



# Policy Statement

## **Common Sense:**

### **Making the Transition to a Sustainable Energy Economy**

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guided by the ASES Policy Committee  
May 2005

for the  
**American Solar Energy Society (ASES)**

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In the following pages I offer nothing more than the simplest of facts, plain arguments and COMMON SENSE, and have no preliminaries to settle with the reader...

Thomas Paine, Sec. III, Common Sense –1776

## American Solar Energy Society

The American Solar Energy Society (ASES) is the national individual membership organization dedicated solely to promoting solar energy technologies. Founded in the 1954 as a professional organization for those, often self-defined as enthusiasts, curious about and eager to attempt development of solar energy and other renewable energy sources. This became an international effort. In the 1990s ASES' mission became, not only to alert the world both to the near- and long-term disasters that will result from failure to act on behalf of renewable energy, but also to educate the world about the rapid gains in solar and other RE technologies that can replace fossil fuel and nuclear power. ASES has over 8,000 members and 25 state, regional and student chapter affiliates serving 34 states. ASES members are engineers, architects, scientists, researchers, educators, builders, planners and interested individuals who support the development and utilization of solar energy technologies. ASES is also the United States Section of the International Solar Energy Society (ISES) and works closely with ISES to promote the use of solar energy technologies worldwide.

The ASES mission is to advance the use of solar energy for the benefit of U.S. citizens and the global environment.

The ASES strategic goals are:

- Ensure that federal, state and local policies support the development and use of renewable energy—in addressing national, state and local policy positions or legislation, ASES supports the inclusion of all viable renewable technologies;
- Advance research, development, demonstration and use of renewable energy technologies;
- Educate consumers about renewable energy technologies;
- Prepare the future workforce for the transition to renewables and support continued development of professionals currently in the field. To support these goals, ASES operates the following programs:
- ASES publishes *SOLAR TODAY*—the Voice of the Renewable Energy Community—the award-winning magazine providing engaging articles on practical solar technologies. In addition to distribution to members, *SOLAR TODAY* is available by subscription and on newsstands nationwide.
- ASES sponsors the National Solar Energy Conference. This annual conference showcases the state-of-the-art in solar technologies.
- ASES sponsors the National Solar Tour in October each year. Over 75,000 people visit solar houses across the country at this annual event.
- ASES publishes briefing papers on the development of solar energy technologies. Written for non-technical audiences, these papers provide excellent background information for people unfamiliar with the field.
- The ASES bookstore is one of the most complete sources of solar and renewables related publications.
- ASES uses the media to educate the public on renewable energy technologies.
- The ASES Solar Action Network alerts members when to write their legislators in support of good federal, state and local solar policy.

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All photos are courtesy of the National Renewable Energy Lab, Golden, Colorado, and the individual noted with each photo.

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# Executive Summary

This policy statement—“Common Sense: Making the Transition to a Sustainable Domestic Energy Economy”—has been prepared by the American Solar Energy Society (ASES) to provide governmental and lay leaders with a better understanding of the need to exchange the nation’s current fossil and nuclear fuel standards for an energy economy based upon clean, available, renewable domestic energy sources such as solar, wind, biomass and geothermal. The necessity of the transition is based principally on the emergence of two very clear global trends:

1. The precipitous decline of available petroleum supplies and the estimated depletion of all petroleum reserves within the current century; and,
2. The destabilization of the Earth’s climate principally as the consequence of the increasing amount of greenhouse gases, mainly CO<sub>2</sub>, generated by human action—primarily the burning of fossil fuels.

The occurrence of global climate change and depletion of available petroleum reserves are matters of science—not conjecture.

Common sense suggests that something constructive needs to be done now to respond to the rapidly decreasing reserves and eventual effective loss of oil and the threat of catastrophic climate change largely caused by burning fossil fuels. What that something needs to be is the beginning of a meaningful replacement of dangerous or depletable energy sources like coal, oil and nuclear with cleaner and more available ones like solar, wind, biofuels and geothermal.

Neither ignoring the problem nor delaying substantive action for another twenty years is sound policy. If not arrogant, it is at least questionable to dismiss the overwhelming opinion of the scientific community. ASES believes the nation and world are fortunate to have available a portfolio of renewable energy technologies like solar, wind, biomass and geothermal that have shown themselves reliable and capable.

## **Economic losses to American business due to delay**

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Newly emerged and emerging clean energy technologies already generate billions of dollars of economic activity and power. World solar photovoltaics production grew to \$4.7 billion dollars in 2003.<sup>1</sup> Wind will experience double-digit annual growth well into the next decade. Investment in new wind power equipment totaled \$9.0 billion in 2003, up from \$7.0 billion in 2002.<sup>2</sup>

Unfortunately U.S. manufacturers are losing market share to foreign competitors. For example, the U.S. photovoltaic industry has lost its world leading position. In 1997 the U.S. industry had nearly 100 percent of the domestic market and more than 40 percent of the world market. In 2003 the U.S. share of the world market was only 14 percent. In 2003, shipments by U.S. manufacturers fell by 10 percent, while European shipments grew by 41 percent and Japanese shipments grew by 45 percent.<sup>3</sup>

The groundwork for a transition to a renewable energy economy has already been laid. The growth of a domestic clean energy economy will not only provide new jobs and investment opportunities, it will help U.S. companies to compete in the growing world market for renewable energy.

## Changing the nation's energy economy must be done in a measured manner

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Change is difficult. Changing the nation's energy economy is to change industrial and consumer cultures. Sudden change leads to confusion, chaos and massive inefficiencies, whereas, a more gradual and measured march allows the private sector time to make the changes in products, processes and investments needed to successfully accomplish the transition.

Measured action over the next decade will allow governments to propose and accommodate change. For example state and local governments will need to change existing building codes; builders will need to incorporate those changes in their practices and pricing; manufacturers will be required to ramp up manufacturing processes to meet demand; utilities will need to bring clean domestic energy alternatives into their portfolio of generating options; consumers must be educated about how their action, e.g. demanding more efficient automobiles and houses, is part of the solution; and, researchers require time to improve upon existing technologies and to create new ones.

The very magnitude of the needed change requires deliberate and gradual progress toward the goal of sustainability. A clean, sustainable energy economy cannot be accomplished in one giant technological leap. There is simply too much to change; expecting to do so overnight is impractical; more than that, it is impossible. Worst of all, continually waiting for the next big technology, perhaps hydrogen, forestalls needed near-term action.

To delay action is to risk disaster—more precisely, multiple disasters. Failing to make a timely transition to clean domestic energy sources will amplify the economic consequences of running out of oil. Being behind the supply curve means the economy will have to take the full brunt of the upward price spiral. Whereas the commercialization of clean ener-

gy alternatives decreases the cost by reducing demand and creates new opportunities for economic growth. A near-term shift to coal, nuclear and natural gas, as some advocate, does not provide either an effective or quick fix to the problem. These are solutions with a great deal of environmental and political downside. Meeting U.S. energy demand by importing LNG continues dependence upon foreign sources, increasing the use of nuclear fuel exacerbates the problem of storing and protecting radioactive waste, while burning coal adds to existing health and environmental problems. Overall the reticence of the U.S. government to reduce fossil fuel use and to commit to international efforts at reducing greenhouse gas emissions, i.e. the Kyoto Protocols, places the nation at odds with many of its closest political allies, in particular Great Britain.

It is no longer prudent to push off the start date of a true transition to reliance upon domestically available clean energy technologies and sources. Realizing the enormity of the task and political realities, ASES' recommendations focus on a first few steps that should be taken.

Renewable energy has proven it spans all national and socio-economic boundaries, as evidenced by a solar-powered yurt used as the renewable Energy Experiment and Demonstration Center in Hohhot, Inner Mongolia, China.



Credit: Jean Ku

# ASES' Recommendations



The Solar Patriot was recently "installed" in Purcellville, Virginia. The house is modular in construction and includes 6 kilowatts of PV modules, a solar water-heating system, an upgraded building envelope, and low-emissivity (low-e) windows. It will consume about 50% of the energy of a conventional home. The Solar Patriot was developed under the U.S. Department of Energy's Building America Program and was displayed on the National Mall in Washington, D.C. in April 2001.

These recommendations are only a beginning. ASES believes it imprudent to propose a massive new array of policies and programs. What ASES is proposing is possible and could be implemented by the 109<sup>th</sup> Congress over the next two years. Many of the recommendations, such as a national Renewable Energy Standard (RES) and a Renewable Fuel Standard (RFS), reflect proposed legislation that has been debated but not acted on for nearly a decade. Other recommendations, like net metering, are based on successful state efforts.

ASES' principal recommendation, however, is that the political leadership of the country at federal, state and local levels act now to begin the transition to a clean domestic energy standard.

## Specific recommendations

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The recommendations below include numerous terms that may be unfamiliar to the average reader.

Most of the terms will be defined later in the text or will be clear in context.

### Tax policies

- Remove selected federal subsidies for fossil and nuclear energy sources.
- Stabilize and expand the federal production tax credits for renewable energy sources.
- Apply the federal gas-guzzler tax to SUVs.
- Offer both state and federal tax credits for the purchase of high mileage and alternative fueled cars and trucks.
- Enact state and local investment tax credits for sustainable energy systems, products and designs.

### Built environment

- Establish a national Building Code Task Force to work with state and local jurisdictions in an effort to incorporate building energy efficiency standards, as well as the use of renewable energy technologies like solar water heating, into the design and construction of new residential, commercial and industrial structures. The objective should be to have building energy codes in every jurisdiction by 2007.
- State and local governments should amend local building, permitting and zoning laws to accommodate, encourage and expedite the construction of renewable energy projects.

### Electricity

- National and state Renewable Energy Standards<sup>4</sup>
- Expanding electric generating options to include distributed renewable energy systems
- National and state net metering laws
- National and state nondiscriminatory interconnection standards
- Expanding federal, state and local government purchases of green electricity, energy performance services and renewable energy systems.

### A national public education campaign

# Preface

Throughout history, scientific and technological discoveries have provided answers to problems once thought unsolvable. Whether the wheel or the semiconductor, advancements in learning and adoption of new products and processes based on such discoveries have contributed positively to the health, welfare and safety of succeeding generations.

The world is dynamic and so too is its need for new energy technologies; technologies that increase the efficiency with which scarce resources are used and that decrease reliance upon sources whose continued availability, safety and impact upon health can legitimately be called into question. Over the past several decades substantial public and private research of clean energy alternatives like solar, wind, biomass and geothermal has produced a portfolio of proven technologies that bring with them a wide range of economic, security and environmental benefits. Unlike traditional fossil and nuclear technologies, emerging clean energy alternatives come in a wide variety of shapes and sizes, lending themselves to both large and small-scale applications.

The American Solar Energy Society believes that now is the time to integrate these sources into the nation's mainstream energy economy. Expanded public and private investment in these technologies, at this time, offers a viable answer to growing concerns over global climate change and the availability of petroleum and natural gas supplies throughout the twenty-first century.

## **Renewable energy offers more than the solution to oil depletion and climate change.**

Its full benefits include reduced health consequences resulting from fossil fuel emissions; rural economic development in terms of new cash crops; new jobs; improved balance of payments as a result of sending fewer dollars overseas, reduced terrorist opportunities; and an improved national image abroad

The benefits of clean energy alternatives are numerous and well documented. To be realized, however, these technologies must be widely deployed on a large enough scale. Recognizing that change of such magnitude cannot occur overnight without disruptive consequences, ASES is putting forth a series of first steps that can sensibly and sustainably begin the transition to a clean energy economy and that are based on well recognized and reliable scientific and technological data.



Credit: Jean Ku



Credit: April Allerdice





The transition to a sustainable energy economy is the responsibility of all Americans

Some of the Society’s recommendations are based on successful state action (e.g., renewable portfolio standards and net metering), while others like production tax credits have already shown themselves effective in encouraging the growth of emerging clean energy alternatives in the private marketplace—but suffer from political inconsistencies. Another important recommendation, educating consumers, is intended to provide consumers with the information needed to make reasoned choices that are in both their own and the nation’s best interests. The transition to a sustainable energy economy is the responsibility of all Americans.

Credit: Seimens solar



**The overarching messages of this white paper are:**

- 1. Denying the existence of well-documented problems like the beginning of catastrophic climate change and the loss of petroleum makes no sense;
- 2. Making clean domestic energy sources the mainstay of the nation’s energy economy will take time to accomplish;
- 3. Today the nation has the experience and technology required to begin a measured march towards a clean energy economy, it need not wait for new technological discoveries;

Credit: Roger Taylor



Time is currently on our side, delaying the transition turns time into an enemy, while taking measured steps toward a clean energy future promises significant economic, environmental, health and security benefits. The choice to act now is simply a matter of common sense.

Page 4, left: solar water heater systems on rooftops in Kynming, Yunnan Provice, China; right: Bangladeshi electrical repair shop uses a solar-powered light and soldering iron. This page, top: portable PV units provide electricity to power computers in the desert; bottom: modern building with wind turbine in Brazil

# Introduction

Corroborating ASES' long held belief that ignoring the twin pandemics of diminishing petroleum reserves and global climate change can only lead to disaster are three recent articles in the mainstream press. According to the editors of *Fortune*, *Business Week* and *National Geographic* the world is confronting resource and climate change challenges of historic proportions and would be wise to do something substantive about them now!

Evidence is mounting that half the Earth's remaining available petroleum supply is about to be drained. Although estimates vary as to when the halfway mark will be reached, there seems no substantial disagreement about being close to that point. By some estimates the summit has been scaled, while by others it will be reached within the next few years. (See Chart Oil and Gas Liquids Depletion Scenario)

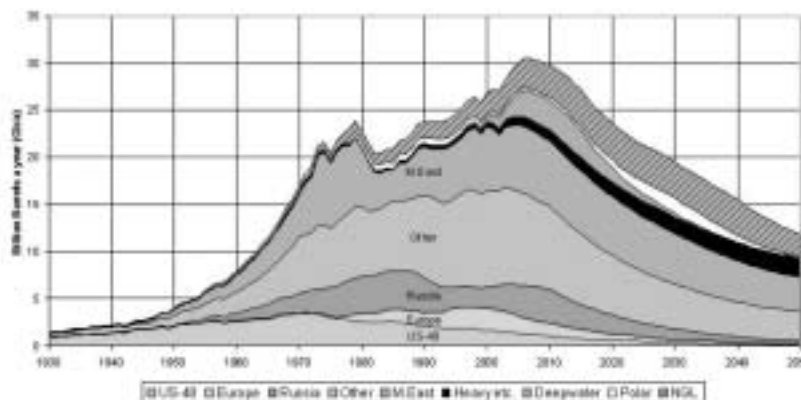
Climate change and man's impact on it is a scientific fact, not a political ideology! Its consequences cannot simply be measured in terms of degrees or its effect on non-human biological systems and species. Global warming must also be measured in terms of human life and the cash cost of responding to natural disasters like floods, hurricanes and typhoons. By comparison to the recent tsunami in

the Indian Ocean, the cost of global climate change will prove orders of magnitude greater. The faster the world slows global warming the less will be the human and economic costs of its consequences.

Although there are still some political leaders and a few scientists who believe "global climate change" is a scare tactic used by the environmental community, there is just too much independent evidence to take such claims seriously. "From Alaska to the snowy peaks of the Andes the world is heating up right now, and fast. Globally the temperature is up 1 degree Fahrenheit over the past century, but some of the coldest, most remote spots have warmed much more. The results aren't pretty. Ice is melting, rivers are running dry, and coasts are eroding, threatening communities.... These aren't projections, they are facts....

"Things that normally happen in a geologic time [thousands of years] are happening during the span of a human lifetime," says Daniel Fagre of the U.S. Geologic Survey Global Climate Change Research Program. In speaking about the glaciers that give Glacier National Park in Montana its name,<sup>5</sup> he ...laments, "It's like watching the Statue of Liberty melt".<sup>6</sup>

OIL AND GAS LIQUIDS  
2004 Scenario





As difficult as these dilemmas of climate change and diminishing oil may be, they can be dealt with successfully. ... the answer to one is the answer to the other.

It has taken 175 years to deplete half of the world's accessible oil reserves. It will take considerably less time to consume the rest of them. Increasingly exploration and extraction are becoming more costly as fewer major finds are made and the depth at which oil is found is increased.

**Our most dangerous addiction.** It is important to understand that an addiction to oil—not simply foreign oil—is the problem. Although oil supplies controlled by politically unstable countries give urgency to the situation, drilling new oil wells in the U.S. does not solve the problem. If anything, it depletes remaining reserves faster. Although much debated, oil in the Arctic National Wildlife Reserve, for example, will never amount to more than a few percent of current U.S. demand. Neither can these oil reserves be made available to the market in anything less than a decade. Investment in clean energy alternatives like solar, wind, geothermal and biofuels over the next ten years would have far more positive impact on both the availability and cost of energy to U.S. consumers than opening the Arctic to oil drilling.

There is a fixed amount of oil that can reasonably be retrieved from the Earth. Whatever the amount, when it is gone it is gone! Petroleum is the basis for much of what modern society produces and consumes. When the price of petroleum rises, so too does the price of synthetic fabrics, fertilizers, chemical feed stocks, car bumpers, medicines and the plastics used in consumer electronics. To lessen the economic impact of increasingly scarce petroleum and rising prices means we must focus on the most important uses of petroleum. It is a matter of common sense, therefore, not to use petroleum in those applications for which there are acceptable alternatives.

Burning petroleum as a transportation fuel is the least economically sound thing that can be done with it. The availability of renewable fuel alternatives and the potential of significantly improved mileage efficiencies mean that remaining oil supplies can be extended past the predicted end dates.

**The nation needs enlightened and committed political leadership** The potentially dire consequences of the paired pandemics of peak petroleum production and global climate change can be diminished—if not avoided—but only if political leaders use the available time and not wait to the last minute to recognize and act upon the problems. The nation, along with its elected leaders, must begin now with definitive steps designed to wean the United States from reliance upon fossil fuels—whether those fuels are found inside or outside of U.S. borders.

As difficult as these dilemmas of climate change and diminishing oil may be, they can be dealt with successfully. As overwhelming as the task may seem, the nation and the world are fortunate, nevertheless, that the answer to one is the answer to the other. Increased efficiency and the transition to biofuels and renewably derived hydrogen will protect the nation from the economic and political vulnera-

bilities that flow from reliance upon petroleum and other fossil fuels. The use of solar, wind and geothermal as primary energy sources for the generation of electricity will significantly reduce pollution and slow Earth's warming. Moreover, employing clean energy alternatives will increase economic opportunities, slow ecological degradation, improve human health and contribute to national security.

**Prudence, common sense, and courage.** It is no longer prudent to push off the start date of a true transition to reliance upon domestically available clean energy technologies and sources. Realizing the enormity of the task and the reality of politics, ASES' recommendations focus on a first few steps that should be taken. The recommendations are only a beginning. ASES believes it imprudent to propose a massive new array of policies and programs. What ASES is proposing is possible and could be implemented by the 109th Congress over the next two years. As noted earlier, many of ASES' recommendations reflect proposed legislation that has been debated but not acted on for nearly a decade. Others are based on successful state efforts. The proposals are neither radical nor fringe and represent the best of available and proven policy options.

ASES' principal recommendation is that the political leadership of the country at all levels, federal, state and local, act now to turn the nation toward a clean and sustainable energy future. As evidence has mounted that a global climate change of catastrophic proportions is occurring and petroleum reserves are diminishing, political leaders have fiddled but done little of substance to respond to the problems

**The challenge for public education.** ASES' objective in preparing and publishing this policy statement is to stimulate a dialogue between political leaders and the constituents they represent. Only when elected officials understand that their con-



London will be one of the first cities to go if the planet's ice continues to melt. Prime Minister Blair has ... gone so far as to state that global climate change—not terrorism—is the greatest threat to the world.

stituents believe an immediate transition to a sustainable energy economy is a national priority will something of substance be done.

Sustainable energy and environmental advocates have been predicting the coming of these problems for years. These predictions were passed off as hysteria. Now that they are happening, the nation's political leaders—from both sides of the aisle—must step up to the challenge.

Now should be a time of commitment by local, state and federal governments to place the nation securely on the road to a sustainable energy standard. ASES believes the recommendations of this policy statement reflect the minimum that must be accomplished within the next 12 to 18 months. Indeed, immediate action will not only reduce the costs of such a transition, it will also increase the benefits that can accompany such a change.

It is important not to speak in abstract terms when predicting the possibility of pandemics. Below is a brief discussion of the consequences of global climate change and the reality of petroleum depletion.

## Global Climate Change

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Global climate change is a complex and multi-faceted issue. To better understand its consequences it is useful to divide climate change into four impact categories.

1. The actual **physical impact on the environment** of global warming, for example, changing weather patterns including rainfall amounts and locations, changing average temperatures in particular regions, expansion/reduction of various natural habitats and the flora and fauna supported by them.
2. The **impact on human health** (morbidity/mortality) of both the causes of global warming (e.g., burning fossil fuels) and the physical consequences in 1 above.
3. The **economic cost** of climate change, that is, costs borne by governments, relief agencies, insurance companies, and other entities in responding to more severe/frequent natural disasters like typhoons and hurricanes, or in rising

health care costs because of higher incidences of respiratory and circulatory disorders brought on by pollution, or by private businesses attempting to mitigate the use of polluting fuels and through the loss of worker hours due to illness.

4. The **political cost** paid by polluting nations viewed by the international community as doing too little to contribute to a worldwide solution to the problem.

A destabilized world climate is projected to cause rising sea levels worldwide. “More than a hundred million people worldwide live within three feet of mean sea level.... Megacities where human populations have concentrated near coastal plains or river deltas—Shanghai, Bangkok, Jakarta, Tokyo, Miami, New York—are at risk. The projected economic and humanitarian impacts on low-lying, densely populated, and desperately poor countries like Bangladesh are potentially catastrophic. The scenarios are disturbing even in wealthy areas like the Netherlands or Florida, with nearly half their land-mass already near or below sea level.”<sup>7</sup>



This suburban Miami street was lit by solar power after Hurricane Andrew struck in 1992. Solarpal safety streetlights not only survived Hurricane Andrew, but lit their communities until grid power was restarted 33 hours later.

Global warming will continue to have multiple consequences, from melting the polar ice caps to radically changing weather patterns and increasing the incidence of respiratory and infectious disease. “Heating of the atmosphere can negatively influence health through several routes. Most directly, it generates more, stronger and hotter heat waves; episodes which become especially treacherous if the evenings fail to bring cooling relief. Unfortunately, a lack of nighttime cooling seems to be the emerging pattern; the atmosphere is heating unevenly and showing the biggest rises at night, in winter and at latitudes higher than about 50 degrees.”<sup>8</sup>

“Weather becomes more extreme and variable with atmospheric heating in part because the warming accelerates the water cycle—the process in which water vapor, mainly from the oceans, rises into the atmosphere before condensing out as precipitation. A warmed atmosphere heats the oceans, leading to faster evaporation. Hotter atmospheres hold more water than cooler ones. When the extra water condenses, it ...drops from the sky as larger downpours.”

“While the oceans are being heated, so is the land, becoming highly parched in dry areas. Parching enlarges the pressure gradients that cause winds to develop, leading to turbulent winds, tornadoes and other powerful storms. In addition, the altered pressure and temperature gradients accompanying global warming can shift the distribution of when and where storms, floods and droughts occur.”

**Global warming is a threat to human health.** Floods and droughts associated with an increasingly destabilized world climate undermine health because they promote “the emergence, resurgence and spread of respiratory and infectious diseases.” (Scientific American.com, August 20, 2000). Prolonged heat enhances smog production and the dispersal of allergens.<sup>9</sup> Floods, as well as droughts, promote the growth of parasites and mosquito-borne diseases like malaria, dengue and yellow fevers, as well as several kinds of encephalitis.

A recent article in *The Guardian* reads: “The monsoon flood which hit London and parts of Southern England on Tuesday, causing sewers to overflow and



NREL/Geothermal Resources Council



NREL/Green Mountain Power Corporation

Left: The Mammoth Pacific Power Plant, located in the eastern Sierra Nevada mountain range in California, showcases the environmentally friendly nature of geothermal power. Right: The 6.0-MW Green Mountain power plant consists of eleven 550-kW Zond Z-40FS wind turbines developed under the DOE Turbine Development Program. Construction crews cut as few trees as possible to build the Searsburg wind power plant. Now that construction is complete, the area around the turbines is being allowed to “brush in” and return to its natural state.

thousands of dead fish to float down the Thames, was a salutary reminder of the effects of worldwide climate change in the years to come.<sup>10</sup>” The article quotes Britain’s top scientist, Sir David King, warning that London will be one of the first cities to go if the planet’s ice continues to melt. Sir David is not alone in this judgment, as Prime Minister Blair has repeatedly echoed similar sentiments and even gone so far as to state that global climate change—not terrorism—is the greatest threat to the world.

Fossil fuel use is also having more direct and immediate health impacts, the increasing incidence of respiratory disease can be laid directly at the feet of fossil fuel, according to the Harvard School of Public Health.<sup>11</sup> Years of exposure to the high concentrations of tiny particles of soot and dust from cars, power plants and factories in some metropolitan areas of the United States significantly increases residents’ risk of dying from lung cancer and heart disease, states a study financed largely by the National Institute of Environmental Health Sciences and conducted by scientists at Brigham Young University, Provo, Utah; the University of Ottawa, Ontario; the American Cancer Society; and the New York University School of Medicine, Tuxedo, N.Y.

The findings of these and other studies corroborate what pathologists like Tony DeLucia, Ph.D., know to be the case. Dr. DeLucia is the immediate past chairman of the board of the American Lung Association. The Association was an active partner

in ASES’ 2003 Renewable Hydrogen Forum.

According to Dr. DeLucia, environment plays a major role in determining the health of an individual. Although not as determinative as lifestyle, environment is as important as genetics and more important than the frequency and quality of health care.

**When a nation is not a good citizen of the world.** Politically, delay erodes the standing of the U.S. in the international community and seriously jeopardizes relationships with its staunchest allies, including its closest ally, the UK. U.S. allies are much more willing to recognize the problem and understand that they alone cannot slow the occurrence of global warming. Prime Minister Blair has announced his intention to make global climate change a priority of his term as president of the G8, an organization of the world’s largest economies. G8 members include Britain, Canada, France, Germany, Italy, Japan, Russia and the United States. It is notable that Germany has made a national commitment to Renewable Energy and has set goals and deadlines for achieving it.

Concerned that President Bush and his administration refuse to accept the scientific bases of global warming, allies could soon become adversaries as the health, welfare and economy of their nations increasingly depends upon the unwillingness of U.S. political leaders to acknowledge, at the least, that there is a problem.

Factors determining the health of an individual	
Lifestyle	51%
Genetics	20
Environment	19
Health care	10

Source: DeLucia presentation, ASES H<sub>2</sub> Forum  
[http://www.ases.org/print\\_catalog/ases\\_reports/PS\\_Hydrogen.pdf](http://www.ases.org/print_catalog/ases_reports/PS_Hydrogen.pdf)



Concerned that President Bush and his administration refuse to accept the scientific bases of global warming, allies could soon become adversaries

### Running Low: The World's Diminishing Oil Reserves

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The Earth's diminishing oil reserve is not the conjecture of rabid environmental organizations. An increasingly large body of credible experts both in and out of the petroleum industry is being quoted on the subject in well-respected publications.

According to *Fortune*:

Production capacity is stretched so thin, demand is so high and supply is so fraught with uncertainty that we're just a few riots or explosions away from another oil crisis....

Much as we might like to, we can't blame it on OPEC. After all, Americans have been on a two-decade oil pig-out, gorging like oversized vacationers at a Vegas buffet.<sup>12</sup>

High prices and disruptions in supply aren't the only problems. Some veteran observers, like investment banker Matthew Simmons, think we are nearing the point—if we're not already there—at which the world's supply of crude peaks and then begins to decline. (The 61-year-old Houston oilman has advised the 2000 and 2004 Bush presidential campaigns and Vice President Dick Cheney's secret energy task force.) Even the optimists believe the

start of the downward slope is less than 35 years away. Frankly, it doesn't matter who's right. Three decades is precious little time to reconfigure the world's energy systems.

Although reasonable doubt may be cast on anyone knowing the day when production will peak and depletion will begin, there seems little doubt about whether there is enough oil left in the Earth to sustain developed and developing economies much beyond the mid-point of this century. The ever-growing cost of finding and producing more oil are signals of the trouble that lies ahead.

According to Karl Kurz, vice president of marketing and minerals for Anadarko Petroleum: "There is lots of oil out there. But it's a finite resource; we can't get around that. Eventually, you are going to get to the point where there's not any more to find."

M.A. Adelman, an MIT economics professor states, "There is plenty of oil around, as long as consumers are willing to pay the price to produce it." The price will be steep, even if Kurz and Adelman are right.

Based on the laws of supply and demand and the additional burden of continued political unrest in oil-producing regions, a barrel of oil could quite conceivably reach \$80 within the next several years. Assuming that the United States could afford to keep subsidizing the price of gasoline at the current rate \$100 a barrel petroleum will translate to a pump price of \$4.50 or more per gallon. The impact on the economy, of course, does not end there. Petroleum-based medicines, plastics and chemical feed stocks would also escalate in price, by significant amounts.

Although the domestic economy has managed to weather 2005's rise of oil beyond \$50 a barrel, it is questionable whether it can continue to do so. Inflationary pressure alone is capable of causing a worldwide recession.



It is important to understand that whatever the actual amount of oil left in the ground, the crunch will come much in advance of the last drop's having been squeezed out. Currently there is little, if any, excess refinery capacity. A situation unlikely to change—since oil companies are likely to loathe investing billions of dollars for plants likely to outlive reserves and instead choose to enjoy the profits produced by limiting supplies. The cost and time required to site and build new refineries is considerable, and most refining companies have no plans to do so.

Today worldwide production capacity is about 84 million barrels a day—roughly equal to current demand. According to the Department of Energy (USDOE) and the International Energy Agency (IEA) however, world demand will grow to 120 million barrels per day by around 2020. This is a substantial shortfall. If Keynes is right about the relationship of supply and demand and the nation is not ready with good alternatives, the price of petroleum and petroleum-based products will skyrocket and remain aloft. As it is, most economists have accepted that the days of \$30 per barrel oil have gone the way of the typewriter.

The amount of petroleum left in the Earth is far from an academic debate. Even assuming that the doubters are right and the pinnacle point of available reserves will not be reached for another 30 years, three decades is precious little time to accomplish a transition of such scope.

### Avoiding the use of fossil and nuclear fuels as a quick fix for the loss of petroleum

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To delay action is to risk disaster—more properly disasters. Failing to make a timely transition to clean domestic energy sources will amplify the economic consequences of running out of oil. Being

behind the supply curve means the economy will have to take the full brunt of the upward price spiral. Some will argue that a shift to coal, nuclear and natural gas can provide an effective and quick fix to the depletion of oil. These are solutions, however, with a great deal of downside.

Coal and nuclear both risk the environment. With nuclear there is the added problem of waste storage and the possibility that waste will become weapons. North Korea recently announced they “have [already] weaponized nuclear waste from their power plants,”<sup>13</sup> as a defense against South Korea and the United States. Soon, Iran may also be counted among the world's nuclear nations.

Domestic natural gas supplies are less than growing domestic demand and, therefore, do not represent a viable long-term alternative. Imported LNG (liquid natural gas) has been proposed as a way to assure the nation of stable future natural gas supplies. Proposals to expand investment in LNG transport and delivery systems will take the nation in the wrong direction. Importing LNG will not only require massive investment in port facilities and ships, it requires once again having to rely upon many of the same sources of petroleum (e.g., Saudi Arabia, Russia)—countries whose interests are often in conflict with those of the United States.

**How reasonable is the LNG option?** ASES sees this as simply swapping addictions. Although natural gas may be cleaner than petroleum, its finite nature and the need for foreign supplies lead to the same vulnerability the nation now confronts with oil. Such vulnerabilities do not attach to clean domestic energy sources. Most importantly, the investment to bring renewable energy sources on line is much less than the dollar cost of building the necessary LNG infrastructure and will result in a permanent solution to the nation's energy problems, while at the same time improving human health and the environment.

## What's the worst that could happen by investing in sustainable energy?

Why risk chaos and further environmental degradation, when proven, achievable alternatives are available today? ASES believes that individuals should be asking themselves, their communities and elected leaders, "What is the worst that could happen by investing in the continued development and immediate deployment of domestically available clean energy alternatives, then finding out that the experts were wrong and there is enough petroleum left in the Earth to meet any conceivable need for five or seven decades instead of three?"

At worst, some money would be wasted. Less money than will be spent to defend our access to Middle East oil, or has been spent to just partially ameliorate the health and environmental effects of our current use of fossil fuels. At best, a transition to a sustainable energy economy means the nation will have prepared itself for a potential catastrophe of epic proportion and have reduced harmful greenhouse gas emissions. Moreover, the United States would show itself a responsible partner in the worldwide effort to curb greenhouse gas production.

When compared to the worst-case scenarios for coal, natural gas and nuclear, a transition to a sustainable energy economy seems a pretty good bargain and an even better insurance policy.

Time is of the Essence: Gradual and measured progress is the most effective strategy.

Matthew Simmons<sup>14</sup> is right when he says that three decades is precious little time to accomplish a transition of such scope. The very magnitude of the needed change requires deliberate and gradual progress toward the goal of sustainability. A clean, sustainable energy economy cannot be accomplished in one giant

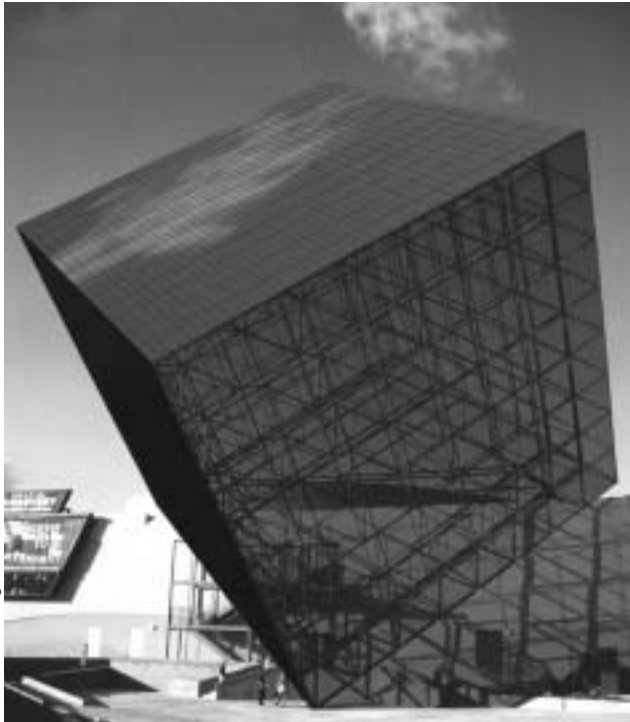
technological leap. There is simply too much to change; expecting to do so overnight is impractical; more than that, it is impossible. Worst of all, continually waiting for the next big technology (e.g., hydrogen) forestalls needed near-term action.

Gradual and measured progress will accomplish the goal of sustainability much better than sudden and abrupt change. The problem is here today and it must be addressed today in meaningful ways. Waiting only results in the need for more radical and expensive solutions tomorrow. Worse, waiting will lead to bad decisions as panic replaces reason.

Practical constraints to immediate wide-scale change exist. Two of these are the amount of capital investment required to develop and deploy (emerging and emerged) sustainable energy technologies and the need to change the enormous existing fossil fuel infrastructure to accommodate clean sustainable energy sources and more decentralized approaches. (see recommendations)



NREL/Andrew Gordon Photography and Fox & Fowle Architects



Changing the nation’s energy economy is to change industrial and consumer cultures. Sudden change leads to confusion, chaos and massive inefficiencies. Whereas, a more gradual and measured march allows the private sector time to make the changes in products, processes and investments needed to successfully accomplish the transition. It allows state and local governments the time necessary to change existing building codes; builders to accommodate those changes in their practices and pricing; manufacturers to ramp up manufacturing processes in-line with demand; utilities to meet demand using sustainable energy sources; consumers to understand how their demand for high mileage vehicles and energy efficient homes are part of solution; and researchers time to improve upon existing technologies and to create new ones.

It is not that the development of future technologies like hydrogen should stop, but that deployment of reliable and existing clean domestic energy technologies should begin now on a large enough scale to create a strong, broad and secure foundation upon which to build a sustainable energy economy.



Page 14: 4 Times Square was the first major office building constructed in New York City in the 1990s. The upper stories of this 48-story skyscraper in Times Square feature a “skin” of thin-film photovoltaic panels that replace traditional glass cladding material. The PV curtain wall extends along sections of the 35th to the 48th floors on the south and east walls of the tower, making it a highly visible part of the midtown New York skyline.

This page, top: Close to 500 thin-film Millennia photovoltaic modules from BP Solar were used on the Solar Cube. The cube stands 135 feet tall on top of the Discovery Science Center in Santa Ana, and can be seen for many miles from the neighboring Interstate Highway 5. bottom: the nine-story Williams Building in Massachusetts, which houses the General Services Administration, has a 28-kilowatt photovoltaic system integrated into the roof consisting of 372 panels. Shading from other buildings is not a problem at this site, which is in urban Boston. The ASE Americas PV panels are made of amorphous silicon.

The Nation has the technology and know-how to make the transition to a clean and sustainable energy economy

Fortunately the U.S. has been investing in the development and, to a lesser extent deployment, of energy efficiency and renewable energy technologies for more than 30 years. Had this investment not been made, it is likely that the world would not have the clean energy alternatives necessary today for a successful transition.

Important policy, as well as technological experience, has been gained over the past three decades. Moreover, the experiences of other nations, including Germany, Japan and the UK, are also available to guide U.S. policymakers and enhance U.S. alternative energy development.

The following policy recommendations represent what ASES believes are the essential first few steps that be taken to accomplish the transition to a clean energy economy within the next several decades or less. ASES members condemn the political gridlock of the past decade and urge administration and congressional leaders to adopt and enact a realistic, sustainable, and cost-effective national energy policy within the first session of the 109<sup>th</sup> Congress, a policy responsive to the reality and science of global climate change, as well as the fact of having reached or of soon reaching the summit of accessible global petroleum supplies. ASES further encourages state and local jurisdictions to do the same over the next several years.

Implementation of the following proposals would alleviate near-term pricing pressure by reducing demand for petroleum and natural gas and avoiding it for coal and nuclear, while establishing a firm and broad foundation upon which to build future clean energy policies and programs. As a general rule the inability of past Congresses and administrations to agree has been the result of partisan politics—

although there have been supporters and detractors in both parties.

### The need for bi-partisan action

Support for clean domestic energy alternatives is more collegial at the state and local levels. As a consequence, action has been possible. The Republican governors of New York and California, for example, are among the nation's staunchest supporters of sustainable energy technology. Governors Pataki and Schwarzenegger, along with their state's legislatures, have proposed and are implementing policies that can serve as models for national action. New York has recently mandated that twenty five (25) percent of its electricity come from renewable sources by 2013. Including New York, eighteen states in total have already enacted a Renewable Energy Standard (Renewable Portfolio Standard). California is already the world's third largest market for solar electric systems due to its progressive policies.

As important as the content of any legislation is its value as a symbol of the seriousness with which the nation's political leaders view the problem of climate change, the impending shortage of global petroleum supplies, and the negative health effects of burning fossil fuels. More, it represents the will to act.

### Elements of successful policymaking

In order to accelerate the long-term cost reductions required for full commercialization, the sustainable energy industry needs reliable, sustained and expanding domestic market demand and government policies. Any public policy for accelerating the commercialization of clean energy technologies must itself be sustained. The on-again/off-again nature of demand and government policies (e.g., the



Particularly in the transportation and built environment sectors, improved efficiency will have a profound impact upon demand, price and the extension of supplies of petroleum and natural gas.

production tax credit for wind) has made it difficult for domestic clean energy companies to attract and keep investor and consumer interest and support.

It is as impossible to conceive of a voluntary transition as it is to believe that the federal government has the resources necessary to accomplish the task unilaterally.

ASES believes that to be effective, any renewable energy deployment effort—whether national or local—must be based on the principles of sustained orderly development and commercialization. When applied in the public policy arena these principles translate into programs that are:

- sustained over a period of time sufficient to result in market and manufacturing changes—at least a decade.
- substantial enough to affect market changes and stimulate exponential growth in demand, investment and production.

- predictable over the initiative period so investors, manufacturers and suppliers know what the details and ground rules are over the period. Investments, whether in a company or by a company, are avoided in the face of uncertainty.
- credible to investors, manufacturers and suppliers. For public investment to achieve the objective of stimulating private sustained investment, then the terms of the public investment must be consistent with the practices and requirements of the private market. Program requirements that are too tilted toward the way governments do business are not viewed as credible by the private sector.
- diminishing government involvement over time to encourage cost reductions so that the market does not become dependent upon such supports.

This last point is particularly important and perhaps seems counter to the earlier elements of sustained and orderly development. Diminishing government supports over time provides an on-going, downward price pressure and is a key element in transferring technology that is in the public interest to the private market.

From ASES' perspective, successful public policies are those that move technology along a continuum that starts with publicly supported research and development and ends with products able to compete on their own in the private market. The perpetual support of nuclear and fossil fuels, in ASES' opinion, is in part responsible for today's difficulties.

Had the federal government not protected the nuclear industry from liability due to accidents (e.g., Price Anderson) and heavily subsidized the fossil energy industry in the form of tax breaks, foreign and defense policies and favorable utility and environmental regulations, it is likely that domestic clean energy technologies would be price competitive today. Committing the nation to becoming a sustainable clean energy economy is not to commit it to perpetual price supports.

# Recommendations

The failure of the federal government to draft and enact a national energy policy capable of making the needed transition from a fossil and nuclear fuel standard to one based on clean domestic energy sources like solar, wind, geothermal and biomass hampers the growth of these emerging technologies in the marketplace. The persistence of administration and congressional leaders in pursuing the expedited development of coal, oil, natural gas and nuclear resources in the face of the environmental, health and depletion issues places the nation—indeed the world—at risk.

According to a recent article in the *Christian Science Monitor*:

In some ways, the energy-environment train may be leaving the station ahead of the administration and Congress. According to a recent study by the Pew Center on Global Climate Change, most states have taken steps to reduce the greenhouse gases (principally carbon dioxide) causing global warming, and 18 states now require that electric utilities generate a portion of their electricity from renewable sources.<sup>15</sup>

Pew also reports “there is a new and important trend towards multi-state regional initiatives that address

climate change. Nine Northeastern and Mid-Atlantic states, for example, are developing a cap-and-trade system for carbon dioxide emissions from electric generating plants. Similarly, the Western Governors’ Association’s 18 member states are looking at ways to increase energy efficiency and the use of clean domestic energy sources in their electric systems.

Not surprisingly, then, efforts by the states, such as net metering laws and renewable energy standards/portfolios for utilities, are generally having the biggest impact these days on the commercial application of renewable energy technologies in the U.S. market. The federal government can learn much from the states. Overall, however, neither the states nor the federal government are doing nearly enough.

Local, state and federal governments must work together for a timely and efficient transition to a national clean energy standard to occur, including the creation of an integrated national clean energy market. Where states can act alone they should. Where, however, federal action is needed, that too must occur. ASES believes that the leadership of state and local leaders from the major political parties and in both red and blue states can, by both their deeds and words encourage the president and

The “Nature House” at the Leslie Science Center in Ann Arbor, Michigan, is an environmental learning center for schoolchildren. It features two solar hot-water panels; a 2 kW PV array composed of 40 cadmium telluride thin-film modules and a 2 kW PV Uni-Solar standing seam PV roofing system. Among the many passive-solar features are the top row of windows with direct-gain glass, the middle row that fronts an 8-inch Trombe wall, and the bottom row that lights a growing room for plants.



NREL/Wayne Appleyard



NREL/Applied Power Corporation

The Porter Square Shopping Center in Cambridge, Massachusetts, was renovated in accordance with Gravestor's "Green Bible," a developer's handbook of environmentally sustainable real estate principles and practices. This renovation included installing a 20-kilowatt roof-mounted photovoltaic system, designed and installed by Applied Power Corporation, which will produce enough electricity to power nearly all of the common areas of the strip-center portion of the plaza.

Congressional leaders to join them in making the transition to a clean, sustainable domestic energy economy a reality within the next two decades.

**Reducing demand for energy.** These first proposals are directed at the areas of greatest energy use and reflect relatively straightforward approaches to reducing significantly the demand for energy, as well as laying the groundwork for a fully sustainable clean energy economy. Immediately beginning to reduce energy demand will accomplish two very important goals:

1. slow the rise in petroleum and natural gas prices; and
2. slow deterioration of the environment and dilatory health effects caused by burning fossil fuels.

The recommendations have been placed in five principal categories: tax policy; the built environment; electricity; investment and education. In each category local, state and federal actions are recommended.

It is important to note that ASES is not limiting itself to renewable energy recommendations. The Society believes that increased energy efficiency is a necessary

first step in many instances. Particularly in the transportation and built environment sectors, improved efficiency will have a profound impact upon demand, price and the extension of supplies of petroleum and natural gas. Increased efficiency reduces the overall need for energy and permits energy systems to be smaller and more economic, in many cases.

Increased efficiency is basic to changing the energy culture of the United States. Why waste energy whatever the price or availability? Efficiency increases rather than decreases the standard of living of all Americans. Efficiency is to be equated with better built homes and offices, lower operating costs for schools, hospitals, businesses, industries, governments and consumers.

Both renewable energy and energy efficiency technologies offer the basis for innovation and the development of new products and services. Innovation leads to new opportunities for the employment of capital and human resources. Although a transition to a sustainable clean energy economy will be neither easy nor immediate, if done in a measured and deliberate manner it will ultimately result in significant improvement to the health of individuals, the environment and the economy.



To be effective, both in terms of cost and results, tax policies must be stable and long term.

In considering these recommendations it is important to understand that the beneficiary of these measures is first the nation and second individuals and corporations. Benefits at the macro level must be the first order of concern. If the nation is at risk, then everyone is at risk. It is the patriotic duty of all Americans to reduce these risks by private investment and consumer action supported by wise public policies. Every individual and every institution in the U.S. has a role to play in making the transition to a sustainable energy economy. Everyone in the nation will benefit.

The type of wholesale cultural change required to become a sustainable energy economy requires a change that will only become harder with delay. The facts of global warming, the rise of respiratory and other diseases attributable to burning fossil fuels, the particular danger of nuclear waste and the depletion of world petroleum reserves are just facts of life.

### Tax policies

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- Remove selected federal subsidies for fossil and nuclear energy sources.
- Stabilize and expand the federal production tax credits for renewable energy sources.
- Apply the federal gas-guzzler tax to SUVs.
- Offer both state and federal tax credits for the purchase of high mileage and alternative fueled cars and trucks.

- Enact state and local investment tax credits for sustainable energy systems, products and designs.
- Remove selected federal subsidies for fossil and nuclear energy sources.

Just as the Society is proposing increased and reliable public subsidies for emerging renewable energy technologies, so too does it recommend weaning mature, commercialized, conventional energy technologies like fossil fuels off of the public dole. Although ASES would like to recommend removing all government supports from any energy source found harmful to the health, environment, economic and/or physical security of the nation, the Society does not believe that this is a very realistic near-term possibility. Therefore, a more focused approach has been taken.

Perhaps the first place to start is changing existing tax policies to reflect the importance of emerging domestic clean energy technologies in the battle to free the nation from its unhealthy addiction to petroleum and other fossil (and nuclear) fuels. There are two directions from which to approach energy tax policy:

1. Encourage the use of domestically available clean energy sources, and
2. Remove the tax benefits that fossil and nuclear have enjoyed for decades.

Eliminating the subsidies for fossil and nuclear sources should be considered the first priority. According to *Fortune*, “eliminating several subsidies for oil and gas industries, whose recent wind-fall profits ... hardly seem to call for federal hand-outs. Eliminating the percentage depletion allowance, which permits some oil companies to write off more than the cost of their capital investments, and a series of other provisions could leave more than enough in the federal coffers to support [high mileage] hybrids [automobiles and trucks].”<sup>16</sup>



Credit: Mendota Hills Wind Farm



NREL/Pacific Gas & Electric



NREL/Warren Gretz



Top to bottom: Sustainable NREL recognized 24 hybrid electric vehicle owners for their efforts in purchasing alternative energy sources by inviting the owners to the Solar Energy Research Facility (SERF); an array of Gamesa G52-800 turbines stands on farmland in Lee County, Illinois, part of the Mendota Hills Wind Farm, the first utility-scale wind farm in the state; the largest geothermal field in the world is The Geysers, near San Francisco

With oil hovering at \$50 or more a barrel, petroleum companies have plenty of reasons to invest in wells that were marginal when oil was selling for \$20 a barrel. As it is probable that petroleum prices will remain high, the need for the allowance is no longer apparent.” Additional tax revenues generated by this change in the current federal tax code could help to finance the transition to clean, sustainable domestic energy sources.

### Stabilize and expand federal production tax credits for renewable energy sources

#### Production Tax Credit for wind

It is possible to use tax policy to encourage the production of power from domestically available clean energy sources. The Production Tax Credit (PTC) for wind-generated electricity has proven itself very successful in terms of encouraging private investment and significantly lowering the cost of wind generated electricity. Over the last 20 years, the cost of electricity from utility-scale wind systems has dropped by more than 80 percent. In the early 1980s, when the first utility-scale turbines were installed, wind generated electricity cost as much as 30 cents per kWh. Today, state-of-the-art wind power plants can generate electricity for less than 5 cents per kWh in many parts of the United States, a price that is competitive with new coal or gas-fired power plants.<sup>17</sup>

The PTC for wind illustrates both the best and worst of government policy. The best has been the effectiveness of the PTC. The worst has been the jeopardy that the credit has consistently been placed in by its nearly annual threat of extinction, dramatically decreasing its effectiveness in commercializing this resource.

To be effective, both in terms of cost and results, tax policies must be stable and long term. Studies

have shown that short-term policies do not effectively meet their end points. A bell shaped curve—starting slowly, building in the middle, declining a year or two before expiration—most clearly illustrates the impact of short term tax policies.

Doubt as to the length of a credit’s life adds a destructive layer of uncertainty. Uncertainty is anathema to private investors. A precipitous slowing of investment in wind energy projects occurred during the 2003–2004 time period because of uncertainty as to extension of the PTC beyond 2003. The delay of investments is vivid evidence of what happens when uncertainty is added to the policy equation.

### Expanding the federal PTC to include solar and geothermal energy technologies

ASES believes it is essential to expand the production tax credit to include solar and geothermal energy technologies. The positive impact that the PTC has had on the commercialization of wind energy provides a sound basis upon which to enact similar tax incentives for other available clean energy technologies. Expanding the credits to include other technologies will help to assure a diversity of available and economic clean domestic energy sources.

Tax policies must be long-term—at least 10 to 15 years—and predictable. Stable and predictable tax policies have contributed significantly to the rise of Japan and Germany as the world’s leading developers of photovoltaic technology. ASES believes that the U.S. would do well to follow suit.

### Federal ethanol and biodiesel incentives

As with the PTC for wind, current tax incentives in support of ethanol and biodiesel are having very

positive impacts upon the research, production and use of bio-based fuels. ASES recommends a similar model of tax support—long-term commitment combined with gradual reduction of support levels—in the case of these clean burning fuels.

Increasing domestic use of bio-fuels not only improves the environment and reduces the amount of petroleum the nation needs to import, but it also provides significant economic opportunities for the nation’s farmers. For example, a study released by the U.S Department of Agriculture’s Office (USDA) of the Chief Economist concluded that tax incentives for ethanol would raise farm incomes and that half of the jobs created would come from the farming and food processing sectors.

According to a joint study by the U.S. Departments of Energy (DOE) and Agriculture (USDA) “the biodiesel life cycle produces more than three times as much energy in its final fuel product as it uses in fossil energy.” The study further concluded that the most commonly used blend of biodiesel offers a 15.66 percent reduction in CO<sub>2</sub>, while a gallon of 100 percent biodiesel produces 78.45 percent less CO<sub>2</sub> than petroleum diesel.<sup>18</sup>

### Apply the gas-guzzler tax to SUVs

Removing other subsidies (e.g., those limiting corporate liability for nuclear accidents and exemption of SUVs from the gas guzzler penalty and the virtual write-off of the entire price paid for heavy-weight vehicles used more for personal than business purposes<sup>19</sup> such as Hummers) would not only generate significant amounts of capital that could be used by the federal government to support sustainable energy development and deployment programs, but would also encourage the purchase of more efficient vehicles.

These proposed tax policy changes would allocate



NREL/Greg Christman



NREL/Spire Solar Chicago

Left: the Valdez family in front of their Earth Smart Homes built by Habitat for Humanity of Denver; right: the Art Institute of Chicago's 130.6 kW PV system.

the national cost of inefficient vehicles to those who use them. Low mileage SUVs cost everyone—not just those who own them.

Offer local, state and federal a tax credits for the purchase of high mileage and alternative-fueled cars and trucks

Cars and light trucks are responsible for 43 percent of U.S. petroleum demand. A reduction in the demand for gasoline would dampen prices at the pumps, as well as reduce reliance on foreign sources. According to Amory Lovins of the Rocky Mountain Institute, if all of the cars in 2025 were

simply as efficient as the highest mileage car on the road today, the U.S. would reduce demand by one sixth.<sup>20</sup> (SEC news stories, October 22)

Congress and the administration, therefore, would do well to enact new tax policies that encourage the purchase of high mileage hybrids. As noted in the Fortune article, the biggest obstacle to highly efficient hybrid vehicles is price. The nearly \$3,000 additional cost is significant, and many consumers do not see a rapid enough payback of this amount, even in the shadow of \$2.50–\$3.00 per gallon gasoline. A consumer trading in a 20 mpg car for a 30 mpg car (assuming 15,000 miles per year of driving) would save \$750 per year—when gasoline hits the



Energy consumption is a national issue; relying solely upon voluntary action is to risk the nation's future.

\$3.00/gallon price. The additional cost both in price and interest payments<sup>21</sup> is significant for many consumers.

As part of a recent tax package, Congress restored the alternate-fuel and hybrid vehicle federal income tax deduction to \$2,000 for calendar years 2004 and 2005. The law, however, did nothing to address the reduction of the credit to \$500 in 2006. ASES believes that the federal government must continue to encourage the purchase of high mileage and alternate-fueled vehicles for at least the next decade and recommends increasing the credit to \$3,000, only to be phased out at the end of a decade.

Sustainable energy organizations, environmental groups and the editors of Fortune are not the only ones recommending that the federal government act to support the development and deployment of high mileage and alternate-fueled vehicles. The conservative Institute for the Analysis of Global Security and the Hudson Institute have identified imported oil as a threat to national security and have proposed a program entitled "Set America Free."

The plan envisions \$12 billion in incentives paid over four years to automakers and consumers to create a market for flexible-fuel cars that run on biofuels distilled from plant material. At the same time they would promote hybrid gas-electric cars.

Recognizing limitations to federal resources and acknowledging the economic and environmental

benefits of higher mileage and less polluting cars and trucks, ASES encourages state and local governments to offer compatible/contributory credits. The \$3,000 price differential is significant both for governments and consumers. State and local taxing authorities should help to reduce the spread by offering sales and property tax exemptions where appropriate, as well as income tax credits similar to those recommended at the federal level.

Enact state and local investment/sales and property tax credits for sustainable energy investors and consumers

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Despite the lowering cost of clean energy sources and the rising prices of petroleum, natural gas and coal, renewable energy technologies remain at a competitive disadvantage in a marketplace geared toward fossil fuels. Investment in any newly emerged or emerging technology is not without its risks. Private investors are risk adverse; adversity, however, can be softened through favorable tax policies.

Although federal investment credits are important, state and local governments should also be expected to encourage the growth of clean energy enterprises through their tax policies. State and local governments have a menu of available options including: investment credits; exemption/reduction of tangible/intangible property taxes; and, exemption/reduction of state/local sales taxes for consumers.

#### Built environment

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- Establish a national Building Energy Code Task Force to work with state and local jurisdictions in an effort to incorporate building energy efficiency standards, as well as the use of renewable energy technologies like solar water heating, into the design and construction of new residential, commercial and industrial structures. The objective

should be to have building energy codes in every jurisdiction by 2007.

- State and local governments should amend local building, permitting and zoning laws to accommodate, encourage and expedite the construction of renewable energy projects.

### Establish a national Building Code Energy Task Force

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Improved efficiencies within the built environment are essential to reducing both the near- and long-term demand for fossil fuels. “Buildings account for over one third of U.S. greenhouse gas emissions. It is straightforward and economic to save 30% of the energy in existing buildings, and 50% in new buildings, and to head ...toward zero net energy use for residential and small commercial buildings.”<sup>22</sup>

Building energy use is a key component in the demand for electricity and heating fuels like natural gas and petroleum. Electricity generated by coal is responsible for significant amounts of pollution, that is, greenhouse gases and particulate matter.

There is little evidence to suggest that the price of home heating and electric generating fuels will significantly decline in either the near or long terms.

Increased building energy efficiency and the incorporation of sustainable energy technologies like photovoltaics, solar water heating and geothermal heating and cooling systems could significantly reduce demand for fossil fuels, while expanding the market for domestic clean energy products.

Although building codes are primarily the responsibility of state and local jurisdictions, ASES believes that the federal government can and should play a much more active role in encouraging and assisting state and local jurisdictions to adopt building codes that reflect the importance of building energy performance to the health, security and economic welfare of the nation.

ASES is recommending, therefore, that a national Building Code Task Force be established. The Task Force would be comprised of federal, state and local government representatives, as well as representatives of the building and mortgage financing industries, product manufacturers and consumers. The objective of the Task Force would be to propose building code changes that would effectively increase building energy efficiency and performance, while keeping consumer cost within reasonable limits. Draft model codes having to do with building insulation, the incorporation of energy savings devices (e.g., automatic set-back thermostats or solar attic vents) and the use of solar water heaters are



Brad Collins

With a combined output of 354 megawatts, the Solar Electric Generating Systems in southern California constitute the world's largest solar power plant. Kramer Junction Operating Company is one of three companies that operate these line-focus parabolic troughs, which were built by Luz of Israel from the mid to late 1980s. During operation, oil in the receiver tubes collects the concentrated solar energy as heat. The hot oil is then pumped through a heat exchanger where steam and then electricity is generated.

illustrative of the measures that might be proposed.

Traditionally government programs have endeavored to educate architects and builders about the value and methods of improved building energy efficiency and the use of renewable energy technologies. These education programs must now be complemented by enacted codes that accomplish the desired savings.

ASES proposes that code changes be made in all jurisdictions. An across-the-board change will place all developers, builders and consumers in the same situation. Using building codes to require behavior beneficial to the community at large is a well-established practice. Energy consumption is a national issue; relying solely upon voluntary action is to risk the nation's future.

State and local governments should amend local building, permitting and zoning laws to accommodate, encourage and expedite the construction of renewable energy projects and distributed generation stations

The work of the proposed national Building Energy Code task force would be to assist state and local jurisdictions to amend local codes, but the "heavy lifting" will need to be done by state and local governments. In addition to modifying building codes to reflect the importance of energy efficient designs and practices, other local laws, regulations and procedures should be developed and implemented.

Experience teaches that the devil is in the details. A local ordinance that permits someone to block a PV panel's access to the sun is likely to give potential PV purchasers pause. On the other hand, reducing the cost of a permit for a building that incorporates a solar or geothermal system is likely to increase the use of sustainable energy technology.



NREL/PowerLight Corporation



NREL/Chris Gunn Photography

Top: 30,000 feet<sup>2</sup> of PV panels grace the roof of the Moscone Convention Center in San Francisco, generating up to 675 kW of electricity; bottom: the University of Delaware house has a south-facing semi-circular wall of windows, allowing occupants to follow the sun's path across the sky.

In reviewing local codes, ordinances and regulations, particular attention should be paid to changes that encourage the use of decentralized generating facilities. Large central generating plants make better terrorist targets than smaller decentralized facilities. Clean domestic energy technologies like wind and solar lend themselves particularly well to distributed generation. As a consequence, distributed generating systems tend to be environmentally safer than the fossil and nuclear fuels used by large central station power plants.

## Electricity

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- National and state Renewable Energy Standards<sup>23</sup>
- Expanding electric generating options to include distributed renewable energy systems
- National and state net metering laws
- National and state non-discriminatory interconnection standards

## National/State Renewable Energy Standards

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Enactment of a national renewable energy standard (RES) is central to the timely transition to a sustainable energy economy. An RES would reduce demand for natural gas, as well as for coal and nuclear fuels. Most importantly, an RES would create an escalating demand for electricity generated by sustainable energy technologies and do so in a manner capable of creating an expansive private market for these technologies.

According to the Union of Concerned Scientists, a national renewable energy standard (RES) of 20 percent by 2020 would save families and businesses

\$49 billion in lower electricity and gas bills. Other benefits to the economy include:

- the creation of 355,000 jobs;
- new opportunities for investment;
- an alternative income source for the agricultural community (in the case of biomass from plants (e.g., switchgrass, corn and timber); and
- reduction of reliance on petroleum and natural gas from the Middle East and former Soviet states.

The UCS analysis found 20 percent renewable electricity by 2020 would boost the U.S. economy generating:

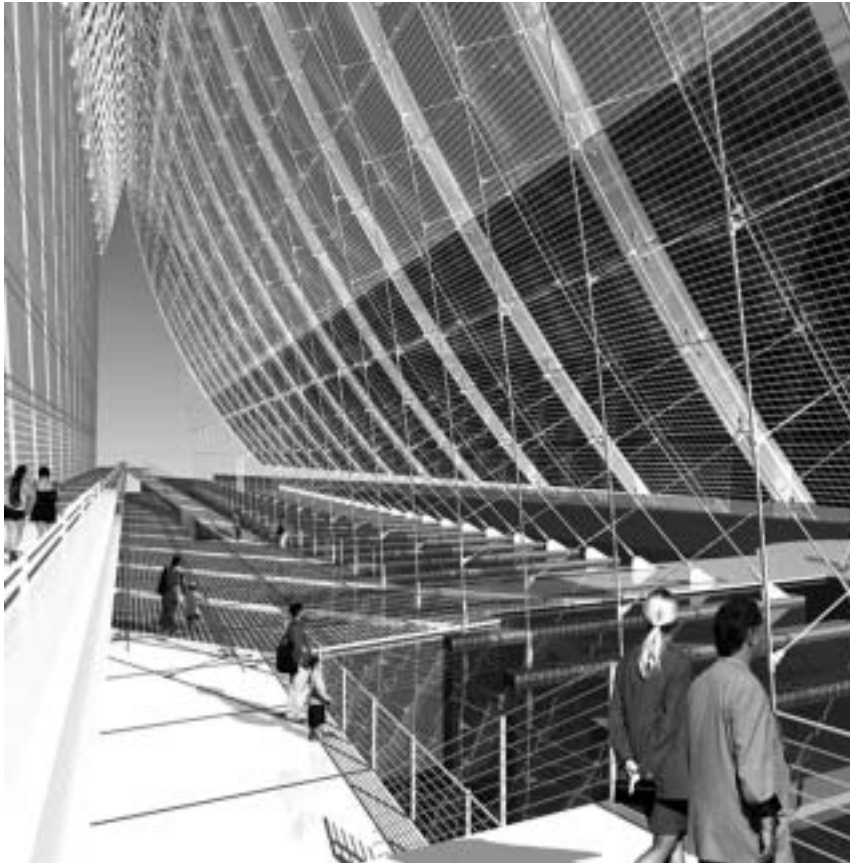
- \$73 billion in capital investment;
- \$16 billion in income to farmers, ranchers, and rural landowners for biomass energy supplies and wind power land leases; and,
- \$5 billion in property tax revenues for rural communities.

In the case of a federal RES, Congress and the administration would simply be following suit with eighteen states. New York is the latest state to have adopted a renewable energy standard. The New



NREL/Lloyd Herziger

Utility-scale wind plants coexist very well with ranching and farming. In fact, some ranchers in Altamont Pass, California, receive more income from leasing part of their lands to operators of wind power plants than they do from ranching itself. Farmers can graze cattle right up to the base of the turbine towers, as on this wind farm operated by Zond Systems. Ranching is the primary use of land in large areas of this country that have good wind resources.



NREL/Solomon Cordwell Buenz and Associates

This solar wall (pictured as an architectural rendering) won a national design competition sponsored by the U.S. Department of Energy and the American Institute of Architects in 2000. It was designed to cover the windowless 30,000-sq. ft. south wall of the Forrestal Building, DOE's headquarters in Washington, D.C. If the wall is built, the photovoltaic panels in its lower section will generate more than 100 kilowatts of electricity, and the solar thermal collectors in its upper section will heat water for the building's heating system.

York law is estimated to add 3,700MW of new renewable generation by 2013. Other large states that have enacted a renewable energy standard include Texas (2,000MW by 2009) and California (9,000MW by 2017).

The European Union has also seen the value of the RES and has established a target of 12 percent (EU-wide) from renewables by 2010. The EU anticipates a 22.1 percent penetration by sustainable energy technology into the electricity sector by that same year. There is substantial evidence to suggest these amounts of renewable electricity are both realistic and achievable. (Aitken)

A federal RES would expand the renewable elec-

tricity market to the 32 states that have yet to enact a standard and provide a significant impetus to power producers to incorporate domestically available clean energy technologies into their generation mix. To provide the time needed by power producers to bring green power on-line, ASES also recommends the standard to be phased in over the next fifteen years.

A federal RES could also help to provide some consistency for the market. The initiative shown by the states that have enacted an RES has proven very helpful to the expansion of the sustainable energy market. Each state, however, is free to act on its own, and quite naturally a state's RES reflects its unique circumstances. A national RES standard



could allow for regional differences, for example resource allocation, but emphasize consistency, supporting both technological diversity and provision for emerging as well as emerged technologies across jurisdictions, thereby creating a larger unified market.

Rather than a series of markets defined by state borders, a national RES market would permit companies to realize the benefits of scale, saving investors and consumers tens of millions of dollars. This concept is the basis for the constitutionally provided interstate commerce powers of the federal government. Consistency across state and regional lines makes for larger and more efficient markets. Size does matter in markets, and consumers and developers both profit from an efficient marketplace.

A typical federal RES would require that a share of the power sold throughout the U.S. come from qualifying new renewable facilities/sources, for example wind, photovoltaics and concentrating solar power plants. Companies that generate qualified power would be issued credits they can hold for their own use or sell to others. In a competitive market, the price of renewable credits should rise to the level

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Consumer choice is as powerful as any mandate, regulation or government program.

needed to stimulate power plant developers to bring on-line the capacity needed to meet the RES requirement.

Although government mandates that power companies must offer electricity generated by a mix of both traditional and sustainable energy sources, the market largely determines the most economical technology options. Ex cathedra technology decisions by the federal government have most often resulted in colossally expensive mistakes such as synthetic fuels.

A federal RES leaves most of the technology decisions to the private sector, while guaranteeing the existence of a private sustainable energy market



A solar thermal system provides hot water for the headquarters building of the U.S. Department of Agriculture in Washington, D.C. The U.S. Department of Energy Federal Energy Management Program (FEMP) helped to fund this project, which is one of hundreds that have been done by FEMP and its government partners to help Federal agencies reduce energy costs, increase energy efficiency, use more renewable energy, and conserve water. FEMP projects have helped agencies reduce their energy bills by hundreds of millions of dollars since 1985.

sector. ASES believes that a national RES should be attentive to the need for resource diversity, however, and recommends that adequate provisions be included to ensure that more than one renewable source is used to meet the standard.

The U.S. Department of Energy's Energy Information Administration has estimated that 20 percent standards by 2020 would do little to increase a consumer's monthly electric bill. Increasing reliance on domestically available renewable energy sources would in all likelihood lower costs, as they would replace more expensive natural gas. Natural gas has become the preferred fuel of power generators because it is better able to meet environmental regulations. The growing scarcity of domestic natural gas will continue to increase its cost. Domestically available renewable energy technologies, on the other hand, are becoming cheaper as economies of scale are realized and new materials and manufacturing practices are developed and used.

As stated at the beginning of the Recommendations Section, the Society is not sanguine about the likelihood of the 109th Congress enacting a national RES. ASES, therefore, reiterates the need for continued state action. Although a more difficult way to go about encouraging needed private investment in clean domestic energy sources, it will get the job done; in lieu of federal action there is no alternative but individual state action.

### Expanding electric generating options to include distributed renewable energy systems

The current centralized electric grid must be expanded to include distributed energy systems. The central grid is not only prone to technical difficulties, resulting in black- or brown-outs affecting 50 million or more people, it is vulnerable to terrorist attack.

Adding distributed generation options to the current electric production mix will decrease vulnerabilities while increasing the contributions that could be made by sustainable energy technologies; technologies that lend themselves to smaller-scale applications.

Accommodating distributed energy technologies requires two basic changes—net metering laws and non-discriminatory interconnection standards. Although many states have net metering and/or non-discriminatory interconnection standards, national legislation would create a larger and more consistent market for developers and system purchasers than would likely result from individual state action. There has been considerable work done on both of these issues and significant public debate—meaning that crafting and enacting federal provisions could be done in relatively short order.

- National/state net metering laws
- National/state non-discriminatory interconnection standards

Net metering laws permit residential and business/industrial consumers installing renewable energy technologies to send excess power back into the grid.

The ability to “reverse” the flow of electricity helps purchasers of renewable energy systems recoup their investment more quickly and avoid the need for battery storage banks. It helps electric utilities to obtain the supplies of green power needed to meet the RES.

Currently 36 states have a net metering law on their books. The specifics of net metering agreements vary widely, however. Most net metering agreements allow for either solar or wind technologies and usually range in size of systems from 10 kW to 40 kW. The biggest difference from one net metering agreement to another is what to do with the net excess generated (NEG). In some jurisdictions the excess is actually sold to the



NREL/Stennis Young, National Park Service

Left: A solar-powered traffic counter is used along the Natchez Trace Parkway near Tupelo, Mississippi. Because of the sensitivity and remoteness of portions of the transportation corridor, the National Park Service is using photovoltaics for various power applications.

Below: In October, 2000, officials from the U.S. Department of Energy, the General Services Administration, and Applied Power Corporation dedicated one of the largest thin-film photovoltaic installations in the United States. The new system provides 100 kilowatts of power to the General Services Administration at the Suitland Federal Center in Maryland. Pepco Energy Services and Applied Power partnered with DOE and GSA to install the thinfilm, amorphous-silicon PV system.



NREL/Mark Bing

utility at the full retail rate, while in other situations excess power is credited to the consumer's account as an avoided cost.

It is essential that owners of distributed renewable energy systems are able to connect them to the grid with relative ease and without incurring a penalty or substantial additional cost because of political—as opposed to technological—requirements. Experience at the state level has shown that opposition to distributed renewable energy systems raise regulatory barriers in the form of burdensome and costly interconnection requirements.

Both net metering and non-discriminatory interconnection laws permit the integration of distributed sustainable energy generating systems into the existing electric grid. Federal laws in both these cases would optimize the contribution that can be made by existing and future sustainable energy technologies.

As is true for a national renewable energy standard, action by the 109th Congress would greatly expedite the process of integrating clean domestic ener-

gy sources into the existing electric grid. In lieu of federal action there is no alternative but to approach the remaining states individually. The market can be expected to work out inconsistencies between the various state jurisdictions.

### Expanding federal, state and local government purchases of green electricity, energy performance services and renewable energy systems

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Government action should not be limited to the enactment and administration of programs like the RES or production tax credits. Governments comprise the largest class of energy consumers in the U.S. Whether gasoline for their vehicle fleets or electricity for their facilities, government purchases can drive the market as surely as any regulatory policy.

ASES recommends that governments at the local, state and federal levels adopt proactive procurement practices that give preference to domestic sustainable energy sources, systems, products and designs.

This has been a long-standing recommendation of the Society.<sup>24</sup>

Sustainable energy purchases should include: transportation fuels; distributed renewable energy systems; electricity generated by renewable energy technologies; and energy performance contracts. An energy performance contract involves a private company's auditing a government facility, recommending improved efficiency opportunities and retrofitting the facility with the appropriate technologies and products. To pay for the improvements, the government agency splits the monthly savings with the private contractor. Should the retrofits not produce the stated savings, the contractor will not be paid. Like the production tax credit, the award is based upon actual performance and not on unfulfilled promises.

Government purchase of renewable energy technologies do not generate positive cash flow as immediately as efficiency improvements. However, there are benefits nonetheless. For local governments the growth of a sustainable private power market might lead to economic development opportunities. The City of Chicago, for example, has applied photo-

A 15-kilowatt photovoltaic system installed in Arlington, Virginia, feeds clean energy into the utility grid that supplies electricity to the Pentagon. Staff from the National Renewable Energy Laboratory coordinated this project. Ascension Technology of Lincoln, Maine, installed the 60SunSine® AC photovoltaic modules, which were developed under a Photovoltaic Manufacturing R&D project. The innovative modules feature built-in microinverters that produce alternating current.



NREL/John Thornton

voltaic technology successfully on public buildings. In doing so, it has benefited from the location of a photovoltaics manufacturing facility in the city. The facility contributes jobs to the local economy and taxes to the city government, while also encouraging the growth of a new businesses, for example, solar installation companies, solar supply stores, service contractors for the installed systems, training programs for installers.

In most cases the additional costs of increasing government demand would be offset by efficiency savings, higher tax revenues from sales and corporate income, and immunity from the rising price of traditional generating fuels, whether natural gas, coal or oil. Most importantly from a consumer's perspective, expanding government purchases will bring down the cost of alternative energy products through economies of scale. Unlike fossil and

nuclear energy sources, renewable energy technologies will come down in price as demand increases.

### A national public education campaign

Public education represents the ultimate in voluntary action. Consumer choice is as powerful as any mandate, regulation or government program. Without adequate and objective information, however, consumer demand will remain an underutilized resource.

Although consumer awareness about the pitfalls of continued reliance on fossil and nuclear fuels is growing, a public education campaign that outlines for people what they can do as individuals to improve the health, welfare and security of the nation would expedite the transition to a sustainable energy economy.

ASES believes that too little credit is given to the individual when it comes to helping the nation make the needed transition to a sustainable energy economy. Polls consistently show that people are aware of the deleterious impact of fossil and nuclear fuels on the health, safety, economy, environment and security of the nation and support efforts to employ domestically available clean energy sources. Public education efforts at the local, state and national level would help harness the desire of most Americans to help the nation and provide the information needed for informed individual action.



NREL/Southern California Edison

Utility planners in California were surprised to learn that photovoltaic systems made the most sense in certain older residential areas with overloaded underground circuits. Installing PV at Monterey Hills Elementary School in Rosemead eliminated the need to dig up and replace overburdened circuits. These children are proud and pleased to have PV modules installed on the roof of their school. The project is part of Southern California Edison's Solar Neighborhood Program.

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