

# Renewable Energy—It's Never Too Early

By Jim Geringer

*Governors and legislators should develop a suite of policy options that would recognize market demand with environmental sensitivity to cost-effectively increase energy efficiency and deliver sufficient and timely clean energy resources to citizens they serve.*

“The best time to plant a tree was 20 years ago.  
The second best time is now.”

“No shade tree? Blame not the sun but yourself.”

Both these quotes are attributed to old Chinese proverbs. Trees are traditional symbols of long-term planning and renewal, and in today's world of energy policy, trees represent a cycle of carbon sequestration and renewable energy.

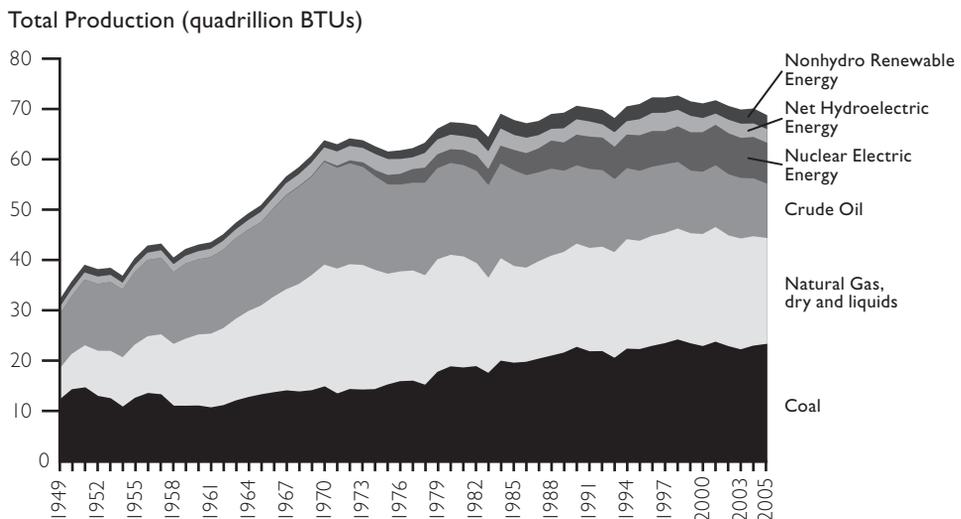
The top 10 priorities of governors and legislators typically include education, health, economy and energy. Education has been the most dominant state policy issue in recent years. Achievement, finance, graduation rate and competitiveness pepper policy discussions. Recently however, health care has replaced education in the top spot on many state prior-

ity lists. Quality, availability and cost of health care, the aging population and Medicaid dominate budget debates and legislative initiatives.

While both health and education will continue to rank high and continue to challenge governors and legislators, the convergence of three other issues—climate change, peaking of world oil supply and water shortages—could be an even greater problem for these policymakers. These three embody the overall challenge we face with energy access and consumption.

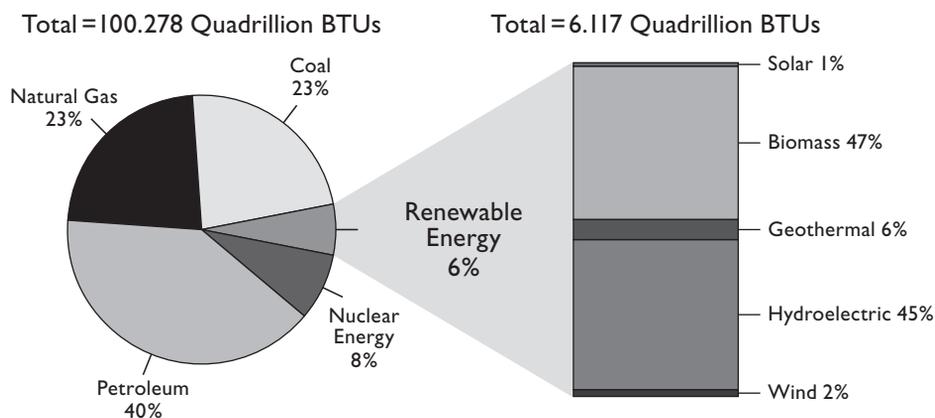
“We have a serious problem. America is addicted to oil, which is often imported from unstable parts of the world,” President Bush declared in his 2006 State of the Union address. To break the addiction, Bush announced new research into and support for clean energy, and set a goal to replace more than 75 per-

**Figure A: U.S. Energy Production, 1949–2005**



Source: GAO analysis of data is from the Energy Information Administration (EIA).  
The EIA chart is Figure 5 at the Web address [http://www.eia.doe.gov/aer/ep/ep\\_text.html](http://www.eia.doe.gov/aer/ep/ep_text.html).  
The source data used is from [http://www.eia.doe.gov/aer/ep/fig\\_source.html](http://www.eia.doe.gov/aer/ep/fig_source.html).

**Figure B: The Role of Renewable Energy Consumption in the Nation's Energy Supply, 2004**



Source: Energy Information Agency, <http://www.eia.doe.gov/cneaff/solar/renewables/page/trends/highlight1.html>.

cent of our oil imports from the Middle East by 2025. President Bush upped the ante in his 2007 State of the Union Address by challenging us to meet the 75 percent goal within the next ten years and further advocated even greater use of clean coal technology, solar and wind energy, and clean, safe nuclear power.

Former Vice President Al Gore became an unlikely matinee movie idol with *An Inconvenient Truth*, prodding people about greenhouse gasses and the current state of energy production. He advocated clean and diversified energy sources.

That these two men, who often disagree, are drawing attention to energy security and sustainability reflects America's increasing awareness of energy policy and consumption. For many Americans, the new focus on energy issues is a wake-up call, prodding us with painful realities about our consumption. We as a country are ready to move toward alternative energy sources and lifestyles.

In 2006, the Western Governors Association said in a report, *Clean Energy, a Strong Economy and a Healthy Environment*, that it "recognizes that no organization, state or person is motivated by one single factor. Environmental issues including climate change, economics of energy, such as price spikes in electricity, natural gas and gasoline, along with personal choice, such as being unwilling or unable to change—each plays a role." The governors had asked a special committee, the Clean and Diversified Energy Advisory Committee (CDEAC), for recom-

mendations that would stress nonmandatory, incentive-based approaches that could be implemented by individual states, through action on a regional level, or through national policy.<sup>1</sup>

How hard would it be to reduce our oil imports from the Middle East by 75 percent? Not an easy task, considering the current known world oil and natural gas reserves and production capabilities. Although the United States accounts for only 5 percent of the world's population, we now consume about 25 percent of the energy used each year worldwide, yet America has only about 5 percent of the world's reserves of oil and gas. According to the Energy Information Administration, fossil fuels (coal, oil, and natural gas) provide about 86 percent of our total energy consumption, with the rest coming from non-fossil sources such as nuclear (8 percent) and renewables, such as hydroelectric energy and wind power (6 percent).<sup>2</sup> See the General Accounting Office figure (Figure A) on U.S. energy production history from 1949 through 2003.

Public policy is now pushing aggressively for us individually and collectively to pursue renewables and clean alternative fuels. At least 20 states have adopted mandatory renewable portfolio standards, or RPS, that would require up to 25 percent of energy for electricity to come from renewable sources. The question is how will states achieve the standards? Doug Larson of the Western State Energy Board observes that wind is generally the most economic renewable outside of hydro-electric, which generally doesn't

count against RPS requirements. Federal Production Tax Credit subsidies were extended through 2008 just before Congress adjourned this past December. Further extensions are likely, but the fitful and costly stop and start on tax credits creates far too much uncertainty for investors. Solar costs are still high, but we will soon know if mass production can bring down the cost using Sterling Energy Systems dish technology based on the Southern California Edison work in the Mojave Desert.<sup>3</sup> Photovoltaics (PV) are extremely popular and expensive even though costs are dropping. When available, state and utility subsidies for PV installations are quickly exhausted.

Excluding hydropower, meeting a national goal of 25 percent would require as much as a sevenfold increase in renewables, certainly a daunting goal. However for one renewable energy source, the U.S. Department of Energy/Energy Information Agency estimates that if the federal tax credit were to remain predictable for several years, wind power generation in the United States could indeed grow nearly sevenfold over the next 20 years. The EIA summary of year 2004 renewable energy depicted in Figure B outlines the task ahead.<sup>4</sup> Hydropower, which doesn't count for RPS, constitutes nearly half of all renewables today followed by biomass. Wood-burning stoves and fireplaces make up most of biomass use today although ethanol made from high cellulose matter is

much cleaner and efficient. The apparent conclusion is that we have a significant but not impossible challenge to meet.

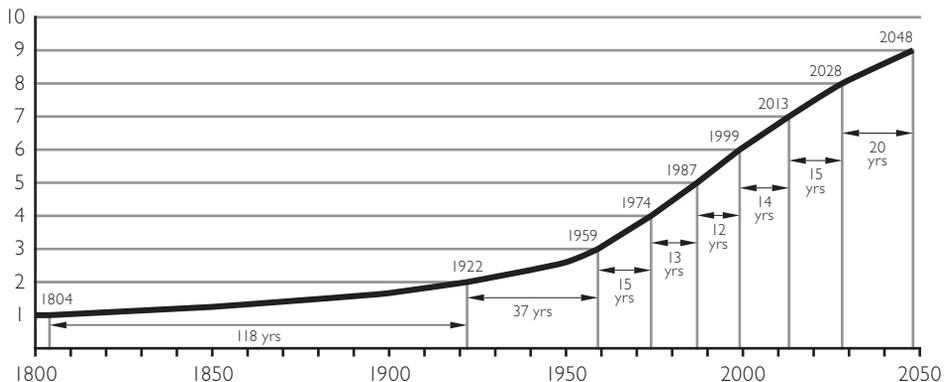
As we discuss the issues of climate change and energy security, we must discuss energy sources and our rate of consumption. How much energy do we consume? How much do we really need? While the issue of climate change is hotly debated, one thing is clear: Human activity is contributing to problems for our environment. The number of humans on the globe continues to increase, as will energy consumption. We can effect change even while the debate goes on.

There is broad agreement that the U.S. must act now to ensure it will have a diverse supply of secure, environmentally responsible and affordable energy well in the future. As traditional sources become more limited, could we quantify the difference and bring in alternative and renewable energy? If something needs to be done, who's in charge? Policy begins with governors and legislators. Our federal government plays a significant role but the policies should be nationally developed, not federally mandated. We are partners.

According to the U.S. Census Bureau analysis, world population from the dawn of mankind didn't reach 1 billion people until the turn of the 19th century, or roughly 8,000 years. It only took 100 years for human numbers, increasing at higher rates, to

**Figure C: Annual Additions and the Annual Growth Rate of Global Population**

Total World Population (in billions)



Source: United Nations, *World Population Prospects: The 1994 Revision*; U.S. Census Bureau, International Programs Center, International Data Base and unpublished tables.

reach about 1.7 billion people by 1900. Even with declining birth rates and in spite of the toll taken by HIV/AIDS in most countries, world population quickly reached 6 billion by 2000. Check the comparison again—it took 8,000 years to reach 1 billion but only 12 years to increase from 5 billion to 6 billion from 1987 to 1999.

The Census Bureau projects world population will reach nearly 8 billion by 2025 and hit or exceed 9 billion just before 2050 as seen in Figure C.<sup>5</sup> The Census Bureau notes that the rate of growth has slowed to the point that it will take 20 years to go from 8 billion to 9 billion, whereas it only took 12 years for population to go from 5 billion to 6 billion. That change is small comfort as we contemplate what it might be like, having 50 percent more people in the world than we have today, clamoring for the energy they choose to use. Today's volatile competition for resources will pale by comparison to what our children will face when they reach retirement age.

Alternative energy sources are being evaluated today at a faster pace than ever. Every generation has the goal to pass along something better to their children than what the current generation received. That goal cannot be sustained without significant commitment.

Oil is used in the transportation sector as gasoline, diesel and jet fuel, with oil-based products accounting for more than 98 percent of the U.S. transportation sector's fuel consumption. The transportation sector—where there are currently no alternative fuels that compete widely with oil—accounts for about one-half of the total projected increase in oil use between 2003 and 2030. The International Energy Agency projects that the worldwide use of oil for transportation will nearly double between 2000 and 2030, with a commensurate increase in greenhouse gas emissions. Biofuels, such as ethanol, biodiesel and other liquid and gaseous fuels, could offer an important alternative to petroleum over this timeframe and help reduce atmospheric pollution.<sup>6</sup> However, the transportation sector relies on a complex network of pipelines to connect supply, processing, distribution and retailing. Not all biofuels, particularly ethanol, are as available or transportable as refined oil-based fuels.

Transportation may be the last sector to wean itself from the addiction to oil. In the meantime, we can devote considerable effort toward using alternative sources of energy in every other sector.

We can look at clean, alternative and renewable energy both as replacements for and as supplements to existing fossil fuels. Popular renewables today include solar collectors, photovoltaic, wind, fuel cells,

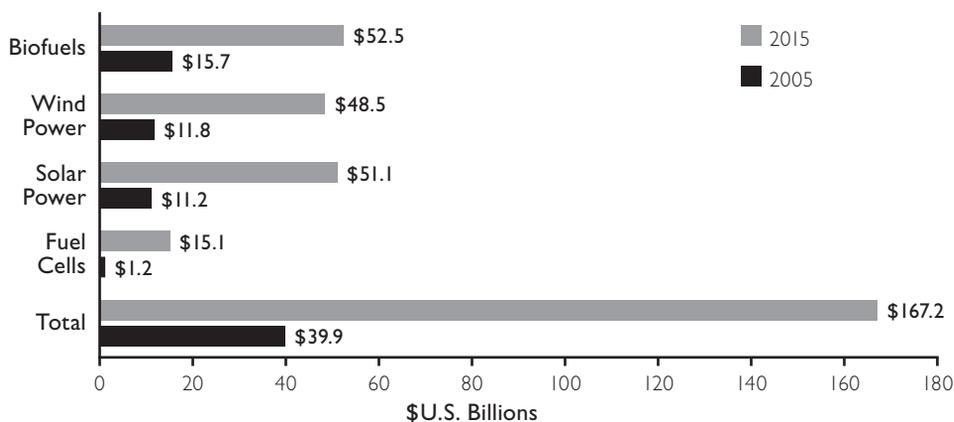
geothermal, biomass, biodiesel, wave action, hydro-power and others. One indicator of public acceptance is the willingness of investors to participate in funding clean energy ventures. Economic advantage stimulates creativity, often toward positive outcomes.

According to Ron Pernick, co-founder of Clean Edge,<sup>7</sup> clean energy is going from niche to mainstream in at least four primary areas: biofuels, wind, solar and fuel cells. The amount of venture capital available for investment in these areas will increase fourfold in the next 10 years.

According to Pernick and others at Clean Edge, the tipping point is nigh: For the first time in modern history, clean-energy technologies are becoming cost-competitive with their "dirtier" counterparts. While oil and natural gas prices remain stubbornly high and frustratingly volatile across the globe, and as nuclear and coal-based energy remain dogged by environmental and safety concerns, the cost of renewable energy continues the steady downward trend. Public acceptance and expectations are higher than ever which will have a positive effect on entrepreneurs and market strategies.

As noted by Clean Edge however, turbulence remains in the clean-energy sector. The solar industry is experiencing growing problems, unable to gain access to enough silicon feedstock to keep pace with demand for photovoltaics (PV). But even with the pressure on upward pricing over the short term, new materials and manufacturing could dramatically reduce cost of PVs and increase availability. Biofuels, while showing great promise, face obstacles, not the least of which is how to quickly ramp up widespread distribution channels. Ethanol has the annoying habit of picking up water, particularly in pipelines, a habit that gasoline does not have. Biodiesel has great promise both in energy conversion efficiency and by having a variety of sources for the oils used. Growth of wind turbines, while currently expanding rapidly, could flag given short-term price increases due to high steel costs and shifting currency valuations. But new vertical axis turbine designs and use of composite materials could create a new positive tipping point. Mass adoption of fuel cells and hydrogen may be decades away absent research and development breakthroughs. Even though renewables appear to be constrained far below what we might like, we should not overlook the American knack for innovation and creativity. We recall the admonitions of two former presidents, Kennedy and Reagan, who called for actions that seemed impossible at the time.

In early 1961 President John F. Kennedy issued a challenge to Congress that he repeated to students

**Figure D: Clean Energy Projected Growth, 2005–2015 (\$U.S. Billions)**

Source: Clean Edge, Inc. 2006 ([www.cleandge.com](http://www.cleandge.com)).

at Rice University later that year. “We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win,” Kennedy said.

President Ronald Reagan stood at the Brandenburg Gate, West Berlin, Germany, June 12, 1987, and boldly said “Mr. Gorbachev. Tear down this wall!” The resulting rally of world opinion caused Gorbachev to yield, and the wall was torn down!

In times of national interest and in times of crisis, we as a country do respond and respond effectively. We can and should respond again with a national commitment to deal with energy concerns.

Meeting future energy needs will depend upon the extent that state, regional and federal policies promote energy efficiency, renewables and the development of advanced alternative energy generation. Tax credits, carbon trading opportunities and transmission lines are only three of the possible policy alternatives. Fossil fuel developments that are dramatically cleaner will aid transition to renewables in sufficient amounts to keep up with demand.

Connecting energy sources of any type to locations of consumption will require the necessary transmission infrastructure. If renewable energy sources are produced at smaller scales suitable for home and other modest applications, transmission lines won’t be needed. However, any significant addition to elec-

tric energy will require large scale installations in close proximity to new or existing transmission lines. Coinciding with this issue are the serious strains on the North American power delivery system, which are beginning to surface due to the system’s aging infrastructure. and the pending retirement of highly skilled technicians within the utility work force. Integration of large amounts of intermittent wind and solar into the grid will further challenge utility managers. While they may be slow to adapt, utility system operators will soon figure out a way to deal with intermittent generation just as they deal with today’s fluctuations in load. New control technology and management processes will enable utility operators to consider wind and solar as base loads with traditional or clean fossil based generation making up the difference to match demand.

Doug Larson of the Western Interstate Energy board points out two big hurdles:

- First, determine how to virtually or physically consolidate control areas through shared generation reserves. Regional transmission organizations could have accomplished the task but they were pre-empted by federal and Congressional mandates over strong objection by the states. We now need immediate practical agreements among control areas to accommodate large amounts of intermittent generation. An interconnection-wide wind variability study would help determine how wind generation spread over large areas could generate a relatively firm and manageable output for consum-

**Table A: Energy End-Use Sector Sources of U.S. Carbon Dioxide Emissions, 1990–2005**

Sector	Million metric tons carbon dioxide		Percent change	
	1990	2005	1990–2005	2004–2005
Residential.....	953.7	1,253.8	31.5%	3.30%
Commercial.....	780.7	1,050.6	34.6	1.6
Industrial.....	1,683.6	1,682.3	-0.1	-3.1
Transportation .....	1,566.8	1,958.6	25.0	1.0

Source: Energy Information Agency, November 2006.

[http://www.eia.doe.gov/oiaf/1605/ggrrpt/enduse\\_sector.html](http://www.eia.doe.gov/oiaf/1605/ggrrpt/enduse_sector.html).

Note: Electric power sector emissions are distributed across sectors.

ers. This important building block would determine the benefits of consolidating control areas and what the transmission connections would have to be.

- Second, induce designers, developers and owners of fossil fuel plants to acquire fossil generation equipment that is capable of tracking the fluctuations in wind and solar output. That capability could have been achieved with recent gas-fired electric generation but several of the new natural gas combined-cycle power plants have sacrificed rapid ramping capability in order to achieve maximum thermal efficiency. In other words, near real-time reaction to fluctuating loads is possible with current technology but operators and designers have opted not to include that capability.

One possible option that Larson suggests is to combine wind generation with the most recent design of Integrated Gasification Combined Cycle (IGCC) clean-coal technology. IGCC power plants can turn coal or other fossil fuels into a clean-burning gas, which fires a gas turbine to generate electricity. This low emission technology also facilitates the cost-effective capture and sequestration of carbon dioxide, rather than releasing it into the atmosphere. The operating concept would have the gasification process running constantly so that when the collective wind generation in a given region is sufficient, gas would be put into storage. When wind generation falls below the demand, gas would be withdrawn from storage and put into a combined cycle plant. The result could be very low carbon-yield electric generation provided that the CO<sub>2</sub> from the gasification process be sequestered. This type of scenario recognizes that U.S. energy demand cannot be met just through conservation and renewables, that some

companion generation using fossil fuels will be necessary. In this case, new processes that are much more environmentally friendly would be applied.

Policies that encourage new approaches and ideas such as wind and IGCC could be accelerated with incentives such as carbon trading and tax credits. We will need that kind of thinking to avoid the magnitude of growth in carbon dioxide emissions summarized by the Energy Information Agency in Table A.<sup>8</sup>

Governors and legislators should develop a suite of policy options that would recognize market demand with environmental sensitivity to cost-effectively increase energy efficiency and deliver sufficient and timely clean energy resources to citizens they serve.

The policy options would result from analysis and balancing of affordability, environmental performance, resource diversity, domestic energy security and reliability implications. No single correct answer will suit every state's needs and priorities.

Choices that are developed regionally with cooperation among states will be more successful and effective so that partnerships with federal regulators and Congressional members recognize that the best solutions come from the states.

Two policy questions state leaders could ask:

- To what extent do state energy policies and incentive structures encourage appropriate energy development and usage over the long term?
- What is the appropriate balance between enhanced production of fossil fuels, alternative renewable energy sources and energy conservation?

Raymond L. Orbach, undersecretary for science at the U.S. Department of Energy, put it best: "The world therefore has a twofold problem: Where will

this new energy come from, and how can we provide energy that is environmentally friendly? Solving this problem will—and should—challenge the scientific community. Current fossil energy sources, energy production methods and technology will be unable to meet this challenge, and incremental changes in technology will not suffice. To meet these energy and environmental needs, we need transformational discoveries in basic science and truly disruptive technologies. Electricity was not discovered by perfecting the candle.”<sup>9</sup>

It’s never too early to plant a tree. Or develop a renewable and clean energy source!

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## Notes

<sup>1</sup> <http://www.westgov.org/wga/initiatives/cdeac/index.htm>.

<sup>2</sup> <http://www.eia.doe.gov/cneaf/solar.renewables/page/trends/highlight1.html>.

<sup>3</sup> <http://www.renewableenergyaccess.com/rea/news/story?id=35263>.

<sup>4</sup> <http://www.eia.doe.gov/cneaf/solar.renewables/page/trends/highlight1.html>.

<sup>5</sup> <http://www.census.gov/ipc/prod/wp02/wp02-1.pdf>, 2002, Updated January 2006.

<sup>6</sup> [http://www.iea.org/textbase/publications/free\\_new\\_Desc.asp?PUBS\\_ID=1262](http://www.iea.org/textbase/publications/free_new_Desc.asp?PUBS_ID=1262).

<sup>7</sup> Ron Permick, Co-founder and Principal, Clean Edge, Inc., SRI In the Rockies, Oct. 30, 2006.

<sup>8</sup> [http://www.eia.doe.gov/oiaf/1605/ggrpt/enduse\\_sector.html](http://www.eia.doe.gov/oiaf/1605/ggrpt/enduse_sector.html). Updated November 2006.

<sup>9</sup> Innovation: America’s Journal of Technology Commercialization, December 2006–January 2007, <http://www.innovation-america.org/index.php?articleID=212>.

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## About the Author

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