Trading one dirty energy source for another is not the only option. We don't have to choose between coal and nuclear.

The Answer

Trading one dirty energy source for another is not the only option. We don't have to choose between coal and nuclear. Renewable energy sources such as wind, solar and geothermal, along with increased energy efficiency, are better alternatives to meeting our energy needs than either coal or nuclear. It is technically and economically feasible to completely meet the energy needs of the US over the coming decades with them.[8]

Researchers at Stanford University recently evaluated the potential of wind power globally. After analyzing wind speeds in various locations around the world, the researchers concluded that wind could generate about one and a half times current annual world energy use.[9]

Existing solar electric technology could also make a significant contribution to energy production. According to a recent study, the US could accommodate about 1 million megawatts of photovoltaic (PV) panels by 2025, which would generate approximately half of current US electricity use.[10] With improvements in panel efficiency, the total long-term technical potential of solar PV in the US could provide more than three times current world energy use, according to a National Renewable Energy Laboratory analysis.[11]

Furthermore, a recent report out of Duke University by John Blackburn, professor emeritus, suggests that nuclear may be overtaking solar energy in its cost per kilowatt hour. The report, *Solar and Nuclear Costs: The Historic Crossover*, examines North Carolina's future energy costs using solar and nuclear sources. Their findings show that, at 16 cents per kilowatt-hour, solar energy becomes more affordable and a better investment. Nuclear plants take years to build, often with great delays. If solar energy can gain the same financial traction currently held by the nuclear industry, it will only become more financially accessible as demand grows.[12]

In addition to renewable technologies, using energy more efficiently is an important part of moving to a clean energy future. Efficiency is the cheapest and easiest way to reduce electricity use and facilitate the transition to renewable technologies.

Renewable energy opponents argue that renewable energy is far too variable and inconsistent to meet our energy needs because of weather conditions and natural cycles of availability. But a recent analysis by the International Energy Agency concluded that intermittency is not a technical barrier to renewable energy. Distributed generation, links across geographic areas, a diverse mix of technologies harnessing different resources and the continued development of storage technologies are potential solutions.[13] Renewable technology growth is steadily increasing its portion of the US energy portfolio. For instance, wind energy contributed up to 39 percent of all new US electric generating capacity in 2009.[14]

When you add up the safety and security risks, financial implications for taxpayers and environmental and community impact potentials, it is clear that nuclear power is not the answer to our future energy needs. It is time for a renewable energy revolution—one that is clean, secure, cost-effective and that will create the jobs and stability that we need.

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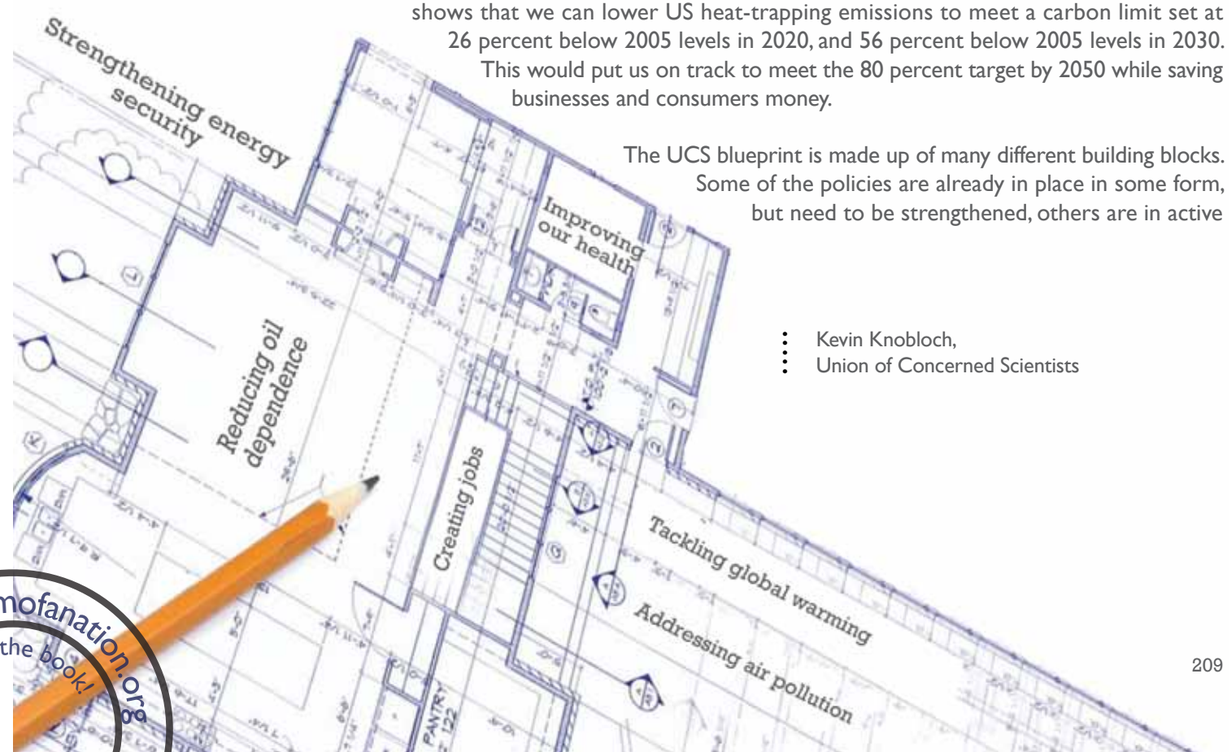
A Blueprint for a Clean Energy Economy

Reducing oil dependence. Strengthening energy security. Creating jobs. Tackling global warming. Addressing air pollution. Improving our health. These are just a few of the many reasons for the United States to move to a clean-energy economy, one that does not depend on oil, does not contribute to global warming and invests in technologies that will spur American innovation and entrepreneurship, create jobs and keep the US globally competitive. The transition to a clean-energy economy is under way, but the changes are still too gradual to reduce heat-trapping emissions sufficiently to protect the well being of our citizens and the health of our environment.

Recent analyses by the Union of Concerned Scientists (UCS) and other experts indicate that, even with aggressive action by other nations, the US must reduce its emissions by at least 80 percent below 2005 levels by 2050 to have a reasonable chance of avoiding some of the worst impacts of climate change. UCS has developed a comprehensive blueprint for the way forward. It shows that we can lower US heat-trapping emissions to meet a carbon limit set at 26 percent below 2005 levels in 2020, and 56 percent below 2005 levels in 2030. This would put us on track to meet the 80 percent target by 2050 while saving businesses and consumers money.

The UCS blueprint is made up of many different building blocks. Some of the policies are already in place in some form, but need to be strengthened, others are in active

Kevin Knobloch,
Union of Concerned Scientists



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discussion, while still others may face large political hurdles, but are nonetheless finding opportunities through state, regional or administrative action. Meeting the blueprint's goals will require continued effort to foster further progress on all fronts. Every year we delay increases the risk of costly climate impacts.

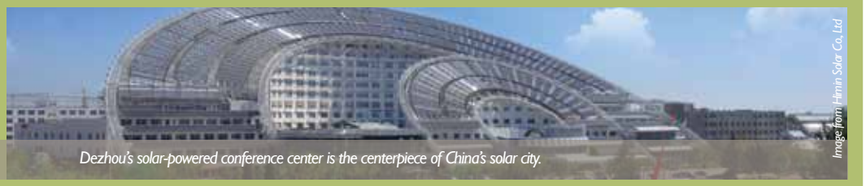
The Blueprint's Building Blocks

Energy efficiency: The energy used to power, heat and cool our homes, businesses and industries is responsible for nearly three-quarters of all US energy consumption and two-thirds of all US carbon emissions. Fortunately, some of the most significant and readily available global warming solutions can be applied in our industries and buildings. If every American home replaced one ordinary light bulb with an efficient one, we would save enough energy to light 3 million homes a year and prevent 9 billion pounds of greenhouse-gas emissions per year.[1] Weatherization programs, which will likely gain popularity with President Obama's "Cash for Caulkers" program, can reduce the average energy consumption of a single-family home by 12 to 23 percent or more.[2]

While installing energy-efficiency measures can reduce emissions and save consumers money, several market barriers are limiting their potential. Barriers include a lack of capital needed for upfront investments in more efficient technologies and a lack of information and expertise for purchasing and installing those technologies. The blueprint shows that increasing energy-efficiency standards for appliances, equipment and buildings and providing incentives for consumers to invest in efficiency are effective policies for overcoming market barriers.

Lower-carbon electricity: Almost half of America's electricity is produced by burning coal, helping to make heat-trapping emissions from power plants the country's greatest contributor to global warming. We can greatly reduce our reliance on fossil fuel–based electricity and create new jobs by shifting to clean, renewable energy sources that are commercially available and ready to be deployed today, such as wind, solar, geothermal and bioenergy. The

from the editor



Dezhou's solar-powered conference center is the centerpiece of China's solar city.

Image from Himin Solar Co, Ltd.

China's Solar Thermal City

In Dezhou, China almost everyone has a solar water heater. Of the city's 5.5 million residents about 90 percent of the homes have solar water heaters. A solar water heater in Dezhou costs about $190 and pays for itself in five and a half years. Solar thermal is much less expensive than gas or electric energy sources. A single-family sized unit can save 660 pounds of coal a year. Multiply that by 200 million families and that's 60 million tons of coal saving 500 million tons of carbon emissions annually, the equivalent of taking 42.5 million vehicles off the road.[1] Not coincidentally, Dezhou is home to the world's largest solar thermal manufacturer, Himin Group. The solar industry is a major employer in the city— about one-third of working-age residents have jobs in the industry— and that figure is only expected to increase. Himin Group company officials project that within 10 years 15 to 20 percent of the China's energy needs will be met by solar thermal energy.[2]

In the US, each Energy Star-certified solar water heater saves about 4,000 pounds of carbon emissions annually. If 40 percent of US homes installed solar thermal water-heating systems, the amount of CO2 saved would be the equivalent of shutting down every power plant in Mexico—about 104 million tons.[3]

Creating a Sustainable Energy Future With a Smart Grid

While much of the talk about our energy future has focused on renewable energy, a quiet revolution has begun that could reimagine our entire energy system. The idea is to marry information, automation and clean technology to create a "smart grid" that moves us toward the cleanest, cheapest and most reliable electricity choices.

In a smart grid world, home thermostats and appliances would adjust automatically depending on the current cost of power, and heating and cooling systems would be powered from the neighbor's rooftop solar panel. Business and facility managers would access a real-time display of energy costs through their cellphones and make adjustments remotely. Utilities would know instantly when the power goes out and would easily shift between conventional power plants and renewable sources.

The US Department of Energy has calculated that smart grids could save about $75 billion and 135 gigawatts of energy over the next 20 years. That's about the same energy output of 170 standard size coal-fired power plants.

Ireland is a leader in smart grid innovation. The country obtains 20 percent of its electricity from wind turbines, and it recently built a smart grid that quickly switches to gas-fired generators when wind power lags.[1]

Plans for a smart grid and other clean energy technologies are underway in the US. The Obama administration's smart grid initiative was designed to speed development of a next-generation electrical network. Under the White House plan, administration will work closely with the nation's power companies as they invest in new power technologies, while a new Energy Department "research hub" will fund smart grid research and development.[2]

from the editor

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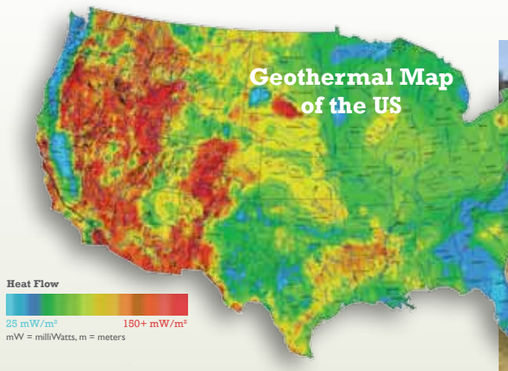


Hydrothermal sources on land across 13 western states have the potential capacity to produce an estimated 33,000 megawatts annually, enough to power about 7.5 million homes.

The Oregon Institute of Technology was the world's first university to be entirely powered from geothermal energy. Geothermal energy was chosen because Klamath Falls sits near a fault line, making it a relatively inexpensive and easily accessible resource.

blueprint shows that a national renewable electricity standard requiring electricity providers to produce at least 40 percent of the nation's power from sources like wind and solar power by 2030 is achievable and affordable for making this shift.

A study by the US Department of Energy found that wind power has the potential to provide more than 10 times the electricity that the country requires today. That study also showed that wind power could be expanded to 20 percent of the total by 2030 without affecting the reliability of the nation's power supply.[3] In fact, that level of wind power would create more than 500,000 new US jobs, displace 50 percent of the natural gas used to produce electricity, reduce coal use by 18 percent, reduce global-warming emissions from power plants by 20 percent and cost only 2 percent more than investing in new coal and natural gas plants (about 50 cents per month per household).

Installing solar photovoltaic panels, which use semiconducting materials to convert sunlight into electricity, on one percent of the nation's land area could potentially generate enough power to meet our entire annual electricity needs.[4] The National Renewable Energy Laboratory estimates that concentrating solar power (CSP) has the potential to generate roughly ten times the nation's entire current electricity capacity.[5] CSP, which works by using sunlight to heat a fluid that drives a turbine to produce electricity, is most often used in large utility-scale plants that are far from urban areas yet connected to the transmission grid. In 2010, the US solar energy industry employed more than 93,500 people—almost 10,000 more people than steel production.[6] One recent study estimates that the industry will create 440,000 permanent jobs and spur $325 billion in investments by 2016.[7]

A study by the US Department of Energy found that wind power has the potential to provide more than 10 times the electricity that the country requires today.

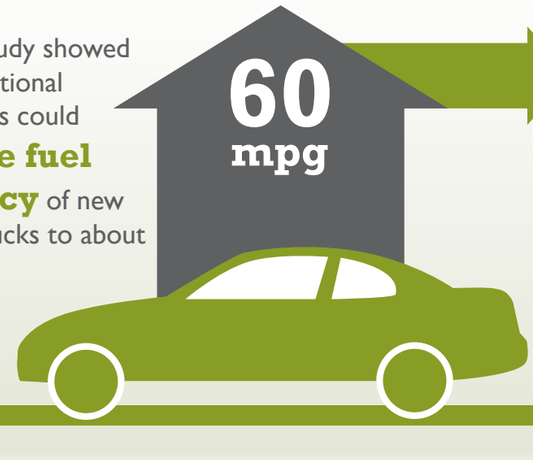
Geothermal energy—heat from the earth—can be used directly to heat and cool buildings and also to produce electricity in power plants. The US generates more electricity from geothermal power plants than any other country in the world, about two-thirds of it in California, where 43 geothermal plants currently provide nearly 5 percent of the state's electricity.[8] The US Geological Survey estimated that geothermal reservoirs of steam and hot water on private land and accessible public land in 13 western states have the potential capacity to produce an estimated 33,000 megawatts annually, enough to power about 7.5 million homes.[9]

Biomass energy, produced primarily from burning plants and organic residues generated by the agriculture and forest products industries, is the oldest source of renewable energy. The growth of biopower will depend on the availability of resources, land-use and harvesting practices and the amount of biomass used to make fuel for transportation and other uses. To account for potential land-use conflicts, to ensure sustainable production and to minimize the use of land that now grows food crops, UCS calculated that 367 million tons of biomass would be available to produce both electricity and biofuels, which has the technical potential to produce up to 19 percent of our current electricity needs.

to reduce annual premiums and create an incentive to drive less; and promoting the use of next-generation technologies such as high-speed rail and plug-in hybrid, battery and fuel-cell vehicles powered by renewable sources and lower-carbon electricity.

Each of these solutions will have an important impact, but the biggest savings in the next 20 years will come from more efficient cars and trucks. Recent studies from the US and California governments and UCS show that the average fuel efficiency of new cars and light trucks could reach as much as 60 mpg by 2025—

A recent study showed that conventional technologies could **raise the fuel efficiency** of new cars and trucks to about



which would cut carbon emissions **by more than one-half.**

Cleaner transportation: Transportation—commuting, traveling and shipping goods—produces the second-largest share of US global-warming emissions, increases air pollution and makes our nation dependent on the highly volatile oil market. Creating a more stable transportation system requires three steps: using technology to improve vehicle efficiency, shifting away from oil to cleaner alternatives and reducing the amount of time people spend stuck in traffic alone in their cars.

A broad suite of policies would help break our dependence on oil, including improving fuel economy in cars and trucks of all sizes; requiring the use of low-carbon fuels and supporting the launch of an industry to produce biofuels from grasses, wood waste, and even garbage; encouraging smart growth policies by insisting on more public transit in residential and commercial development; instituting pay-as-you-drive vehicle insurance

an improvement that would more than double today's fuel economy, with most of that boost coming from conventional technology, including hybrids. Cars and trucks would cost about $3,000 more than the typical 34 mpg vehicle that will be required by 2016, but at future fuel prices ranging from about $3.50 to $4.50 per gallon, owners would save $6,000 to $7,000 over the average vehicle's lifetime, even after the initial technology costs are covered.[10] Additional research shows that even a fuel economy boost of about 12 mpg by 2018 would help create more than 200,000 jobs throughout the economy and more than 20,000 new jobs in the auto industry alone.[11] In other words, consumers would save thousands of dollars while cutting carbon emissions, reducing oil use and creating hundreds of thousands of new jobs.

A limit on carbon emissions: A limit on heat-trapping emissions in all sectors of the economy—


Photo courtesy Steve Ryan, Flickr

> Burning entire forests is neither a solution to climate change nor a smart, efficient use of America's woodlands.

Being Smart About Biomass: Burning Forests Is Far From Clean Energy

As the nation recognizes the need for climate-friendly sources of energy, many options are being explored, including woody biomass—cutting and burning forests for electricity—as a renewable alternative to oil and coal. Proponents claim biomass is carbon-neutral because new tree growth absorbs the same amount of carbon as the old forest released when burned.

However, early experiments with biomass have a poor track record. A study commissioned by the state of Massachusetts found that over a 50 year period biomass and coal-fired power plants have roughly the same carbon footprint.[1] Over a longer period new trees may recapture some of those emissions, making biomass a more climate friendly choice than coal, but biomass will not be carbon-neutral any time soon.

Some critics have pointed out that the Massachusetts study only looks at biomass harvested from natural forests and that larger, industrial "tree farms" would absorb carbon faster. But a large biomass power plant would require turning enormous tracts of land into unproductive, monoculture forests. A single 200MW plant proposed in Ohio is estimated to require 730,000 acres of forest to fuel – an area roughly the size of Rhode Island. And even forests engineered for biomass are still estimated to take 40 years to regrow and absorb their carbon.[2]

Biomass is not all bad. Many smaller plants turn waste products into low-carbon energy, and many rural families run very energy efficient biomass furnaces with low-quality timber culled from local woods. But burning entire forests is neither a solution to climate change nor a smart, efficient use of America's woodlands.

that puts a price on carbon and draws on the power of the marketplace to reduce emissions in a cost-effective and flexible manner – is a critical climate policy. The Blueprint's carbon limits were informed, and designed to be regularly updated, by the latest scientific information to ensure we are on the right track.

A carbon price would encourage companies to find ways to reduce these harmful emissions and would reward innovations in clean technology. We have successfully used this approach to curtail emissions of sulfur dioxide, a major component of acid rain. Those reduction goals were met three years early at a quarter of the anticipated cost and, most importantly, the billions of dollars of public health and environmental benefits outweighed the costs of the program by 40 to 1.[12]

Several states and regions in the country—including ten states in the Northeast and California—have implemented or are in the process of implementing carbon limits. There is strong interest in linking these initiatives to send a powerful, unified market signal favoring a clean and efficient energy system nationwide. The Environmental Protection Agency is also empowered to regulate global warming pollution under the Clean Air Act in order to protect public health and welfare. Beginning on Jan 2, 2011 it will, for the first time, be requiring some large power plants, oil refineries and industrial facilities to purchase permits for their emissions—a step that could prompt important improvements in energy efficiency at these facilities.

Smart Policies Bring Big Results

Taken together, the blueprint policies can help meet our emissions-reduction target in a cost-effective manner. Although they require upfront investment, the economic results are impressive, with consumers and businesses reaping a net annual savings of $255 billion in 2030. Consumers alone would save more than


Photo courtesy Takver

Thousands of cyclists gathered outside a museum in Melbourne as one of many events around the world to send a message to world leaders in Copenhagen in December, 2009.

$126 billion in 2030, about $900 per US household: $320 from lower costs for electricity, natural gas and heating oil and $580 from lower transportation costs.

Addressing climate change will require a concerted effort to show policy-makers and civic and business leaders that our climate and economy are intricately connected and that following the path toward a clean-energy future will not only help ensure a healthy climate for future generations but also encourage long-term economic prosperity. Implementing the approaches outlined in the blueprint is an important step down this path. And as recent climate and economic research shows, the most expensive thing we can do is nothing.

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Kevin Knobloch brings 32 years of experience in public policy, government, advocacy and media to his job as leader of Union of Concerned Scientists (www.ucsusa.org), the nation's leading science-based non-profit organization working for a healthy environment and a safer world. Knobloch was named president of UCS in December 2003, after four years as the executive director. In the 1980s, he was the legislative director for US Senator Timothy Wirth and legislative assistant for US Representative Ted Weiss. He began his career as an award-winning newspaper journalist.