

**AMERICAN PLANNING ASSOCIATION
POLICY GUIDE ON
ENERGY**

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I. INTRODUCTION

The planning profession already recognizes the urgency of such issues as urban sprawl, the degeneration of inner ring suburbs, the disappearance of agricultural and green space land resources, and the proliferation of pavement. We can easily see the need to design ways to reduce our ecological footprint.

What is less obvious but equally important is that in order to create the sustainable communities we desire, we must also plan to first increase energy conservation and renewable energy production while significantly reducing use of non-renewable energy sources as well. Most Americans are unaware of the large role energy plays in their everyday lives, and particularly how today's energy production and consumption are directly connected to the condition of the environment, the health of the economy, and the quality of life that will be experienced by future generations.

The planning profession is well positioned to contribute to this aspect of sustainability planning for two primary reasons. First, the planner's role now includes a broad range of community-based planning functions. Second, as communities adopt the concept of sustainability and "smart growth," their expectations of traditional comprehensive planning and zoning processes become more complex. In response, planners are striving to keep pace with the environmental, social, and economic interconnections in their communities in order to provide the leadership comprehensive planning demands.

The power to shift energy habits and priorities is within reach of every individual American. Where we exercise the most control over our energy future is in our personal actions and professional practice. Thus, the most effective energy policy recommendations that planners develop will be those that guide and facilitate progressive citizen-level actions, decisions, regulations, and land-use policies that lead to energy market shifts towards competitive, healthy, and safe energy alternatives.

II. POLICY RATIONALE AND FINDINGS

This energy policy guideline addresses primarily non-transportation energy issues. APA's transportation-related energy policies are set forth in the *APA Policy on Surface Transportation* (adopted 1997), which is incorporated by reference in this policy guide. Smart growth planning initiatives generally address transportation energy use, but non-transportation energy issues such as clean energy and energy efficiency tend to be applied somewhat anecdotally to individual projects. The advantages of anticipating and managing other community energy needs are less obvious but no less important to "smart growth." For example, if a community chooses to promote renewable energy to increase self-reliance, a comprehensive set of energy efficiency goals will be needed to make this practical. Energy efficiency can also be an effective tool for designing economic development strategies (see Appendix A).

While planners can exert only minimal influence on the selection of energy sources, planners are in a position to greatly affect the demand, location, and mitigation of energy production. Through legislation that encourages and accommodates localized power production, sets standards for extraction and pollution, and establishes criteria for building and site design, planners can greatly affect energy choices and consumption.

At the same time, with the help of land-use and transportation planning, planners can influence their communities to reduce the need for energy and reduce the environmental impacts of electric generation and consumption and other energy resource use. In some instances, planners can also influence local energy decisions through the use of local subsidies and education.

Energy consumption becomes a significant land-use issue from a number of perspectives. These include the siting of energy generation and transmission facilities, renewable energy, natural resource extraction, transportation policy, resource conservation, industrial development, waste management, and site design. The planning profession is uniquely well placed to advance the adoption of resource sustainability principles through its comprehensive planning processes. The creation of "green buildings and infrastructure," such as LEED™ (Leadership in Energy & Environmental Design) standards for building design, will enhance our ability to reduce energy dependence and promote the conservation of resources.

POLICY FINDINGS:

1. **A safe, reliable energy supply is important to every community's health, safety, and commerce.**
 - a. Energy is not only a critical component to the functioning of our communities (both urban and rural) but also a major trade commodity and determinant of the country's foreign policies and strategies.
 - b. Utilities have historically made little substantive investment in transmission system improvements especially since deregulation appeared on the horizon. The August 2003 blackout brought this issue to public attention. It was not lack of power but rather the inability of the stressed transmission system to deliver on the demand. This triggered automatic controls to shut down plants and substations. These automatic shutdown controls are there for safety purposes.

- 2. The urbanization that has occurred over the past few decades has created a demand for energy that is quickly surpassing its current rate of production.**
 - a. Continued population growth and technological advances are generating higher demands for reliable energy supply sources. Right now, consumption patterns show that a tremendous amount of energy will be needed in the future to keep the national economy running. While capacity varies from place to place, this is where, with the proper guidance, community-based planning can begin to have some impact. Greater energy efficiency can be achieved through community commitment beyond individual efforts. Even with the advances made with alternative energy sources and conservation efforts employed, the need for new and upgraded electric generation and transmission facilities has continued.
 - b. Due, in part, to the country's increasingly electronics-based economy, electricity is the fastest growing segment in the American energy mix.¹
 - c. Americans now are spending 90 percent of their time indoors, in buildings that consume two-thirds of U.S. electricity.² Perhaps the majority of the time that Americans spend outside of buildings is spent in transit between them, generally as single occupants in fossil fuel powered vehicles.

- 3. Some of the most useful fossil fuel reserves, particularly petroleum, are not expected to last beyond the year 2050 at current consumption levels.³**

In the past decade from 1990 to 2000, proven oil reserves worldwide increased by only 4 percent. According to Kenneth S. Deffeyes, an acclaimed oil geologist, world production of oil will peak sometime this decade and will then slowly and irreversibly decline. Today the U.S. produces only 38 percent of the oil it consumes. It is now seeking solutions such as drilling in the Arctic National Wildlife Refuge. This will yield only 2 percent of U.S. annual consumption at its peak output, 25 years from now. That is unlikely to make even a small dent in the country's demand for oil.

- 4. The alternative energy industry has matured over the past few decades.**
 - a. Renewable energy equipment has become more reliable and economical, and installation standards are more professional.
 - b. There are a number of promising alternatives for electricity production including solar, wind, and alternative fuels that provide a balance of economic and environmental benefits.

- 5. Fair share or other equitable approaches are needed for siting energy generation and distribution facilities, and land-use plans and policies need to provide flexibility and guidance for communities involved in development of new energy sources.**
 - a. Potential sites are increasingly difficult to locate and approve due to environmental, land-use, social equity, and operational requirements.
 - b. Utility-scale renewable energy development is raising new siting and land-use issues.
 - c. The development of both renewable and non-renewable sources of energy presents specific challenges to the communities involved, including permitting

and zoning of facilities and support industries, provision of appropriate infrastructure, and worker housing.

6. The way we plan urban areas significantly affects the energy usage of individual building sites. Appropriate site design standards and building codes can encourage energy conservation and the use of renewable energy technologies on site.

- a. Most existing building codes ignore such considerations as latitude, elevation, microclimate, and building proportions, orientation, and size. This frequently results in requirements for excessive use of energy in buildings.
- b. The use of renewable energy equipment such as photovoltaic panels and solar water heaters is frequently discouraged in housing development covenants because people assume they will be unattractive.
- c. Energy professionals have developed a substantial number of technologies, policies, and education programs that promote sustainable use of energy resources. Many local government entities have received grants to incorporate energy efficiency and renewable energy into schools and other government facilities, and to increase public transportation. These projects have helped raise awareness of clean energy alternatives and have made these options visible to the public. In brief, there is evidence to suggest that in the absence of federal leadership, throughout the U.S. resource-efficient energy policy is being envisioned and formulated by consensus at the state, county, and municipal levels.

III. GENERAL POLICY STATEMENTS

Thus, in summary, APA supports the following policy position and specific policy statements:

POLICY POSITION:

APA and its Chapters recognize regional, community, and site planning and design as central and integral determinants of our nation's energy future and overall well-being. In response, APA and its Chapters endorse managing energy consumption and encouraging efficiency by modifying development patterns, architecture, and the design of household, commercial, transportation, and industrial technologies to reduce energy demand, and by forecasting the energy demand of long range land-use plans and strategies, and mitigating the impacts of that demand.

Furthermore, APA and its Chapters endorse supply side investments, subsidies, policies, and education that support clean energy fuels, renewable energy sources, zero-waste distribution systems, and the decommissioning of hazardous energy sources.

IV. SPECIFIC POLICY INITIATIVES

Policy Statement 1: APA and its Chapters encourage planners and decision makers to evaluate the effects of plans, programs, and policies on energy usage, and to determine how to reduce energy impacts by making more efficient use of all energy resources.

Initiative 1:

Reduce energy consumption through comprehensive planning and urban design that incorporates strategies for both mobile and non-mobile energy efficiency.

(Reference: APA Smart Growth Policy Guide and APA Policy Guide on Surface Transportation)

Reasons to support Initiative 1:

City planning and design that focus on efficient use of land resources for roads and infrastructure and that limit low density areas and segregated land uses can contribute significantly to lower energy consumption. Planners can directly affect the manner in which communities are designed and laid out. Therefore, planners can affect the amount of energy consumed in the construction, maintenance, and operation of their communities, and in the daily lives of community residents and businesses. Comprehensive and general plans should include land-use policies crafted to reduce energy consumption. At the same time energy conservation should be the basis for implementation strategies and programs.

Initiative 2:

Provide technical assistance for the development of guidelines and codes for energy-efficient site planning and building methodologies that take advantage of the energy flows of the natural environment.

Reasons to support Initiative 2:

Even though information about solar energy and other renewable energy sources has been available for decades, and demonstration sites and buildings have shown the potential for significant savings in energy use, these methods are still not part of mainstream design and construction. Buildings continue to be built that rely entirely on mechanical heating, lighting, and cooling systems regardless of environmental conditions. Development of rules and regulations that allow and encourage energy-efficient and environmentally sensitive design of buildings will have the potential to lower energy costs and reduce the country's dependence on foreign energy sources. APA encourages discussion with building code officials to ensure that local land-use standards are consistent with industry-wide construction and safety standards.

Initiative 3

Support programs to increase energy efficiency and reduce life-cycle costs of all construction projects, including public and institutional projects.

Initiative 4:

Support federal, state, and local programs that reward energy savings rather than consumption through incentives, appropriate subsidies, and regulation.

Reasons to support Initiative 4:

Currently tax incentives and sales tax programs promote the consumption of energy rather than lower usage and conservation of energy. By reviewing and revising these current tax incentives with utility providers, planners can play a role in promoting conservation of energy, thereby reducing the associated environmental damages.

Initiative 5:

Continue to support the Low Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program as means towards greater energy conservation.

Reasons to support Initiative 5:

Energy conservation is a top priority and the most important component of a sound energy program. This is particularly important for low- and moderate-income persons, who benefit from both technical *and* financial assistance in implementing low and no-cost methods for conserving energy in their homes. For instance, a full funding of a weatherization program requires a relatively small capital investment yet can go a long way to reducing LIHEAP expenditures in our most energy inefficient homes over the long-term.

Initiative 6:

Support education, incentives, and subsidies that reduce consumption at the individual level.

Reasons to support Initiative 6:

There are many programs aimed at reducing individual energy consumption, such as EnergyStar Rating Programs, home insulation, energy leakage tracking programs, smart technologies, and hybrid or electric vehicles. Incentives or legislation at the local level for more efficient use of energy can greatly promote the awareness and use of these programs. Many states have public benefits programs that direct ratepayer dollars into efficiency and renewable energy incentives programs. At the federal level there are a number of programs that can benefit communities and individuals including Zero-Energy Homes and Million Solar Roofs (DOE), and Fannie Mae energy-efficient mortgages.

Initiative 7:

Increase the corporate average fuel economy (CAFE) standards.

Reasons to support Initiative 7:

Given the high percentage of energy consumption for transportation, it is important to achieve as much fuel economy as possible in that sector. Average fleet fuel efficiency has actually decreased in recent years. The technology exists to increase efficiency. APA

supports efforts that require automobile manufacturers to meet ever-increasing CAFE standards without impacting safety or convenience as it has wide-ranging benefits from less fuel consumption to reduced air pollution.

Policy Statement 2: APA and its Chapters support legislation that will help to reduce dependence on fossil fuels and stimulate the development of renewable energy resources.

Initiative 8:

Develop and encourage appropriate applications of renewable energy.

Reasons to support Initiative 8:

Renewable energy is a means of attaining sustainability because it decreases dependence on fossil fuels and nuclear energy. However, renewable energy comes from a variety of sources, and different technologies are appropriate in different climates and circumstances.

There are a number of promising alternatives for electricity production that include solar and wind power and alternative fuels that promise to provide a balance of economic and environmental benefits. Planners are in a position to work with utility providers to plan for the land-use and infrastructure requirements of renewable energy production such that they only minimally impact the environment.

Initiative 9:

Support utilization of on-site, distributed generation technologies.

Reasons to support Initiative 9:

Some electric utilities are exploring the concept of moving away from large, centralized power stations designed to meet computer-projected demand, toward a diverse system that responds more directly to local needs. Distributed generation systems essentially generate electricity to be used on site, with any surplus power being fed back into the grid. These systems can be large or small and can use either renewable or fossil fuel power. Possible systems range from a set of solar panels on the roof of a home, to a small hydropower plant on a river, to a natural gas-powered micro-turbine at an industrial plant.

One important advantage of a distributed generation system is its close proximity to the user. Transmission requirements are reduced, as are the power losses that occur over long distance lines. Distributed generation is also an important trend, both for generation flexibility and energy security.

- a. APA encourages discussion with building code officials to ensure that local land-use standards proactively encourage the installation of renewable energy technologies.
- b. Local incentive programs, such as subsidies can also support many of these more environmentally friendly distributed energy resources, at long-term savings for the consumer.

- c. Smart growth planning could provide the forum for planners to broker open discussions between utilities and their customers regarding distributed renewable energy generation.

Initiative 10:

Support the adoption of consistent initiatives by state Public Regulatory Commissions nationwide for net metering, renewable energy portfolio standards, and the establishment of public benefits funds that encourage all customer sectors to conserve energy and invest in renewable sources.

Reasons to support Initiative 10:

Utility regulation is a state-level function, and there are currently a wide variety of rules and requirements among states regarding the promotion of renewable energy and distributed generation technologies as part of the nation's energy supply. At present, most states allow net metering,⁴ but requirements and guidelines are inconsistent, even within individual states themselves. Ten states have renewable energy portfolio standards in place, but requirements and deadlines vary. Another 10 states have some form of renewable energy power purchase obligations established. Public benefits programs are usually created as part of a utility restructuring effort, and they also vary widely by state. The energy efficiency and renewable energy programs are generally only a small part of the overall restructuring package.

Much could be done. Local and state APA chapters could establish an energy sub-committee to track the renewable energy policies and regulations of their state's utility regulatory commission, and keep abreast of statewide efficiency targets and renewable energy portfolios. Municipal and county planners can work with their state energy office to promote public education programs about green power and distributed generation.

Policy Statement 3: APA and its Chapters support the adoption of legislation and regulations that require the planning and evaluation of decisions regarding energy production, distribution, and use to mitigate associated adverse impacts.

Initiative 11:

Develop procedures and standards to ensure that siting decisions for energy generation, transmission, and distribution facilities will be evaluated to ensure consistency with community and regional development objectives, and the overall protection of public health, safety, and the environment.

Reasons to support Initiative 11:

The environmental impacts and other potential hazards of electricity generation and distribution may take years and huge investments to mitigate. Nevertheless, many energy facility siting and system design decisions are not subjected to the same comprehensive planning process and environmental evaluation that is required for other land-use decisions. Planners should be involved in the development of local and regional public

health, safety, design (particularly in redeveloping areas and scenic corridors), and environmental standards and hazard mitigation planning for power generation and distribution facilities to reduce their potential damage to the environment and achieve local and regional development objectives. These, in addition to the regular safety and maintenance precautions energy companies carry out, can help to reduce energy waste and as well as greatly minimize potential risks and damage to the a community.

Large power plants are often located in or near rural communities that rely heavily upon the taxes they generate to fund local government and schools. Such communities should be targeted for intensive ongoing planning expertise (that their local economies may not be able to afford) to help mitigate known and potential impacts. Additionally, these communities would benefit from economic development expertise to deal with the job losses and brownfields when their fossil or nuclear power plants make way for transition to other more sustainable sources.

Initiative 12:

Recognize that providing transportation options and good urban form design is the first step to changing pollution intensive choices for mobility. Actively promote alternative transportation modes through the planning and implementation of bicycle and pedestrian pathways and transit systems.

Reasons to support Initiative 12:

During the past century, the automobile has raised per capita consumption of both energy and space, thereby altering the form of 21st century American communities more than any other single variable. With cross-generational subsidies further hiding the costs of this technology, other choices for mobility quickly disappeared. Yet over the past few decades, it has been shown that with appropriate subsidization of transit and incentives for pedestrian and bike paths, people have been changing their mobility choices. People have been voluntarily selecting travel modes that are much less energy intensive and pollute less per capita than a single-occupied vehicle.

Initiative 13:

Develop community based lighting design guidelines that promote energy efficiency and safety while reducing light pollution or "sky-glow," light trespass on adjacent properties, and glare.

Reasons to support Initiative 13:

Since lighting in American communities is typically designed to attract attention or to limit safety liability, it is frequently excessive and poorly designed, sending half of the light directly skyward where it is of little use. These excess lumens create light pollution and waste significant amounts of energy. It has been estimated that a community of 100,000 people could save more than \$500,000 per year through improved lighting design.

For safety reasons too, light levels need to be maintained within a certain range, as over-lighting creates problems for drivers who pass through brightly lit areas and are blinded

as they pass back into darker areas. Over-lighting creates glare directly from the fixture, temporarily impairing vision. Light trespass, defined as unwanted light shining on adjacent property, clearly is inefficient and has a negative impact on the enjoyment and value of the affected adjacent property.

Community lighting guidelines need to address lighting that promotes "true color" in the physical environment, or the color seen by natural light. True color representation is necessary for efficient and effective crime prevention and detection. Lighting approaching true color also is important to enable EMS personnel to identify blood, oil, and other substances when attending an accident.

APA and its Chapters recommends working with the International Dark-Sky Association (IDA), the Illuminating Engineering Society of North America (IESNA), and the International Crime Prevention Through Environmental Design Association (CPTED) through their respective United States affiliates to recommend/establish community based and energy efficient lighting design options. Planners can also work with the state to establish statewide lighting standards for public spaces and thoroughfares.

Initiative 14:

Continue to reduce the negative environmental impacts of current fossil fuel extraction and electricity generation through research, technology, and community involvement.

Reasons to support Initiative 14:

The United States relies primarily on fossil fuel energy to generate electricity. However, the production and combustion of fossil fuels has tremendous impacts on air, water, and soil quality, which, in turn, can negatively affect the health of humans and other species as well as harming the earth's atmosphere. Despite the fact that stringent regulations have led to an ongoing decrease in pollution levels in the U.S. since the 1970s (with the notable exception of CO₂), pollution levels continue to rise because demand for all levels of energy continues to grow due to both population growth and increasing per capita consumption. The problem is compounded by the complexities of enforcing the Clean Air Act and other regulatory standards.

Transportation, stationary source combustion (primarily fossil fuel power plants), and industrial process emissions compose the bulk of anthropogenic sources of air pollution. Air pollution is implicated in a variety of health and atmospheric problems including respiratory disease and cancer, acid rain, ozone depletion, and global warming.

Pollutants produced when fuel is burned to generate electricity include nitrogen oxides (NO_x), which contribute to ozone (smog), fine-particle soot and acid rain; sulfur dioxide (SO₂), which contributes to fine-particle soot and acid rain; mercury, which is released to the air and deposited on land and water resources, concentrating in edible fish populations; and carbon dioxide (CO₂), which contributes to the greenhouse effect and climate modification.

Initiative 15:

Support the development of new renewable energy technologies and endorse an unbiased evaluation of their environmental impacts.

Reasons to support Initiative 15:

A wide variety of new renewable energy technologies are in development, primarily ways to harness energy from organic or biomass sources. Also, traditional renewable energy sources such as wind, solar, and hydropower continue to be refined. While renewable energy technologies show great promise for sustainable use, it is important that they be objectively evaluated for their impacts on the social and natural environment. Controversial questions have already been raised about the social impacts of siting wind turbines, the health impacts of burning biofuels, or the wisdom of promoting a hydrogen fuel cell future when either fossil or renewable energy must be used to produce the hydrogen.

Initiative 16:

The continued generation of electrical power from nuclear energy is a part of the mix of power sources, and while APA recognizes the benefits offered by nuclear energy, it advocates that the social and environmental concerns applicable to the siting and operating nuclear power plants, as well as the transportation and disposal of nuclear wastes continue to be addressed.

Reason to support Initiative 16:

The nation's 102 nuclear power plants supply 20 percent of all electrical power in the U.S. Nuclear power has a safety record that is better than coal-fired plants per megawatt hour and does not result in the production of greenhouse gases. Reactors can also be designed to "burn" up weapons grade materials left over from the Cold War. Most of the commercial nuclear power plants now operating will likely seek relicensing to allow continued operation for another 20 years. These plants must undergo a rigorous safety and environmental review by the Nuclear Regulatory Commission before being granted a renewal.

These plants are often located in or near rural communities that rely heavily upon the taxes they generate to fund local government and schools. Such communities should be targeted for intensive ongoing planning expertise (that their local economies may not be able to afford) to help mitigate known and potential impacts of nuclear plants.

Additionally, these communities would benefit from economic development expertise to deal with the job losses and brownfields when their nuclear energy plants make way for transition to other more sustainable sources.

Policy Statement 4: APA and its Chapters should work to promote environmental equity and justice with regard to energy production and distribution, and to assist communities with meeting the challenges inherent in the development of new energy resources.

Initiative 17:

Recognize that while energy is a commodity for sale and consumption, it is also a national resource that must be equitably managed.

Reasons to support Initiative 17:

The availability of energy is central to the functioning of our communities, yet the current management and distribution of energy has created great economic vulnerabilities. Making energy resources more affordable, with more stable pricing, and available to everyone in the community will require partnerships — governments, utility companies, private energy enterprises, and interest groups.

Initiative 18:

Integrate community energy efficiency goals into the "Smart Growth" planning process.

Reasons to support Initiative 18:

Planners in both urban and rural communities interested in "smart growth" should recognize the importance of integrating energy efficiency and energy resource management goals into their planning process. A plan for energy efficiency would address energy used for municipal services and infrastructure such as water and sewage treatment and street lighting, public buildings and facilities, and commercial, residential, and industrial uses.

Initiative 19:

Develop a fair share siting process for energy generation and distribution facilities that reflects sound environmental practice and does not place undue environmental justice burdens on any one community.

(Reference: *Policy Guide on Locally Unwanted Land Uses*)

Reasons to support Initiative 19:

There is a need to address environmental justice issues that emerge with the siting or maintenance of electrical generation and transmission facilities, fuel storage facilities, and other potential health hazards related to energy production and use. All stakeholders in the community should be involved in the formulation of appropriate solutions. The location of existing and new energy facilities should be part of a comprehensive planning process, which includes the opportunity for meaningful public participation and public consensus. New facilities should be consistent with local land-use plans and meet the most rigorous standards to protect the environment.

A clearly defined process is needed to establish priorities and requirements and identify participants/stakeholders in siting of new energy facilities. The process should ensure compliance with all applicable local, state, and federal regulations governing such issues as air quality, water/wetlands, land use, noise, cultural and natural resources, public health and safety, and other environmental issues in addition to ensuring that environmental justice issues are addressed. The location of energy facilities should be

part of a comprehensive planning process, which includes the opportunity for meaningful public participation and public consensus, in advance of the "public hearing to announce the new plant" scenario. The process also needs to ensure that a "fair" decision is ultimately made and ensure that energy generation facilities are not being disproportionately placed in low-income and minority communities. Planners should ensure and facilitate the involvement of the entire community, including low-income and minority populations, in the siting of energy facilities

Initiative 20:

Support efforts to include energy efficiency in all affordable housing guidelines.

Reasons to support Initiative 20:

Affordable housing programs make home ownership available to eligible low- and moderate-income families. The cost of owning a home, however, includes both the mortgage and the ongoing operational expenses, primarily the energy costs. Homes that are built for participants in affordable housing programs should be designed and built for energy efficiency to assure affordable energy bills as well.

Energy efficiency is particularly important in keeping affordable housing stock affordable. Particular attention should be placed on upgrading appliances, windows, doors, heating systems, and insulation in those units occupied by households that might not otherwise be able to make these improvements on their own.

The ability to afford heating and cooling is an issue that affects inner cities and rural areas alike. Low- and moderate-income persons pay a disproportionate amount of their annual family budget on heating and/or cooling their homes. Typically, this comes at the sacrifice of other necessary household expenditures. If people forego heating and cooling, substantial health impacts will arise.

Initiative 21:

Recognize that energy generation is also an economic development activity and plan adequately for all aspects of an energy generation and production facility and its workers.

Reasons to support Initiative 21:

Land-use plans and regulations should recognize and accommodate the types of development that support the various stages of energy related growth. For communities that are confronted with energy production, their land-use plans and policies should accommodate new energy growth through mechanisms such as flexible zoning regulations. Land-use plans should also be reviewed for sufficient developed and zoned industrial areas to accommodate support industry. In addition, the community plans and zoning regulations may need to address temporary housing for the facility's construction workers.

NOTES

¹ "U.S. Energy Consumption Patterns," Energy Information Administration, <http://www.eia.doe.gov/emeu/iea/wec.html>, Internet, accessed July 2002.

² Hawken, Paul, Amory B. Lovins, and L. Hunter Lovins. *Natural Capitalism: Creating The Next Industrial Revolution*. Boston: Little, Brown, & Company. 1999. p. 85.

³ *Ibid.*, p. 264.

⁴ Net metering allows the owner of a distributed generation system to direct surplus power back to the grid when their system is generating more power than they require, and draw from it when more is needed, generally at the same retail rate. While accessibility to interconnection is mandated at the federal level, net-metering rules and allowances vary widely from state to state.

APPENDIX A: ENERGY EFFICIENCY OPPORTUNITIES

Opportunities exist to improve energy efficiency in number of different sectors:

1. Residential
 - a. Structural materials and design, HVAC systems, and site orientation of single and multi-family homes
 - b. Home appliances, electronics, and lighting
 - c. Power tools and landscaping equipment
2. Commercial and institutional
 - a. Structural materials and design, HVAC systems, and site orientation of office buildings, retail, and other commercial buildings, government buildings, and facilities (including schools)
 - b. Office electronics and equipment, food service equipment, commercial business equipment, building maintenance and landscaping equipment, institutional and commercial lighting, hospital and medical equipment, municipal wastewater and solid waste management equipment
3. Industrial
 - a. Structural materials and design, HVAC systems, and site orientation of industrial buildings and facilities
 - b. Industrial process equipment, materials handling equipment, process monitoring systems
 - c. On-site electric generators
4. Agricultural
 - a. Structural materials and design, HVAC systems, and site orientation of agricultural buildings and facilities
 - b. Food processing and refrigerated storage equipment
 - c. Planting and harvesting equipment, agricultural waste management equipment
5. Transportation
 - a. Vehicles
 - i. All private, commercial, and government-owned vehicles used primarily for transportation including automobiles, vans, trucks, buses, RVs

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- ii. Construction and road-building equipment, road maintenance equipment
 - b. Road engineering
 - i. Traffic lights and timing
 - ii. Lighted road signs
 - iii. Integration of public transportation
 - c. Municipal transportation planning
 - i. Public Transportation
 - ii. Bicycle paths
 - iii. Urban walkability
 - 6. Infrastructure
 - a. Utility distribution systems including transmission and pipelines
 - b. Municipal and utility infrastructure planning

Additionally, one can target improved efficiency at four different levels.

- 7. Level One: Individual — through improved appliance design (rated by the EnergyStar program), building design (through double and triple pane windows where appropriate, energy leakage tracking programs, appropriate building siting, and arrangement of glass and ventilation systems), change in usage behavior
- 8. Level Two: System design — support research that reduces leakages through transmission, provide technology sources closer to the user
- 9. Level Three: Land-use distribution and community design — by reducing need for vehicular trips, excessive lighting, and encouraging energy efficient building designs.
- 10. Level Four — alternative and realistic choices for mobility — through the use of transit, walking/biking, and other less consumptive habits