

PUBLIC EDUCATION AND PROFESSIONAL TRAINING

LARRY SHIRLEY

North Carolina Solar Center
North Carolina State University
Box 7401
Raleigh, NC 27695-7401
(919)515-3480; Larry_Shirley@ncsu.edu

SHAWN FITZPATRICK

North Carolina Solar Center
safitzpa@ncsu.edu

CHRIS LARSEN

North Carolina Solar Center
eclarsen@unity.ncsu.edu

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I. INTRODUCTION

To bring about a large-scale deployment of photovoltaic (PV) systems in the United States and create a sustainable market that reaches beyond short-term financial incentives, a comprehensive public and professional education program for PV must be put in place. The program must be broad enough to reach the general public and specific enough to target niche markets. It must also be immediate, while visionary enough to reach the next generation.

A public education effort aimed at expanding the markets for PV must have as its cohort an equally strong and comprehensive professional education program. Such a program must target *each* of the professions or trades that are directly involved in recommending, selling, establishing value for, designing, installing, or maintaining PV systems. The history of solar energy is replete with examples of high consumer expectations and a combination of poor system performance or unconsummated deals—deals that were thrown off track because of a lack of quality training or barriers thrown up by one or more of the professions.

In the renewable energy community, limited resources have forced the question of which of these areas—public or professional education—should receive the greatest focus. If greater public awareness and education spurs demand for solar systems, it is argued, then the professions will be there to serve them. On the other hand, some suggest that industry and advocates must target professionals first: untrained professionals discourage consumers from buying systems, install poor systems, and generally increase transaction costs that stymie even motivated early adopters.

The arguments of both sides have merit, but one cannot be successfully accomplished without the other. The market must be enlarged, strengthened, educated and motivated to capture the interest of the professional community. Finally, once consumers come to the table, they must find an encouraging professional community that performs quality work.

As a starting point to determine the best strategies for educating the public and professionals about PV technology, the North Carolina Solar Center surveyed the solar community. The Center queried approximately 454 industry, nonprofit, government, and utility leaders for their thoughts on issues ranging from the most important messages about PV to get out to the public, to identifying those professions that most need targeted training. The results of our survey are discussed throughout the sections below, and detailed results are provided in Appendix A.

One other major issue that has surfaced in discussions with activists and members of the PV industry is the extent to which a public and professional education program for PV should be carried out

independently of other renewable technologies.¹ Although the ideas presented below are focused on PV, many of the efforts suggested will apply to other technologies and the larger sustainable energy movement as a whole. Indeed, the limited resources that hamstring the PV movement are a problem facing all renewable technologies, so whenever ideas and campaigns can work together in concert, efforts should be made in that direction.

Another major issue is the question: Who should pay? Or as phrased by many activists, “Why doesn’t the industry shoulder more of the cost of educating the public and professional communities that it relies on?” Many of the companies that have a stake in the PV manufacturing market are subsidiaries of major, multinational corporations with potential access to substantial financial resources. It should not be assumed, however, that the PV subsidiary can tap these deep pockets easily or often. Some of the companies have preferred that their PV subsidiaries stand “on their own,” requiring them to show a profit or jump through many hoops before getting funding for plant expansion or marketing activities.

Despite this history, one of the best things that could happen to the PV industry is if the parent companies with large resources put real money into advertising and education campaigns. Such investment and marketing by PV firms will be an integral component of a successful long-term education program. We feel, however, that there is no compelling reason to expect this to happen in the immediate future. Thus, many of the actions suggested in this paper build upon and continue the work of organizations that have traditionally been at the forefront of PV awareness and education efforts.

In this paper, we propose a comprehensive, although not exhaustive, set of recommendations for public awareness, public education, and professional PV education activities. In each of the sections below, the discussion is followed by a series of recommendations. The long list of recommendations which are discussed below are summarized in the concluding section of this paper.

II. EDUCATION FOR THE GENERAL PUBLIC

A. Introduction

At first glance, the thought of educating the public seems both amorphous and overwhelming. How does one construct a plan to bring PV’s message to millions of Americans when its industry is relatively small and both foundation and government resources are limited?

Like a resourceful chef, the industry and advocates must look around and determine what ingredients are available and can be thrown in the pot. Just about everything that can be found in the kitchen will be needed. The industry does not have the luxury of deciding if this should be a top-down, national leadership strategy or a bottom-up, grassroots led movement. Both are necessities if the market for PV is to expand.

¹Joel Stronberg and Virinder Singh, “Government Procurement of Photovoltaics,” *Expanding Markets for Photovoltaics* (Washington, D.C.: Renewable Energy Policy Project, 1998).

1. The Solar Community Survey Says. . .

As a starting point to determine the best strategies for educating the public and professionals regarding PV technology, we at the North Carolina Solar Center surveyed the solar community—including members of the PV industry itself, solar activists, and individuals involved through government. The results of our survey are discussed throughout this paper, and detailed results are provided in Appendix A.

Looking for guideposts by which to check our own assumptions about what is needed, we began with a series of general questions on barriers, messages and strategies for conveying messages. When we asked about the greatest barriers to PV usage, we found few surprises in the solar community's responses: Survey respondents identified cost as the biggest concern. After cost, the solar community identified information, financing, and education as its next three greatest barriers to the use of PV, which points to the importance of crafting a strong national PV education program. Opposition from utilities, often seen in the past by some elements of the solar community as the greatest threat to PV's development, is ranked only seventh. This could possibly be explained by the achievements of the Utility Photovoltaic Group or by the present disarray in the utility industry as a result of restructuring efforts.

But if education about PV is important, what is the message to be conveyed? Survey respondents agreed there were three primary messages that needed to be relayed:

- “PV is good for the environment.”
- “PV works—it's reliable.”
- “PV is cost-effective and economically competitive...[in certain situations].”

Interestingly, the third listed message—PV's cost-effectiveness and economic competitiveness—drew responses that were phrased in uneasy ways, with many pointing out that we had to get across the situations where PV was cost-effective and where it was not.

Recognizing that the survey respondents are not, for the most part, media or outreach experts, we also questioned them about the best media to use for a public education campaign. Television received the most support; newspapers and radio came in second. Other strategies supported include exhibits, other advertising, workshops and seminars, direct mailings, and fairs. In addition to these strategies, several people mentioned the World Wide Web and using utility bill inserts as effective means of getting the messages out to the public.

2. A PV Educational Framework

In trying to build public awareness of PV and then translating this awareness into purchases of PV systems, an educational framework with adequate resources needs to be established to guide the consumer through this process. The educational effort can be broken down into two elements:

- **General Public:** The general public needs to be made aware of PV and informed about PV's uses and applications on a very general level, to lay the foundation for other education

and marketing efforts. The public needs to know that PV is real, fully functional, affordable, and environmentally beneficial. But it does not need to know the difference between amorphous and crystalline silicon cells.

- **Early Adopters:** Early adopters are those people willing to try new technologies before they have been in the public marketplace for an extended period of time. When asked to prioritize the age groups of the population that they thought should receive the most attention for PV education and awareness efforts, our survey respondents gave the most support for young professionals. In the associated comments received alongside these rankings, it is clear that “Young Professionals” are ranked high because they are seen as being the group that will potentially purchase PV systems in the short term.

In *Building the Market for Renewable Energy in Massachusetts*, Eric Ingersoll of Lucid, Inc., suggests a staged (layered) message pyramid. Moving from the bottom to the top of the pyramid, he highlights the major stages of the renewable energy messages that need to get out the public. At the base, Ingersoll proposes the first message should be that energy use causes unhealthy air pollution. The next message should be renewable power is clean and good for the environment. The concluding, specific message is “Buy my green product.”²

The discussion of public PV education that follows focuses on 1) general strategies for raising public awareness of PV, including media campaigns, high-profile events, and grassroots institutions; 2) targeted sector campaigns to tap the critical early adopters of PV; 3) shaping the education offered by traditional educational institutions; and 4) educating government and other policy-makers, respectively. The last two topics are broken out as separate sections because efforts in these areas require a unique set of tools and will yield important long-term results.

B. Raising Public Awareness of PV

Educating the general public about PV is a long-term endeavor, but the PV community needs to give PV a major kickstart to focus the public's attention on PV and other solar technologies.

1. Using the Media Effectively

In most public education or awareness programs, media coverage plays a critical role. As activists and those in the PV industry know, PV is a powerful *magnet* for media coverage. On the national level, there is presently no coordinated media strategy for PV. Instead, what exists are often disparate and fragmented efforts that reflect a need for increased leadership, coordination and resources for and among the groups attempting to play some role in this area.

All too often, even well planned national media efforts suffer greatly from a severe lack of resources. Governmental funding sources are concerned that such work is "soft" or may become too political. Foundation support often lacks staying power, reflecting a desire to seed or start a new program but

²Eric Ingersoll, *Building the Market for Renewable Energy in Massachusetts through Coordinated Public-Private Education Campaigns* (Cambridge, MA: Lucid, Inc.), p. 6.

not support it in the long run. Furthermore, although there have been occasional initiatives by industry trade groups, often attempting to repel attacks launched by the heavily-funded conventional fuel industries, these efforts have not been sustained—a reflection of the current limited size and wealth of the industry.

The best existing vehicle for coordinating national PV education activities is the PV Compact—an informal consortium of organizations and stakeholders working in the PV and utilities arena. The PV Compact already includes the Solar Energy Industries Association (SEIA), Utility Photovoltaics Group, Pace University (UPVG), the U.S. Department of Energy (DOE), the National Renewable Energy Laboratory (NREL), Sandia, American Solar Energy Society (ASES), Interstate Renewable Energy Council (IREC), Energy Foundation, and several others that are more utility specific: the National Association of State Consumer Advocates (NASUCA), the National Association of Regulatory Utility Commissioners (NARUC), the Edison Electric Institute (EEI), etc. IREC has recently taken the initiative to revive the PV Compact, and it is recommended that IREC continue in this important coordinating role. Our recommendation is as follows:

⇒ ***To oversee and guide a national PV education effort, the PV Compact should create an Education Council with members drawn from the organizations most involved with and interested in these activities.*** Within the Education Council of the PV Compact, responsibilities would be divided along the lines of constituency and expertise. Activities might fall under three principal areas: 1) state and local education programs and outreach, 2) national media, and 3) national public awareness events. State and local education programs and outreach should be headed by organizations with state and local chapters, members, or grantees throughout the country—for example, the American Solar Energy Society (ASES), the Interstate Renewable Energy Council (IREC), the Utility Photovoltaic Group (UPVG), and the Energy Foundation.³

Three specific media tools that can be used for raising public awareness of PV are discussed below: 1) public service announcements (PSAs), 2) paid advertising, and 3) national spokespeople.

a. Public Service Ads

Public service announcements, or PSAs, are free ads that usually run from 15 to 60 seconds and are aired by radio and TV stations at the discretion of each individual station. Radio and TV stations usually run PSAs for the benefit of the community or to enhance their public image. PSAs are also printed in newspapers and magazines at no cost to the organization. A PSA campaign, using fresh new spots each year, should run continuously. One veteran PV leader has referred to this strategy as the “Drip, Drip, Drip” media action plan.

³The American Solar Energy Society (ASES) has 19 nonprofit chapters covering 30 states. The Interstate Renewable Energy Council (IREC) supports Photovoltaics for Utilities (PV4U) collaboratives in 14 states. The Utility Photovoltaic Group (UPVG), made up of 101 utilities interested in PV development in the utility industry, and the Energy Foundation support an advocacy network of public interest organizations and law firms working on energy issues in many areas of the country.

Eric Ingersoll described this situation succinctly when he recently wrote:

Changing consumer preference is a process and consumers need to hear a message or see an image many times before it is effectively absorbed. One rule of thumb is that a person must be exposed to an advertisement three times before they actually see it, and that they must see it nine times before they remember it. Therefore, educational efforts must be sustained for a significant period of time, and be delivered via effective channels so that the targeted consumers are reached with the required level of saturation.⁴

Our recommendation with respect to PSAs is as follows:

⇒ ***PV advocates should prepare TV and radio spots and print ads that can be aired as public service announcements and then distribute them to the media.*** How widespread and frequently the spots are played by stations will probably be determined by four factors: 1) the quality of the PSA, 2) whether the PSA addresses what station would perceive as a relevant and current issue, 3) whether the PSA is placed in the hands of the station by respected community leaders, and 4) how much pressure is put on the station to play the PSA.

The two critical elements to making a PSA campaign work are having the resources to produce quality PSAs and having a network of local advocates to distribute them and see that they are run. Furthermore, all PSA campaigns should ensure that there is an avenue for the viewer to contact someone to see how they can get more involved or get more information. National, state, and local institutions should be listed as contact points in a trailer attached to the PSA.⁵

b. Paid Advertising

Paid media advertising strategy costs millions of dollars. Yet the reality is that paid advertising is the only way in which you can control when and how often your spots are played. PSAs, which should be deployed in parallel, have the reputation of being played more at 4 a.m. than 4 p.m.

⇒ ***Given the high costs of paid media advertising, PV advocates should develop a pilot campaign to promote public awareness of PV and try the campaign in several key markets before going to a full-scale operation.*** Consideration should be given to recouping some of the costs through a modest fee collected in response to a request for information or a membership in a PV-related organization. Markets that should be initially targeted are those in which there is 1) a solid market infrastructure for PV sales and service; a well-organized local campaign underway to advance PV; cost-sharing available from a state, local, or utility source; and a local nonprofit solar organization or solar center exists to provide referrals and independent assistance to the respondents.

⁴Eric Ingersoll, *Building the Market for Renewable Energy in Massachusetts through Coordinated Public-Private Education Campaigns* (Cambridge, MA: Lucid, Inc., 1998), p. 10.

⁵The Energy Efficiency and Renewable Energy Clearinghouse (EREC) would be a good first point of contact through their toll-free number. A state energy office, solar center, or American Solar Energy Society (ASES) chapter would provide a more decentralized point of contact.

c. National Spokespeople

⇒ *PV advocates should recruit White House officials, celebrities, and a solar leader to serve as national spokespeople to educate the public about PV.* The White House can be a powerful instrument for PV public awareness and education. What the White House decides to highlight receives high-profile coverage by TV, radio, and print media. With his environmental background, Vice President Gore is the logical official to lead a White House effort to raise public awareness of PV.

In addition to Vice President Gore, other national spokespersons are needed to ensure that a national PV deployment effort will not be seen as a partisan affair. One or more public figures or celebrities should be signed up as high-profile spokespersons for television and radio public service and paid advertising. This should be possible to accomplish, as there have been many who have gone before them over the last 20 years—for example, Ed Begley, Pam Dawber, Jackson Browne, Robert Redford, Grant Tinker, Eddie Albert, Jack Klugman, Ted Turner, Art Linkletter, and many more.

White House and celebrity efforts should be closely coupled with a solar leader who can serve as the “content” spokesperson to support and fill out the initial message. Such content spokespersons would include Denis Hayes of the Bullitt Foundation, Amory Lovins of the Rocky Mountain Institute, and consumer advocate Ralph Nader. As part of all national media campaigns, a professional public relations firm should seek feature interviews with major daily newspapers and television and radio talk shows for these content spokespeople.

2. Using National Campaigns Effectively

⇒ *In undertaking a PV public awareness campaign, PV advocates should make the most of at least two key events: Earth Day 2000, the 30th Anniversary of Earth Day on April 22, 2000, and the 25th Anniversary of Sun Day on May 3, 2003.*

a. Earth Day

Action on climate change will likely be the central message of Earth Day 2000. As the Earth Day 2000 chairman, Denis Hayes should have the opportunity to repeatedly offer PV as one of the focal points of a national climate change strategy—a linkage he has addressed repeatedly in his writing.⁶ Hammering home this point and promoting PV in this context not only will initiate PV public awareness, but should also help to educate environmental organizations that are working on Earth Day and climate change issues. The *active support* of these groups is vital to any successful broad-based campaign because the members of these groups represent both early adopters and potential advocates for PV policies and programs.

⁶Denis Hayes, *A U.S. Government Purchase Program Would Lower Prices for Everyone, Recreating the Success of the Computer Revolution* (San Francisco, CA: Energy Foundation, 1998).

b. Sun Day

The 25th Anniversary of Sun Day is in 2003. The first Sun Day, held in 1978, reached 25 million Americans with its media coverage. New solar organizations were started (and continued) in 35 states and existing ones were bolstered in the remaining 15 states. Tens of millions of publications were distributed with funding from the U.S. Department of Energy, the Environmental Protection Agency (EPA), the U.S. Department of Housing and Urban Development (HUD), and other federal agencies.

The impact of Sun Day was to put solar energy on the radar screen of federal, state, and local decision-makers all across the United States. It also put an organizational structure in place to deliver educational programs and advocacy for renewable energy in the field and in Washington. This structure included a nonprofit lobbying organization with 55,000 members at its peak, a nonprofit educational organization, and a network of nonprofit state educational advocacy groups in nearly all of the states. With the advent of the Reagan Administration, this organizational structure could not be sustained after about a 6-year period.

Although a reconstituted PV Compact may be able to fulfill many of the national education efforts through its member organizations, there is a tremendous void in both Washington and the field regarding PV advocacy efforts. No structure now exists to provide independent, public interest advocacy for PV at city hall, state legislatures, public utility commissions (PUCs), the White House, and Capitol Hill.

To have a sustainable PV program, the education of policy-makers, decision-makers, and other key leaders must be persistent. Persistent education requires a national organizational and field structure not yet adequately in place, although the American Solar Energy Society (ASES) has 19 chapters covering 30 states. The way to build this organizational structure is through the organization of a major national campaign, such as Earth Day and Sun Day, that requires groups to form in cities and states to conduct the campaign.

3. Using Local Events and Organizations Effectively

⇒ *Local events and organizations such as the Midwest Renewable Energy Fair, the National Solar Home Tour, the Cooperative Extension Service, and existing and potential solar centers should be viewed as opportunities to raise public awareness of PV.* Many decisions regarding the purchase of PV are made at the local level. Thus, there must be grassroots action at the local community level. These efforts will help determine whether there will be public education events in the community on solar technologies and whether the media will have local material for solar stories.

a. Festivals

The power of the grassroots to educate the American public was showcased at this year's Midwest Renewable Energy Fair, which was sponsored by the Midwest Renewable Energy Association in the middle of Wisconsin. About 12,500 people attended the 3day fair (a 25% increase from 1997), participated in over 80 workshops and tours, and witnessed the entire operation being run on power generated from renewable energy sources, primarily PV and wind.

The success of this fair in the Midwest has led to the revival of the Toward Tomorrow Festival in Massachusetts and plans for future fairs in Arizona, California, Iowa, and other states and communities. Such events bring people directly in touch with technologies and the businesses that sell and install them.

b. National Solar Home Tours

In the consumer area, a tremendous amount of media coverage and public education was achieved as a result of the 1996 and 1997 National Solar Home Tours. Organized by the American Solar Energy Society (ASES), the 1997 tour was held in 37 states and drew more than 10,000 visitors on a single Saturday (October 18, 1997). This number was double the number of visitors who attended the previous year, and ASES organizers think the tour may double again in 1998. Media coverage was outstanding in 1997, with coverage on three national news programs and major front-page newspaper features obtained in a score of participating cities.

Almost as important as the media coverage is the quality of the participant that attends a tour. In most cases, participants are early adopters, planning to build a home, and giving solar a serious look. And, frequently it is the PV homes on the tour that attract the most attention of consumers and the media. Thus, the National Solar Home Tour represents an ideal vehicle for reaching those consumers, as well as the media.

The National Solar Home Tour has achieved its remarkable success on a shoestring budget. Outside funding for the 1996 National Solar Home Tour was limited to a \$30,000 grant from the U.S. Department of Energy (DOE). The 1997 tour received less than \$100,000 from DOE and private companies.

If DOE, foundations, and other funding agencies realized what could be achieved through this vehicle and funded it accordingly, National Solar Home Tours in 1999 and 2000 could be held in all 50 states and hundreds of communities. It could reach direct attendance levels of 50,000 to 100,000 or more. For local and state organizations, an expanded National Solar Home Tour would be a major booster shot. It is the local organizations, not ASES, that actually organize the tours in the local communities, obtain the local press coverage, raise the needed local funds, and can point the participants to businesses and other avenues for later participation. The availability of limited financial resources for staff time and paid advertising would greatly boost attendance and, as a result, membership in their organizations.

Ideally, ASES would make available to state and local organizations mini-grants to purchase limited advertising and hire part-time staff to organize and support the event. ASES might also provide a 2-day training session in the effective use of the media for local and state organizers at least once per year.

c. The Cooperative Extension Service: A Potential Local Partner

In the absence of a local solar organization, a more immediate pathway for accomplishing community solar objectives and education may be the local county office of the Cooperative Extension Service,

formerly known as the Agricultural Extension Service. Nearly every county in every state has an office staffed with county extension agents.

Many of the county offices have an agent charged with housing-related responsibilities and many have adopted environmental protection as one of their top priorities. As North Carolina has shown through its award-winning Solar Communities Program, partnering with the Cooperative Extension Service can be effective in getting a community agency that is focused largely on consumers and small businesses to direct a portion of its staff resources to solar and energy education.

The Cooperative Extension Service is a tri-level governmental entity that responds to signals coming from the federal, state, and local levels. With this structure, extension services may serve as a valuable part of both a bottom-up grassroots campaign as well as an effort organized from the top down. It is worth noting that the state headquarters for most cooperative extension services are located at the state's leading technical and agricultural university.

d. A Network of Solar Centers

A network of solar centers—such as those in Florida, North Carolina, and Georgia—could be a vehicle for moving early adopters of PV to the point where they can make confident, informed purchases. The ideal solar center would organize and encourage people to attend workshops and tours, provide design reviews and sample home plans, conduct site visits for commercial and industrial clients, provide a video and reference library, distribute free publications on all aspects of solar energy, and offer a demonstration venue that they can tour to see and touch PV applications. The ideal solar center should also be able to respond to technical questions, answer inquiries about financing, and help commercial and industrial customers make and implement their decisions to install larger PV systems.

Box A lists existing solar center sites in Florida, North Carolina, and Georgia, as well as potential solar center sites throughout the country. There are a number of locations where solar centers could be quickly established to provide PV the services outlined above by augmenting their existing missions. Potential sites include the following: 1) universities with solar laboratories or programs and technical expertise; 2) federal laboratories, such as the National Renewable Energy Laboratory (NREL) and Sandia, which could assume more outreach responsibilities in their regions and provide more accessible public demonstration sites; 3) nonprofit organizations that already provide some of these educational functions and could be expanded to offer an array of services; and 4) state energy offices and local government energy centers that can perform these functions.

The advantage of solar centers, as opposed to utility or trade associations, is that they are independent organizations not attempting to sell specific products. Still, education should lead to action, so the hand-off must be made from the designated educational institution to the business sector. This requires that the solar center, or entity providing the information, give the potential PV owner a list of businesses that sell and install products, provide easy access to product literature and, if possible, bring the potential customer into direct contact with an array of businesses and products.

Box A: Existing and Potential Solar Center Sites

Existing solar centers:

- Florida Solar Energy Center (Cocoa)
- North Carolina Solar Center (Raleigh)
- Southface Energy Institute (Atlanta)

Potential solar center sites:

- Sacramento, Calif. (SMUD/PVUSA)
- Los Angeles, Calif. (Los Angeles Department of Water and Power)
- Bay Area, Calif. (Northern California Solar Energy Association)
- Reno, Nev. (Sunrise or University of Nevada at Reno)
- Las Vegas, Nev. (University of Nevada at Las Vegas)
- Portland, Oregon (Solar Energy Association of Oregon)
- Olympia, Wash. (Washington State University Extension Service)
- Minneapolis, Minn. (University of Minnesota)
- Madison, Wis. (Midwest Renewable Energy Association or University of Wisconsin)
- Ann Arbor, Mich. (City of Ann Arbor)
- Albuquerque, N.M. (City of Albuquerque, N.M., Solar Energy Association, or Sandia)
- Austin, Tex. (City of Austin or Texas Solar Energy Society)
- Denver, Colo. (NREL or Colorado Renewable Energy Association)
- Boulder, Colo. (ASES or City of Boulder)
- Gainesville, Fla. (University of Florida or City of Gainesville)
- Greenfield, Mass. (Northeast Sustainable Energy Association)
- Boston/Lowell, Mass. (University of MA at Lowell or IREC)
- Columbus, Ohio (Ohio Solar Energy Association)
- Annapolis, Maryland (Maryland Energy Administration),
- Albany, N.Y. (SUNY at Albany or IREC)
- New York, N.Y. (Metropolitan Solar Energy Society)
- Manhattan, Kansas (Kansas State University/KS Cooperative Extension Service)
- Montana (Alternative Energy Resources Organization or NCAT)
- Chicago, Ill. (City of Chicago, University of Chicago or Center for Neighborhood Technologies)
- Philadelphia, Penn. (City of Philadelphia)
- Washington (Potomac Region Solar Energy Association)
- Phoenix, Ariz. (Arizona Solar Energy Association)
- Tucson, Ariz. (City of Tucson)
- Iowa (Iowa Energy Center or Iowa Energy Office)
- Las Cruces, N.M. (Southwest Technology Development Institute/NM State University)
- El Paso, Tex. (El Paso Solar Energy Association)
- Chattanooga, Tenn. (Center for Sustainable Development)
- Middle Tennessee (Tennessee Solar Energy Association)
- Delaware (University of Delaware or Delaware Energy Office)
- Boise (Idaho Energy Division)
- Honolulu, Hawaii (Hawaii Energy Office or Hawaii Renewable Energy Association)

C. Target Sector Campaigns: Reaching Early Adopters of PV

Work in educating specific markets regarding PV opportunities and applications remains to be done. Commercial and industrial markets, ranging from restaurants and office buildings to manufacturing plants, have been largely ignored to date. Institutions such as schools and parks have received more attention, and the number of PV applications in those markets has been growing. And, outside of a few cities like Sacramento, Austin, and Gardiner, Mass., little effort yet has been placed on the grid-connected residential markets.

In each major sector, additional research is needed to best determine the markets that should receive priority attention. However, certain subsectors appear to show immediate promise, either because of successful past experiences or potential identified through demonstration programs. Some of these are described below.

1. *The Institutional Sector: Targeting Government Procurement Officials*

Although the government has been one of the major domestic purchasers of PV systems—the U.S. Department of Defense, for example, has purchased more PV than any other private or public entity in the United States—PV’s potential in local, state, and national government agencies has hardly been touched.

Recently, the Clinton Administration announced that the federal government would install solar systems on 20,000 federal facilities by 2010 to fulfill its part in the Million Solar Roofs Initiative. This initiative will necessitate a large educational effort for federal personnel charged with the design, selection, purchase, installation, and maintenance of these systems.

- ⇒ ***The Federal Energy Management Program (FEMP) has the structure in place to provide this training for federal agencies and should expand its efforts to specifically target PV applications.***⁷ FEMP should also utilize the federal labs, universities, solar centers and other institutions that already have training programs and expertise in place to meet these educational needs. Additional information on the role of the federal government in accelerating PV deployment is addressed elsewhere in this study.⁸
- ⇒ ***The purchasing of PV must be simplified through the use of packaged systems.*** Until recently, PV system components were so segregated that many niche markets had little to choose from in the way of packaged systems. Fortunately, this situation is beginning to change as companies realize the potential business opportunities and international markets increasingly demand packaged systems in requests for proposals and bid specifications. Some alliances have even been formed between manufacturers of modules, inverters, batteries and other components to advance system packaging. Procurement officials also need warranties on systems that are comparable with competitor’s products. In addition, they need installation to accompany the system rather than be forced to separately bid this important component.

⁷Federal Energy Management Program, *FEMP Training Catalog*, DOE/EE-0174 (Washington, DC: U.S. Department of Energy, 1998).

⁸Joel Stronberg and Virinder Singh, “Government Procurement of Photovoltaics,” *Expanding Markets for Photovoltaics* (Washington, D.C.: Renewable Energy Policy Project, 1998).

On the state and local level, outreach and training activities should target park agencies, correction facilities, transportation applications, state and local government buildings, environmental monitoring sites, and a host of other applications in a variety of agencies. Local solar centers, state energy offices, and other appropriate resource organizations should also be actively involved in training and education of procurement officials.⁹

⇒ ***PV advocates should seek to have PV products included on “state contract” lists and bidder lists.*** To get PV products included on these lists, local and state officials must be convinced that a higher initial cost for a PV system is often offset by other benefits, such as energy savings, less maintenance, and no fuel requirements.

2. The Residential Sector: Targeting Builders and Early Adopter Homebuyers

The Environmental Protection Agency’s (EPA) Energy Star Program is a voluntary program that is off the runway and gaining altitude. Although the success of EPA’s Energy Star Program in the building sector has not yet reached the levels it has reached in the computer sector, the program has great potential here. It is now being aggressively pursued by the solar hot water industry in Florida, where builders wishing to receive Energy Star recognition can get substantial points toward this goal by using solar water heating.¹⁰ In some cases, the points awarded are even greater than for high-efficiency windows or HVAC equipment. PV systems should be similarly considered.

The Energy Star Program for homes keys off a rating provided by a Home Energy Rating System (HERS) at the state level. Unfortunately, only 33 states in the United States now have the Energy Star program in place.¹¹ If the program could be expanded to all 50 states, then Energy Star recognition could serve both as 1) an incentive for builders to use PV and 2) an education and purchasing guideline tool for consumers. Consumers attracted to adopting new technologies, interested in lowering energy expenses, and wishing to lower their burden on the environment could use the ratings system to do comparative shopping. With the Energy Star certification, homebuyers would be able to get an energy-efficient mortgage, stretching the amount they could borrow by 2% to 4%.

However, the Energy Star program for homes in its current state does little to promote the incorporation of PV into homes. The reason is that the Energy Star “stamp” is given when a home is 30% more energy-efficient than a home that just meets the energy code; it doesn’t matter what initiatives are taken to achieve this goal. PV used to power an entire home would increase its energy-efficiency well beyond 30%, making PV less cost-effective than other measures *for that goal*. However, if a second tier to the Energy Star for homes program were established—one requiring a higher level of efficiency—PV might be more enticing for builders.

⁹The Interstate Renewable Energy Council (IREC) has published the *Procurement Guide for Renewable Energy Systems: A Handbook for Government*, 2nd ed.,(Latham, NY: IREC, 1997).

¹⁰William Guiney, Florida Solar Energy Center, Cocoa, FL, personal communication, July 1998.

¹¹Energy Star Homes Team, *Energy Star Homes Update* (Washington, DC: Environmental Protection Agency, July 1998), p. 8.

Energy Star and HERS described above would greatly facilitate the PV education of builders and consumers alike. If consumers are demanding the product and builders are therefore encouraged to supply it to meet this demand, then the training of builders and the related trades will be greatly advanced. Likewise, as they learn about the Energy Star Program and what makes up a home energy rating, consumers will learn about PV. Taken together, this or a similarly constructed program could help to reverse the dilemma that builders refuse to build solar homes because of inadequate demand, while consumers complain that there are not enough builders who will build a solar home.

⇒ ***PV advocates should encourage the White House to hold meetings with the Environmental Protection Agency's (EPA) Administrator Carol Browner to get EPA to incorporate PV into the Energy Star Program.*** Once PV is incorporated into EPA's Energy Star Program, then several states with existing Home Energy Rating System (HERS) programs should be targeted for pilot programs. States with renewable energy funds generated through utility restructuring would also provide a pool of early candidate locations. These funds could be used to help establish training and education programs for builders and consumers, as well as provide a low-interest loan pool for early participants in the program.

3. The Industrial and Commercial Sectors: Finding the Champions

Industrial and commercial firms are a difficult market for PV, but the motivation for most firms to install PV will be to advance their image as a "green" industry. Ray Anderson, chairman of Georgia textile manufacturer Interface, Inc., co-chairs the President's Council on Sustainable Development. To promote renewable energy and sustainability, Anderson has installed a 9 kW PV system at Interface's Intek carpet panel plant in Aberdeen, N.C.; the plant in Aberdeen couples the PV system with batteries to lower the facility's peak energy demand on the utility. At another Interface plant, Bentley Mills, efforts are underway to install a 100 kW PV system to "produce the worlds first solar tufted carpet."

Interface's attitudes toward renewable energy are expressed in the following two excerpts from the 1997 *Interface Sustainability Report*:

[Interface is] pursuing renewable energy supplies. This includes installing alternative technologies at our facilities, as well as contracting with power companies to provide us with energy from renewable sources.

At present, fossil fuels receive large direct and indirect subsidies, but their cost does not reflect the pollution, acid rain and climate change they cause. Renewable energy, on the other hand, receives scant support in the form of subsidies, and is not given credit for being safer. All things considered, renewable energy is far less expensive.¹²

⇒ ***To locate companies willing to take actions similar to those taken by the textile manufacturer Interface, Inc., the chairman of that company, Ray Anderson, who co-chairs the President's Council on Sustainable Development, should convene a roundtable education session on renewables for industrial leaders.*** The briefing session should address all renewables but should give PV applications substantial attention. Companies that should be invited include those on the President's Council for Sustainable

¹²Ray Anderson, Chairman, *Interface Sustainability Report* (Atlanta, GA: Interface, Inc., 1997).

Development, members of the U.S. Green Building Council, and conglomerates that own PV companies. The companies attending the briefing session should be encouraged to take leadership positions in the PV arena and install demonstrations on their own facilities. The computer chip analogy, as expressed by Denis Hayes in a recent article,¹³ should be emphasized to move the industrial leaders in the direction of committing to the purchase of PV in increments over a number of years. Those companies that go on to implement PV projects must be widely publicized, both in the national media and in their own trade press.

4. The Institutional Sector: Targeting Nonprofit Organizations and Schools

Nonprofit organizations and schools are excellent locations for PV applications from the standpoint of advancing public awareness and education. Together, they have some of the most visible and visited buildings in a community. Several utilities have backed solar in schools ventures, including Wisconsin Public Service and Detroit Edison. In addition, state energy offices in Maryland and Colorado have recently begun programs that would help pay a portion of the school's PV system cost.

⇒ ***The Utility Photovoltaic Group (UPVG) and the Interstate Renewable Energy Council (IREC) should expand funding and resources for their "Schools Going Solar" Program.*** An effort should be made to include conferences on the state level to highlight solar applications in schools. Linkages between curriculum and a PV school application should be highlighted. The ideal audience should include school superintendents, assistant superintendents for facilities, school board members, state school officials, PTA presidents, and lead science teachers who may have ultimate responsibility for linking the PV application with the curriculum.

Through the solar centers described above, or similar resource organizations, free site visits should be provided to schools to determine the feasibility of adding a PV application. Such visits would provide the opportunity for key local officials to get answers to their questions regarding PV's technical and economic feasibility.

The nonprofit community, which numbers in excess of a half of million nationally, also has many highly visible facilities: museums, churches, shelters, YMCAs, Boys' and Girls' Clubs, day care centers, hospitals, children's homes, and a host of other facilities. Some nonprofit organizations installed solar water heating systems under the now defunct federal Solar and Conservation Bank program in the early 1980's, and many of them took advantage of energy-efficiency measures that were partially financed by foundations throughout the 1980's and early 1990's.

Free site visits should be made available to nonprofit organizations. As a vehicle for reaching the wide variety of nonprofits, the local United Ways and Community Foundations should be sought to gain their co-sponsorship and to request that they either send a letter or gather the directors of their funded groups for a presentation on solar applications. All site visits should be followed up with a brief report and an offer to present the findings before the organization's board of directors.

¹³Denis Hayes, *A U.S. Government Purchase Program Would Lower Prices for Everyone, Recreating the Success of the Computer Revolution* (San Francisco, CA: Energy Foundation, 1998).

D. Shaping the Education Offered by Traditional Educational Institutions

1. K-12: Preparing Children to Embrace the PV Future

Shell International Limited has predicted that the world could get 50% of its energy supply from renewable sources by 2050.¹⁴ Whether the world reaches that lofty target will be significantly influenced by the decisions made by today's yet unborn, today's kids and teenagers, and the young adults studying in colleges, universities, and trade schools. If we educate and adequately prepare them for the energy and environmental dilemmas they are likely to face, then we will have gone a long way in protecting our future and ensuring our planet's health.

Tragically, on a national level, we are ignoring the importance of our children. U.S. Department of Energy (DOE) expenditures for K-12 renewable energy education are so limited that we were unable to locate, despite repeated calls, any DOE office that even tracks or compiles these numbers. Even the PV community itself, as evidenced in the survey conducted for this study (see appendix), ranks students at the bottom of the list of target audiences that need to be addressed. We must focus, they say, on those who can buy PV *today*.

This is not to say there are not some bright spots around the nation in renewable energy education. In their *Schools Going Solar* compendium, released this year, the Utility Photovoltaic Group (UPVG) and the Interstate Renewable Energy Council (IREC) identified a number of exemplary school programs, both in the area of curriculum and in the technologies and design that the schools demonstrated in their buildings. Interestingly, most of the programs were an outgrowth of the resourcefulness of a particular school system, an innovative local utility, or a creative educator. Sadly, PV still hardly registers a blip on the radar screens of most of the 115,000 schools¹⁵ in the United States.

For the renewable energy community, PV may provide the key to turning this situation around. Solar cars, PV gadgets, and battery chargers fascinate kids. The popularity of the Junior Solar Sprint model solar car competition—abandoned in recent years by DOE—attests to this. Each semiannual Sunrayce competition, a DOE-supported race of full-scale solar cars constructed by college engineering programs, draws thousands of spectators at each stop along its week-long, 1,000+ mile race route.

One approach that seems to have been catching on in several states over the last year is the installation of a PV system for a school, followed by incorporation of a curriculum or series of lesson plans in the classrooms that are directly linked to the PV system. In this instance, the PV system becomes a teaching tool on a highly visible public facility. Children are educated, parents are exposed to the technology, and teachers have a wonderful educational aid.

⇒ ***Funding should be provided so that a special committee of the National Science Teacher's Association or the Education Division of the American Solar Energy Society***

¹⁴*The Evolution of the World's Energy Systems* (London: Shell International Limited, 1996).

¹⁵National Center for Educational Statistics, personal communication, Sept. 11, 1998.

- (ASES) can assemble renewable energy curriculum to reach children in schools. Education packages should be prepared for at least four grade levels: K-2, 3-5, 6-8, and 9-12. It will be important to provide cost sharing to local and state school authorities for the procurement of these packages, with a minimum level of associated training required for teachers.*
- ⇒ *PV advocates should reestablish the Junior Solar Sprint program for solar cars and make the program available to all states and school systems.*
 - ⇒ *Nongovernmental organizations and states should create week-long summer teacher training institutes in renewable energy at key centers for solar energy training around the United States. The institutes should develop “Master Solar Teachers” who can return to their states and communities to train other teachers in the use of renewable energy curriculum.*¹⁶ The programs might be similar to the summer study programs regularly conducted by many investor-owned utilities.
 - ⇒ *PV advocates should establish a central clearinghouse for K-12 renewable energy education materials so they are easily accessible to grades K-12 teachers and students. The clearinghouse should also post these resources on the Internet.* Organizations most capable of carrying this out this task might be the Interstate Renewable Energy Council (IREC), the National Energy Education Development Project, the National Energy Foundation, and the American Solar Energy Society (ASES).

2. Colleges and Universities

Not long after receiving a \$195 million loan from the World Bank, including \$55 million for PV,¹⁷ the India Renewable Energy Development Authority (IREDA) contacted a U.S. university and requested a meeting. In this meeting, IREDA laid out their predicament: lots of money and government backing for renewables but limited infrastructure to deliver quality implementation. They needed project managers, they said, who could manage the wide variety of applications that were to be established throughout India. They were wondering if it might be best to send their prospective managers to the United States for training, but they could not find many comprehensive programs at our higher education institutions.

Comprehensive training and education programs in community colleges, colleges and universities—at one time quite prevalent around the United States—have almost entirely vanished from our higher education landscape. In the mid-1980’s, for example, more than half of North Carolina’s 33 community colleges taught solar technology and drafting courses, with many giving associate degrees

¹⁶These might include National Renewable Energy Laboratory (NREL) in Golden, Colo.; Florida Solar Energy Center in Cocoa, Fla.; Sandia National Laboratories in Albuquerque, N.M.; North Carolina Solar Center in Raleigh, N.C.; Southwest Technology Development Center in Las Cruces, N.M.; and at solar energy laboratories and appropriate technology programs at the following universities: Colorado State University, Appalachian State University, University of Florida, University of Wisconsin, University of Minnesota, and University of Massachusetts at Lowell.

¹⁷For more information on World Bank loans to the India Renewable Energy Development Authority (IREDA), see the Web site: solstice.crest.org/renewables/ireda/

in the field. By 1998, no community college in the state had a degree program and only a few scattered courses remain.

Our lack of an adequate formal education infrastructure for PV means that we are ill prepared to manage a major ramp up of PV across the nation. While one part of this equation is the training of electrical contractors and other trades, we will probably draw our managers for major projects from existing colleges and universities.

- ⇒ ***PV advocates should support the reestablishment of comprehensive renewable energy training and education programs—at one time quite prevalent—in community colleges, colleges, and universities around the United States.*** At the community college and technical institute level, PV design and installation courses are needed and should be seeded through a cost-sharing, mini-grant process. As the number of installations grows, these programs should be expanded to provide associate degrees in solar technology that include strong PV components. Lesson plans in building-integrated PV will also need to be integrated into solar drafting courses for designers.
- ⇒ ***PV advocates should compile a list of undergraduate, graduate and community college courses available in solar energy, including PV, and maintain the list on an active Web site.*** Furthermore, sample curricula for PV courses should be prepared and distributed to university architecture (i.e., building-integrated PV) and engineering programs to encourage their creation. One-time mini-grants should be provided to university instructors to organize and initiate a course in PV to help offset the initial course preparation time. The nearest solar center should maintain a roster of qualified professionals who would be willing to teach PV and solar courses on an adjunct basis.
- ⇒ ***The PV industry and nongovernmental organizations should establish a competitive process under which colleges and universities wishing to host a solar center, as described earlier, would be eligible to share costs for a renewable energy curriculum with a strong PV component.*** The link between the solar center and the curriculum is important because the solar center provides the student with field experience and experiential learning that is a key aspect of solar project implementation. Universities hosting solar centers, and working to put a curriculum in place, should initiate solar clubs and associations for students, such as a chapter of the American Solar Energy Society (ASES).
- ⇒ ***Nongovernmental organizations should initiate a National PV Internship and Cooperative Education Program, building initially on cooperative education programs already in place at several universities.*** Under this program, an active roster of solar internship positions would be maintained on an international basis, and students could be selected for placement in these positions.
- ⇒ ***PV advocates should help develop national PV design competitions among universities to encourage collective student learning of PV.*** The Sunrayce program is one such effort, but this could be greatly expanded to include designs of other, more practical PV applications. Such learning opportunities can help fill a void of PV classes, and encourage students to get hands-on design and construction experience through independent and group project efforts.

E. Educating Government and Other Policy-Makers

Policymakers are a formidable group to try to reach, because it is difficult to get their attention and because they are a diverse group. Lots of people “make policy” within their own fields and professions—for example, school board members and superintendents in the K-12 education arena. For the discussion in this section, however, we will focus on PV educational activities for national legislators, state legislators, public utility commissions (PUCs), consumer advocates, and local city and county leaders. It should be noted that all of these policymakers will also be affected by a larger public education and awareness campaign.

1. Educating National Legislators

Congress currently has before it several utility restructuring bills, authorizations and appropriations for PV, and, potentially, a national net-metering bill and funding for global climate change initiatives. This Congress, though, has not been supportive of the PV industry and needs immediate attention.

⇒ *PV advocates should use the bipartisan Renewable Energy Caucus as a focal point for directly educating and briefing Members of Congress about PV issues.* This caucus, which is almost evenly balanced between Republicans and Democrats, is a potentially powerful apparatus for legislative education. Briefing sessions for Members of Congress should also be held through other forums, such as the Energy and Environmental Study Institute or special meetings organized by the American Solar Energy Society (ASES) and other groups.

To complement direct educational efforts, grassroots lobbying is critical to reaching legislators, grassroots organizations already exist with ASES and its Solar Action Network, and the recently created Americans for Clean Energy. In addition to continuing their present activities, these and other membership organizations need to target legislators at the home district level. This is usually a much more effective time to get their attention.

2. Educating State Legislators

A strong case can be made that the most important group of policymakers to educate *now* is state legislators and their staffs. With almost every state either currently or soon to be engaged in utility restructuring, this is a compelling argument. In state after state, decisions will be made on opening markets to competitive generation, systems benefit charges, portfolio standards, fuel disclosure and a host of other issues. With billions of dollars for renewable energy development at stake, these decisions could make or break PV. State legislators will decide if a state restructures and if a systems benefit charge (SBC) or portfolio standard is included in the law.¹⁸

¹⁸ For further discussion of the use of a systems benefit charge (SBC), see Thomas J. Starrs and Vincent Schwent, “Government Buydowns for the Residential Market,” *Expanding Markets for Photovoltaics* (Washington, D.C.: Renewable Energy Policy Project, 1998); for further discussion of portfolio standards, see Ray T. Williamson, “Renewable America: A Portfolio Approach to Developing Renewable Resources,” *Expanding Markets for Photovoltaics* (Washington, D.C.: Renewable Energy Policy Project, 1998).

⇒ ***In states with utility restructuring on the agenda, PV advocates should organize briefing sessions for state legislators.*** State legislators in positions to decide how utility restructuring plays out need to be fed information on the value of PV and other renewables in their states. These efforts can be undertaken by state chapters and working groups of the American Solar Energy Society (ASES), the Solar Energy Industries Association (SEIA), and the National Photovoltaics for Utilities program (PV4U). Wherever possible, representatives from universities, national laboratories, and national industries should supplement the presentations and build their credibility.

Funding and staff need to be allocated not only to oral and visual presentations to state legislators, but also to the development of a written renewable energy plan for states that do not have a renewable energy plan. The written plan should include treatment of renewables under restructuring, the status and benefits of renewables, and a list of actions needed from the legislature. Such reports have been prepared as part of restructuring education campaigns in Massachusetts, Rhode Island and North Carolina. In many states, there may be funding available from the legislature for such undertakings, as was the case in Massachusetts and Rhode Island. Otherwise, funding needs to be made available by foundations, as it was in North Carolina, and the effort should be coordinated by the Energy Foundation.

3. Educating Public Utility Commissions and Consumer Advocates

As utility restructuring unfolds in state after state, public utility commissions (PUCs) or special commissions have filled the role of implementing body. While state legislators will decide if a state restructures and if a systems benefit charge (SBC) or portfolio standard is included in the law, it is the PUC or another body that largely determine whether PV is included in an RPS or SBC.

⇒ ***PV advocates should make efforts to influence public utility commissions (PUCs) through briefings on PV issues.*** Some PUCs have mechanisms in place for informal briefings, and others require a more formal process. PUC briefings should be performed by state organizations—supported by their national counterparts—that can present a credible case for PV at the briefing. The state plan described above for legislators is one item that should specifically be relayed to PUCs and their staffs in a serious presentation. Another route to reaching PUCs is the official state consumer advocates for utility affairs in Attorney General’s Offices or independent state agencies. Often, these offices play a major role in utility proceedings and, in some cases, have more staff and responsibilities than even the PUC. Given their historical emphasis on keeping rates low for consumers, presentations need to address PV costs, projected economics, and expected rate impacts. Favorable resolutions passed by the National Association of State Consumer Advocates (NASUCA) and National Association of Regulatory Utility Commissioners (NARUC) should be highlighted.

4. Educating City and County Leaders

When it comes time for PV deployment, the focus will be on the local level. That is where the installations will go in, the permits pulled, the interconnection agreement with the utility consummated, and a host of other decisions made. For those municipalities that own their utility, numbering 2,014 in the United States, the stakes are even higher.¹⁹ Effective deployment of PV on a local level will greatly benefit from the active support of its city council, county commission, and other key organizations in the community. However, outside of the cities that own their own utility, many local government leaders do not readily understand how they can or should work to advance PV.

Local government leaders who can be champions for PV in their communities need to be identified and trained by local solar advocates. Along with communities that own their utility, communities that should be targeted are those in states with existing or prospective renewable energy funds and portfolio standards, or who have otherwise expressed a desire to lower their community's impact on climate change.

⇒ ***To oversee local implementation of PV deployment in each target community, PV advocates should organize steering committees with a broad cross-section of community leaders, drawn from the government, utility, environmental, nonprofit, energy and business sectors.*** One example of educational efforts to target communities considering solar energy is the Interstate Renewable Energy Council's (IREC) Neighborhood Power program, which has organized workshops for community and municipal leaders around the country.

III. EDUCATION FOR PROFESSIONALS

A. Introduction

In this section, we consider a critical component of the PV infrastructure—the many professionals that are involved in expanding markets for PV—and how the PV industry and advocates can reach out to educate and train them. These professionals include PV installers, inspectors, builders, developers, architects, utility engineers, lenders, appraisers, and realtors. Each one of these professionals plays a different role or set of roles through the life of a PV project, and although some professionals are more critical than others, each needs PV-related education.

For the PV industry and PV advocates, trying to deal with nine different professional areas (and there are more²⁰) is a rather daunting task. What solar advocates must acknowledge, however, is that the infrastructure requirements for the PV industry are not extraordinary in comparison to those for other

¹⁹Energy Information Administration, *Electric Sales and Revenue 1995*, DOE/EIA-0540(95) (Washington, DC: U.S. Department of Energy, December 1996).

²⁰Two additional areas are facilities maintenance personnel and the larger engineering community. Other professional areas that impact the use of PV in important ways are educators and policy-makers. These professions were included in the survey and policy makers ranked third overall while teachers ranked seventh. These professions are not included in the discussions that follow because they are dealt with elsewhere in this paper.

technologies such as conventional hot water heaters, large home satellite dishes, or private wells—that is, the PV industry and its advocates are not necessarily facing unique barriers.

Rome may have been sacked by the Huns in 455 AD, but vestiges of the Coliseum and other extant monuments suggest that not all was lost. Such can be said of the solar hot water industry and its downfall after 1985. The question is whether the infrastructure that has endured is of any value to the growing PV market. Although many of the same professional groups will be dealing with PV (lenders, inspectors, etc.), the following practical gaps limit applicability: 1) PV is a different technology; 2) the economics of PV are distinct; and 3) many of the individuals who worked with the solar water systems of the 1970's and early 1980's are no longer working in the solar field. The lessons of solar past that can be applied to today's PV, however, are discussed below.

In the discussion below, PV installer training is given a fairly extensive look for two reasons. First, there are extensive training requirements. Second, installer training is where the most activity has taken place to date and where many believe the need is greatest. The chief issue surrounding PV installer training is whether installers should be certified. Our recommendation is that PV installers be required to have certification. This recommendation is consistent with our solar community survey results: 85% of our survey respondents favored some sort of certification requirements for PV installers (see appendix A). The justification for PV installer certification requirements, what those requirements might be, and where accreditation fits into the picture are reviewed below.

In addition to PV installation and service contractors, there are other professionals for whom PV educational activities should be undertaken. In the discussion below, these noninstallation professionals are divided into two categories: “technical and building professionals” and “financial and related professionals.” There is no magic to these categories; rather, they suggest the obvious differences in these professional groups, and much of the discussion can be generalized within these two categories.

For professionals in each of the two categories—“technical and building professionals” and “financial and related professionals”—we first address the question: “What role does this profession play in the development of PV and what are the potential barriers that it puts up?” We then address the corollary: “What is the ideal state of affairs with regard to the education of this profession?” Recommendations for each profession focus on identifying organizations that can implement the needed professional training and education programs.

B. Educating PV Installation and Service Contractors

Defining the qualities of PV installation and service contractors requires review of several issues. Opinions in the industry vary on who should be qualified to install PV systems and whether or not there should be any required certification of installers. If there is certification, who should do the training, certification, and accreditation? Should PV installers be licensed electricians? These considerations must also be weighed against the needs of the industry.

The PV installer infrastructure in the United States today leaves much to be desired. On the one hand are multinational corporations manufacturing and distributing PV modules and systems; and, on the other, an installation industry that largely consists of a patchwork of small (1 to 10 employee) companies. Distribution companies such as Hutton Communications and Atlantic Solar have put considerable effort into developing

“Photovoltaics are particularly effective when implemented in a distributed fashion, whether integrated into conventional urban residential or commercial buildings, or at the remote home or village level. This results in the installation of many small systems, and requires a dispersed resource of field technicians and businesses to service this decentralized market.”²¹

dealer and installer networks but have had difficulty with a grid-tied market that is still in its infancy. Steady market expansion and sheer potential in the United States is slowly starting to change this. Meanwhile, there is a solid base of training organizations that the industry can tap as it grows. PV training programs at different levels are offered by the following organizations, among others: the Colorado Solar Energy Industries Association, Florida Solar Energy Center, Midwest Renewable Energy Association, National Renewable Energy Laboratory (NREL), North Carolina Solar Center, Real Goods, Sandia National Labs, Siemens Solar Industries, Solar Energy International, and Southwest Technology Development Institute.

The aim of this section is to examine installer training issues and make recommendations for how we get to an ideal state with regard to installation professionals. We are a long way from an ideal state, but with a set of goals in mind, the industry and advocates may begin to better craft those policies set them in motion today.

In the discussion that follows, we tackle the following issues:

- Should PV installers be licensed electricians?
- Should certification be required for PV installers?
- If certification is required, who should confer certification?
- Should there be accreditation for training firms and organizations?

The recommendations below are made with a view toward the most effective way of expanding PV markets while maintaining high standards of safety and quality.

²¹Mark Fitzgerald, Mark Mrohs, and Jamie Mulky, *Global Training Accreditation and Certification: Objective Standards of Professional Quality for PV Systems Design, Installation and Maintenance* (Highlands Ranch, CO: Institute for Sustainable Power, 1997).

1. PV Installer Training and Certification

Training and certification prominent issues for PV advocates, who are split between requiring certification for PV installers. Some say that certification itself is a barrier for the industry, discouraging many PV installers.

Still, there seems to be far greater support for creating and enforcing certification requirements. Eighty-five percent (85%) of survey respondents favored some sort of PV installer certification requirement. This strong response suggests that the solar community and PV industry recognizes the importance of quality installation and is ready to put a certification process in place.

In a recent paper by Mark Fitzgerald of the Institute for Sustainable Power, Mark Mrohs of Siemens Solar Industries, and Jamie Mulky of Hewlett Packard, they point out that the PV industry has been focusing too long on the costs of certification, and not on the benefits.²² Fitzgerald, Mrohs, and Mulky came up with the following list of benefits of standardized PV installer training and certification requirements:

- better employment opportunities
- industry is viewed as more professional
- knowledge of new developments spreads
- better maintained systems
- ability to assess capabilities
- better customer interface
- better pay
- lower insurance costs
- more reliable installations
- more cost-effective systems
- risk minimization
- professional validation and personal satisfaction

In addition, Fitzgerald, Mrohs, and Mulky point out that “as with all successful industries, a professional credential of knowledge and skills, based on objective standards, is beneficial for industry professionals, important for market credibility, and necessary for risk assessment by financing organizations.”

As a way of prioritizing efforts to implement installer certification, it may be beneficial to first look to those states that have solar hot water certification requirements. Thirteen states have specific solar licenses: Arizona, Arkansas, California, Colorado, Connecticut, Florida, Hawaii, Maine, Michigan, Nevada, Oregon, Rhode Island and Utah.²³ In the majority of these cases, solar contractor licenses are issued under the plumbing category and apply to solar water and space heating systems. Arizona, Colorado and Maine offer voluntary, solar-specific certifications. Fifteen other states do not have

²²Mark Fitzgerald, Mark Mrohs, and Jamie Mulky, *Global Training Accreditation and Certification: Objective Standards of Professional Quality for PV Systems Design, Installation and Maintenance* (Highlands Ranch, CO: Institute for Sustainable Power, 1997).

²³Courtesy of Marc Roper, Colorado Office of Energy Conservation, who has conducted surveys of the states' contractor licensing and training programs.

specific solar contractor licenses but do require solar contractors to have a general contractor license.²⁴

When queried as to the minimum length of training, several survey respondents noted that it depends on knowledge of electricity, previous experience in installing PV, and a host of other factors. Perhaps the most significant thing we can discern from these responses is that over half (53%) of the respondents feel that adequate training can be accomplished in 1 week or less.

As to who should provide certification if it were required, a “state licensing agency” was clearly preferred by the largest percentage (38%) of respondents by more than a two to one margin over “state energy office or solar center.” The remainder of responses was scattered among a number of other agencies and organizations, including the Solar Ratings and Certification Corporation (SRCC), Community College/Technical Institute, Solar Energy Industry Association, American Solar Energy Society (ASES) Chapter/State Nonprofits, Institute for Sustainable Power (ISP), and federal laboratories.

2. Accreditation of PV Training Institutions

Accreditation takes the certification requirements one step further by requiring that a third party approve training institutions for PV installers. The Institute for Sustainable Power (ISP) has completed nearly all of the recent work on training accreditation issues. ISP is a nonprofit umbrella group that has proposed and begun implementing an international program for accrediting trainers and training organizations. It has laid out the arguments for accreditation.²⁵

Training involves the attainment of minimum levels of knowledge and skills, so that specific tasks can be performed to measurable standards. To date, training efforts in sustainable technologies are implemented without clear competence targets, as measured against third-party standards, so the effectiveness of training cannot be properly judged. Programs do not build upon one another, and isolated training activities are undertaken around the world, often "reinventing the wheel" in terms of content, lab and field activity, methodology, logistics, and other important dimensions.

Modern learning theory and instructional design technology are not usually among the strengths of the parties involved, and are often neglected. A worldwide acceleration in market development for decentralized energy technologies will be impeded until training program accreditation, against a third-party standard, and skills certification, to accepted levels of knowledge and skills competence, emerge to help focus efforts and scarce resources. These will allow development and funding organizations to do conventional risk assessments for their investments and loans when reviewing project submissions; and, it will allow training organizations to concentrate on presenting their programs and products in the context of accepted standards for content quality and participant performance.

²⁴Chris Larsen, Henry Rogers, and Larry Shirley, *National Summary Report on State Programs and Regulatory Policies for Renewable Energy* (Raleigh, NC: North Carolina Solar Center and Interstate Renewable Energy Council, 1998).

²⁵Mark Fitzgerald, Mark Mrohs, and Jamie Mulky, *Global Training Accreditation and Certification: Objective Standards of Professional Quality for PV Systems Design, Installation and Maintenance* (Highlands Ranch, CO: Institute for Sustainable Power, 1997).

Although we strongly agree that some form of accreditation is necessary to assure both quality and consistency of PV instruction, the question of who serves as the accrediting body remains an issue to be resolved, and this is a question that will likely be decided by each individual state that mandates certification. California and Florida are the first states out of the blocks. Their PV installer certification programs will be in place by 2001. The PV industry and its advocates must closely watch what happens in these states.

3. Should PV Installers Have an Electrician's License?

The case has been made that unless licensed electricians do all PV installations, safety will be compromised. The rigors of obtaining an electrician's license in any state are well known: 4,000 hours of apprenticeship are required for a specialty electrician's license and 8,000 hours are required for a journeyman's license in most states.²⁶ Additionally, examinations must be passed before the state's licensing department will grant an electrician's license. The accumulated training and experience of licensed electricians is a compelling argument that overall safety is improved if electricians do all PV installations.

On the other hand, electricians know little about PV and are not as familiar with DC current systems as they are with AC current systems. Some specialty electricians deal with DC in alarms and controls, but this is the exception instead of the rule. It can be argued that an experienced, nonelectrician PV installer is safer than a non-PV-experienced licensed electrician. This may be a moot point if electricians are required to have PV training as a part of the requirements for an electrician's license, as is recommended below.²⁷ Proper training and certification of PV installers, coupled with installations following the National Electric Code (NEC), would ensure a high level of safety however.

A final issue raised by some survey respondents is that requiring PV installers to be licensed electricians may be an onerous requirement that will stifle the industry without any gains in safety. Nonetheless, it can be expected that as the market grows, more licensed electricians will enter the field, and they will be favored by consumers. This should not influence the decision to not require PV installers to be licensed electricians, but it does point to the fact that safety standards will likely also be communicated through the market. The key is the short and medium term—the period of dynamic industry growth when nonelectrician installers will be playing a critical role in bringing clean, distributed PV power to tens of thousands of first- and second-wave homes. Our recommendations are as follows:

⇒ ***PV installers should be trained and certified with a minimum experience requirement, and PV installers should be trained by an accredited training organization or business.***

²⁶For more information on electrical apprenticeships, see the Web site: www.wa.gov/lni/ipub/i5000040.htm

²⁷It is encouraging to note that the International Brotherhood of Electrical Workers (IBEW) and the National Electrical Contractors Association (NECA) have put together a course on PV systems through the National Training Institute (NTI) of the National Joint Apprenticeship and Training Committee (NJATC). The course, called Sunology, provides 20 hours of comprehensive classroom training in five days and graduates are presented with a trainer's package and accreditation which will enable them to return to their respective locals and initiate their own NJATC Sunology Orientation Certification program.

- ⇒ *State governments should be ultimately responsible for certification—either through state certification or by approval of a nongovernment certification organization.* Efforts to bring uniformity to training and certification standards should be supported. State training and certification requirements should be the same or similar around the country to allow for reciprocity between states.
- ⇒ *PV installers should be encouraged to be licensed electrical contractors, but they should not be required to have an electrical contractor’s license.*

C. Educating Technical and Building Professionals

The professional sectors grouped in the discussion in this section—building inspectors and code officials, residential home builders, commercial developers and construction companies, architects, utility engineers and energy service professionals—will play very important roles in expanding the markets for PV. Surveys and anecdotal evidence suggests that these professions are still largely unfamiliar with PV. This indicates that education for these groups is needed on two levels: general awareness and technical familiarity.

General awareness of PV within these professions will be affected by the national campaigns targeting the larger public, but each of these professions has trade journals and annual meetings that could serve as more direct conduits to raising awareness levels. Technical familiarity with PV technologies will increase through: 1) such professionals’ voluntary attendance at nonprofessional specific PV training seminars, and 2) incorporating PV training directly into the continuing education programs offered by professional associations and state-mandated continuing education programs.

For each group of professionals described below, we identify the unique roles the professional group plays in expanding the use of PV; we describe an ideal state in terms of levels of awareness and market penetration; and we conclude with recommendations for steps to move toward the ideal state. In most cases, it should be emphasized that the recommendations are first steps—*what we can do now*. As markets expand, new opportunities will arise and changes in strategy may be necessary.

1. Educating Building Inspectors and Code Officials

Everyone has heard the horror stories about code-compliant PV systems’ not being approved by an electrical or building inspector because the inspector was unfamiliar with PV. Although such situations appear to occur rarely, the industry remains concerned.

Nationally only 2% of electrical inspectors have received PV training.²⁸ At the center of the issue is the fact that building inspectors have local autonomy;²⁹ they are not bound by national codes and, in most cases, not bound by state codes either. Most local (city or county) building inspection departments do look to the National Electric Code (NEC), which is revised every 3 years and

²⁸Ward Bower, presentation during the NCPV Program Review Meeting, Golden, CO, Sept. 11, 1998.
²⁹Generally speaking, there are two types of building inspectors: 1) public inspectors that come at the time of construction and 2) private inspectors that inspect homes and buildings at the time of sale. In most cases, PV installers will be dealing with city or county building inspectors.

published by the National Fire Protection Association, but inspectors are not obligated to approve systems that are installed in compliance with the NEC if they are not comfortable with the system for any reason. As written by one of the respondents to our survey: “Inspectors are usually not interested in the fact that a PV system owner is saving the planet if they feel that safety is being compromised to accomplish that laudable goal.”

Most problems start because a code official is not properly briefed on the installation. Showing a code official concern about the issues he or she cares about can help ensure a smoother inspection process. In most cases where inspectors are unfamiliar with PV, it is the job of the PV installer to explain the system to the inspector.

One thing that makes it difficult to reach local code officials from the top down is that only four states—New Jersey, North Carolina, Ohio, and Virginia—have state authority over licensing of local inspectors; most states leave licensing of inspectors to authorities at the local level.

- ⇒ ***In states where there is no state inspection office, PV advocates should encourage state inspectors’ associations to incorporate PV into their continuing education programs for inspectors.*** In most states, these professional associations will be the most effective way to reach inspectors from the top down. Most state inspectors’ associations have membership enrollments between 25% and 50% of state inspectors.
- ⇒ ***In the four states with jurisdiction over city and county inspectors, PV advocates should encourage states to incorporate PV into their continuing education requirements for inspectors.*** All four of the states with such jurisdiction—New Jersey, North Carolina, Ohio, and Virginia—have continuing education requirements. In New Jersey, for example, inspectors must have at least 3 days of continuing education within 3 years, and the Licensing Department’s Education Division accepts proposals for seminar topics each year.
- ⇒ ***The PV industry and nongovernmental organizations should encourage state-sponsored energy code training groups, which educate building inspectors in several states on new energy code standards, to incorporate PV topics into seminars.*** There are several energy code training groups in the country.³⁰
- ⇒ ***The PV industry and nongovernmental organizations should incorporate into all PV installer training courses a section on how to address the primary concerns of local code officials and how to relay to code officials the information they need to accept PV as a viable component of a home or commercial building.***

2. Educating Residential Home Builders

The role of home builders in expanding markets for PV is enormous given the amount of personal contact that homebuilders have with such a large sector of society. Whether or not an architect is involved in the project, a home builder has considerable contact with the homeowner and developers—and home builders will play an increasingly important role in the expansion of PV as the trend toward building-integrated PV (BIPV) continues.

³⁰Southface Energy Institute in Atlanta, Ga., is one example of organization providing such training.

Ideally, residential home builders will understand principles of building orientation, the importance of efficiency as the first step, different mounting options (i.e., roof jacks, ballasted systems, ground mounting, or building integrated), and that PV is a valuable addition both in off-grid and grid-tied settings. In most cases, it would not be expected that a general residential building contractor would itself be making PV installations, so another key to the process is putting general contractors in touch with PV installers (“PV subs”) or electrical contractors who are familiar with PV.

- ⇒ ***The PV industry and nongovernmental organizations should educate home builders who are already building highly energy-efficient homes, passive solar homes, and homes with active solar system.*** There is a small but growing population of home builders who are already building these types of homes, and many states have directories or lists of these companies or individuals. We are unaware of any present attempt to develop a comprehensive national directory or database of these builders, but this should be undertaken by the Energy Efficient Building Association, American Solar Energy Society (ASES), National Association of Home Builders (NAHB), Passive Solar Industries Council, or other appropriate national organizations.
- ⇒ ***The PV industry should educate modular home builders on methods of incorporating PV into their designs, be it building integrated or roof mounted.*** Avis America Inc. and Bradley Builders are just two examples of manufactured home builders that are already incorporating PV into their designs. Such companies could be used as models to encourage other manufactured home builders to incorporate PV.
- ⇒ ***PV industry representatives should attend the National Association of Home Builders (NAHB) annual conference, as well as the NAHB’s state-affiliated conferences, to raise general awareness of PV technology and building products and to offer educational seminars.*** NAHB holds an annual conference every January and the local-level association of home builders typically hold meetings monthly.
- ⇒ ***PV industry representatives should encourage the Graduate Builder’s Institute (GBI), a national trade group, to incorporate PV into its professional development program.*** GBI certification, though not a requirement for home builders, is a symbol of excellence for those wishing to stay within the forefront of the profession. In order to have GBI certification, builders have to complete nine courses (approximately 6 hours each). In addition, to retain certification, builders are required to have 6 professional development hours every 2 years. Two PV courses could be offered in GBI’s professional development program: one on PV fundamentals and another on residential PV applications.

3. Educating Commercial Developers and Construction Companies

Much of what can be said of residential builders also applies to commercial builders. Commercial buildings use roughly 29% of the nation’s electricity³¹ and are therefore are a major market for PV. More than in the case of residences, commercial buildings typically have load profiles that match up well with PV availability. In the ideal state, commercial builders and developers will view PV as a

³¹Energy Information Administration, *Electric Sales and Revenue 1996*, DOE/EIA-0540 (96) (Washington, DC: U.S. Department of Energy, December 1997).

valuable peak shaving technique and as an aesthetically valuable addition. A growing number of commercial development firms will serve to push the market by incorporating building-integrated photovoltaics (BIPV) into their plans. Those developers and builders not aggressively pursuing this option should be generally familiar with PV, knowing how to contact builders or specialists with more knowledge.

- ⇒ ***The PV industry should use high-profile examples to spread the word about PV within the commercial building industry.*** The focus here is on sexy new products that add value to a building as well as increase tenant or potential tenant interest. Examples include the new #2 Times Square Durst building, the Natatorium in Atlanta, the Intercultural Center at Georgetown University, the Recycling Center at Rikers Island, the Bradlee's Department Store, the Ell Student Center in Massachusetts, Applebee's Restaurant and Central Carolina Bank building in North Carolina. Slides of these and other attractive examples should be made more widely available for presentations to the commercial building industry.
- ⇒ ***The PV industry and nongovernmental organizations should target commercial builders and developers who are already incorporating energy-efficient features, passive solar design, daylighting, and active solar systems for educational efforts.*** Workshops and training sessions in PV commercial building applications for these builders and developers could be held through the solar center structure and training organizations described earlier.
- ⇒ ***The PV industry should take advantage of existing forums such as the Building Owners and Managers Association (BOMA) annual conference and office building show to educate commercial developers and construction companies about PV.*** At the BOMA conference, over 400 exhibits on new products and concepts are presented. Additionally, the PV industry should advertise and publish in *Skylines Magazine*, BOMA International's official publication. *Skylines Magazine* presents monthly news articles covering the latest legislative, regulatory and codes activities, as well as information on emerging technologies.

4. Educating Architects

With the increased use of building-integrated PV (BIPV) and the importance of general building orientation, architects are a critical profession to educate on PV. Homebuyers come to architects for advice, and as one survey respondent noted, "If the architects do it, the contractors, inspectors, etc., will eventually have to learn about it too."

In the ideal state, all architects not only would be familiar with PV but would also have received some training on PV technology as part of their education in school or through continuing education seminars. Getting to this state will require that university architecture programs have offerings in solar design which will incorporate PV with passive concepts and other active solar systems. The American Institute of Architects (AIA) also must offer aggressive support for PV through its journal and continuing education requirements.

- ⇒ ***PV advocates should encourage universities to incorporate a complete solar offering—passive/daylighting/solar domestic water heating/building-integrated PV (BIPV)—into their architecture curricula.*** In conjunction with general curriculum development, funding

- needs to be made available for university and private architectural research in BIPV. Such research will spawn a wave of architects who specialize in BIPV and expand its applications.
- ⇒ ***PV advocates should encourage the American Institute of Architects (AIA) to support PV through its educational efforts.*** The AIA has a continuing education requirement of 9 hours per year. Many active architects have no problem meeting these requirements, so attracting architects may depend more on the content of the course than the fact that the course is certified by the AIA as a continuing education course. Workshops focusing on all building-specific PV applications, with a strong BIPV component, should be provided by the AIA.
- ⇒ ***A list of architects with passive solar and daylighting backgrounds should be maintained by the AIA, Passive Solar Industries Council, American Solar Energy Society (ASES), or other appropriate national organizations for referral purposes and should be widely disseminated to home builders and commercial developers.*** Architects with passive solar and daylighting backgrounds are the architects most ready to incorporate PV into their designs.

5. Educating Utility Engineers and Energy Service Professionals

Many utilities and utility personnel have traditionally been viewed as barriers to the expansion of the PV market. From many utilities' perspective, PV is a threat to the utilities' existing customer base. Fortunately, things are beginning to change. With electric utility industry restructuring sweeping the nation, utilities are in the most flux since the passage of the Public Utility Holding Company Act (PUHCA) and the Federal Power Act (FPA) in 1935. This situation is forcing utilities to reevaluate their roles and, most importantly for the PV industry, most utilities are in a position where they must market themselves to their customers. PV has therefore become a popular marketing tool for several utilities.

As a result of the leadership of the Utility Photovoltaic Group (UPVG)—an association of 101 utilities interested in PV development in the utility industry—there are now more than 25 “green pricing” programs being offered by utilities, and the number is growing rapidly. A number of big programs are being cost shared by the U.S. Department of Energy (DOE) through the UPVG’s TEAM-UP program, which supports utility PV programs. Readers will be familiar with PV “green pricing” programs being offered by the Sacramento Municipal Utility District (SMUD), Detroit Edison, Hawaiian Electric Company (HECO), and others.

With utilities going through so many changes, it is difficult to define an ideal state of affairs in terms of utility personnel because so many of the services we associate with utilities will soon be offered by nonutility entities. Nonetheless, it remains an important step to familiarize and educate utility personnel in the value of PV as a distributed peak shaving mechanism and as a customer-oriented marketing tool.

On a technical level, utility engineers must be knowledgeable about PV interconnection issues and must be educated on the safety and power quality mechanisms that are built into modern inverters. Without such knowledge and understanding, utilities can create barriers to grid-connected PV that are

truly formidable, ranging from the requirement of expensive safety equipment to unreasonable contract and insurance requirements.

- ⇒ ***The PV industry and nongovernmental organizations should accelerate the Electric Power Research Institute's (EPRI) research into PV as a distributed power resource and get EPRI more involved with TEAM-UP projects.*** Although its activities in PV have been limited, EPRI is currently involved with two of the TEAM-UP projects.³² Through its research and journal, EPRI can offer a reputable endorsement for PV as well as a location for technical information and advice.
- ⇒ ***The PV industry and nongovernmental organizations should increase funds for the Utility Photovoltaic Group's (UPVG) TEAM-UP program, which supports utility PV programs.*** Since 1994, the TEAM-UP initiative has provided \$15 million in U.S. Department of Energy (DOE) funds to mesh with \$58 million from private industry for TEAM-UP ventures. These ventures will result in over 2,500 PV installations that will total more than 7.5 megawatts of power.³³ Increasing funds for high-profile TEAM-UP projects will encourage utilities to join UPVG.
- ⇒ ***The PV industry and nongovernmental organizations should expand the National Photovoltaics for Utilities program (PV4U) and its 14 state working groups or collaboratives to serve as the principal state-level forum for education of utility officials and closely related stakeholders—for example, utility regulators, environmental and consumer groups, governmental agencies, educators, and the PV industry.*** A short-term goal should be to assist PV4U in establishing new groups in 10 additional states.
- ⇒ ***The PV industry and nongovernmental organizations should engage energy services organizations such as the National Association of Energy Service Companies (NAESCO) and the Association of Energy Services Professionals (AESP) in educational efforts.*** Educate these professionals on the evolution of the PV industry and the areas and situations which make PV more competitive than traditional energy systems.
- ⇒ ***The PV industry and nongovernmental organizations should organize specific seminars for utilities on the business opportunities for utilities in PV.*** Under utility restructuring, PV will be screened more from a business perspective by utilities than as a research and development program. Many utilities are not, for example, fully aware of the tremendous growth rate of the PV industry (42% in 1997)³⁴ and the corresponding international and domestic sales potential.

³²For more information about TEAM-UP projects with which the Electric Power Research Institute (EPRI) is involved, see the Web site: www.upvg.org/upvg/tugca1+2.htm

³³For more information on TEAM-UP, see the Web site: http://www.upvg.org/upvg/team_mn.htm

³⁴Christopher Flavin and Molly O'Meara, "Solar Power Markets Boom," *World Watch* 11, no. 5 (1998) 23-27.

D. Educating Financial and Related Professionals

The professions grouped in this section—lending firms and agencies, appraisers, and realtors—each play key roles in the process of carrying PV projects through to completion. These financial and related professionals have a great deal of direct contact with clients and, in the case of lenders and realtors, they are in positions to offer advice. In the ideal state, these professionals will become PV advocates.

1. Educating Lending Firms and Agencies

Finance receives a great deal of discussion among PV advocates for very obvious reasons, but how to reach out to and educate financial professionals is not so clear. In interviews with bankers and trainers around the country, one distinct message has come through: There is little need to educate bankers and other lenders on PV beyond the stage of general familiarity.

Lenders do not need to know how PV works but need to feel comfortable that PV is part of the mainstream. A home with a PV system is similar in concept to a home that has well water instead of city water or a home with a septic tank instead of municipal sewage. Septic tanks and well water are so common as to be taken as viable, mainstream options to municipal utility services. In the ideal state, PV will be viewed in the same light.

Another concept that came out of our interviews is the “check box.” As soon as PV is simply another home feature that has a check box on a lending form, it will have officially come into the mainstream. Lenders, the thought goes, will need no further education beyond recognition of “PV” on a standard form.

- ⇒ ***The PV industry and nongovernmental organizations should start from the top down by educating federal lending agencies about PV.*** About half of all new single-family mortgages originated today are sold to secondary mortgage market conduits such as Freddie Mac, Fannie Mae, or Ginnie Mae (FHA/HUD mortgages).³⁵ Primary mortgage lenders look to the secondary mortgage market conduits for guidelines in the form of handbooks and standardized forms. All household systems have a standard they must meet in order for a home to qualify for a mortgage; there does not exist, however, a standard for complete PV systems. The major secondary mortgage market conduits need to develop lending handbook chapters on PV outfitted homes, just as they have for energy efficient homes. This is a lengthy process that the U.S. Department of Energy is now giving considerable attention.³⁶
- ⇒ ***The PV industry and nongovernmental organizations should create tailored seminars for bankers and mortgage lenders that focus on the economics of PV and provide these at the national, state, and local level.*** Plenty of workshops on technical PV topics exist, but not enough are tailored to educate lenders—at their level.

³⁵For more information on federal mortgage lenders, see the Web site: <<http://www.freddiemac.com/function/fm-homby/homefaq.htm>>.

³⁶Phil Overholt, Photovoltaics Program, U.S. Department of Energy, Washington, DC, personal communication, Sept. 3, 1998.

⇒ ***The PV industry and nongovernmental organizations should encourage interaction between PV installers and lenders.*** A valuable referral network can be established whereby installers inform clients which lenders will make loans for PV. Lenders, in turn, can direct interested clients to PV installers. These referrals can also be done by a state entity, such as a solar center, a state energy office or state chapters of national solar organizations.

2. Educating Appraisers

Educating appraisers on the value of PV is a double-edged sword. As one survey respondent noted, “No, no, let them not know [about PV]—they’ll raise the assessed value of your property and PV owners will have to pay more in property taxes.” With an assessed value at \$20,000, a PV system may increase annual property taxes by as much as \$250.

What exists is a conflict between the activities of public inspectors whose job is to assess values for property taxes and private inspectors whose job is to assess property values as part of the process of a sale. In the ideal state, appraisers will have a working familiarity with PV and be able to make accurate valuations. As a tool for expanding markets—and ensuring the appraiser knowledge does not hurt PV— it is important that more states consider exempting or limiting the value of PV for property tax purposes. This points to a discussion of property tax policies which is beyond the scope of this section, but was emphasized by those interviewed.

⇒ ***The PV industry and nongovernmental organizations should seek to have states incorporate PV into the continuing education requirements for appraisers.*** Most states require appraisers to complete a certain number of continuing education hours in order to keep their license. State level approval must be sought for PV seminars to be incorporated into the continuing education offerings.

⇒ ***The PV industry and nongovernmental organizations should engage the Appraisal Institute to set up a PV program that qualifies as a continuing education program.*** The Appraisal Institute is a national organization with state chapters that have an enrollment of roughly 25% of all appraisers in the United States. Members of the Appraisal Institute must complete 20 hours/year in continuing education programs. In order to arrange a program that qualifies as a continuing education program for the Appraisal Institute, approval by the state must first be awarded before approval by the Appraisal Institute can then be granted. If granted, the Appraisal Institute will setup the program, supplying a venue and possibly providing a stipend for expenses.

⇒ ***In states where PV systems are exempt from property taxes, the PV industry and nongovernmental organizations should organize seminars for tax assessors at the annual state meetings to alert them of this tax exemption and briefly educate them on the components of a PV system.*** Articles in their trade journals and the distribution of information fact sheets can also alert them to this issue.

3. Educating Realtors

As consultants to buyers and sellers of residential and commercial property, realtors serve an important sector of the population, and need to be able to effectively convey PV's value to potential buyers. The history of other solar technologies is strewn with countless examples of potential solar home purchases that were negated by realtors who discouraged their clients from such purchases, often because of poor information or a lack of understanding of solar principles and technologies.

It is important to remember that realtors make their money from the real estate transaction and they want to make these transactions happen as quickly as possible. If a client wants PV and the realtor does not understand it, then the transaction can become delayed unless the realtor persuades the client to drop the PV approach. Thus, educated realtors are critical to the widespread residential use of PV.

Toward the education of realtors, the U.S. Department of Energy's (DOE) Denver Regional Office has developed an educational piece that targets this professional group. This document will be available from DOE in the fall of 1998.³⁷

- ⇒ ***The PV industry and nongovernmental organizations should educate realtors on PV through continuing education programs.*** Realtors are required to pursue continuing education requirements. All states but New Jersey, which will join the others soon, have continuing education programs; however, each has its own set of rules and regulations.
- ⇒ ***The PV industry and nongovernmental organizations should educate realtors on PV at the REALTORS Annual Convention and Trade Exposition held each fall by the National Association of Realtors (NAR).*** This convention is an excellent forum for educational seminars. The 1998 convention will be held November 59 at the Anaheim Convention Center in Anaheim, Calif.
- ⇒ ***The PV industry and nongovernmental organizations should develop videotapes of PV homes that are appropriate for both realtors and clients and distribute through national, state, and local realtors' associations.***
- ⇒ ***The PV industry and nongovernmental organizations should hold educational events in conjunction with local realtors' associations.*** One venue should be the National Solar Homes Tour sponsored by the American Solar Energy Society (ASES) each October. Realtors routinely tour homes in groups to learn about offerings in the market and many are actively involved in their annual local Parade or Showcase of Homes. Also, provide 30- to 45-minute presentations on special topics in PV during regular meetings of local realtor associations. These can be made by local Solar Energy Industries Association (SEIA) and ASES chapters, solar centers, state energy offices, and similar organizations.

³⁷For more information about this brochure, contact Steve Sargent of the U.S. Department of Energy's Denver Regional Support Office, 1617 Cole Blvd., Golden, Colo. 80401, 303-275-4826.

IV. FINANCING PV EDUCATIONAL ACTIVITIES: WHERE WILL THE MONEY COME FROM?

In the absence of an overt energy crisis as perceived by the American public, public and professional PV education will occur only with a solid investment of dollars behind it. The situation with the California PV buydown program is a recent and clear indication of the need for public education and marketing. There, with public marketing and education efforts for residential consumers not yet underway, only 7% of the initial allotment of small system³⁸ buydown funds had been expended after 5 months of program operation.³⁹ With a \$3 per watt buydown, or about a 30% discount, one would have predicted that these funds would have been almost instantly swallowed up. But that has not happened.

In the arena of PV education for professionals, California is scrambling to train installers and inspectors, develop a certification process, and get an infrastructure in place that can handle a massive ramp-up of grid-connected PV installations. As the California Energy Commission (CEC) can attest, it is a huge effort to get this established while active funding and installation of systems is underway. Ideally, states should have the mechanisms in place in advance of starting their PV acceleration efforts.

Resources and funding are necessary for such an effort, however, and they are currently in short supply from the sources that have traditionally funded such activities: the U.S. Department of Energy, state energy offices, utilities, foundations, and industry. Beyond the obvious need for greater industry support, it appears that the best sources of funding for professional and public education about PV in the future will be threefold:

- *state renewable energy funds* created through system benefit charges as part of utility restructuring;
- *federal government sources* (if PV is a major component of a global climate change initiative or a national utility restructuring bill passes Congress with a systems benefit charge and or portfolio standard in place); and
- *utilities* that regard PV education as important to the success of their green power programs or meeting the solar portfolio standards established under utility restructuring.

Although it is beyond anyone's abilities to predict what funding will unfold, it appears that the next few years will find the most available funding at the state level where there are renewable energy funds as part of restructuring. Congress and the Administration could take several years to reach agreement on global climate change and utility restructuring issues and, without resolution of those issues, there appears to be little hope of major federal appropriation increases. Regarding utilities and portfolio

³⁸Small systems are those of less than 10 kW peak output. Under the rules of the California PV buydown program, a minimum of 60% of program funds are reserved exclusively for small systems.

³⁹For a discussion of California's Emerging Renewables Buydown Program, see Vincent Schwent and Thomas J. Starrs, "Government Buydowns for the Residential Market," *Expanding Markets for Photovoltaics* (Washington, D.C.: Renewable Energy Policy Project, 1998).

standards, this also may take years to gear up, as witnessed by the utility's objections to implementation of the standards in the first state to authorize them, Arizona.

If this is a realistic picture of the next 3 to 5 years, then it strongly suggests that public and professional education efforts should be directed at those states that have either enacted renewable energy funds or are seriously considering this possibility. This situation also underscores the importance of advocacy groups, trade organizations and other stakeholders needing to put energy into seeing that these funds are created in states undergoing utility restructuring.

Two states, Rhode Island and California, are already dispensing funds under the guidelines for renewable energy established by their restructuring legislation. California has set aside \$5.4 million, or 10% of the total funds set aside for emerging technologies (which includes PV), for marketing and education expenses. Arguments are being currently waged over how these funds should be spent, and it is too early to know whether the funds are sufficient to market this program to the residential sector over a 4-year period.

There is, in fact, no concrete formula to determine how much money should be allocated for public and professional education efforts. In California, in contrast to the residential market, commercial and industrial firms quickly used up their portion of the first allocation under the PV buydown program with very little public funds for marketing being expended. When marketing and education efforts can be limited to very specific audiences, costs can come down significantly. If the potential profit is great enough and the PV industry infrastructure is in place, then the private sector should contribute significantly to this marketing effort.

When the education and marketing efforts must be broadcast over a much wider audience, costs will go up considerably—and if the goal is to get beyond limited niche markets to widespread deployment of grid-connected PV, then there must be a formidable public and professional education effort put in place.

Funding should ideally begin first at its lowest level, as efforts are planned and media spots prepared for a limited number of states and target sectors; thereafter, the budget should ratchet upward as the program expands to more states and national campaigns. Although very preliminary and requiring much more extensive analysis, some ballpark recommendations for the major public and professional education activities advanced in this paper are shown in Box B.

**Box B: Ballpark Budget Recommendations
for Public and Professional Education Activities**

Activity	First Year	Fifth Year
National PSA Campaign	\$2,500,000	\$7,500,000
National Paid Advertising	2,000,000	15,000,000
National Solar Home Tour 2,000,000		750,000
Targeted Sector Campaigns	3,000,000	12,000,000
Earth Day 2000	1,000,000	
Sun Day 2003	100,000	5,000,000
Solar Centers	3,000,000	12,500,000
State Energy Offices, Cities & Nonprofits	2,500,000	9,000,000
Education Seed Grants	1,500,000	5,000,000
Professional Education & Training	8,500,000	20,000,000
TOTAL:	\$27,850,000	\$88,000,000

It should be emphasized that these numbers are preliminary and will need to undergo adjustments as more detailed plans are constructed for PV deployment. A recommended crude rule of thumb is that 10% to 20% of total expenses for a PV project should be reserved for public and professional education.

It should also be kept in mind that this is not a federal government budget, but drawn from all funding sources: state renewable energy funds, utilities, industry, the U.S. Department of Energy (DOE), other federal agencies, state agencies, and foundations.

V. ACTION RECOMMENDATIONS: PUBLIC EDUCATION AND PROFESSIONAL TRAINING

A. Action Recommendations: The Abbreviated List

The preceding sections of this paper have proposed a comprehensive, although not exhaustive, set of recommendations for PV education activities. The list of proposed recommendations is long—as there is much to do—but the recommendations generally fall into two major categories: first, educating the public, and second, educating professionals. In the absence of an overt energy crisis as perceived by the American public, public and professional PV education will occur only with a solid investment of dollars behind it. Thus, a third category of recommendations pertains to the financing of PV educational activities. If the commitment and courage of the nation's leadership is up to the task, the public and professional education needed to accompany a program to expand markets for PV can, assuredly, be delivered. In condensed form, our primary recommendations are as follows:

Education for the General Public

- ⇒ The PV industry and advocates must begin to use all aspects of the media along with national spokespeople and targeted events to promote public awareness of PV.
- ⇒ The PV industry and advocates should organize national broad-based campaigns around Earth Day 2000 and the 25th Sun Day.
- ⇒ The PV industry and advocates should utilize and expand local events and local institutions to promote PV awareness.
- ⇒ The PV industry and advocates should target specific market sectors that will act as early adopters.
- ⇒ The PV industry and advocates should encourage traditional educational institutions to shape future PV markets.

Education for Professionals

- ⇒ The PV industry and states should require certification of PV installers through accredited training institutions.
- ⇒ The PV industry and advocates should encourage the development of special PV education programs for professionals in real estate and finance-related fields who advise and provide financing for homebuyers.
- ⇒ The PV industry and advocates should provide special PV education programs for technical and building-related professionals who are essential to the deployment of PV.

Financing for PV Educational Activities

- ⇒ PV advocates should continue to seek resources for PV educational activities from a variety of sources: the PV industry, utilities, state and federal government, and foundations.
- ⇒ The PV industry, in particular, must step up to the plate and support an increasing number of education activities, including paid national advertising campaigns.
- ⇒ PV advocates should pay special attention to including PV and PV education in the state renewable energy funds established under state utility restructuring legislation.

B. Action Recommendations: The Full List

Our full list of recommendations that pertain to educating the public and educating professionals are summarized in Table 1 and Table 2. Table 1 pulls together the complete list of public education recommendations discussed in section II of this paper. Table 2 pulls together the complete list of professional education recommendations discussed in section III. Although these activities can be scaled up or down, they are essential to ensuring that PV sales are made to an informed and educated population and that quality systems are installed and maintained.

The six columns on the right hand side of each table use suns “☼” and dollar signs “\$” to assign responsibility for carrying out the recommendations and defining funding sources. Suns “☼” designate who should carry out the recommendation, and dollar signs “\$” indicate suggested funding sources. For almost every individual recommendation, there are multiple stars and dollar signs—an observation that strongly suggests that cooperation among many players will be necessary. Where multiple players and funding sources are listed, we have not attempted in the tables to flag the lead organizations or decide who should provide the bulk of the funding. Some of these interactions are discussed in the text of the report.

In both tables, “NGOs” (nongovernmental organizations) is used as a catch-all category that includes national nonprofits (such as the American Solar Energy Society and the Interstate Renewable Energy Council), local organizations, existing solar centers, and other organizations that are not foundations, part of government, or in the solar business. Note that there are no dollar signs under the NGO column while there are many suns. Although money ultimately will be flowing out of NGOs, we have attempted to specify the sources of funding for their various activities. This funding will generally come from foundations, the industry, or government.

**Table 1: PV Public Education and Awareness:
Summary of Action Recommendations**

PUBLIC EDUCATION FOCUS	ACTION AND RESPONSIBLE SECTORS \$ denotes funding source C denotes action source	Solar Industry	NGOs	Foundations	Local Govt.	State Govt.	Fed. Govt.
PUBLIC AWARENESS CAMPAIGN							
Using the Media	Expand and provide greater funding for the PV Compact Education Council.	\$	C	\$			
	Develop and distribute public service announcements (PSAs) for TV and radio.	\$C	C	\$		\$	
	Use paid advertising. Begin with pilot campaign to be developed and tried in several key markets.	\$C					
	Use celebrity spokespeople to promote awareness along with "content" spokespeople to educate.	C	C	C			
National Campaigns	Earth Day and Sun Day	\$C	C	\$C	\$	\$	
Local Events and Organizations	Festivals such as the Midwest Renewable Energy Fair	\$C	C	\$	\$	\$	
	National Solar Home Tour	\$	C	\$	\$C	\$	
	Cooperative Extension Service		C		\$C	\$	
	Network of Solar Centers	\$C	C	\$		\$C	

PUBLIC EDUCATION FOCUS	ACTION AND RESPONSIBLE SECTORS \$ denotes funding source C denotes action source	Solar Industry	NGOs	Foundations	Local Govt.	State Govt.	Fed. Govt.
TARGET SECTOR CAMPAIGNS							
Institutional Sector: Government Procurement Officials	Use Federal Energy Management Program (FEMP) to provide PV training for federal agencies.						\$C
	Make purchasing PV easier through packaged systems.	\$C					
	Have PV products included on "state contract" and bidder lists.	C	C			\$C	
Residential Sector: Builders & Homebuyers	Incorporate PV into the EPA's Energy Star Program.	C	C	\$		C	
	Expand the Home Energy Rating System (HERS) to all 50 states to serve as platform for Energy Star.	C	C	\$		\$C	
Industrial & Commercial Sectors	Convene a roundtable education session for industrial leaders considered early adopters.	C	C	\$			
Nonprofit Organizations & Schools	Expand funding and resources for the Utility Photovoltaic Group (UPVG) and the Interstate Renewable Energy Council (IREC) <i>Schools Going Solar</i> program.		C	\$			

PUBLIC EDUCATION FOCUS	ACTION AND RESPONSIBLE SECTORS \$ denotes funding source C denotes action source	Solar Industry	NGOs	Foundations	Local Govt.	State Govt.	Fed. Govt.
	Provide free site visits to schools and nonprofits to assess PV feasibility and provide follow-up.		C	\$		\$	
EDUCATIONAL INSTITUTIONS							
K-12	Assemble existing PV and renewable energy curricula for all grade levels.		C	\$	\$	\$	
	Reestablish the Junior Solar Sprint program for solar cars in schools.	\$C	C	\$	\$	\$	
	Create week-long summer teacher training institutes to establish "Master Solar Teachers."		C	\$	\$	\$C	
	Establish a central clearinghouse for K-12 renewable materials, and post these materials on the Internet.		C	\$			
Colleges and Universities	Reestablish comprehensive training and education programs in community colleges.	C	C		\$C		
	Colleges and universities with an active faculty may wish to host a solar center.	C	C	\$	\$	\$	
	Establish a National PV Internship and Cooperative Education Program.	\$	C			\$	
	Enhance student learning through national PV design competitions such as Sunrayce.	\$	C	\$		\$	

PUBLIC EDUCATION FOCUS	ACTION AND RESPONSIBLE SECTORS \$ denotes funding source C denotes action source	Solar Industry	NGOs	Foundations	Local Govt.	State Govt.	Fed. Govt.
POLICY-MAKERS							
	Use the Renewable Energy Caucus as a focal point for direct education of the Congress.	C	C	\$		\$C	
	In states with restructuring on the agenda, briefing sessions and written testimony needs to be submitted to state legislatures and public utility						
	Work with the state utility consumer advocate (or attorney general's office) to influence the Public Utility Commission.	C	C	\$		C	
	Organize steering committees to oversee local implementation.		C	\$	\$C	\$C	

**Table 2: PV Professional Education:
Summary of Action Recommendations**

PROFESSIONAL EDUCATION FOCUS	ACTION AND RESPONSIBLE SECTORS \$ denotes funding source C denotes action source	Solar	NGOs	Foundations	Local Govt.	State Govt.	Fed Govt.
		Industry					
PV Installers	Require PV installer certification and encourage PV installers to be licensed electrical contractors.	C-\$	C			C-\$	
	Require accreditation for training organizations.	C-\$	C			C-\$	
	State government responsibility for certification, but bring uniformity to training and certification.	C-\$	C			C-\$	
Building Inspectors and Code Officials	Engage states with state-level continuing education requirements and encourage state inspectors associations to incorporate PV into their continuing education offerings.	C-\$	C			\$	
	Encourage state-sponsored energy code training groups to incorporate PV topics into seminars.	C-\$	C			\$	
	Incorporate into <i>installer training</i> courses a section on how to address the concerns of local code officials.	C-\$	C			\$	
Home Builders	Target those home builders who are already building highly energy efficient homes and solar homes.	C	C				
	Target modular home builders.	C	C				
	Attend National Association of Home Builders (NAHB) national and state conferences.	C	C				
	Incorporate PV into professional development program. of the Graduate Builder's Institute (GBI).	C	C				

PROFESSIONAL EDUCATION FOCUS	ACTION AND RESPONSIBLE SECTORS \$ denotes funding source C denotes action source	Sola r Indu- stry	NGOs	Foun- da- tions	Local Govt.	State Govt.	Fed Govt.
Commercial Builders	Use high-profile examples to spread the word within the industry.	C	C				
	Target those commercial builders who are already incorporating energy-efficient and solar features.	C	C				
	Utilize existing forums such as the Building Owners and Managers Association (BOMA).	C	C				
Architects	Incorporate solar offerings into university architecture curricula and fund BIPV research.		C			\$	\$
	Engage the American Institute of Architects through its continuing education program.	C	C				
	Target architects with passive solar and daylighting backgrounds.	C	C				
	Increase funding for TEAM-UP and expand the National Photovoltaics for Utilities program (PV4U).	C-\$	C				\$
	Engage energy services orgs such as the National Association of Energy Service Companies (NAESCO).	C-\$	C				
	Organize seminars for utility on PV business opportunities in the restructured environment.	C-\$	C				
Lending Firms & Agencies	Start from the top down with federal lending agencies such as Freddie Mac, Fannie Mae, or Ginnie Mae.	C	C				C-\$
	Create tailored seminars for bankers and mortgage lenders that focus on the economics of PV.	C-\$	C				
	Encourage interaction between PV installers and lenders. Establish referral network.	C	C				

PROFESSIONAL EDUCATION FOCUS	ACTION AND RESPONSIBLE SECTORS \$ denotes funding source C denotes action source	Sola r Indu- stry	NGOs	Foun- da- tions	Local Govt.	State Govt.	Fed Govt.
	Engage the Appraisal Institute, a national organization with continuing education requirements for members.	C	C				\$
	Organize seminars for tax assessors at the annual state meetings to alert them of property tax exemptions.	C	C			C	
Realtors	Educate realtors on PV through continuing education programs.	C	C				
	Provide seminars at the National Association of Realtors' Annual Convention.	C	C				\$
	Provide videos of PV homes for realtors and clients through national, state and local realtors associations.	C	C				\$
	Hold educational events in conjunction with local realtor's associations.	C	C		\$	\$	

Appendix A:

Solar Community Survey Results

To determine the best strategies for educating the public and professionals regarding PV technology, the North Carolina Solar Center began by conducting a survey of the greater solar community. Approximately 454 industry, nonprofit, government and utility leaders were queried for their thoughts on the following items regarding public education and awareness:

- the three most important messages about PV to get out to the public;
- the best ways to get these messages out to the public;
- the biggest barriers standing in the way of the public embracing and using PV;
- the age groups of the public that awareness and education efforts should be focused;
- what they would do, as the head of PV deployment, to see that the public was aware of PV benefits and applications; and
- what they would do, as the head of PV deployment, to see K-12 students were educated in the fundamentals and applications of PV.

The leaders were also questioned regarding their thoughts on professional education, including:

- which sectors of professionals (12 choices given) were in the most need of PV training;
- whether PV installers should be certified;
- The minimum level of training that should be required for those installing PV systems; and
- Who should provide the certification if required.

Responses to the survey were received from 93 leaders (20.5% response rate), including most of the key organizations now presently engaged in PV work on the national level. The profile of the respondents is as follows: 41% industry, 17% state government, 15% federal government, 9% nonprofit organizations, 8% utility, 5% university and 5% other.

The results, summarized below, show consensus on some points and a fragmentation of opinions in other instances.

The Most Important Messages

Although the question of what were the three most important messages about PV was an open ended one, a clear consensus emerged. While the three messages below received a similar response, all other responses trailed considerably and were registered by only a few people in each instance.

Message	Percentage Listing
“It’s good for the environment”	56.8%
“PV works—it’s reliable”	45.9%
“PV is cost-effective and economically competitive... [in certain situations]”	43.2%

Interestingly, the third listed message, PV economics and cost-effectiveness, drew responses that were phrased in clearly uneasy ways, with many pointing out that we had to get across the situations where PV was cost-effective and where it was not.

Other messages recommended by several respondents in each case included: 1) PV promotes self-reliance; 2) The United States needs to retain its position as the world leader in PV/International importance of PV; 3) Explaining PV applications; 4) PV's real and happening NOW; 5) PV can be integrated into your home; 6) Energy efficiency comes before/goes hand in hand with PV; 7) PV is a quality/luxury product (where PV is not cost-effective); 8) PV is low maintenance; 9) Fossil fuel education along with PV education; and our favorite, 10) "PV is really cool!"

Best Ways to Get These Messages Out

Recognizing that the survey respondents are not, for the most part, media or outreach experts, below are the results to the question concerning the best media to use for a public education campaign. The survey asked the respondents to rank the options from 1 to 8, where 8 is the highest priority.

Strategy	Average Rating
Television	5.81
Newspapers	4.88
Radio	4.72
Exhibits	4.53
Other advertising	4.37
Workshops and seminars	4.28
Direct mailings	4.07
Fairs	4.01

In addition to these strategies, several people mentioned the World Wide Web and using utility bill inserts as effective means of getting the messages out to the public. Many people also mentioned that their choice of media strategy would be determined by whether they were trying to reach a targeted audience or the greater public.

The Mightiest Barriers for PV

The next survey question addressed the barriers to expanding the PV market. Given nine options and requested to rank them, 52% of the respondents stated that "Cost" was the greatest barrier of all. "Information" was second and was identified by 19% of the respondents as being the greatest barrier. The composite rankings, on a scale from 1 to 9, appear below.

Barrier	Average Rating
Cost	7.55
Information	6.34
Financing	5.93
Education	5.88
Leadership from policy-makers	5.36
Access to installers	4.68
Opposition from utilities	4.34
Access to equipment	3.93
Reliability of equipment	3.16

While cost is clearly the predominant concern, the solar community has identified information, financing and education as its next three greatest barriers to the use of PV. These results point to the importance of crafting a strong national PV education program.

The ranking of access to installers in the fifth position, or the middle of the pack, points to concerns about the existing infrastructure for PV. However, when it comes to the reliability of equipment, the solar community has great confidence in their products, placing it as the least important barrier of those listed. Leadership by policy-makers, later identified as the most important professional audience to be trained, is seen as only the sixth most important overall barrier.

Opposition from utilities, often seen in the past by some elements of the solar community as the greatest threat to PV's development, is ranked only seventh. This could possibly be explained by the achievements of the Utility Photovoltaic Group or by the present disarray in the utility industry as a result of restructuring efforts.

Targeting the Appropriate Population Groups

Survey respondents were asked to prioritize, on a scale from 1 to 7, the age groups of the population that they thought should receive the most attention for PV education and awareness efforts. The results are as follows:

Population Age Group	Average Rating
Young professionals	5.37
College and university students	4.74
Middle-age workers	4.52
High school students	4.50
Middle school students	4.17
Elementary students	3.28
Older Americans	3.12

In the associated comments received alongside these rankings, it is clear that “Young Professionals” are ranked so high because they are seen as being the group that will potentially purchase PV systems in the short term. A number of people felt that this should be the only focus—those who can be moved *now* to purchase PV—and that students of any age should not be given consideration. However, the fact that “College and University Students” were identified as the second most important audience to address, suggests that a majority of the respondents disagree with this philosophy.

If I Were the Head of PV for a Day...

Survey respondents were asked to state what steps they would take to see that the public was aware of PV's benefits and applications if they were in charge of PV deployment for the United States. They were also asked to identify the steps they would take to see that K-12 students were educated in the fundamentals and applications of PV. Allowed to provide their own responses, rather than select from a list, the responses ranged all over the map. They could not be grouped in any statistically significant manner, but a selection of general response themes are presented below.

- TV ad campaign with a catchy slogan and logo
- TV ad campaign with popular celebrity/leader
- Advertise the most cost-effective applications
- Solar demonstration sites in every community
- Solar installations on high-profile buildings

- Institute federal financial aid program of loans and tax credits
- Government purchasing and installation of PV to provide a given amount of power
- Institute utility commission policy changes with incentives for including renewables
- Educate the public on the dangers associated with the use of fossil fuels and nuclear energy
- Educate the public on the current, artificially low price of conventional energy

The Professionals Most in Need of PV Training

Twelve different professional audiences were identified and survey respondents were asked to rank them, from 1 to 12, in priority order as to those most in need of PV training. The rankings are listed below.

Profession	Average Rating
Electrical contractors	8.43
Builders	8.27
Policy-makers	8.01
Electrical/building inspectors	7.95
Architects	7.95
Lenders	7.01
Science teachers	6.59
Utility engineers	6.34
Electrical engineers	6.16
Appraisers	5.86
PV installers/dealers	5.85
Realtors	5.72

While it was not surprising to see electrical contractors ranked highest amongst priorities for training, given that they will be called upon to do a large number of the installations, PV installers and dealers were ranked much lower (11th), perhaps reflecting confidence in the abilities of those now installing systems. Significant, however, is the high priority placed on policy-makers. Given that they were not seen by this group as a barrier to PV, this suggests they are perceived as a major force in advancing PV in the future if they can be properly informed and educated.

The other important point to note from the above ratings is the importance placed on several aspects of the building profession. Builders, inspectors, and architects were ranked as the second, fourth, and fifth highest priority audiences.

To Certify or not to Certify...That is the Question

Should those installing PV systems be certified? This question, a historically thorny one, received a resounding “Yes!” from 85% of the respondents. This strong response suggests that the solar community and PV industry recognizes the importance of quality installation and is ready to put a certification process in place. This is significant and is discussed in more detail later in the section on professional education and training.

When queried as to the minimum length of training for PV installers, the following responses were received:

Minimum Level of Training	Percentage Listing
1 week	21%
1-2 days	16%
3-4 days	16%
2 weeks	12%
4 weeks	5%
No minimum requirement	7%

From these numbers, it is hard to tell where the bar for a minimum level of training should be set. Several respondents noted that it depends on knowledge of electricity, previous experience in installing PV, and a host of other factors. Perhaps the most significant thing we can discern from these responses is that over half (53%) of the respondents feel that adequate training can be accomplished in one week or less.

As to who should provide certification for PV installers if it were required, a “state licensing agency” was clearly preferred by the largest percentage (38%) of respondents by more than a 2 to 1 margin over “state energy office or solar center,” the second organization most often listed (16%). The remainder of responses was scattered among a number of other agencies and organizations.

Organization/Agency	Percentage Listing
State licensing agency	38%
State energy office or solar center	16%
Solar rating and certification corporation	15%
Community college/technical institute	14%
Solar industry association	13%
American solar energy society chapter/state nonprofit	6%
Institute for sustainable power	5%
Federal laboratory	1%