Achieving a New Energy Future

How States Can Lead America to a Clean, Sustainable Economy

National Association of State PIRGs

August 2005

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National Association of State PIRGs

August 2005

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Introduction: A Time of Opportunity

At the dawn of the 21st century, America faces immense energy challenges, and enjoys boundless opportunities.

The current crisis in our energy system is the result of decades of bad decisions: the decision to unleash an unconstrained boom in natural gas-fired power plant construction during the 1990s that has since contributed to price spikes throughout the economy; the decision to allow aging coal-fired power plants to continue to operate under outdated emission standards; the decision to subsidize fossil and nuclear fuels at the expense of renewable power and energy efficiency.

The effects of these bad decisions are now apparent. Natural gas prices have doubled in recent years, squeezing the pocketbooks of consumers and the profit margins of industry; both of whom have become increasingly dependent on natural gas for heat, hot water and industrial purposes. Old coal-fired power plants continue to spew pollution that threatens public health, while a new generation of coal-fired plants has been proposed that would add to America's already substantial contribution to global warming. The nuclear power plants built in the 1960s and 1970s are coming to the end of their original lifespans, but many are receiving a new lease on life from federal officials, presenting a continuing threat to public health and safety.

Environmentally, our bad energy decisions have made the United States the world's leading contributor to global warming, threatening the health and welfare of future generations, the ecosystems on which life depends, and America's standing in the global community. Economically, our decisions have left the United States — historically a world leader in technological innovation — well behind Europe and Japan in the development and deployment of the energy technologies of the 21st century and have tied our continued prosperity to fluctuations in fossil energy prices over which we have little control.

Should we remain on our present course, the energy challenges facing the United States will only grow in magnitude. The depletion of fossil energy reserves, increased demand for energy, aging domestic energy infrastructure, and the acceleration of global warming will continue to pose problems both for our immediate welfare and our nation's long-term economic and environmental sustainability.

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To properly address these challenges, America must transform how it produces and consumes energy. We must do it. And we can. Renewable forms of energy such as wind and solar power are increasingly cost-competitive with traditional forms of energy; indeed wind power is a least-cost option for new power generation in some parts of the country. And new renewable technologies that sustainably tap the natural energy of the earth, water, wind and crops are on the horizon.

America also has vast "strategic reserves" of energy efficiency — a resource that could cost-effectively reduce, or even eliminate, the growth in demand for energy for the foreseeable future, and do so with a net benefit to the economy. New technologies promise to make our homes and businesses more energy efficient than ever before, providing immediate savings to consumers, reducing energy demand at peak periods, and lowering prices for everyone.

Despite the emerging promise of a new, clean energy future, there has been little momentum toward that goal at the federal level. President Bush and many in Congress remain wedded to a future energy vision built around the dirty, dangerous and unstable energy sources of the past at the expense of the reliable, sustainable and clean sources of the future. Congressional efforts to increase energy efficiency and deal with the worst by-products of our overreliance on fossil fuels — such as global warming emissions — have gone nowhere.

America is at a critical point. Continuing to delay a transition to cleaner energy sources will leave the United States even further behind other nations in the development of renewable energy, even more wedded to energy sources that are unsustainable in the long run, and facing an even greater uphill battle in the effort to control global warming emissions.

It is in this atmosphere of challenge, opportunity and political stalemate that state governments have stepped in to take leadership. Across the nation, states have developed innovative tools to encourage a shift to a clean energy strategy. Renewable energy standards for electricity generation; dedicated, ratepayer-supported energy efficiency and renewable energy funds; tighter appliance efficiency standards; and stronger residential and commercial building codes are just a few of those tools.

The momentum for state action on energy has only increased over the past five years. A coordinated, multi-state effort to promote clean energy policy can ensure that that momentum continues — and, in the process, create the conditions for renewed initiative at the federal level.

Such an effort, however, must proceed from a set of shared assumptions, values and approaches. This document sketches out the basics of such a program — highlighting the major energy-related problems facing the United States, suggesting technologies and policy approaches that should be prioritized, and assessing how these approaches would impact America's energy future.

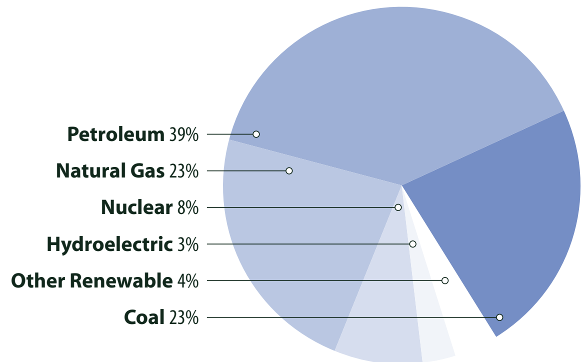
America's Energy Crisis

America's reliance on dirty, dangerous and unreliable sources of energy is the source of many of the nation's economic, environmental and public health problems.

Tied to the Tracks — America's Economy in Jeopardy

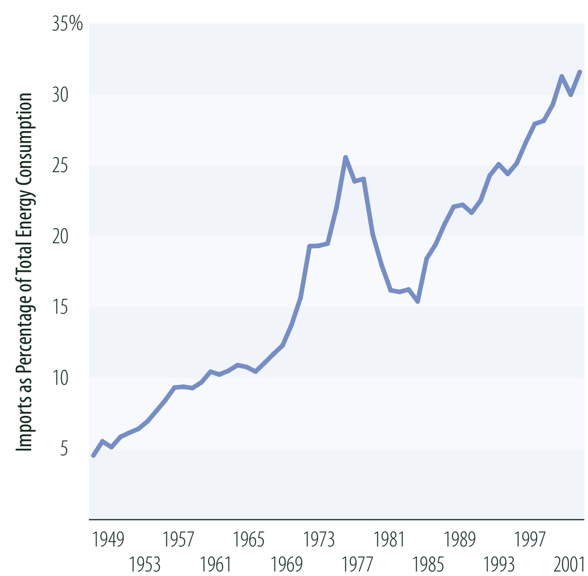
America's economic prosperity is increasingly tied to events beyond the nation's control. The central problem is the United States' continued overreliance on fossil fuels, which supply more than 86 percent of America's energy.[1]

Fig. 1. Energy Consumption in the U.S. By Source



The most obvious problem caused by this overreliance — and one acknowledged by virtually all observers — is that America obtains too much of its fossil fuel from foreign nations. America's dependence on imported energy has increased dramatically in the last two decades. In 1985, imports represented only 15 percent of U.S. energy consumption; today, they represent nearly one-third (32 percent).[2] Most of these imports are in the form of petroleum, providing petroleum exporting nations with immense power over the future of the American (and world) economy.

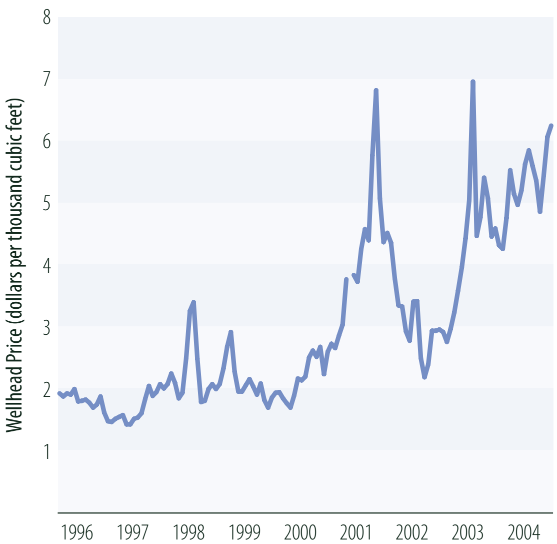
Fig. 2. Imports as Percentage of U.S. Total Energy Consumption[3]



(For more about how petroleum is addressed in this document, see "What About Transportation?" on next page.)

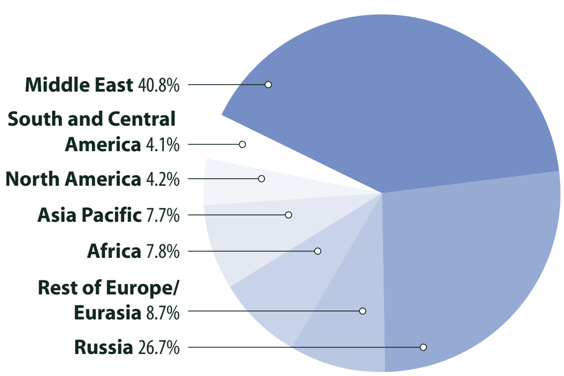
The growth in import dependence also extends to natural gas, an increasingly important fuel in America's energy mix. While the bulk of America's natural gas is currently produced domestically or imported from Canada, North American production has proven unable to meet rising demand — leading to the natural gas price spikes of recent years. (See Fig. 3.)

Fig. 3. Volatility in Natural Gas Prices[4]



Importation of liquefied natural gas (LNG) has increased dramatically to meet the supply shortage, and will likely increase further in the years to come. But LNG importation threatens to further increase the nation's dependence on foreign nations for critical energy supplies. Natural gas is more widely distributed around the globe than petroleum, but reserves are still highly concentrated in a small number of nations, including Russia and several nations in the Middle East. (See Fig. 4.)

Fig. 4. Global Proved Reserves of Natural Gas



Import dependence may garner headlines and public attention, but less often discussed is the threat that fossil fuel reliance *itself* poses to the American economy, regardless of the fuel's country of origin. Fossil fuel markets are notoriously volatile, as the recent run-up in natural gas and petroleum prices has demonstrated yet again. Fluctuations in demand, production capacity, weather and other factors can cause dramatic jumps or declines in fossil fuel prices, straining the pocketbooks of consumers and threatening the stability of industries dependent on fossil fuels.

What about transportation?

Transportation is a major consumer of energy in the United States, responsible for 27 percent of energy use, the vast majority of it in the form of petroleum.[5] Reducing the petroleum dependence of the transportation system is a key facet of any clean energy strategy.

States, however, have less leeway in the development of policies to reduce transportation-sector energy use, largely owing to the federal preemption of state efforts to regulate automobile fuel economy and limitations on how federal transportation dollars may be spent.

While these limitations do not prevent states from implementing policies to reduce transportation energy consumption – and while several states have made significant progress in this regard – we have opted to focus on energy use in other sectors of the economy. We encourage further efforts to promote sound state energy policies on transportation.

Declining Production, Long-Term Constraints

Some fossil fuels face inherent constraints in their availability — constraints that are already making their presence felt. Domestic reserves of natural gas are showing signs of strain. In 2002, the number of producing natural gas wells in the U.S. hit an all-time high, yet aggregate production *decreased* from the year before due to declining well productivity. The average natural gas well operating in 2002 produced half as much gas per day as the average well in operation in 1980, despite improvements in extraction technology.[6] Drilling our way out of the natural gas crisis is not a viable option.

There are growing concerns about the long-term viability of global petroleum supplies, with some analysts projecting that global oil production will peak at some point in the next few decades (and perhaps by the end of this decade), leaving production unable to satisfy demand and triggering massive price spikes and economic instability.[7] Discoveries of new supplies of oil peaked during the 1960s and new discoveries have lagged behind production since the late 1980s.[8] In other words, every year we consume much more oil than we discover. And while technological advances have made it possible to squeeze more oil from existing fields

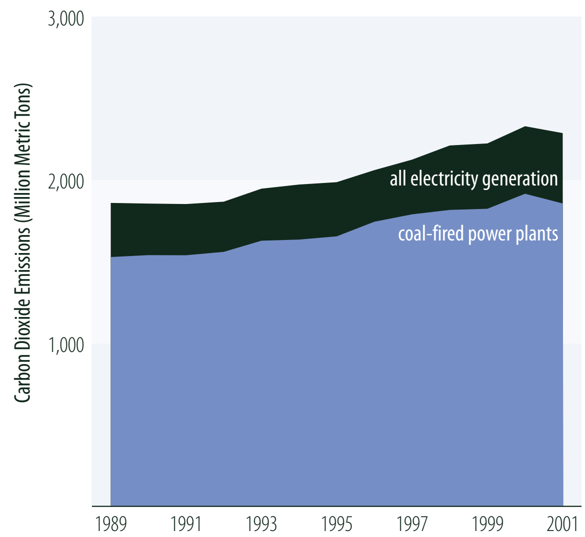
— and to produce oil from non-conventional resources such as oil sands — extraction of oil will continue to become more difficult and expensive over time.

The roiling debate over "peak oil" masks the acknowledged fact that, even without a global production peak, more of America's oil imports will soon be coming from nations in the Middle East. At least 50 oil-producing nations are already past their production peaks, including the United States, where domestic production peaked in the 1970s.[9] But Middle Eastern nations such as Saudi Arabia, Iran and Iraq claim to have petroleum reserves that would last 75 years or more at current rates of production. Inevitably, supplying global demand for oil will require more production from those nations, as supplies from other nations dwindle — a development with potential geopolitical consequences.

At first glance, coal appears to face none of the supply problems affecting natural gas and oil. It is domestically available, abundant and (when social, environmental and public health costs are not factored in) cheap. Yet, coal faces its own limitations, largely with regard to its outsized impact on global warming. Coal combustion is responsible for about 37 percent of the world's emissions of carbon dioxide from fossil fuel burning. In America, coal's share of global warming emissions is even higher, 39 percent. And carbon dioxide emissions from coal burning have been increasing in the U.S. (up 17 percent since 1990) and worldwide (up 8 percent since 1990).[10]

The vast majority of coal consumed in the United States is for electricity generation. In 2001, coal was used to generate 53 percent of America's electricity, but it was responsible for producing more than 80 percent of the carbon dioxide emitted by all forms of power generation.[11] (See Fig. 5.)

Fig. 5. Carbon Dioxide Emissions from Power Plants[12]



The scientific consensus in support of global warming — and the recent spate of killer storms, ice shelf collapses and other severe events consistent with climate change — show that it is not a matter of if, but rather when the U.S. and the world will take concerted action to reduce carbon dioxide emissions. The entering into force of the Kyoto Protocol in early 2005, coupled with nascent efforts to regulate carbon dioxide emissions in several regions in the United States, suggest that the time is coming soon when coal consumption will either be constrained through regulation or discouraged through emission trading schemes, carbon taxes or other measures. The burning of coal, especially in the absence of efforts to capture and store carbon dioxide, cannot be considered a reasonable replacement for increasingly constrained supplies of oil and natural gas.

Clear and Present Dangers — Public Health and Environmental Risks

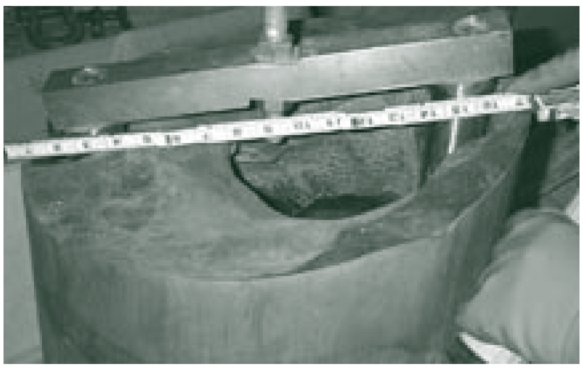
Energy production and consumption pose numerous threats to the environment, public health and public safety. The United States has made many worthwhile efforts to mitigate these threats, but they have not been eliminated.

Many of the environmental and public health impacts of energy production and consumption are widely recognized and need not be discussed in detail here. These impacts include particulate matter and mercury releases from coal-fired power plants; emissions of smog-forming and toxic pollutants from automobile exhaust; and oil spills and pollution from offshore drilling.

Yet, even many of the technologies and resources hailed as potential "solutions" to the nation's energy crisis bring their own threats to the environment and public safety.

Nuclear Power

Nuclear power poses massive risks to public safety and the environment. The world has been fortunate to have gone two decades without a major nuclear accident, but the impacts of such an event — particularly were it to occur on American soil — would be dramatic. The Chernobyl disaster, for example, exposed approximately 4.9 million people to radiation and has led to increased rates of thyroid and breast cancer in the area surrounding the plant.[13] The economic impact has been estimated to be as much as half a trillion dollars.[14]



Nuclear power regulators failed to prevent the corrosion of the reactor vessel head at Ohio's Davis-Besse nuclear plant, which could have led to a serious accident.

PHOTO: U.S. NUCLEAR REGULATORY COMMISSION

Unfortunately, the potential for a serious nuclear accident in the United States remains real. The American nuclear industry has experienced a series of "near misses" over time, including the partial meltdown of the Fermi nuclear reactor near Detroit in the 1960s and the Three Mile Island accident in 1979. But problems continue up to the present day. In 2002, for example, workers discovered a football-sized cavity in the reactor vessel head of the Davis-Besse nuclear reactor in Ohio. Left undetected, the problem could have eventually led to leakage of radioactive coolant from around the reactor core and, possibly, a meltdown. The U.S. Government Accountability Office (GAO) concluded that the Nuclear Regulatory Commission (NRC) "should have but did not identify or prevent the vessel head corrosion at Davis-Besse" and that the NRC's "process for assessing safety at nuclear power plants is not adequate for detecting early indications of deteriorating safety."[15]

The prospects of such mishaps increase as the nation's nuclear fleet continues to age, and as the competitive pressures spawned by deregulation of the electric industry cause operators to push nuclear reactors to their operational limits. The bulk of America's nuclear fleet is between 20 and 36 years old, and the original 40-year licenses of nuclear reactors are scheduled to end beginning in 2009.[16] The NRC has already begun to issue 20-year license extensions for some nuclear plants. But continued operation of nuclear plants beyond their original 40-year lifespans could lead to unforeseen safety problems. In 2001, the Union of Concerned Scientists identified eight instances in just the previous 17 months in which nuclear reactors were forced to shut down due to age-related equipment failures.[17]

Since 2000, the NRC has approved 55 power "uprates" for nuclear reactors, allowing the reactors to produce power at greater levels than their original licenses allowed. The number of uprates approved in the last five years has exceeded the number approved in the previous 23 years.[18] Uprates have already caused some safety concerns, particularly at two boiling water reactors that experienced vibration-induced damage following the implementation of NRC-approved uprates.[19] Meanwhile, economic pressures to continue operating the Davis-Besse reactor despite known safety concerns played a large role in the near-disaster at that plant, and could lead to the filing of federal criminal charges against the owner of the plant, FirstEnergy, for allegedly lying to federal officials in an effort to delay the shutdown of the plant.[20]

Nuclear safety, therefore, is a major concern even without considering two of the most severe threats: the possibility of terrorism or sabotage and the dangers posed by nuclear waste. The security record of nuclear plants is not reassuring. In tests at 11 nuclear reactors in 2000 and 2001, mock intruders were capable of disabling enough equipment to cause reactor damage at six plants.[21] A 2003 GAO report found significant weaknesses in the NRC's oversight of security at commercial nuclear reactors.[22] As late as September 2004 — three years after the September 11, 2001 terrorist attacks — GAO reported that the NRC had not yet implemented some of GAO's earlier recommendations and that the NRC is not yet in a position to assure that plants are able to defend against terrorism.[23]

Nuclear waste disposal poses yet another long-term environmental and public health threat. Nuclear power production results in the creation of tons of spent fuel, which must be stored on-site or in a centralized repository. Neither option is ideal. Centralized repositories

— such as the proposed Yucca Mountain facility in Nevada — require the transport of high-level nuclear waste across highways and rail lines within proximity of populated areas. Once the waste arrives, it must be held safely for tens of thousands of years without contaminating the environment or the public. On-site storage is dangerous as well. Nearly all U.S. nuclear reactors store waste on site in water-filled pools at densities approaching those in reactor cores. Should coolant from the spent-fuel pools be lost, the fuel could ignite, spreading highly radioactive compounds across a large area. One estimate has put the cost of such a disaster at 54,000 to 143,000 extra deaths from cancer and evacuation costs of more than $100 billion.[24]

It is conceivable that a new generation of nuclear reactors could be built to operate more safely, without routine radionuclide releases, and with reduced risk of accident — although the technological complexity of nuclear power makes this unlikely. It is even conceivable that nuclear power plants could be built that are impenetrable to outside terrorist attack or to in-house sabotage. But the prospect that all of these conditions could be met — and at an economic cost that would be acceptable to consumers and the public — is remote. And even if they were to be met, nuclear waste storage and disposal would remain an unsolved, and possibly insurmountable, problem.

The nuclear industry has also historically suffered from dismal economics, and the industry itself would not exist in its current form without massive taxpayer subsidies, such as research and development funding and the Price-Anderson Act, which protects nuclear operators from liability for damages from a serious nuclear accident. One study has estimated the cost of federal subsidies to the nuclear industry over the past 50 years at greater than $145 billion.[25] These economic concerns, coupled with the ongoing public health and safety issues, make nuclear power a poor bet for the nation's energy future.

Natural Gas

Natural gas has long been thought of as a "clean" fossil fuel for its relatively low emissions when burned. But the domestic extraction of natural gas poses its own environmental problems and the importation of liquefied natural gas (LNG) from overseas can pose a significant threat to public safety.

Natural gas extraction is not environmentally benign. Natural gas drilling creates many of the same environmental impacts as oil drilling. The drilling of natural gas wells produces drilling wastes containing numerous toxic substances such as lead, mercury and arsenic, which, if not properly disposed of, can pollute the environment. When built in wilderness areas, natural gas drilling infrastructure — such as roads, pipelines and the wells themselves — fragments wildlife habitat and produces air emissions.[26]

Increasing demand for natural gas is driving greater reliance on imports of liquefied natural gas from abroad — imports that pose both public safety and energy security concerns.

PHOTO: U.S. COAST GUARD, PA3 DONNIE BRZUSKA

Some forms of natural gas extraction — such as the extraction of coal bed methane — pose even more serious environmental and social consequences. Coal bed methane extraction, which is becoming increasingly common in Wyoming and other western states, requires the pumping and disposal of millions of gallons of saline water from underground coal seams. Pumping this water to the surface frequently depletes local aquifers — threatening the livelihood of farmers and ranchers — and results in the discharge of toxic substances to ecosystems.

Importation of LNG from overseas poses a different, but still significant, set of risks, the greatest of which are the risks posed by accidental or deliberate spills from LNG tankers. A 2004 report by researchers with Sandia National Laboratories estimated that a large-scale breach in an LNG tanker (such as might be created by a terrorist attack), if ignited, could cause major injuries and significant damage to property within about one-third of a mile of the tanker, as well as lesser injuries and property damage within a radius of about one mile.[27] Should LNG facilities be located in or near population centers, the risk would be great: in Boston, for example, hundreds of thousands of people live and work within one mile of an LNG terminal and the shipping lanes used by LNG tankers.

Coal

Discussions of the environmental impact of coal often focus on air emissions resulting from coal combustion, and for good reason: coal combustion is a major source of hazardous particulate matter, mercury, and global warming-inducing carbon dioxide. Yet, the environmental impacts of coal extraction are themselves important and cannot be ignored.

"Mountaintop removal" coal mining has leveled hillsides and polluted water supplies in Appalachia.

PHOTO: V. STOCKMAN

Coal mining is a significant source of toxic discharges to the air, land and water. In 2002, coal mining operations reported the release of more than 600,000 pounds of toxic substances to the air and more than 150,000 pounds of direct toxic emissions to surface waterways, including emissions of ammonia, arsenic, chlorine, chromium and lead.[28]

Mining is also often destructive of local landscapes. In Appalachia, a form of mining known as "mountaintop removal" has leveled many hills and filled valleys with the resulting debris. In recent years, mountaintop mining has affected more than 1,200 miles of streams, with an estimated 724 stream-miles of waterways covered by valley fills.[29] Underground "longwall" mining has triggered land subsidence that has undermined more than 5,000 homes, businesses and other properties and altered steams and wetlands.[30] Federal and state mining and mineral rights laws often leave surface property owners and nearby landowners with little recourse to protect their properties and quality of life.

Myths Driving America's Energy Policy

America's dependence on fossil fuels has led the nation to a crossroads. Continuation of the policies and practices of the past will lead the nation to economic peril and environmental disaster. This crisis presents an opportunity to chart a major shift in direction for the nation's energy policy.

As yet, however, there is little agreement about what that direction should be and who should take the lead — even among those who agree that the nation's current course is ill-advised. The past several years have seen a slew of reports, analyses, plans and proposals touting everything from coal gasification to smart electric grids, and from hydrogen to LNG, as the ultimate solutions to the nation's energy problems.

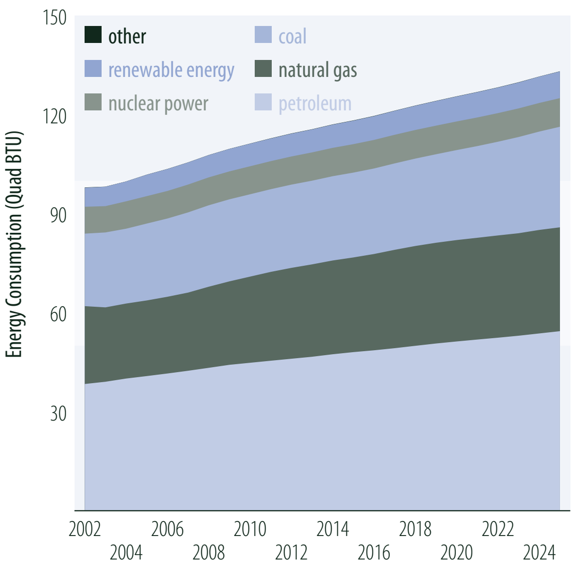
Many of these technologies can play a role in a more sustainable energy system for the United States. But none alone will solve the problem. And the emphasis on these technologies — many of which rely on the indefinite future use of fossil fuels — has sometimes come at the expense of renewable technologies and conservation and efficiency efforts that would make far better economic and environmental sense.

Ultimately, many of the proposed "solutions" start from a false understanding of the nation's current energy predicament — in particular, two "myths" that continue to dominate the nation's energy debate.

Myth #1: Energy Use Will (and Must) Continue to Increase

The most prevalent myth underpinning the energy debate is that a vigorous economy and sound standard of living can only be achieved through ever-increasing consumption of energy. The "more, more, more" school of thought is exemplified by the Energy Information Administration's (EIA) annual projections of future energy consumption. According to EIA's most recent projections, Americans living in 2025 will consume 39 percent more petroleum, 40 percent more natural gas, and 34 percent more coal than their counterparts in 2003.[31]

Fig. 6. Projected Energy Consumption, U.S. (EIA Reference Case Forecast)[32]



Assuming that energy consumption will increase dramatically leads one naturally to the question of where all that energy will come from. Which is exactly the point — the assumption that increasing energy consumption is a given leads to an errant focus on *supply-side solutions*.

A more constructive approach to America's energy crisis would require us to ask a different set of questions: Can we reduce our consumption of energy without sacrificing our quality of life? And if so, how?

The answer to the first question is easy: Yes, we can. In fact, we already have.

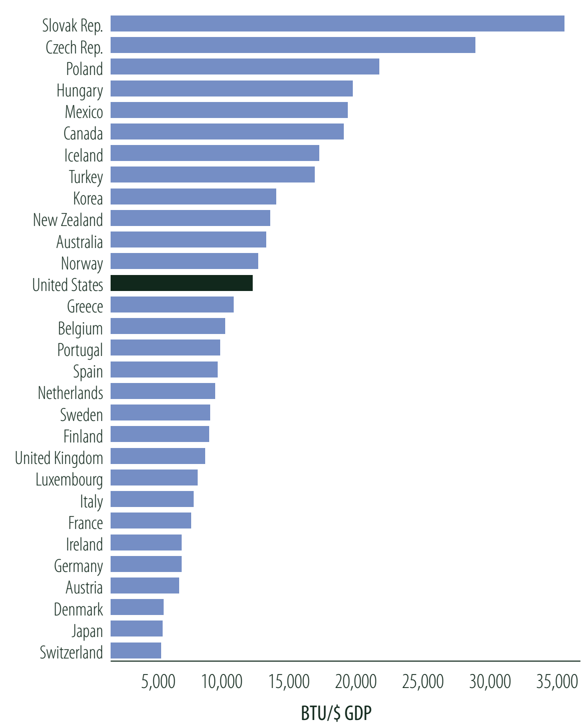
Energy efficiency improvements, such as the installation of insulation in residential buildings, helped America reduce its energy consumption after the energy crises of the 1970s.

PHOTO: NREL/KAREN DOHERTY

In 1979, the United States consumed 80.9 quadrillion BTU of all forms of energy. From 1979 to 1982, energy use in the U.S. declined each year, and energy consumption did not surpass its 1979 level again until 1988.[33] Over that nine-year period of 1979 to 1988, the nation's inflation-adjusted gross domestic product (GDP) increased by 30 percent.[34] Improvements in energy efficiency — driven by a mix of market conditions (higher prices) and government programs such as tighter appliance and automobile efficiency standards — created conditions for both reduced energy consumption *and* robust economic growth.

Over the past two decades, America has consistently used less energy to produce more economic wealth. In 1980, the U.S. used 16,000 BTU for every dollar in gross domestic product; by 2002, we were using only 10,500 BTU — a drop of about one-third. But the United States still remains a profligate user of energy compared to many of our peers in the industrialized world. America's economy remains twice as energy-intensive as that of Germany and nearly three times as energy-intensive as that of Japan.[35]

Fig. 7. Energy Use per Unit of Gross Domestic Product, 2002



On a per-capita basis, the U.S. uses more energy than the vast majority of industrialized countries, surpassed only by Norway, Luxembourg, Iceland and Canada.[36]

The potential for additional energy efficiency improvements in the U.S. is immense. A number of analyses published in recent years suggest that there are enough cost-effective potential energy efficiency improvements to reduce electricity demand by 11 to 23 percent below projected levels by 2010, and by as much as 21 to 35 percent by 2020. Given reasonable assumptions about future electricity consumption, this would result in electricity demand in 2025 being barely higher than demand in 2005.[37]

These estimates include only efficiency improvements that are *cost-effective* to the consumer in narrow economic terms — the inclusion of efficiency efforts that would be cost-effective to the nation, factoring in environmental, public health and national security concerns, would likely be significantly higher. Moreover, the amount of energy efficiency that would be cost-effective to the consumer would increase significantly should fossil fuel prices continue to rise.

Similar efficiency improvements are possible for the direct use of natural gas and other fossil fuels. The American Council for an Energy Efficient Economy (ACEEE) estimates that cost-effective efficiency measures could reduce natural gas consumption by at least 10 percent below projected levels by 2020.[38]

Not only can energy efficiency contribute to solving the nation's long-term energy problems, but it can also often be implemented quickly and inexpensively — serving as a "strategic reserve" of energy that can be tapped in event of a crisis. California demonstrated the importance of this strategic reserve in its response to the state's 2000-2001 energy crisis. In 2001, California dramatically ramped up its energy efficiency and conservation efforts — slashing electricity consumption and alleviating the pressures that had helped to cause the state's rolling blackouts and spiking electricity prices.

America has already proven that economic growth and long-term stability in energy consumption can exist side-by-side. Indeed, taking advantage of the ample energy efficiency opportunities that currently exist would be a boon to America's economy as jobs and money are retained domestically (rather than paying for imported energy), businesses become more efficient producers of goods and services, reduced demand drives down energy prices, and the costly environmental and public health impacts of energy production and use are reduced.

Therefore, the nation and each of the states should establish a goal of (at minimum) stabilizing energy consumption at current levels over the next two decades.

Myth #2: America Must Continue to Rely on the Energy Sources of the Past

The energy debate in the United States often devolves into a choice among a series of unpalatable options. Do you want to reduce dependence on foreign energy sources by increasing our reliance on coal (with its massive impacts on the environment and public health)? Or do you prefer cleaner-burning natural gas (with its supply problems and volatile prices)? If not, then you must support low-carbon, "non-polluting" nuclear energy (which is high in cost and potentially devastating to public safety).

Clean, renewable energy — such as solar, wind and many forms of biomass energy — rarely enters into the discussion in a serious way. To the extent that it does, it is either as a bit player or as an option that might be nice at some unknown point in the future.

To ignore or downplay the importance of renewable energy, however, is to miss a golden opportunity. After decades of anticipation, research and study, renewable energy has arrived and is ready to play a leading role in solving America's energy problems — if we seize the opportunity.

America has vast potential to harness energy from the sun, wind, crops and other natural forces. The nation's cumulative wind power potential has been estimated at upwards of 10 trillion kilowatt-hours annually — more than twice the amount of electricity currently generated in the U.S.[39] The Great Plains has been dubbed the "Saudi Arabia" of wind for its vast, high quality wind resource. Similarly, the United States could generate all of its electricity using solar photovoltaics (PV) by installing solar panels on only 7 percent of the land area currently used for buildings, parking lots and other built-up areas.[40] Tapping solar thermal energy through "passive solar" applications, such as solar hot water heating, can significantly reduce use of fossil fuels in buildings. And there is tremendous potential for energy from crops, tides, underground heat and other renewable sources.

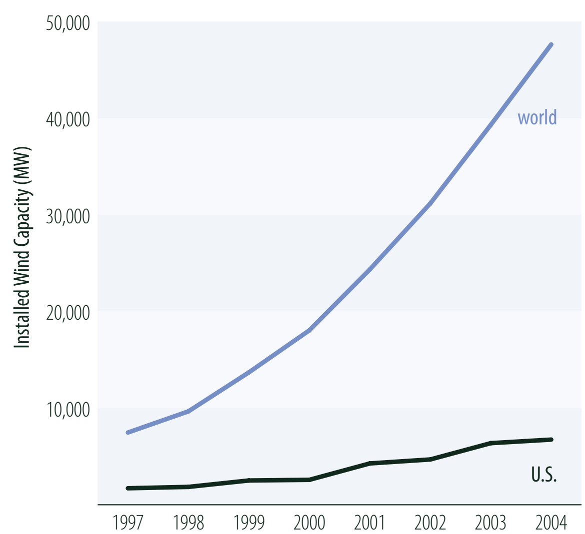
Until recently, the cost of renewable power has caused it to be rejected by utilities and regulators for most applications. Not any longer. The Energy Information Administration (EIA) projects that, in 2010, the cost of power from new wind power plants will be lower than new coal-fired power plants and on a par with advanced natural gas combined-cycle plants — and even that conclusion assumes future natural gas prices well *below* today's levels.[41] In some areas of the country, wind is already the lowest-cost resource over the entire life cycle.

Denmark and other European nations are generating increasing amounts of energy from wind power installations, such as this one off the Danish coast.

PHOTO: BONUS ENERGY A/S

So why has wind power not taken off on its own accord? To a certain extent it has: the amount of installed wind capacity in the United States has more than tripled in the last six years and could double again within the next five years.[42] (See Fig. 8.) But wind power has been held back by the economics and uncertainty of the deregulated electric industry. For all its benefits, wind power is a capital-intensive power source; the bulk of investment must be made up front. The continuing uncertainty surrounding how the electric industry will be structured, the recent emphasis on short-term power purchases over long-term contracts, and lingering bias on the part of utilities, their large customers and regulators have put wind power at a disadvantage — even when it is the best option in the long run.

Fig. 8. U.S. and World Installed Wind Capacity[43]



The economics of solar PV as a direct electricity generation source are not nearly as favorable as the economics of wind, but that too is changing. As with wind power, the cost of solar PV has dropped dramatically in recent years — over the last two decades, the cost of solar panels has declined from about $20 per Watt to as low as $3.50 per Watt today.[44] Moreover, residential and commercial PV provides unique economic value because of its status as a distributed resource — meaning that PV installations can reduce the need for additional investments in electricity transmission and distribution infrastructure.

Thanks in large part to government research and development programs and incentive programs (such as tax credits) in the 1970s, the United States was once

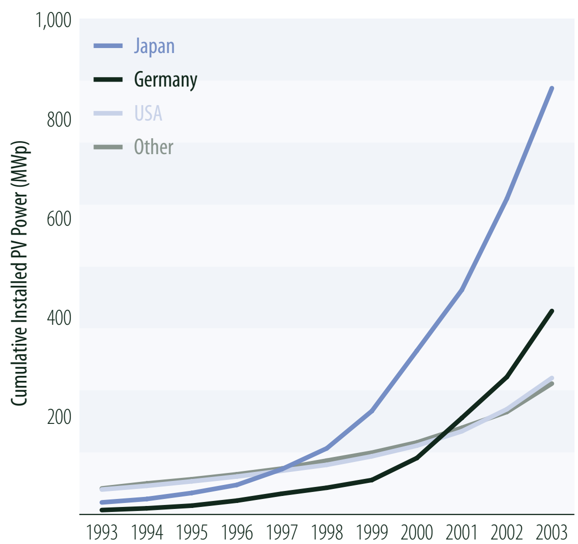
The cost of solar panels has dropped dramatically and could become increasingly competitive in the years to come.

PHOTO: DOE/NREL/ROBB WILLIAMSON

a world leader in the production and installation of renewable energy technologies. Unfortunately, in recent years other nations — most notably Japan and several European countries — have recognized the long-term benefits of renewables and surged ahead of the United States. Just three European nations — Spain, Germany and Denmark — account for 60 percent of the world's installed wind power capacity, compared to just 16 percent for the United States. In Denmark, wind power now accounts for about 20 percent of all power generation.[45] In Germany, aggressive efforts on the part of the government (including guarantees of high, fixed prices for wind power) resulted in a quadrupling of installed wind capacity between 1998 and 2003.[46]

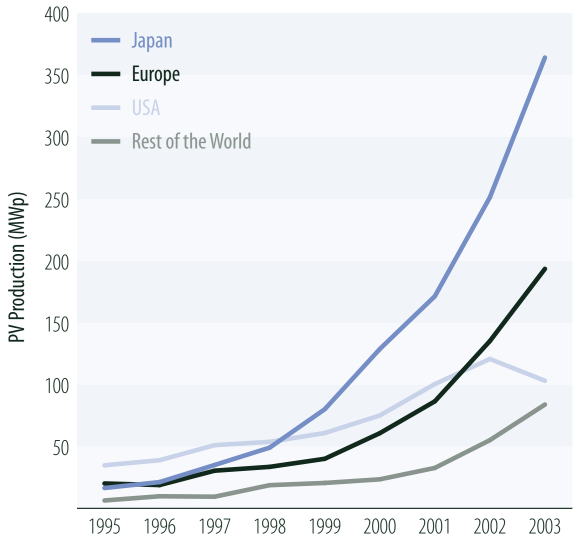
The same thing has happened with regard to solar power. In 1993, the United States accounted for 37 percent of the world's installed solar PV capacity and was far and away the leading country for solar power generation. By 2002, the U.S. had slipped to third behind Japan (which now accounts for nearly half of global solar PV capacity) and Germany. (See Fig. 9.) Japan's progress has been especially remarkable; over the last decade, installations of solar PV have increased 35-fold, while system prices have declined by 76 percent.[47] Solar power is now virtually cost-competitive with utility-based power for residential applications in Japan and the number of solar installations is only expected to increase over time.

Fig. 9. Installed Solar PV Capacity (MWp)[48]



The U.S.'s failure to keep up with renewable power development in other nations has consequences for the nation's future economic growth. As late as 1997, the United States was the world's leading producer of solar PV systems. But by 2003, Japan's PV manufacturing outstripped that of the U.S. by a factor of more than three and America had fallen behind Europe in the race to supply the growing market for PV. (See Fig. 10.) Danish companies now supply more than half the wind turbines used worldwide and the industry employs more than 12,000 people in Denmark, while the German PV industry now employs more than 10,000 workers.[49] By failing to invest in renewable energy now, the United States risks falling even farther behind other industrialized nations in the development, manufacturing and sale of renewable energy technologies.

Fig. 10. World Solar PV Module Manufacturing (MWp): 1995-2003[50]



America could achieve other economic benefits from renewables as well. Like efficiency, renewable energy reduces demand for fossil fuels, reducing the risk of price spikes and keeping American money at home. Wind power has provided additional income to farmers in several states, helping to keep struggling rural communities afloat. Even though many components of renewable energy systems are made abroad, installation and maintenance of those systems is a homegrown industry, one that can provide more and better jobs than fossil-fuel fired power plants.[51] Indeed, a number of studies have shown that renewables are a potential boon to economic development.[52]

So, how big a contribution can wind and solar power be expected to make in solving America's energy problems? Denmark has already shown that renewables can contribute as much as 20 percent of power generation without adverse effects on the electric system. *A medium-term goal of achieving 20 percent of power production from new renewables by 2020 is realistically achievable in the United States.* The ultimate share of the nation's electricity and overall energy use that can be created from renewable sources may be higher still.

Even with the investments in energy efficiency and renewables described here, America will still rely, in the medium term, on fossil and other sources of energy for much of its needs. But shifting toward a clean energy path would reduce the strain on the nation's energy supplies, reduce the environmental and public health impacts of energy production and consumption, and set the nation on the right course for the long term — away from the dirty, dangerous and unstable energy sources of the past and toward cleaner, more efficient technologies.

The Vision: A Clean Energy Future, 2020 and Beyond

An America that uses no more energy than it does today — and that relies on renewable sources for a large and growing share of that energy — is not a fantasy. It is a realistic, perhaps even conservative, goal that can be achieved using technologies and policy tools existing today.

Achieving that goal will leave America cleaner, safer, more secure and more prosperous in the years to come. But it is only a beginning: the imperatives of global warming alone demand that we reduce our consumption of fossil fuels even further within the foreseeable future. By increasing energy efficiency, ramping up the deployment of renewable power, and continuing with research and development of the next generation of energy technologies, America will be in a better position to meet the challenges of the future.

A Clean Energy Vision for 2020

Stabilizing energy demand and shifting to renewable energy will have significant impacts on America's mix of energy sources. By 2020, according to one recent analysis, the United States could reduce its generation of electricity from coal by nearly 20 percent and generation from nuclear power by 25 percent, while holding natural gas-fired generation to a relatively modest increase of 23 percent (compared to the 70 percent increase forecast by the U.S. Energy Information Administration).[53] Stabilizing consumption of oil and natural gas in transportation, industry and buildings would head off major increases in consumption in these areas as well. Such a shift would have profound impacts on the nation's economy and environment.

The Economics: Greater Stability, More Investment at Home

Renewables and efficiency are economic winners. Investment in these resources will generate jobs, renew communities, stabilize energy prices, and reduce the American economy's exposure to events abroad.

Energy Cost Savings

Investments in efficiency and renewables can make energy cheaper — not just for those who make the investments, but for the entire economy.

A shift to renewables and efficiency in the electric sector, for example, is projected to produce electricity cost savings of $36 billion by 2025 — reducing the cost of producing electricity by about 10 percent versus business-as-usual.[54] A similar scenario, in which a renewables-and-efficiency policy is paired with a shifting of federal fossil fuel and nuclear subsidies to clean alternatives, would produce an estimated $16 billion in savings on electricity bills and $11 billion on natural gas bills by 2020.[55]

A recent study by researchers at the Lawrence Berkeley National Laboratory estimated that the net present value of savings from renewables and efficiency policies could reach $23 billion *in natural gas bill savings alone* through 2035.[56] And many of these benefits can be achieved quickly: the American Council for an Energy-Efficient Economy estimates that a policy path that reduces natural gas demand by 4 percent in the next five years would slash wholesale natural gas prices by one quarter, saving the American economy $100 billion at the cost of $30 billion worth of government and private-sector investment.[57]

Jobs and Economic Development

In addition to saving money on energy, investments in renewables and efficiency will generate jobs for American workers and economic development for American communities. The reason is simple: investments in efficiency and renewable energy replace expenditures for fuel (much of which is sent overseas) with expenditures for labor and materials produced at home.

One 2005 study estimates that a clean energy strategy, coupled with a shifting of federal energy subsidies to renewables and efficiency, could create as many as 154,000 new jobs in the United States and increase net wages by $6.8 billion.[58] The Union of Concerned Scientists estimates that a 20 percent national renewable energy standard for electricity generation would create twice as many new jobs as meeting demand growth with fossil fuels, while adding $10.2 billion to the nation's gross domestic product.[59]

Wind energy has potential advantages for spurring rural economic redevelopment. The U.S. Department of Energy estimates that producing about 5 percent of the nation's power from wind by 2020 would create $60 billion in capital investment in rural America by 2020, provide $1.2 billion in new income for farmers and rural landowners, and create 80,000 new jobs. This new source of income — which could amount to as much as $14,000 per year for the owner of a 250-acre farm — could make the difference between insolvency and survival for many remaining family farmers, and the property tax revenues from the installations could provide a new source of income for struggling rural communities.[60]

Investments in renewable energy sources also support American businesses that manufacture renewable energy components. Despite the ground lost by

Numerous studies have shown that investments in renewable energy and energy efficiency create more jobs than meeting our energy needs through fossil fuels.

PHOTO: NEG/MICON

American renewable energy manufacturers over the past decade, significant manufacturing infrastructure remains. Creating a home-grown market for renewable energy technologies could ensure that these manufacturers remain and grow in the United States.

Improved Economic Stability

Finally, a clean energy strategy would reduce America's exposure to price spikes, supply disruptions and other repercussions of our reliance on fossil fuels. The recent natural gas crisis, for example, has been estimated to cost the American economy as much as $111 billion over the last four years, and has had ripple effects throughout the economy.[61] The oil price spikes of 2004-2005 have imposed similar costs. A clean energy strategy would reduce demand-side pressure on oil and gas prices, while also insulating the United States from the impacts of unpredictable overseas events on our energy supply.

Other Benefits

Energy efficiency and renewables would reduce many of the costs imposed by energy production and consumption on American society. Investments in energy efficiency, for example, would likely reduce the need for additional transmission infrastructure for the American electric system — saving billions of dollars in the process. Reducing the pressure to drill for natural gas in ecologically important lands would preserve water resources and wildlife that are important to many agricultural and tourism economies. And reductions in power plant pollution would likely result in reduced public health costs for the treatment of asthma and other diseases that are triggered by these pollutants.

In short, while various studies use different methodologies to quantify the benefits of a transition to clean energy, the ultimate conclusion is clear: the American economy would benefit, likely to the tune of tens of billions of dollars, from an energy strategy that emphasizes energy efficiency and renewable energy.

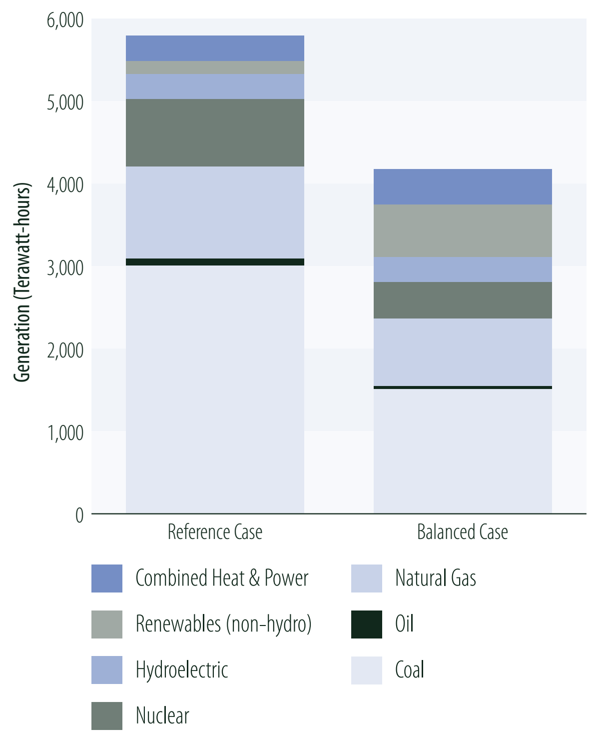
The Environment

For many, the desire to improve the environment is the primary impetus for a clean energy future. A medium-term strategy emphasizing efficiency and renewables would produce significant environmental benefits.

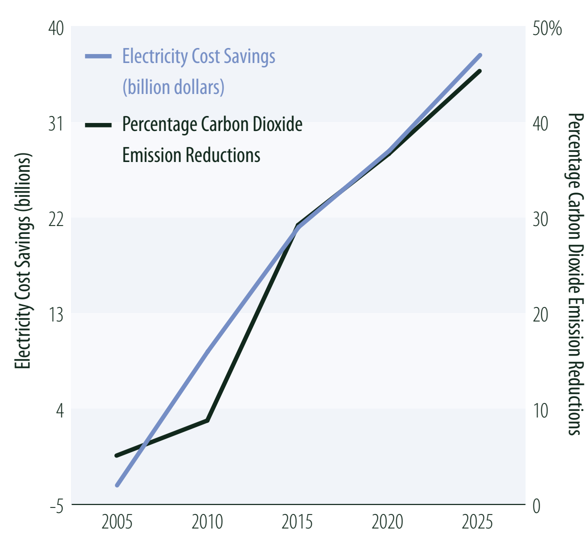
Perhaps the most important contribution of a clean energy strategy is in the reduction of global warming emissions. By 2020, according to one study, a clean energy transition of the kind envisioned here would reduce emissions of carbon dioxide (the leading greenhouse gas) from electric generation by about 17 percent below current levels, and by about 37 percent below the levels projected by the U.S. Energy Information Administration.[62] (And these reductions would come at a net economic *savings* to electricity consumers.)

Fig. 11 (a-b). One Scenario for a Clean Energy Transition — The Synapse/PIRG "Balanced Case"[63]

a. Total Electricity Generation by Fuel, 2025



b. Electricity Cost Savings and Carbon Dioxide Emission Reductions of "Balanced Case" vs. Reference Case



New renewable energy technologies — such as low-impact tidal energy — could make a contribution to the nation's energy needs in the years to come.

PHOTO: MARINE CURRENT TURBINES

Similar reductions could be expected for emissions of toxic mercury, acid rain-forming sulfur dioxide, health-threatening particulate matter, and smog-forming nitrogen oxides. Many of America's older, coal-fired power plants emit levels of pollution that would be illegal for new power plants built today — putting communities and public health at risk. A clean energy strategy emphasizing renewables and efficiency — and particularly one paired with efforts to cap emissions of carbon dioxide and hazardous pollutants from power plants — would create the conditions that would allow many of these older plants to be shut down, creating significant public health improvements and savings in medical costs.

Finally, a clean energy strategy that reduces nuclear power generation would reduce the need to store and transport nuclear waste — as well as reduce the dangers of a nuclear accident. Enough nuclear waste will have been created to fill the proposed Yucca Mountain depository by the day it opens. Given Yucca Mountain's $60 billion cost, reducing the need for nuclear waste disposal would likely save taxpayers and ratepayers money far into the future.[64]

Even these benefits do not fully address the "upstream" benefits of a clean energy strategy: the natural lands that remain undrilled or unmined, the oil spills averted, and the water resources that remain pristine. While any energy source — including solar and wind power — has some environmental impact, a shift to efficiency and renewables would yield dramatic benefits for the environment.

Technological Advances

A clean energy strategy could also serve as the spark for a new wave of technological innovation. This innovation, if properly managed, could increase the opportunities for clean energy development in the future.

Renewables

The development of renewable energy sources should be the first priority in any clean energy strategy. Programs such as renewable energy standards for electricity generation, ratepayer-supported renewable energy funds, financial incentives for individuals who generate renewable power, and research and development funding can support the continuing development of renewable technologies.

Many of the most promising renewable technologies have yet to reach full maturity. The solar photovoltaic industry, for example, has seen costs plummet over the past decade, but there is still a long way to go. Japan and Germany have shown that a thoughtful, consistent program of market-based incentives can drive increases in demand that, in turn, can drive down the price of PV systems. Moreover, new PV technologies — such as flexible thin-film systems that can be affixed to a variety of surfaces — bring with them the potential for further expansion in PV deployment.

A sustained market development and research effort that begins now could put solar PV "over the hump" in terms of consumer cost within the next decade, something that is already beginning to occur in Japan. The domestic solar PV industry has set a goal of reducing the delivered cost of solar electricity to 5.7 cents/kilowatt-hour by 2015 (including incentives) — a level below the retail residential cost of electricity in most of the country.[65] Should these cost reductions take place, solar PV could experience a dramatic increase in installations, with the solar industry estimating that PV could supply as much as half of all new U.S. electricity demand by 2025.[66]

Wind power will also benefit from increased installations and new technological developments. As with solar power, costs have declined dramatically in recent years — 90 percent in the past two decades — and should continue to do so as production volumes increase and technologies improve.[67] In addition, technological advances in small-scale wind power could allow some businesses and homeowners to generate their own electricity from the wind in the years to come. The wind industry has set a target of obtaining 3 percent of America's electricity from small wind turbines by 2020.[68] Several options are now under study for the storage of wind energy, which would further enhance the value of the wind resource by allowing power to be fed to the grid at any time, not just when the wind is blowing.

Other renewable technologies are emerging as well. Low-impact tidal energy — which uses turbines to generate electricity from water flows in a way similar to the generation of power from the wind — has the potential to provide significant amounts of electricity. A 300 kW tidal energy system has recently been installed off the coast of Great Britain, and a similar system is to be installed in New York City.[69] Analysts with the Electric Power Research Institute suggest that the amount of power that can be tapped from the tides could be as much as 10 times the amount currently generated from hydroelectric dams, which provided about 8 percent of America's electricity in 2003.[70]

Biomass energy also has tremendous potential to meet America's energy needs, particularly for transportation and other applications requiring liquid fuels. Some have suggested that America could develop a "carbohydrate economy" based on plant wastes and fast-growing energy crops. Already, biomass is the largest source of renewable energy in the U.S., due largely to the use of ethanol in motor fuel and production of electricity from forest product industry wastes.[71] It is estimated that energy crops could ultimately provide up to 14 percent of U.S. electricity or 13 percent of motor fuel, while at the same time bolstering the health of rural economies.[72]

Geothermal energy is yet another area in which great potential exists. Already, geothermal is a major source of electricity in several U.S. states, including California, Nevada and Hawaii. Currently identified geothermal resources could provide as much as 25 to 50 gigawatts of additional capacity in the United States.[73]

A combination of wind, photovoltaic, tidal, biomass and geothermal resources — coupled with energy-saving renewable technologies such as passive solar heating and lighting, solar hot water heating and geothermal heat pumps — could provide a large and growing share of America's energy. A consistent emphasis on renewables in public policy and in research and development funding could bring many of these technologies into the mainstream.

Combined Heat and Power and Distributed Generation

Another area of technology that could benefit from a clean energy strategy is the development of combined heat and power (CHP) and distributed generation (DG) resources. DG systems generate electricity locally, avoiding the efficiency losses that occur during long-distance transmission of power. Many DG systems also allow for the capture and productive use of waste heat through CHP.

CHP is a proven energy saver. The thermal efficiency (the percentage of the energy in the fuel that is converted to useful electricity or heat) of CHP systems can reach 80 percent, compared to the 45 percent efficiencies typical in traditional electric power plants.[74] CHP is already a viable option for many businesses and industries. And it could eventually become available to residential customers through distributed generation technologies such as fuel cells and natural gas microturbines.

A number of nonfinancial barriers, including intransigence by some utilities, have hampered the spread of CHP in the industrial and commercial sectors, while fuel cells and microturbines have yet to become cost-competitive for many consumers. CHP systems are not the ultimate solution to America's energy problems, since they still rely on fossil fuels. But they can ensure that those fuels are used far more efficiently than they are today.

Hydrogen

Hydrogen is commonly thought of as a clean and renewable fuel. The most abundant substance in the universe, hydrogen emits only heat and water vapor when used in a fuel cell. The greatest promise for hydrogen is for use as a transportation fuel, but the development of hydrogen fuel cells also has potential impacts on energy use in buildings.

Hydrogen, however, is only as clean and renewable as the energy sources used to create it. Hydrogen exists by itself almost nowhere in nature and must either be extracted from other fuels or created through electrolysis of water. Both processes, and particularly electrolysis, are energy intensive.

Should hydrogen be generated from renewable sources (such as wind- or solar-powered electrolysis or gasification of biomass) it would be virtually emission free over the entire fuel cycle. But the current emphasis of the Bush administration's energy policy is to promote the generation of hydrogen from coal or nuclear power — both options that promise to exacerbate, rather than lessen, America's dependence on dirty and dangerous energy sources.

A variety of analysts have questioned whether renewable generation of hydrogen makes sense in the short run, given the significant energy needed to extract hydrogen through electrolysis and the pressing need to use renewable power to replace dirty coal-fired power plants and other dangerous forms of electricity generation.[75] It is likely that, until renewable power makes up a much larger share of electricity generation than it does today and prices fall dramatically, renewable generation of hydrogen will remain of questionable overall benefit to America's energy security or environment.

Nonetheless, hydrogen can play an important role in America's long-term energy future and continued research and development work — coupled with a renewed emphasis on the generation of hydrogen from renewable sources — would be beneficial and could benefit from a clean energy strategy.

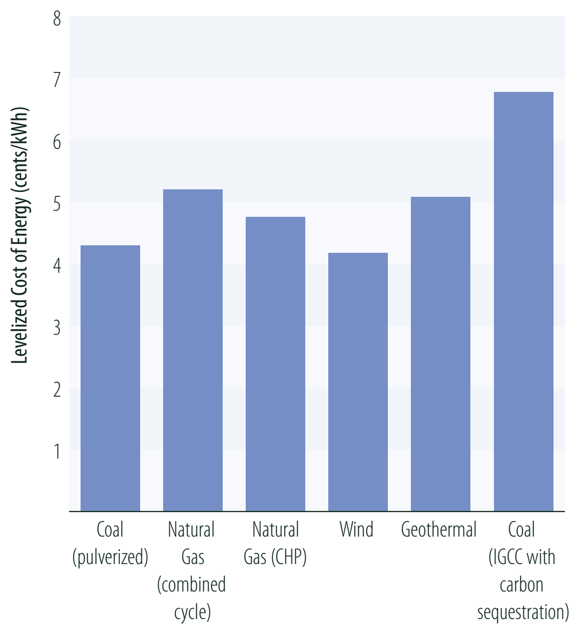
Coal Gasification and Carbon Storage

In contrast to renewable energy sources, which have attracted little federal funding, a great deal of money and attention has flowed toward so-called "clean coal" technologies, such as integrated gasification combined cycle (IGCC) coal-fired power plants.

IGCC power plants have important advantages over conventional coal-fired power plants: they are significantly more efficient and have lower emissions of conventional pollutants. In addition, IGCC technology allows for the capture of carbon dioxide, which some believe can be stored in large quantities underground — theoretically allowing for the production of low- or zero-carbon power from coal.

But there are several problems with IGCC and sequestration technology. First, an expansion of IGCC would require the extraction of more coal, with all its attendant environmental problems. Second, IGCC is not currently cost-competitive, even without the cost of carbon storage factored in. While estimates vary, electricity generated from IGCC plants is expected to cost significantly more than electricity from traditional pulverized coal power plants and possibly (if gas prices are relatively low) natural gas combined cycle plants.[76] (For one comparison of the cost of various technologies, see Fig. 12.) As a result, the cost of energy from IGCC is unlikely to be lower than that of truly renewable resources such as wind. Adding carbon capture, transportation and sequestration to the mix increases the cost of energy by another 40 to 50 percent.[77]

Fig. 12. Estimated Levelized Cost of Energy for Various Technology Options, Interior Western U.S., For New Facilities Constructed 2009-14[78]



Moreover, carbon transportation and storage — on the scale at which it must be implemented to make a major contribution to fighting global warming — is an immature technology with many serious questions about its future viability. Carbon dioxide has been injected into the ground for some time to enhance oil recovery. However, the storage of captured carbon dioxide from utility operations, or from the use of coal gasification to create hydrogen fuel for automobiles, would require a vast expansion of carbon transportation infrastructure and storage. For example, the National Academy of Sciences estimates that the conversion of the entire light-duty vehicle fleet to fossil fuel-based hydrogen would require the capture and storage of 200 to 400 million metric tons of carbon per year by 2050 — requiring something on the order of 1,000 carbon storage projects of the size of the two demonstration projects currently in operation, along with a large network of carbon dioxide pipelines.[79]

In addition, carbon dioxide stored in geological formations must be guaranteed to remain underground for hundreds or thousands of years to prevent re-release to the atmosphere and to prevent accidental, large-scale releases of carbon dioxide, which can be fatal to humans and wildlife. Ocean storage, which has been considered a leading option for carbon management, appears less attractive given recent research tying increasing ocean carbon dioxide levels with adverse effects on marine organisms.[80]

High costs, infrastructure challenges and environmental questions aside, IGCC coal plants could play a role in the nation's energy mix — but only as a *replacement* for the nation's existing fleet of dirty and inefficient coal-fired power plants, not as an addition to them. Unfortunately, the current system of regulatory and financial incentives serves to encourage the continued operation of dirty coal-fired power plants — whose capital costs have already been paid off — rather than hasten their replacement with cleaner energy sources.

Policy tools do exist to encourage the retirement or retrofit of older coal-fired power plants — among them are carbon caps, "four pollutant" regulations, and vigorous federal enforcement of the Clean Air Act's "new source review" provisions. States should use these and other tools to reduce dirty coal-fired generation before allowing the construction of new coal-fired power plants of any type.

The bottom line is that, from a global warming point of view, any step that increases the "market share" of coal (particularly in the absence of carbon capture and storage) is a step backward, not a step forward. States must recognize this by ensuring that any coal-fired power plants — existing or new — meet exacting environmental standards that reduce the external costs they impose on the environment and the global climate.

Beyond 2020: A Long-Term Vision

The energy challenges facing the United States and the world are serious and long-term. For example, the latest science suggests that the world must cut carbon dioxide emissions by about half by mid-century in order to stabilize atmospheric carbon levels at about 65 percent above pre-industrial levels. Even achieving this goal will succeed only in slowing and reducing the severity of global warming — not ending it.[81] Meanwhile, supply constraints on fossil fuels will continue to grow in severity over time.

The clean energy strategy advocated here will not, on its own, be sufficient to solve these problems. But it will place the United States in a far better position to complete the shift to an economy that relies mainly upon reliable, clean and sustainable sources of energy.

First, a clean energy strategy will buy the United States sorely needed time to make the significant technological and societal changes needed to respond to the nation's long-term energy challenges. Achieving sustainability in our use of energy will require major changes in America's infrastructure and economy — for example, by factoring energy efficiency into considerations of building design, transportation system design, and land use. These changes will take years, if not decades, to design and implement. A short-term focus on renewable energy development and energy efficiency will reduce the potential need for the wrenching social and economic changes that could result from a sudden disruption in fossil energy supplies.

This breathing room will also provide time to fully evaluate the costs and benefits of potentially promising — yet speculative — technologies such as hydrogen fuel and carbon storage. At a time when the nation's untapped potential for renewable energy and energy efficiency is so vast — and the technology for tapping that potential is readily available — it does not make sense to prioritize these more experimental technologies, thus depriving funds from technologies that could make a contribution today. By 2020, with energy consumption stabilized, renewable energy production on the rise, and research and development of these newer technologies farther along, America will be in a far better position to decide what role these technologies can play in our energy future.

Finally, committing to a clean energy strategy now will enhance the possibility for a long-term shift to energy sources with minimal environmental trade-offs. Long-term price trends for solar photovoltaics, for example, suggest that a substantial investment in PV technology that begins now could bring the cost of PV to well below the break-even point for residential consumers by the middle of the next decade. When and if this "tipping point" occurs, solar power could follow the path of rapid technological dissemination recently blazed by personal computers, the Internet, cellular phones and other technologies that went from expensive curiosities to affordable near-necessities virtually overnight. The same dynamics could well be true with regard to other energy efficiency, renewable and distributed generation technologies.

The journey to a truly sustainable energy future is a long one, and the entire path may not yet be clear. But the adoption of a clean energy strategy now will substantially increase our chances for success later on.

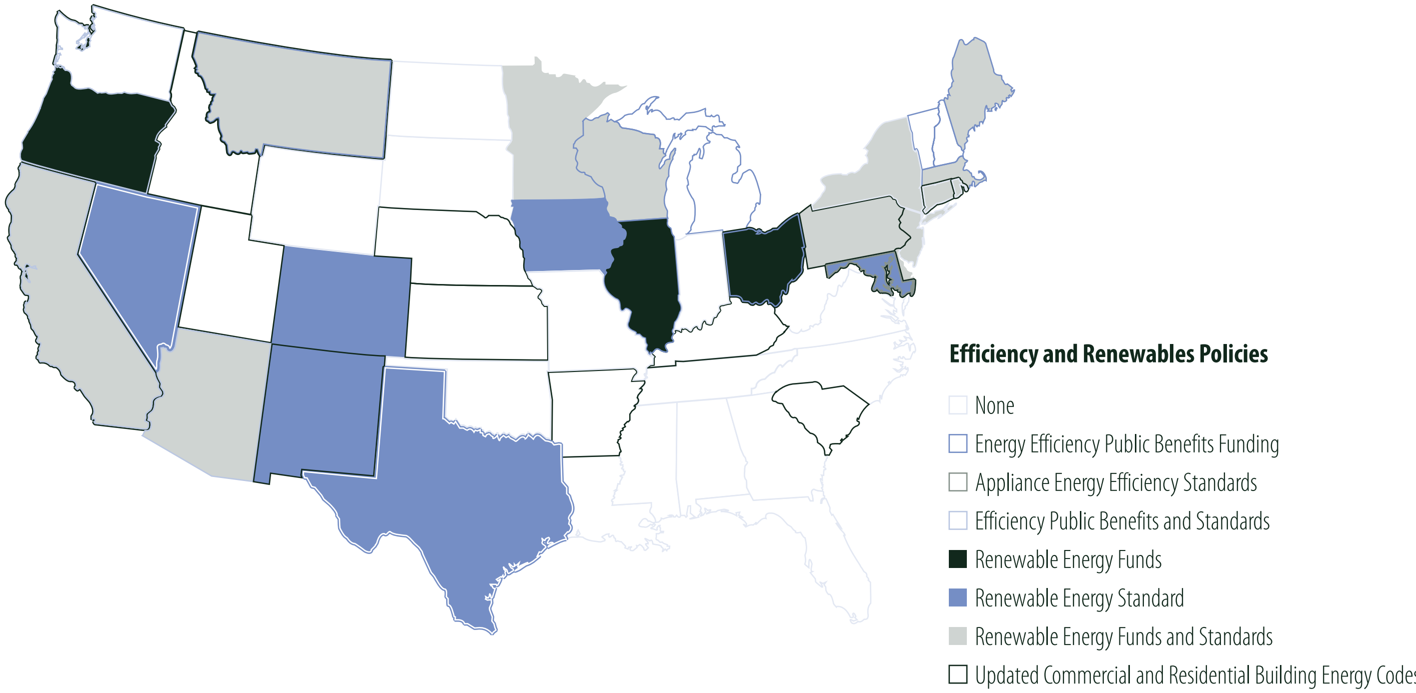


Fig. 13. Energy Efficiency and Renewable Energy Policies in the States[83]

Making it Happen: The State Connection

A quick look at the federal political scene would undoubtedly prove discouraging to any advocate of clean energy. The debate in Congress on the nation's energy policy continues to revolve around the energy bill supported by President Bush and the congressional leadership — a bill that emphasizes subsidies for fossil fuels and nuclear power at the expense of a thoughtful approach to efficiency and renewable energy. Efforts to control the environmental impacts of fossil fuel use — such as air pollution from coal-fired power plants — have been similarly stymied.

In the states, by contrast, clean energy is making significant headway. Recognizing the importance of energy efficiency and renewables to their future environmental health and economic security, numerous states have begun to enact cutting-edge policies to promote a clean energy agenda.

What States Have Accomplished

The clean energy record accumulated by the states in just the last decade is impressive.

At least 19 states have adopted renewable energy standards that set a minimum threshold for the generation of renewable electricity.[82] The percentages of renewable power required (and the definition of what is "renewable") vary from state to state, with the most aggressive states requiring large percentages of new renewable power (on the order of an additional 1 percent per year) to come on line between now and the early 2020s.

At least 15 states devote some amount of funds toward the development of renewable energy — often through ratepayer-supported systems benefit charges (SBCs) on utility bills.[84] These funds support a variety of important projects, ranging from market support for solar photovoltaic installations to research into new methods of renewable power generation. The combination of renewable energy standards and state renewable energy funds will likely result in the installation of at least 22 Gigawatts of renewable electricity capacity by 2020.[85]

At least 20 states now assess systems benefit charges to support state- or utility-run energy efficiency programs. In just 12 of those states, the programs thus far save 2.8 million MWh per year, with benefits that will compound and grow over time.[86]

At least nine states have adopted stronger efficiency standards for a series of residential and commercial appliances.[87] And a minimum of 17 states have adopted the most recent update to the international energy code for residential buildings, while 19 states have adopted the most recent code for commercial buildings.[88]

States have undertaken a variety of efforts to encourage the installation of energy-efficient technologies, such as these light bulbs.

PHOTO: DOE/NREL/D&R INT., LTD

States have also led the way on a variety of other clean energy policies and practices — from renewable energy purchases for state office buildings to net metering policies for solar PV owners to state-sponsored incubators for clean energy technologies. In addition, states have pioneered approaches to reducing the environmental by-products of energy consumption, from "four pollutant" laws to limit dangerous emissions from power plants to new efforts to establish carbon cap-and-trade programs for the electric sector.

The list of states taking leadership on clean energy defies any simplistic "red state-blue state" definitions. Traditionally conservative southwestern states such as Texas, Colorado and Nevada are among those that have adopted renewable energy standards for electricity generation, and several southwestern states are among the leading proponents of solar power.

But there are still tremendous opportunities for action in the states. States that have already adopted clean energy policies can strengthen them. States that have not adopted such policies can do so, based on their own renewable energy potential and potential for energy efficiency.

The Way Ahead

The evidence is clear that a clean energy strategy based on energy efficiency and renewable energy can pay enormous dividends for the environment, the American economy and our nation's future. Achieving those goals, however, requires a new way of thinking.

First, we must recognize that the energy-related decisions we all make have cumulative impacts on our society and economy. A homeowner who installs solar panels, buys "green" electricity, or purchases more energy-efficiency appliances isn't merely exhibiting "personal virtue" (in the words of Dick Cheney) but is actively *saving other consumers money* in the form of reduced fossil fuel prices, reduced need for expensive investments in energy infrastructure, and reduced "external costs" for environmental and public health damage.

Energy policy should encourage more individuals to make the right energy choices and discourage them from making the wrong ones. Unfortunately, the current system of economic risks and rewards does just the opposite. In the electricity sector, regulatory uncertainty and an emphasis on short-term markets inhibits investors from making the upfront capital investments needed to spur a dramatic expansion in renewable power. Outmoded constraints on distributed generation interconnections, net metering, and transmission access for wind power only make matters worse. Utility rate structures often continue to reward utilities for selling more energy, not encouraging cost-effective improvements in efficiency. Businesses and individuals feel financial pressure to skimp on energy efficiency investments when building or renovating structures or buying new equipment — even when those investments would pay off handsomely in the long run. And programs that encourage improvements in efficiency are rarely considered on a par with the construction of new power plants and energy infrastructure when it comes to solving energy supply shortfalls.

This old system of risks and rewards must be replaced with one that encourages rational energy decisions. We must come to think of tax credits, grants, rebates and other financial incentives for consumers who make smart energy decisions not as "subsidies," but rather as due payback for the benefits those consumers bring to society and the economy and as a means to encourage other consumers to make similar decisions. We must create new rate structures and planning processes that remove non-market barriers to energy efficiency and renewable power and allow them to compete on a level playing field. And we must raise the bar on efficiency for all consumers by imposing new, cost-effective efficiency standards for buildings and appliances.

Along with realigning economic and regulatory incentives, we must also begin to think of our energy system in the long term, and devise policies that will get us to our chosen destination. It is unwise and unconscionable, for example, to authorize new coal-fired power plants based on low short-term costs knowing full well that at some point in the lifetime of those plants, limits on carbon dioxide or other emissions will drive up their operating costs. Similarly, it is unwise to sanction, and even subsidize, the construction of new nuclear power plants (or the continued operation of old ones) without a solution to the long-term challenge of nuclear waste disposal.

A long-term view turns investments that seem like economic losers in the short run into economic winners. We know from the example of Japan and other nations, for example, that a consistent, substantial incentive program for solar PV power can drive down prices, making PV systems cheaper and more widely available to consumers. We also know that increasing the use of solar PV can reduce the need for future investments in centralized power plant infrastructure, while also curbing demand for fossil fuels and the resulting pollution. The same is true of other renewable resources. A large and sustained investment in renewables that begins now can ensure that consumers five, 10 and 20 years from now have a broader range of cost-competitive options for renewable energy.

A long-term view of America's energy future is, by necessity, an investment-oriented view. America's current economic prosperity is built on the investments made by previous generations of Americans in the nation's transportation system, its educational system, its system of delivering electricity, and in the space program, among others. It is well past time that we made a similar commitment to invest in clean energy sources for the future.

States have developed unique tools for financing these investments, such the systems benefit charges assessed on electric utility bills. Other tools, such as the expansion of the systems benefit concept to natural gas and oil suppliers, bond issues to support clean energy technologies, and "pay-as-you-save" programs for energy efficient technologies can help to foster these investments as well.

In managing these investments, states must also set clear priorities. Renewable technologies — such as wind, solar, clean biomass and others — have the greatest long-term potential for resolving America's myriad energy problems and should be among the highest priorities for investments. Other technologies — and especially those that perpetuate reliance on fossil fuels — should also receive attention to the extent that they are realistic and can reduce specific problems that arise from energy consumption. But the current federal funding scheme — which emphasizes speculative fossil fuel technologies such as "clean coal" and dangerous technologies such as nuclear power at the expense of renewables and efficiency — has it exactly backwards. States should not make the same mistake.

The greatest shift in thinking we must undertake, however, is to envision a future that is far different from the past. The technological conditions are ripe for creating an America that uses less energy while maintaining the same or better standard of living. They are also ripe for the emergence of clean, abundant renewable sources of energy as major contributors to America's energy mix. Many of the policy tools that can bring about that cleaner energy future already exist.

By taking the lead on clean energy strategies, the states are beginning to shatter the outmoded myths that have set the terms of the energy debate for too long. In so doing, they are setting an example for other states and the federal government to follow. The adoption of proven strategies in other states, coupled with the development of new technologies and new policy tools, will increase the momentum toward a cleaner energy future — and help to secure America's long-term economic and environmental health.

Attaining the Clean Energy Vision: A Short List of Tools and Strategies

The past decade has seen the development of numerous policy tools for the promotion of renewable energy and energy efficiency. The following is a short list of tools states may wish to adopt as part of an overall clean energy strategy.

Renewables

Renewable energy standards

Renewable energy standards (RES) require that a certain percentage of the electricity supplied to consumers in a given state come from renewable resources. States vary greatly in their renewable energy potential, so there is no one-size-fits-all target for the amount of renewable energy states can reasonably require. But an increase in renewable power generation of 1 percent per year is a realistic goal for most states.

The percentage of renewable energy required is not the only important decision that must be made in designing an RES. Important as well is the definition of what is "renewable" and what is not. A few state RES's have allowed polluting fuels such as municipal solid waste and coal waste to receive credit as "renewable" sources of energy. An effective RES sets high standards for renewable energy generation, targeting truly clean and renewable sources of energy such as wind, solar, geothermal, landfill methane and clean biomass.

Renewable energy funds

Dedicated funds to support the development of renewable energy can play a key role in encouraging the development and market introduction of new forms of renewable energy. For example, California is considering tapping its renewable energy fund to support a massive initiative to support residential solar power. Renewable energy funds in other states have supported pilot projects to demonstrate new renewable technologies such as tidal power.

Many state renewable energy funds are financed through small surcharges on electricity bills. Extending these surcharges to cover natural gas and oil users, and protecting renewable energy funds from legislative funding raids, would ensure that these programs have the stable resources they need to develop long-term programs to support renewable energy.

Utility policy reform
Regulatory policy and utility behavior has a major impact on the degree to which renewable energy is a viable alternative. State policy-makers and public utilities commissioners should revise their regulations and practices to encourage the following:

- Fair net-metering rules that reward consumers for generating distributed, renewable power.
- Fair and consistent interconnection policies for distributed generators of electricity.
- Transmission access rules that allow wind power and other renewable sources of power to compete on a level playing field with fossil and nuclear sources.
- Consideration of the external benefits of renewable power for the economy, public health and the environment in regulatory decision-making.
- Consistent, fair rules governing utility charges for stand-by power and exit fees for consumers who choose to generate their own electricity.
- Allowance of long-term contracts for renewable energy developers.
- Imposition of customer service standards for utilities to ensure that they respond quickly and adequately to interconnection requests.

Energy Efficiency
Energy efficiency programs
State energy efficiency programs — supported either through systems benefit charges or mandatory utility expenditures on demand-side management — can encourage residents and businesses to employ energy-efficient technologies in their homes and workplaces. Energy efficiency programs use a variety of tools, including home and commercial energy use audits, rebates for the purchase of energy-efficient appliances, and incentives for construction of more energy-efficient homes to drive energy savings.

States that already have energy efficiency programs funded by electricity consumers should consider expanding funding for those programs and extending them to natural gas and oil customers as well. States that have not yet adopted such programs should consider doing so.

Appliance efficiency standards
States have latitude to impose energy efficiency standards for residential and commercial appliances where the federal government has failed to do so. States may also petition the federal government for a waiver to implement stronger energy efficiency standards for appliances subject to federal regulation.

At least 18 residential and commercial appliances — ranging from torchiere lamps to traffic signals — are potential targets for immediate adoption of efficiency standards.[89] States should consider adopting such standards.

Building energy codes
State building codes regulate the construction of residential and commercial buildings and generally include standards to ensure minimum levels of energy efficiency. Most states have adopted some variation of international building energy codes for residential and/or commercial buildings, but in many states codes are either outdated or are not well enforced. States should move to adopt the most recent version of international building energy codes and work with enforcement officials to ensure that the codes are properly implemented in new construction.

Utility rate and policy reforms
Utility rate structures in many states continue to tie utility profits to sales of energy — acting as a disincentive to cost-effective energy efficiency improvements. In addition, both deregulated electricity markets and regulatory practices in many states fail to treat energy efficiency on a par with new power plants and transmission infrastructure as a solution to electricity supply problems.

To correct this situation, states can:

- Decouple utility profits from energy sales through the use of per-customer revenue caps.
- Require that energy efficiency be considered as an alternative to new power plant construction.
- Include the environmental externalities of new power plants in calculations of cost.
- Require that demand side management (including efficiency improvements) be considered as an alternative approach to new transmission line construction in grid-constrained areas.
- Engage in long-term state and regional planning for the electricity system.

Mitigating Environmental Damage from Fossil Fuel Consumption

A key part of any clean energy strategy must be to assure that energy efficiency improvements and renewable energy are used first to offset the dirtiest and most dangerous sources of electricity — which, in most states, are older, coal-fired power plants. States should consider the adoption of "four pollutant" laws that limit emissions of sulfur dioxide, nitrogen oxides, mercury and carbon dioxide from power plants. Alternatively, states can work together to impose regional caps on carbon dioxide emissions designed to bring about substantial reductions in electric sector carbon dioxide emissions. Both of these policy tools serve to discourage the continued operation of old, inefficient coal-fired generation and hasten its replacement with cleaner and more efficient sources of electricity.

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