficient installations so that they begin to have an impact on the 2001 summer peak. For example, HVAC distributors typically order equipment for the next cooling season around October — to ensure that these orders contain sufficient high-efficiency equipment, distributors would have to be briefed on program plans before these orders are placed. As these programs “ramp up” over several years, peak demand savings would steadily increase. All too often utilities do not begin summer peak planning until the spring, leaving inadequate time to take demand-side actions.

- State utility commissions should encourage, or even require, utilities or other organizations under their jurisdiction to develop and implement energy efficiency programs targeted at reducing peak demand. In states that have restructured, this responsibility (or at least funding) would generally fall on distribution utilities since they remain regulated monopolies, are the service provider of last resort, and commonly operate other energy efficiency programs. For example, the California Public Service Commission (CPUC) recently ordered utilities in the state to issue a request for proposals to solicit proposals for accelerated programs to reduce demand in the summer of 2001. The CPUC then reviewed the proposals and accepted 15 for implementation, with a total budget of $72 million (CPUC 2000). Likewise, the New York State Public Service Commission recently proposed a set of expanded programs to reduce peak demand in the state (NYDPS 2000). As state commissions consider steps along these lines, they will also need to consider ways to provide utilities with adequate incentives and resources to implement these programs (Moskovitz 2000). Alternatively, other organizations could operate programs such as state governments or Independent System Operators (ISOs). For example, the California legislature recently appropriated funds for the California
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Energy Commission to operate some programs (California Legislature 2000) and in New York State, a state “Authority” (a semi-independent state agency) will operate the programs.

- DOE should provide technical assistance to states, utilities, and other program sponsors to help them develop and implement energy efficiency and other programs targeting peak demand. During the early 1990's, DOE provided extensive technical assistance to states and utilities on efficiency and related issues, but due to budget cutbacks these efforts have been scaled back dramatically in recent years. DOE and Congress should increase funding for the DOE Electricity Restructuring Program so that DOE can expand the amount of assistance it can provide.

- States should adopt funding mechanisms for energy efficiency and other public benefit programs. To date, twenty states have established a public benefit fund of some type, supported by a small surcharge on distribution service, to fund programs in the broad public interest including energy efficiency, low income, renewable energy, and public interest research and design. These programs have traditionally been funded through electric rates; a PBF is a competitively neutral mechanism for continuing these programs following restructuring (Nadel & Kushler 2000). States that do not presently have a PBF should enact them; states with minimal PBFs should expand their programs. In addition, as part of federal restructuring legislation, the federal government should encourage states to set up and expand PBFs by establishing a national fund to match state PBF expenditures. Several bills with such a mechanism have been introduced in Congress.¹⁰

- Congress should also adopt pending tax credits on high-efficiency residential air conditioners and energy-saving new commercial buildings as a complement to the programs proposed in this report. Several bills have been introduced in Congress that call for a 10% tax credit on residential central air conditioners and heat pumps with a SEER of 13.5 or more, and a 20% tax credit on systems with a SEER of 15 or more. The proposed commercial building tax would provide incentives of up to $2.25 per square foot for buildings that realize energy savings of 30-50% relative to current model energy codes.¹¹

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¹⁰ Bills with a PBF introduced in the 106th Congress include bills drafted by Senator Jeffords (S. 1369), Rep. Pallone (H.R. 2569), Rep. Kucinich (H.R. 2645), and the Clinton Administration (S. 1047 and H.R. 1828).

¹¹ In the 106th Congress, bills with provisions along these lines include bills drafted by Rep. Matsui (H.R. 2380), Senator Smith (S. 2718), and Senator Roth (S. 3152).
ACKNOWLEDGMENTS

Funding for this work comes from The Energy Foundation, U.S. Department of Energy’s Office of Power Technologies, and Northeast Energy Efficiency Partnerships (NEEP). To them we are grateful. Many people provided information, ideas, and support for this work. While there are too many of these people to list here, we would specifically like to thank Sue Coakley (NEEP), John Proctor (Proctor Engineering), Tim Stout and Kevin Keena (National Grid USA), Debbie Dodds (CH2M Hill), Adam Hinge (Sustainable Development Associates), and Jim Cinelli (Conectiv Power Delivery). Also, we appreciated helpful comments on an earlier draft of this report provided by Neal Elliott (ACEEE) and Rich Ferguson (Center for Energy Efficiency and Renewable Technology).
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# APPENDIX A: ECONOMIC COMPARISON OF DEMAND-SIDE AND SUPPLY-SIDE OPTIONS FOR ADDRESSING PEAK DEMAND

<table>
<thead>
<tr>
<th>Measure</th>
<th>Incremental Cost</th>
<th>kW Saved</th>
<th>Life (years)</th>
<th>$/kW-yr</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply-Side Options</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peaking power plant (capital)</td>
<td></td>
<td></td>
<td></td>
<td>$47</td>
<td>NWPPC figures from Eckman 2000.</td>
</tr>
<tr>
<td>Peaking power plant (capital and operating)</td>
<td></td>
<td></td>
<td></td>
<td>$55</td>
<td>Assumes operation 3% of year, heat rate of 9847 Btu/kWh, and $3/Mbtu for gas.</td>
</tr>
<tr>
<td>Transmission upgrade</td>
<td>$72,000,000</td>
<td>240,000</td>
<td>30</td>
<td>$22</td>
<td>Varies widely; example given is for S. Fork on LI as noted in text.</td>
</tr>
<tr>
<td>Local distribution upgrades</td>
<td></td>
<td></td>
<td></td>
<td>$20-60</td>
<td>NWPPC figures from Eckman 2000.</td>
</tr>
<tr>
<td><strong>Energy Efficiency Options</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-efficiency chillers</td>
<td>$60</td>
<td>0.1</td>
<td>30</td>
<td>$44</td>
<td>Figures are per ton of capacity from XENERGY Inc. et al. 1996.</td>
</tr>
<tr>
<td>High-efficiency commercial package air conditioner</td>
<td>$510</td>
<td>1.71</td>
<td>15</td>
<td>$31</td>
<td>Figures for improving a 7.5-ton unit from 9.1 to 11 EER; from NEEP 1998.</td>
</tr>
<tr>
<td>Efficient residential air conditioner</td>
<td>$550</td>
<td>0.83</td>
<td>18</td>
<td>$62</td>
<td>Figures for improving a 3-ton unit from 10 to 13 SEER; from Thorne, Kubo, &amp; Nadel 2000b. Cost from Appendix C.</td>
</tr>
<tr>
<td>Residential air conditioner tune-up</td>
<td>$375</td>
<td>0.39</td>
<td>15</td>
<td>$98</td>
<td>Based on figures in Appendix C.</td>
</tr>
<tr>
<td>Commercial retrocommissioning</td>
<td>$0.20</td>
<td>0.0006154</td>
<td>7</td>
<td>$58</td>
<td>Figures per sq. ft. and based on data in Suozzo &amp; Nadel 1998 and Appendix C.</td>
</tr>
<tr>
<td>Commercial lighting upgrade</td>
<td>$4</td>
<td>0.01404</td>
<td>20</td>
<td>$22</td>
<td>Figures for T8 lamps and electronic ballasts from Suozzo &amp; Nadel 1998 and assuming 78% of lights on at peak (per Appendix C).</td>
</tr>
<tr>
<td>Commercial lighting design</td>
<td>$0.40</td>
<td>0.000312</td>
<td>20</td>
<td>$112</td>
<td>Figures per sq. ft. from Suozzo &amp; Nadel 1998 and assuming 78% of lights on at peak.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Measure</th>
<th>Incremental Cost</th>
<th>kW Saved</th>
<th>Life (years)</th>
<th>$/kW-yr</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential air conditioner load control</td>
<td>$250 + $26/yr</td>
<td>0.97</td>
<td>15</td>
<td>$53</td>
<td>Fixed costs of ~$200 for switch, installation, and marketing plus $50/point for the central system.</td>
</tr>
<tr>
<td>Residential water heater load control</td>
<td>$250 + $26/yr</td>
<td>0.56</td>
<td>15</td>
<td>$92</td>
<td>Same as above.</td>
</tr>
<tr>
<td>C &amp; I interruptible rate</td>
<td></td>
<td></td>
<td></td>
<td>$44</td>
<td>Average for 1994 programs from EPRI 1995.</td>
</tr>
</tbody>
</table>

Note: $/kW-year is the value of one kW of generating capacity or its equivalent for a 1-year period. This measure is commonly used in power markets. We calculate this value by assuming the incremental cost is financed with a loan at a 6% real interest rate for a term equal to the measure life, and then dividing the resulting annual loan payments by the kW savings.
### APPENDIX B: ESTIMATED PEAK DEMAND SAVINGS FROM PROPOSED PROGRAMS

<table>
<thead>
<tr>
<th>Program</th>
<th>Basecase Use/Unit</th>
<th>Savings</th>
<th>Savings/Unit</th>
<th>Eligible Units/Area</th>
<th>Penetration Rate 2001-10 (%)</th>
<th>Peak Savings in 2010 (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New residential air conditioner*</td>
<td>2.75 (KW)</td>
<td>30%</td>
<td>0.825</td>
<td>63,147</td>
<td>55%</td>
<td>28,700</td>
</tr>
<tr>
<td>Residential air conditioner repair**</td>
<td>2.75 (KW)</td>
<td>14%</td>
<td>0.385</td>
<td>60,172</td>
<td>30%</td>
<td>6,900</td>
</tr>
<tr>
<td>Commercial HVAC equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packaged systems</td>
<td>10.2 (Watts)</td>
<td>18%</td>
<td>1.8 (Watts)</td>
<td>3,150</td>
<td>55%</td>
<td>3,200</td>
</tr>
<tr>
<td>Chillers</td>
<td>108.8 (Watts)</td>
<td>15%</td>
<td>16 (Watts)</td>
<td>70</td>
<td>70%</td>
<td>800</td>
</tr>
<tr>
<td>Commercial retrocommissioning</td>
<td>NA</td>
<td>10%</td>
<td>0.77</td>
<td>28,498</td>
<td>50%</td>
<td>11,000</td>
</tr>
<tr>
<td>Commercial lighting upgrades</td>
<td>1,404 (Watts)</td>
<td>30%</td>
<td>0.42</td>
<td>43,667</td>
<td>50%</td>
<td>9,200</td>
</tr>
<tr>
<td>Commercial lighting design</td>
<td>1,014 (Watts)</td>
<td>20%</td>
<td>0.20</td>
<td>48,750</td>
<td>50%</td>
<td>4,900</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>64,700</td>
</tr>
</tbody>
</table>

* = Includes mandatory standard effective 2006.
** = 10% of these savings overlap w/program above.
*** = Includes mandatory standard effective 2007.
**** = Includes building code standard effective 2006.

Key assumptions for the calculations include the following.

**New residential air conditioning**: basecase use and savings from Appendix C. Number of eligible units based on annual sales of air-source air conditioners and heat pumps less than 65,000 Btu/hour in 1999 (from ARI 2000) times 10 years. Penetration rate assumes 50% average penetration rate for good installation practices over 10 years plus average 25% penetration rate for efficient equipment during the first 5 years due to incentive programs and average 100% penetration rate during the second 5 years due to government standards.

**Residential air conditioner repair**: basecase use and savings from Appendix C. Number of eligible units based on number of homes in 1997 with central air conditioning or heat pumps (from EIA 1999c) plus a 3% annual growth rate through 2005 (from Neme, Proctor, & Nadel 1999). Penetration rate also from Neme, Proctor, & Nadel (1999).

**Commercial HVAC equipment**: Basecase packaged unit is a 9 ton unit — weighted average in 1998 based on analysis of Census Bureau Current Industrial Report data (Thorne, Kubo, & Nadel 2000b) — with an energy efficiency rating (EER) of 9.2 (modestly above 8.9 minimum standard). Savings assumes 11.2 EER (modestly above CEE Tier 2). Peak savings assumes 85% of units on at time of peak, as discussed in Appendix C. Number of eligible units based on
number of units sold in 1998 from Current Industrial Reports (BoC 1999) times 10 years. Penetration rate assumes 25% average participation for first 6 years due to incentive programs and 100% participation in final 4 years due to minimum standards.

Basecase chiller is a 200 ton unit with an efficiency of 0.64 kW/ton. Savings based on an efficiency of 0.54 kW/ton. These figures are all authors' estimates. Peak savings assumes 85% of units on at time of peak, as discussed in Appendix C. Number of eligible units based on sales in past decade from Air Conditioning, Heating and Refrigeration News (1999). Penetration rate from Appendix C for first 5 years and assumes 100% penetration in final 5 years due to energy code requirements.

Commercial retrocommissioning: 10% savings from Appendix C. kW savings based on average kWh/sq. ft. for commercial buildings above 50,000 sq. ft. (from EIA 1998) times 10% savings divided by 1,950 kWh/kW (from Appendix C). Number of eligible units based on CBECS data from 1995 for buildings over 50,000 sq. ft. (EIA 1998) times an 8-year growth from EIA's Annual Energy Outlook (EIA 1999b). Penetration rate is the authors' estimate.

Commercial lighting upgrades: basecase assumes 1.8 W/sq. ft. for buildings that have not yet upgraded their lighting (authors' estimate) times 78% of lights on at peak (from Appendix C). Savings also from Appendix C. Eligible units based on projected commercial building floor area in 2005 (from EIA 1999b) times 0.66, where the latter is the authors' estimate of the proportion of floor area that does not presently use T8 lamps and electronic ballasts (1999 California data indicates a somewhat lower percentage [PG&E 2000b] but California has been aggressively promoting efficient lighting for more than a decade). Penetration rate based on most successful programs, as discussed in Appendix C.

Commercial lighting design: basecase assumes 1.3 W/sq. ft. for new buildings (authors' estimate) times 78% of lights on at peak (from Appendix C). Savings also from Appendix C. Eligible units based on projected annual commercial floor area growth (from EIA 1999b) times 10 years. To this we added 50% of the existing floor area in 2005 (also from EIA 1999b) based on assumption that half of the floor area has its lighting changed each decade (per discussion in Appendix C). Penetration rate based on most successful commercial new construction programs, as discussed in Appendix C.
APPENDIX C: DETAILED PROGRAM DESCRIPTIONS

1. New and Replacement Residential Cooling Systems Program

Overview

This program aims to improve the efficiency of new central air conditioners and heat pumps. It promotes both the sale of high-efficiency equipment and improvements in sizing and installation practices that affect operating efficiency and peak demand. It is modeled on a similar initiative currently being implemented in a coordinated fashion by the three large investor-owned utilities in New Jersey (Public Service Electric and Gas, GPU Energy, and Conectiv Power Delivery). The long-term goal is to transform the market to one in which quality installations of high-efficiency equipment are commonplace. The program employs several key strategies to achieve this goal:

- Incentives for the sale or purchase of high-efficiency equipment for which documentation of proper sizing and installation is provided;
- Training of HVAC technicians on key elements of quality installations;
- Sales training for contractors (i.e., how to sell efficiency);
- Direct marketing to HVAC distributors and contractors through “circuit riders”;
- Promotion of HVAC technician certification; and
- Aggressive consumer marketing/education campaign on key elements and benefits of efficiency.

The success of these strategies would be enhanced significantly if they were jointly implemented by utilities with adjoining service territories or if programs were implemented by other state or regional organizations. This would ensure that clear and consistent messages were sent to market actors that serve large geographic areas that often encompass more than one utility service territory (e.g., HVAC distributors). It would also enable more efficient use of program resources by spreading the costs of developing marketing and other program materials across multiple parties.

Target Market

The program targets all residential dwellings for which a new central air conditioner or heat pump is being purchased, including both existing homes and new construction. In the case of new construction, efforts to promote proper installation of high-efficiency equipment could be coupled with efforts to promote improvements in the efficiency of the thermal envelope of the building, providing even greater savings. Utilities and other program sponsors offering such comprehensive new construction programs could offer builders the option of participating in the HVAC equipment installation program or the more comprehensive program (with sufficient
Incentive offered to encourage as many builders as possible to choose the more comprehensive option.

**Efficiency Measures**

The program promotes two efficiency tiers for central air conditioners and heat pumps:

<table>
<thead>
<tr>
<th>Efficiency Level</th>
<th>Minimum SEER</th>
<th>Minimum EER</th>
<th>(heat pumps only) Minimum HSPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>13.0</td>
<td>11.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Tier 2</td>
<td>14.0</td>
<td>12.0</td>
<td>8.5</td>
</tr>
</tbody>
</table>

To be eligible for an incentive or any other promotion, a central air conditioner would have to meet both the minimum SEER (a measure of average efficiency over the entire cooling season) and the minimum EER (a measure of efficiency at higher temperatures typical of those experienced during utility peak demand periods in many parts of the country) for a given efficiency tier. The minimum EER requirements would be particularly important to any effort designed to substantially reduce peak demand because efficiency at high temperatures can vary significantly among equipment with the same SEER. In particular, equipment with two-speed or multiple speed operation (common at SEER 15 or above and sometimes found in SEER 14 models) generally does not produce the same savings at peak conditions as at milder temperatures. A heat pump would have to meet the minimum HSPF standard (a measure of average efficiency over the course of the entire heating season) as well as the minimum SEER and EER standards.

In addition (i.e., under either efficiency tier), documentation of proper sizing and installation of qualifying high-efficiency equipment would have to be submitted. This would include submission of Manual J load calculations, documentation of proper refrigerant levels in the system, and documentation that airflow over the coil is within the range recommended by manufacturers (i.e., between 350 and 450 CFM/ton of capacity). Documentation of proper charge and airflow could be provided through a form similar to the one at the end of this program description. An alternative could be using charge and airflow software tools similar to those currently in use in parts of California.

This additional requirement could be implemented either from the start or in the second year of the program. Many HVAC contractors would find the proper sizing and installation requirements to represent a significant departure from how they currently do business. Indeed, many would not know how to meet them. Deferring the requirements to the second year would allow the market to begin reacting to the offer of incentives, making contractors reluctant to stop participating once the proper sizing and installation requirements go into effect. It would also enable the program administrator to “warn” contractors of the new requirements, offer training

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on key requirements so contractors understand and are ready to meet them, and begin educating consumers on their benefits. Deferments could be particularly helpful in areas where utilities have had relatively little demand-side management activity in the residential HVAC market, where market shares for high-efficiency equipment are low, and where HVAC contractor use of key techniques for proper sizing and installation are low.

Program Strategies

The residential HVAC business is currently a low-bid business, where investment decisions are usually driven by a desire to minimize first cost. As a result, investments in both efficiency and quality — including high-efficiency equipment, proper sizing and installation, and duct repair — are the exception rather than the rule. This reality is itself a function of a variety of ubiquitous and formidable market barriers. These are summarized in Table C-1.

Table C-1. Market Barriers to High-Efficiency Residential HVAC Systems

<table>
<thead>
<tr>
<th>Market Barrier</th>
<th>Key Issues</th>
</tr>
</thead>
</table>
| Customer Access to Information      | - Customers often do not know that a large majority of central air conditioner or heat pump installations are improperly sized and installed. Because systems are complex, most consumers are incapable of knowing whether they got a good installation.  
- Some customers lack information on the energy savings that would result from installation of an efficient HVAC system.  
- Customers are usually unaware of the comfort, maintenance, and equipment life costs associated with improper installations. |
| Customer Inability to Identify Quality Contractors | - Many customers do not have unbiased sources of information. Certification programs for HVAC technicians are very new and the public is unaware that they exist. Very few technicians have taken certification tests.  
- Certification programs test only “book knowledge.” Some good technicians may not pass and some may pass without having good “hands-on” technique. |
| Lack of Well-Trained Contractors and Technicians | - Many HVAC contractors lack the sales skills necessary to “sell” efficiency.  
- HVAC technicians often do not have adequate training on key elements of proper sizing and installation.  
- No training/certification is required to operate an HVAC business. |
| Lack of Program Consistency          | - Different utility program standards or incentives within the same state or region often creates confusion in the market about the definition of efficiency.  
- Distributors and contractors that serve more than one utility service territory endure hassle of ordering different equipment and/or learning different procedures for customers in each region. |
| Additional Cost                      | - Some customers do not have the capital necessary to pay the incremental cost for efficient equipment and efficient/quality installation. |
| Split Incentives                     | - In new construction and rental housing, the person making the investment decision (i.e., builder or landlord) will not be paying the energy bills. |

To be successful, the program will need to address all of these barriers. Given the diverse nature of the barriers, the program will need to have several different components.
Financial Incentives

The program offers rebates for the purchase and proper sizing and installation of high-efficiency central air conditioners and heat pumps. The incentives need to be large enough to both attract consumer interest and persuade HVAC contractors to "try" proper sizing and installation techniques. Recommended incentive levels are:

- Efficiency Tier 1: $300 to $400
- Efficiency Tier 2: $500 to $600

These incentive amounts are consistent with those currently offered by similar programs in New Jersey and Long Island, where utilities are having considerable success in promoting both the sale of high-efficiency equipment and the use of proper sizing and installation techniques. The incentive amounts are designed to cover approximately two-thirds of the incremental equipment cost at Tier 1, with somewhat higher portions of incremental cost being covered at Tier 2. This progressive structure has proven to be effective in steering customers towards the highest equipment efficiency levels. For example, in New Jersey, nearly half of the more than 16,000 rebates processed in 1999 were for central air conditioners with Tier 2 efficiency characteristics.

Over time, as consumers become conditioned to ask and more willing to pay for high-efficiency equipment, HVAC contractors become more accustomed to selling this equipment, and sales volumes for efficient installations grow, it should be possible to reduce incentive levels.¹

Inspections would be necessary to ensure that program standards for proper sizing and installation are met. However, every effort should be made to also use inspections as an opportunity to further educate contractors and technicians on quality installation procedures and standards.

HVAC Technician Training

The program includes a series of HVAC technician training sessions on key elements of proper equipment installation, including ACCA Manual J-based sizing, proper refrigerant charging, and ensuring proper airflow. Additional training could also be offered on duct design (ACCA Manual D) and duct sealing/repair. Efforts should be made to work with HVAC

¹ For example, between 1992 and 1997 the Potomac Electric Power Company (PEPCO) reduced the rebate it offered for SEER 13 air conditioners in Maryland by nearly 50% (PEPCO 1998). Over the same period of time, the number of Maryland program participants nearly doubled (from 4,712 to 9,114 central air conditioners and heat pumps) (PEPCO 1994, 1998). Moreover, the percent of participants at the SEER 13 level increased from 8% in 1992 to 100% in 1997 (PEPCO 1994, 1998).
distributors, vo-tech programs, ACCA, RSES and other potentially important trade groups in both developing the curricula and providing the training. This would create some critical “buy-in” for the program. Experience in New Jersey suggests that contractors are much more likely to register for training courses if they are promoted and co-sponsored by their distributors.

HVAC technicians (or their firms) would be required to pay fees for the training. However, the program administrator could offer some inducements to complete courses. For example, it could be useful to offer discounts on sizing software and/or other key tools.  

Sales Training

As noted above, few HVAC contractors appear to have the sales skills necessary to sell prospective customers on buying high-efficiency equipment or paying for the extra time required to do a job right. The program offers training designed to help interested contractors to improve their sales skills. EPA’s ENERGY STAR® program has developed and offers a curriculum and related materials for such sales training. Although the ENERGY STAR standard for central air conditioners and heat pumps (minimum SEER 12, no minimum EER) is lower than the minimum efficiency standard promoted by this program, ENERGY STAR’s sales training concepts are applicable to any efficiency standard. Other utilities have developed and are using their own sales training curricula.

Circuit Riders

One of the common attributes of successful HVAC programs has been extensive outreach to and communication with HVAC contractors (Neme, Peters, & Rouleau 1998). Outreach and communication are even more important for the program described here because of the requirements for proper sizing and installation that many contractors would not understand and others would resent. Therefore, the program should employ individuals whose sole job would be to regularly call on HVAC distributors and contractors. Their purpose would be to explain program requirements, recruit technicians for training classes, provide rebate forms and other program materials, encourage contractors to actively participate in the program, and give contractors an outlet for expressing concerns about the program. These circuit riders would be individuals who have extensive HVAC expertise so that they could address technical questions and issues raised by the trade allies with whom they are interacting.

---

The New Jersey utilities currently offer a free manogellic gauge to technicians who complete their two-evening course on refrigerant charge and airflow. Manogellic gauges can be used to measure pressure drops across the coil, which, in turn, can be used to estimate airflow. Surveys of trainees suggested that few had such tools. Offering them to technicians who complete the class ensures that they leave with both the knowledge and the tools necessary to do the job right.

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Technician/Contractor Certification

One of the longer-term strategies of the program is to develop and support a mechanism for helping customers identify quality contractors. This certification mechanism should have several components:

- A certification standard that addresses key elements of efficient installations, is administered by an independent 3rd party, and is likely to have credibility with the HVAC industry;  
- A means for consumers to easily identify contractors that have met the standard (i.e., a registry of firms that have a pre-requisite number of certified technicians and meet other business requirements);
- Assistance to technicians and contractors interested in getting certified (e.g., sponsorship of and perhaps partial subsidization of training courses and certification tests);
- Quality control procedures to ensure both that contractors do not advertise themselves as certified if they are not and that certified contractors maintain relatively high standards in their work; and
- Marketing (or co-marketing) of certified contractors to consumers.

Development of an effective certification standard will be perhaps the most critical element of this effort. Program operators should work with the North American Technician Excellence (NATE) program — together with other utilities, states, and CEE — to enhance the current NATE tests so that they adequately assess technicians’ understanding of key installation procedures that affect equipment operating efficiency. Program administrators could also want to establish a “hands-on” component (or option) to the current NATE written exam, with technicians required to pass the hands-on test as a condition for being on a program’s “preferred contractor” list. Finally, program sponsors would likely want to add business requirements, such

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3 This could be best done by a local nonprofit organization that has ties to the HVAC industry and a strong interest in promoting “best practices.” Alternatively, such a nonprofit organization could be created to serve this need. In either case, program administrators should support these organizations financially and otherwise in the early years of program operation, with the hope that they could gradually transition to becoming self-supporting (e.g., through contractor membership dues).

4 Any certification program must start by certifying individual technicians. However, it will also be important to certify contractor firms for which they work. This could be done, for example, by placing an HVAC contractor firm on a certification registry if at least 50% of their technicians are certified.
as adequate insurance and/or good standing with the Better Business Bureau, to the conditions they establish for being on the certification registry they make available to the public.

Consumer Marketing/Education Campaign

One of the most important factors underlying the "low-bid" nature of the residential HVAC business is that contractors do not feel consumers are demanding or willing to pay for higher-efficiency equipment or work. This, in turn, is related to consumers’ lack of knowledge on both what to ask for and why they should ask for it. Therefore, efforts to educate consumers would be essential to the success of this program. The ultimate goal of the marketing/education campaign is to establish the link between energy efficiency and quality (comfort, durability, etc.) in most consumers’ minds.

To begin with, the program would develop consumer education materials that summarize the benefits of efficiency (both energy costs savings and non-energy benefits such as improved comfort), explain the key elements of an efficiency system, and provide guidance on how to select a quality contractor. These materials could take several forms, including both written pieces and a brief educational video. They could also include a quality installation specification that customers could ask contractors to incorporate into their bids. These materials would be distributed as widely as possible, both to consumers who would request them and to quality contractors who would be interested in using them to help sell their services.

A variety of different marketing vehicles would be used to both alert consumers to the availability of educational materials and deliver shorter, complementary messages to consumers. The precise nature and mix of those vehicles would depend on a variety of local conditions, including customer demographics and local costs (e.g., of media placements). The options to consider would include direct mail to consumers likely to be in the market for a new central air conditioner (e.g., those living in homes built 10-15 years ago), Yellow Page ads, a dedicated internet Web site, billboards, newspaper ads, and other forms of mass media advertising.

Relationship of Program Strategies to Market Barriers

Table C-2 shows how these program strategies address each of the key market barriers to efficiency investments in the HVAC replacement market.

Relationship to Minimum Efficiency Standards

Residential central air conditioners and heat pumps are covered by minimum-efficiency standards set by DOE. The current standard, which mandates that equipment must have an efficiency rating of at least SEER 10, took effect in 1992. As of this writing, DOE is completing a rulemaking for a new standard that will likely take effect in 2006. The standard will likely be
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in the range of SEER 12–13 and may include EER requirements. Promotion and incentive programs could encourage purchase of efficient units before the new standard takes effect and could also be used to promote units more efficient than the standard after the new standard takes effect.

Table C-2. Intervention Strategies' Impacts on Market Barriers

<table>
<thead>
<tr>
<th>Market Barrier</th>
<th>Intervention Strategy</th>
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</thead>
<tbody>
<tr>
<td>Customer Access to Information</td>
<td>• Develop and distribute educational materials on benefits of efficient equipment/quality installations, how to select both equipment and contractors, and information customers should ask their contractors to provide to document quality work.</td>
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<td></td>
<td>• Provide both sales and technical training to HVAC contractors interested in providing quality service so that they could help educate consumers.</td>
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<tr>
<td>Customer Inability to Identify Quality Contractors</td>
<td>• Develop and promote technician/contractor certification.</td>
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<td>• Promote sales training to enable quality contractors to differentiate themselves when meeting with consumers.</td>
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<tr>
<td>Lack of Well-Trained Contractors and Technicians</td>
<td>• Work with trade allies to design and offer high-quality training on sizing and other elements of proper installation that require documentation as part of incentive applications.</td>
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<td></td>
<td>• Provide sales training to contractors (possibly through ENERGY STAR program).</td>
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<td></td>
<td>• Circuit riders to encourage contractors to participate in program and help address issues and questions that contractors have, particularly in early years.</td>
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<td></td>
<td>• Substantial incentives for efficient equipment and quality installations help encourage some contractors to “try” different approach.</td>
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<tr>
<td>Lack of Program Consistency</td>
<td>• Jointly develop efficiency standards, incentive levels, training offerings, marketing plans, and other key program elements with neighboring utilities/sponsors.</td>
</tr>
<tr>
<td>Additional cost</td>
<td>• Offer incentives designed to cover a substantial portion of incremental cost.</td>
</tr>
<tr>
<td></td>
<td>• Education of and marketing to consumers, encouraging them to recognize and consider life-cycle costs of investment decisions.</td>
</tr>
<tr>
<td>Split Incentives</td>
<td>• Offer incentives designed to cover a substantial portion of incremental cost.</td>
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</tbody>
</table>

Key Indicators of Success

A number of different indicators should be used to gauge program success. Key among these are:

• The percent market share of high-efficiency (i.e., minimum SEER 13 and minimum EER 11.0) central air conditioners and heat pumps;
• Reductions in the average over-sizing of new central air conditioners and heat pumps;
• Increases in the percentage of new central air conditioners and heat pumps with both proper refrigerant charge and adequate airflow;
• Increase in consumer awareness of high-efficiency HVAC equipment and services;
• Number of HVAC technicians trained in key elements of equipment installation; and
• The number of certified HVAC technicians and/or contractors.