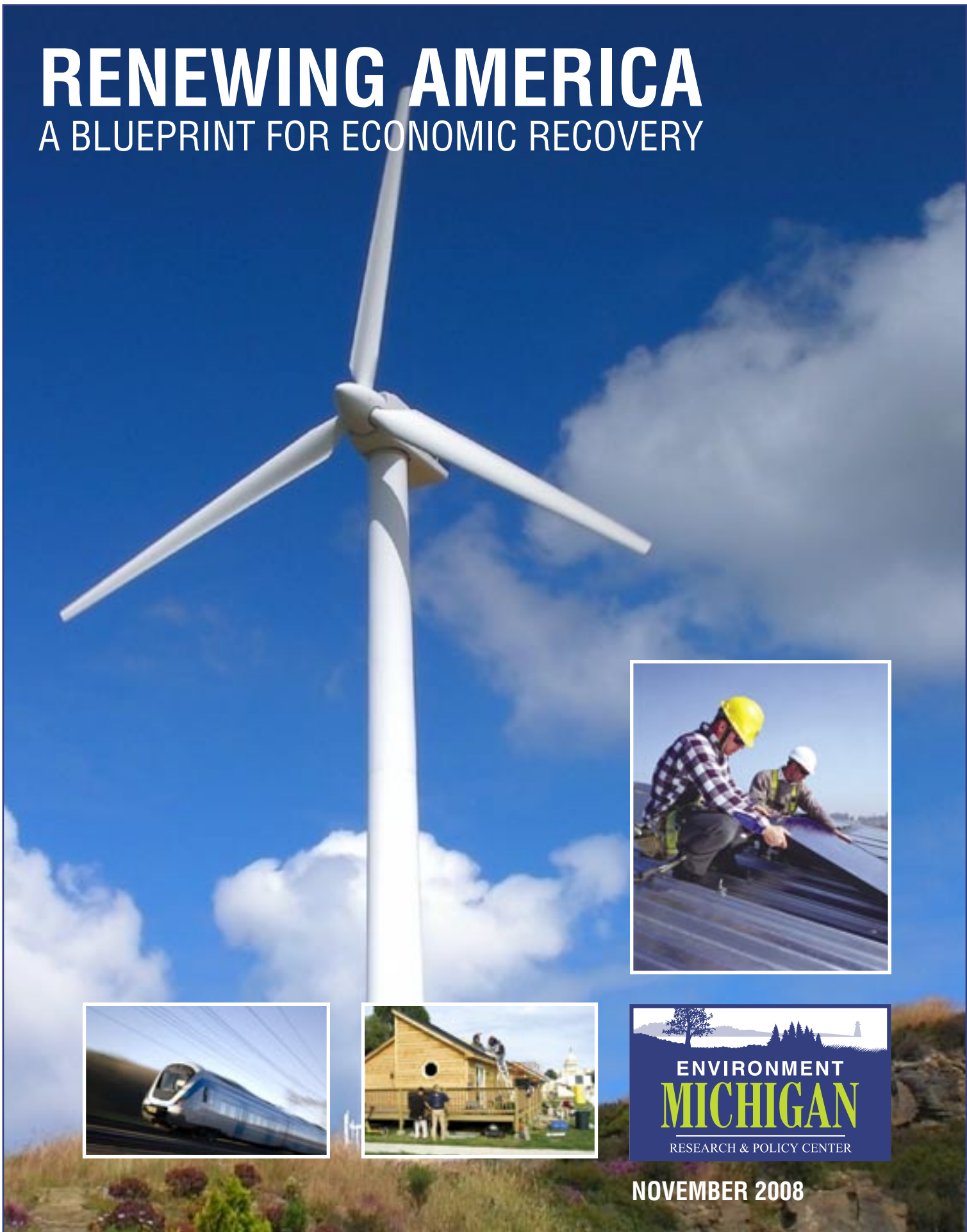


RENEWING AMERICA

A BLUEPRINT FOR ECONOMIC RECOVERY



ENVIRONMENT
MICHIGAN
RESEARCH & POLICY CENTER

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Environment Michigan
Research & Policy Center

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This paper was written by Tony Dutzik of Frontier Group, with input and editorial assistance from Rob Sargent, Anna Aurilio and Emily Figdor of Environment America and Susan Rakov and Elizabeth Ridlington of Frontier Group. Design and layout were provided by Public Interest GRFX.

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Table of Contents

- Rebuild our economy. Repower America.....7
- Clean Power.....8
 - Getting more out of the energy we use*..... 8
 - In our homes.....8
 - In business and industry.....10
 - How much can we save?.....11
 - Getting 100% of our electricity from clean, renewable sources* 12
 - Wind power.....12
 - Solar power12
 - Geothermal energy13
 - Other renewable energy sources13
 - Going all the way: Getting to 100 percent renewables.....13
- Energy Independence15
 - More efficient cars and trucks15
 - Alternatives to driving17
 - Planes and trains.....18
 - Alternative fuels18
 - Adding it up19
- Economic Recovery and Millions of New Jobs.....21
 - All kinds of jobs..... 21
 - All across the country 22
 - Millions of new jobs 23
- Making it Happen24
- Notes26



Rebuild our economy. Repower America.

Across the country, Americans are hurting. From the big cities of the coasts to the industrial heartland to our rural communities, the slumping economy is taking its toll in shuttered businesses, disappearing jobs, bankruptcies, foreclosures and an increased sense of anxiety about our collective future.

To revive the American dream, we need to rebuild our economy on a sound foundation – one that puts people back to work, contributes to long-term prosperity, rebuilds our communities, and protects our environment.

There is one path to a renewed economy that achieves all of those goals – one that is increasingly recognized by opinion leaders, politicians, investors and workers as our best chance to work our way out of our current economic troubles, while building a stronger, more self-reliant and environmentally responsible America.

It is the path to a clean energy future.

Clean energy in America is not some distant dream. We have the technology, the tools and the know-how to use energy more wisely and to get more of our energy from clean, renewable sources. What's more, clean energy can be produced right here at home, creating new jobs in all sectors of the nation's economy – including many jobs that can never be outsourced.

Americans are already beginning to see the benefits

of clean energy in their local economies. Laid-off workers in the nation's "Rust Belt" are getting back to work building wind turbines and solar cells; farmers in the Midwest are supplementing their incomes with royalties from wind farms; residents of economically distressed inner cities are learning how to install solar panels and weatherize homes for greater energy efficiency. Every part of the country has the opportunity to benefit from a transition to a new energy future.

But to turn this trickle of green jobs into a torrent of new economic opportunities, we need to act boldly – and fast. With a strong policy commitment to clean energy and the investment to match, we can:

- Embrace a future of **clean power** by making our economy more energy-efficient and getting 100 percent of our electricity from clean, renewable sources.
- Achieve **energy independence**, by cutting our consumption of oil in half – nearly as much as we currently import from all other nations.
- Speed **economic recovery and create millions of new jobs** in dozens of different occupations in every part of the country.

This report lays out a blueprint for how we can repower America for the 21st century, cleaning our environment while revitalizing our economy. A new president and a new Congress create a golden opportunity to chart a new future for America. The time to begin is now.

Clean Power

There is no energy shortage in America. In fact, we are surrounded by energy – the heat of the sun, the movement of the wind and waves, the heat beneath the earth’s surface, and the energy contained in trees and crops. There is energy waiting to be captured from leaky windows and drafty doors, inefficient light bulbs and other sources of energy waste all across the country.

These clean energy resources exist in every part of America and tapping them can create millions of good domestic jobs – jobs that, in many cases, can never be outsourced – while also saving consumers money and freeing us from dependence on fossil fuels.

Repowering America with clean energy must begin with two commitments: a commitment to get all we can out of the energy we use and a commitment to transition to clean, renewable energy everywhere we possibly can.

Getting more out of the energy we use

Energy efficiency is the cleanest, cheapest, fastest way to address America’s energy challenges – our greatest untapped energy resource for the future. We can start saving energy in America in as little time as it takes to screw in an energy efficient light bulb or install weather-stripping around a drafty window.

In our homes

Air leaks, insufficient insulation and inefficient furnaces make many American homes big energy-wasters. At the same time, energy-wasting appliances in our homes gobble up electricity, sometimes even when they are turned off.

When it comes to reducing our energy use, America’s homes are a great place to start.

Heating and cooling

Heating and cooling account for nearly half of the energy we use in America’s homes.¹ By sealing air leaks, installing insulation and replacing old heating and cooling equipment with more energy-efficient models, we can slash fossil fuel and electricity use in the typical existing American home.

Home weatherization programs already make a big dent in our energy use. The three-decade-old federal program that weatherizes the homes of low-income families reduces energy consumption for space heating by an average of 30 percent per home.² The program delivers \$1.50 in economic benefits for every dollar invested.

But there’s a problem: the federal program only reaches 77,000 homes per year – that’s less than one-tenth of 1 percent.³ At that rate, it would take more than 1,000 years to weatherize all of America’s homes. While

state- and utility-run programs reach more households, we need to move faster.

By weatherizing all of America's homes, we can cut our home heating bills by as much as 30 percent. Similar savings are possible for air conditioning use in hot climates. Replacing older air conditioners with ones meeting current federal standards can shave air conditioning energy use by 30 percent.⁴ And Energy Star models save an additional 14 percent.⁵

Water heating

Hot water for bathing, laundry and other household

uses accounts for 20 percent of home energy use.⁷ Replacing regular tank water heaters with tankless models can cut energy consumption by 24 to 34 percent in many homes.⁸ And reducing the need for hot water by using low-flow showerheads and energy-efficient front-loading washers can cut our energy needs further.

Lighting

Compact fluorescent light (CFLs) bulbs use about 75 percent less energy than incandescent bulbs and last 10 times longer.⁹ Yet, in 2007, CFLs accounted for only about 10 percent of light bulb sales.¹⁰ The American Council for an Energy-Efficient Economy estimates that



Figure 1. Sealing air leaks and installing insulation can combat energy waste that costs us money.⁶

new federal energy efficiency standards for light bulbs will cut America's *total* electricity use by more than one percent.¹¹

Efficient appliances

Many household appliances use electricity even when they're turned off. The federal government estimates that these "vampire" appliances consume between 5 and 8 percent of a home's total electricity.¹² Manufacturers can make appliances that consume far less energy in "stand-by" mode and have other energy-saving features.

Renewable energy at home

In addition to saving energy through enhanced efficiency, there are many ways we Americans can tap renewable energy right at home. Solar water heating systems – which use rooftop solar collectors to pre-heat water – can displace 75 percent or more of the natural gas or electricity used to heat water in a building.¹³ Geothermal heat pumps, which tap the consistent temperatures of the earth's surface to reduce the need for fossil fuel heating, are 48 percent more efficient than the typical gas furnace.¹⁴ And rooftop solar photovoltaic panels can reduce the need to buy electricity from the power grid, serving half or more of a home's total electricity needs.

In business and industry

Just like our homes, America's commercial buildings – our office parks, schools, hospitals and shopping centers – and our factories are far less energy efficient than they could be. Since commercial and industrial facilities account for half of America's total energy use, the opportunities for savings are huge.¹⁵

State-of-the-art lighting systems in commercial establishments, for example, can reduce energy consumption for lighting by up to 40 percent nationally.¹⁶ Wal-Mart, for example has reduced its lighting expenses by approximately 66 percent in all new stores by installing motion sensor-activated LED lighting.¹⁷

Insufficient insulation and air leaks also take a toll on

the energy efficiency of America's commercial buildings. According to one study, tightening up the "building envelope" of commercial buildings can shave anywhere from 3 percent to 36 percent off of heating and cooling costs.¹⁸

Commercial building owners can also take steps familiar to homeowners: turning lights off when no one is in the room and dimming the lights when the sun is shining. Automated controls make it easy. Adobe Corporation installed high efficiency lighting systems, controls to adjust lighting and temperature to the actual needs of the building and other energy efficiency improvements at its San Jose headquarters. Over a six-year period, Adobe reduced per-employee electricity use by 35 percent and natural gas use by 41 percent.¹⁹

Industrial facilities can also achieve big energy savings. The use of high-efficiency motors and better controls in the industrial, electricity generation and commercial sectors could reduce *total* U.S. electricity demand by as much as 15 to 25 percent.²⁰ Efficient boilers, which produce steam and hot water for manufacturing processes, can reduce energy consumption by 15 to 19 percent compared to older oil and natural gas boilers.²¹ And many industrial facilities can get smarter about capturing energy that goes out of smokestacks or is otherwise wasted. Comprehensive analysis of a factory's energy use can reduce energy costs by as much as 40 percent.²²

Both commercial and industrial facilities can also produce their own energy. Many commercial and industrial buildings already have boilers to produce steam. That hot steam could do double duty by also being used to generate electricity, using a technology called combined heat and power. Combined heat and power (CHP) systems can reach 70 to 90 percent thermal efficiency, compared to the 33 percent efficiency of today's power plants.²³ Many industrial facilities already use CHP, but the potential for growth is enormous. Studies conducted for the U.S. Department of Energy found that industry could triple its capacity for CHP and the capacity for CHP in the commercial sector could be increased 15-fold,²⁴ ultimately equaling about 10 percent of America's current electric generation capacity.²⁵

Commercial and industrial building owners also have many of the same opportunities to generate renewable energy as do homeowners. The rooftops of big box stores and parking lots provide acres of open space that can be used to install solar panels or solar hot water systems. Geothermal heat pumps and even small wind turbines can provide renewable energy as well.

How much can we save?

America has vast potential to save energy from our homes, businesses and factories. Simply by using cost-effective energy efficiency measures – those that pay for themselves in energy savings over time – we can cut our use of energy in buildings by 25 to 27 percent, with

even greater savings possible if we make additional investments in small-scale renewable energy production in our homes, businesses and industry.²⁶

Achieving these energy savings will take commitment and investment – weatherizing all of America’s homes, for example, would cost in the neighborhood of \$250 billion.²⁷ That investment, however, would be more than paid for by lower energy bills, reduced pollution, increased energy security, and the new jobs and economic activity that that investment would create.

Moreover, investing in improving the energy efficiency of our commercial buildings and factories will make American businesses more competitive and less vulnerable to the ups and downs of energy prices. Amer-

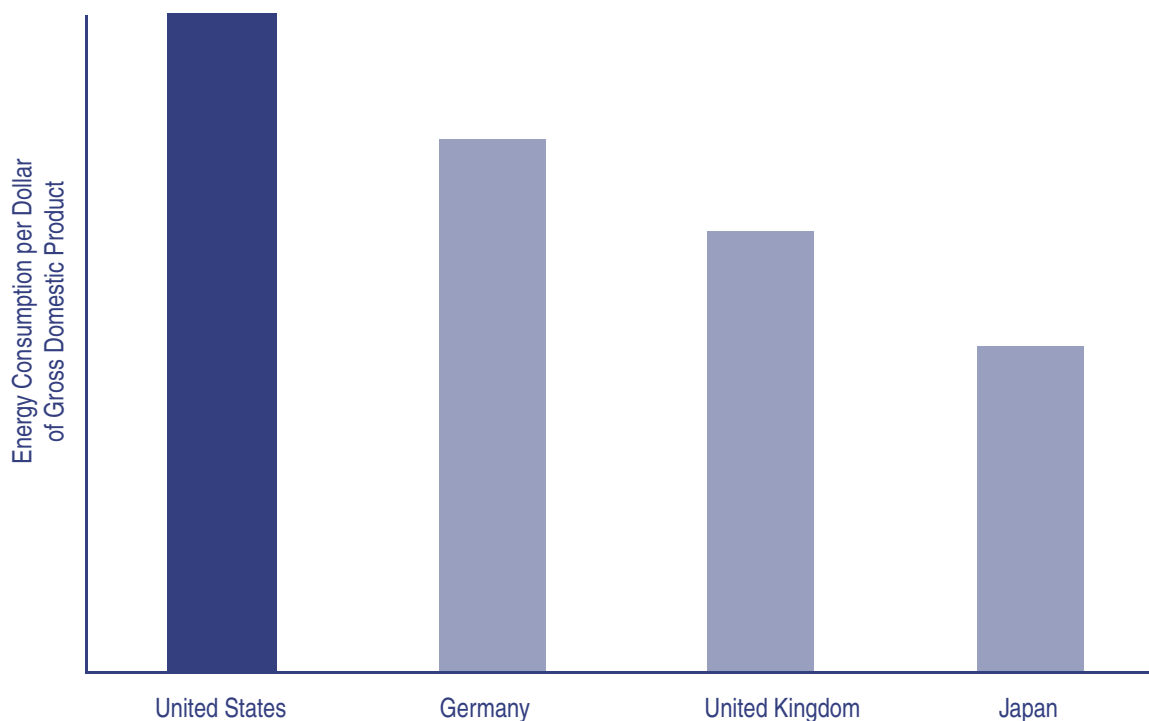


Figure 2. Getting more from less: Some of America’s top economic competitors consume far less energy per unit of economic output than the United States. Reducing our energy use can make America’s businesses more economically competitive.²⁹

ica's economy consumes nearly a quarter more energy per unit of economic output than the German economy, nearly 50 percent more than the economy of the United Kingdom, and twice as much as the economy of Japan.²⁸ Investing in energy efficiency can give our businesses a leg up against their foreign competitors.

Getting 100% of our electricity from clean, renewable sources

America has enough potential for renewable energy to power the country several times over. And renewable energy can do all of the jobs that we rely on power plants to do today, including providing reliable power 24 hours a day.

Just as with energy efficiency, we have the tools we need to take advantage of our renewable energy potential today. Indeed, the last several years have seen a renewable energy boom all across the country. America has doubled its wind-power generating capacity in just the last two years,³⁰ and we've also doubled the amount of energy we generate from solar panels on rooftops.³¹

We don't need to rely on just one source of energy to meet our needs. In fact, America has several forms of renewable energy that can help us meet the challenge.

Wind power

The wind blowing over just five U.S. states – North Dakota, South Dakota, Kansas, Montana and Texas – could theoretically produce enough electricity to power the entire United States.³² Similarly, America's Atlantic, Pacific and Great Lakes coastlines could host enough wind turbines to nearly match the capacity of all of America's current electricity generators combined.³³

Of course, it's not that easy – the wind doesn't necessarily blow all the time. But wind power could produce at least 20 percent of America's electricity without reducing the reliability of the electric grid.³⁴ And with smart planning and management, that percentage could be even higher.

In recent years, wind power has come down in price

to the point where it is competitive with conventional fossil fuel generators. And while coal and natural gas-fired power plants will always be subject to volatile energy prices, the wind is free.

Solar power

Concentrating Solar

In the deserts of the southwestern United States and other sunny areas, there is vast potential to generate electricity from the sun's heat, using technology called concentrating solar power, or CSP. CSP plants installed on just 9 percent of the land area of Nevada – the area contained by a square 100 miles to a side – could produce enough electricity to power the entire United States.³⁵

CSP technology, while unfamiliar to many Americans, is simple and proven – in fact, several small-scale plants in the Southwest have been generating power for decades. Now, however, interest in the technology is booming. In the Southwest, would-be developers have proposed 60 gigawatts of CSP projects – that's twice the current electrical generating capacity in the entire state of California.³⁶ CSP plants also fill an important niche in America's energy future. Unlike the electricity generated by wind turbines and traditional solar panels, the steam produced by CSP plants can be stored and released over time to generate electricity even when the sun is not shining. This thermal storage capability makes CSP one of a few renewable energy sources that can supply consistent, reliable power all day, everyday.

Solar Photovoltaics

Solar panels on rooftops and in arrays in sunny areas convert the sun's light directly into electricity. Cost-effective solar power has long been a dream, but it is now becoming a reality as prices come down and solar panel production ramps up. Manufacturers are right now gearing up their capacity such that they can produce thousands of megawatts of solar devices per year within the next few years.³⁷ As with wind and CSP, there is more than enough solar PV potential to power the entire nation. The space available on America's rooftops alone could host enough solar panels to pro-

vide more than 700 gigawatts of generation capacity – representing about 70 percent of the capacity of America’s existing power plants.³⁸

Between concentrating solar power and solar photovoltaics, America can meet the lion’s share of its electricity needs. A recent scenario published in *Scientific American* magazine proposes that solar energy alone supply 69 percent of our electricity by 2050 – a target that would require an investment of \$400 billion over 40 years (about \$10 billion per year) to meet.³⁹

Geothermal energy

Geothermal energy relies on heat trapped deep within the earth’s surface. Traditional geothermal power plants, found mostly in the West, tap underground reserves of hot water to generate electricity. A new technology – called enhanced geothermal – injects water into the earth, where it comes into contact with hot rocks, thereby creating steam that can be used to power a generator. There are many more sites that have potential for enhanced geothermal power than there are for traditional geothermal.

There is enough traditional and enhanced geothermal energy potential in the United States to support more than 500 gigawatts of electricity generation – equivalent to about half the total electricity production capacity in the United States today.⁴⁰

Other renewable energy sources

Wind, solar and geothermal power are not the only sources of renewable energy available to the United States. The nation has long tapped hydroelectric power to meet a significant share of its energy needs (though not without severe environmental impacts). Other sources of energy that the nation could tap on its way to a 100 percent renewable electric grid are:

- **Biomass energy**, which uses plant matter such as trees or plant waste to produce electricity.
- **Biogas and landfill gas.** Landfill gas plants capture and burn methane escaping from landfills to pro-

duce energy and reduce global warming pollution. Biogas plants capture methane from decomposing manure or other organic materials for use as an energy source.

- **Wave, current and tidal power.** Energy companies and experts are beginning to explore the potential to use the awesome power of the ocean’s waves, currents and tides to produce electricity. While tidal power has been used in a few locations for decades, new technologies have the potential to harvest energy from the ocean in ways that are compatible with healthy marine environments.⁴¹

Going all the way: Getting to 100 percent renewables

There is clearly enough renewable energy potential to power America. But can we harness that potential to provide all of our electricity within the foreseeable future?

The answer is yes. A combination of wind, solar and geothermal power – with an assist from other renewable energy sources and electricity produced through combined heat-and-power in homes, businesses and industry – could meet America’s energy needs.

A recent proposal sponsored by Google delineated what it would take to replace all of America’s coal and oil-fired generators with clean, renewable energy – not getting quite all the way to 100 percent renewables, but close to it. The Google plan calls for:

- Dramatically expanding onshore and offshore wind power. The wind farms called for in the plan would occupy an area roughly one-tenth the size of Texas (with the actual turbines covering only 2 percent of that area) and would generate 29 percent of America’s electricity by 2030.
- Installing concentrating solar power (CSP) plants on a 20 mile-by-20 mile square area of the Southwest, along with installing solar photovoltaic panels on a quarter of America’s homes and a similar number of commercial buildings. That would provide 12 percent of our electricity.

- Tapping geothermal resources – including both traditional and enhanced geothermal power – to provide 15 percent of America’s electricity.

In other words, just these three sources of renewable energy could provide more than half of America’s electricity – and do it within the next two decades, assuming that the nation also cuts its energy use through improved efficiency. With further expansion of solar power, and the addition of other forms of renewable energy, America could go well beyond the Google targets, with an eye toward a 100 percent renewable electric grid.

Getting to that goal will require major investments, but not unprecedented ones. Getting to nearly 70 percent solar power, for instance, would cost in the neighborhood of \$400 billion over 40 years. Wind and geothermal would require billions of dollars in further investments. But by achieving a 100 percent renewable electricity system, Americans could avoid reliance on fossil fuels, slash global warming pollution, clean up our air, and create a vigorous economy for the 21st century.



Energy Independence

America has long been the most powerful and economically advanced nation in the world. But our dependence on oil from overseas is our Achilles' heel. America now imports 58 percent of our oil from abroad – up from 27 percent in 1985 – threatening our economy and our national security.⁴² We spend twice as much each year on gasoline as we did just five years ago – that's an additional \$200 billion per year sucked out of American's pocketbooks, with much of it sent to high-profiting Big Oil companies and unfriendly nations overseas.⁴³

It is time for that to change. America should set a lofty goal of cutting our oil consumption in half within the next two decades. Getting there won't be easy, but it can be done.

Eliminating the use of oil for generating electricity would be a start, but electric generators account for only about 1.5 percent of our oil consumption.⁴⁴ Using oil more efficiently in our homes and businesses would help as well – as described above, energy efficiency improvements of 30 percent or more are possible for homes that heat with oil, while commercial buildings and industrial processes can similarly be optimized for peak energy efficiency. Since an all-renewable electric grid would dramatically reduce our dependence on natural gas, we could even switch some functions for which we use oil today to gas in order to get all the way to a 50 percent cut in oil use in homes, business and industry.

That leaves transportation. Transportation accounts for nearly 70 percent of America's oil consumption.⁴⁵ To free ourselves from dependence on foreign oil, we will need to build a transportation system that uses oil far more efficiently, that takes advantage of alternative fuels, and that shifts as much of our travel as possible from transportation modes that consume a lot of energy to those that consume a little.

Thankfully, America has the tools to begin making that transition, bringing a future of energy independence within reach.

More efficient cars and trucks

Cars and other light-duty vehicles

Over the past few decades, America's cars and trucks have gotten bigger and more powerful, but not necessarily more fuel efficient. The good news is that there are many technologies that could be incorporated in cars and trucks – starting right now – that can curb our dependence on oil.

Among the technologies that could be applied today to start saving oil are the following:

•**Efficient engines**, using technologies including variable valve timing, cylinder deactivation (in which engine cylinders are shut off when not needed, such as at highway cruising speeds), turbocharging, and the use of improved lubricants.

•**Efficient transmissions**, including 5- and 6-speed automatic transmissions and continuously variable transmissions.

•**Improved aerodynamics and reduced rolling resistance** to reduce the amount of energy lost to friction with the air and the road.

•**Enhanced electronics**, such as 42-volt electrical systems and integrated starter generators that allow the engine to be shut off when the vehicle is stopped.⁸⁵

These are not exotic technologies – in fact, they are already features of many cars in use today. We simply need to make them the rule, rather than the exception. Hybrid-electric vehicles, which have become increasingly popular with American drivers, provide another chance to take a quantum leap forward in the energy efficiency of our vehicle fleet.

The Union of Concerned Scientists estimates that federal fuel economy standards could be increased to 40 miles per gallon by 2020 and 50 miles per gallon by 2030, using only conventional and hybrid vehicle technologies.⁴⁶ These are cost-effective improvements – those that pay themselves back over time in fuel savings. By hitting these fuel economy targets, the average new car sold in 2030 would be roughly twice as energy efficient as today’s vehicles, and gasoline consumption would be cut by 30-35 percent below business-as-usual.⁴⁷

With new technologies, we can go even farther. Major automakers are planning to launch the first wave of “plug-in hybrid” vehicles within the next two years – vehicles that could get 100 miles per gallon or more.⁴⁸

Plug-in hybrids perform much like regular hybrids, except that they have larger batteries, can travel farther without using gasoline, and can be recharged from home using only an ordinary extension cord. Outfitted with a battery pack providing a 40-mile electric range, a

plug-in hybrid could accommodate more than 60 percent of the miles traveled by the average U.S. driver, without using a single drop of gasoline.⁴⁹ All in all, a plug-in hybrid gets about double the fuel economy of a conventional vehicle and 30 to 50 percent better fuel economy than a standard hybrid.⁵⁰ A plug-in with a 60-mile electric range could cut gasoline consumption by about two-thirds compared to a conventional vehicle.⁵¹

An aggressive plan that puts millions of plug-in hybrids on the road within the next decade would enable us to reduce our use of gasoline even further.

Heavy-duty trucks

Cars and SUVs aren’t the only energy hogs on America’s roads. Heavy-duty trucks are major consumers of fuel, with large tractor-trailers consuming about 19 percent of the fuel used by all highway vehicles nationally in 2004.⁵²

Unlike cars, which can only achieve mild improvements in fuel economy after they are built, it is possible to get significant improvements in fuel economy from existing trucks – and to do it quickly. Aerodynamic add-ons, low-rolling resistance tires, and reductions in idling can all significantly cut truck energy use. The state of California estimates that these measures alone can improve fuel economy by 7 to 10 percent. Moreover, these changes are cost-effective for truck drivers, paying themselves off in less than one and a half years.⁵³

The potential for energy efficiency gains in new trucks is even greater. Advanced engines, improved aerodynamics, the use of auxiliary power sources to provide electricity and heat to the vehicle’s cab, and improved electronics – including the use of hybrid-electric technology – all have the potential to significantly improve heavy-duty vehicle fuel economy. A 2004 study conducted by the American Council for an Energy-Efficient Economy found that fuel economy improvements for tractor-trailers of 58 percent are achievable and cost effective.⁵⁴ By rolling out these changes in new trucks, we can eventually cut fuel use in tractor-trailers by a third or more.

In addition to improving the fuel efficiency of heavy-duty trucks, America can also reduce oil consumption by shifting more freight from trucks to trains. Trains consume about one-tenth as much energy, on average, to carry a ton of freight one mile as heavy-duty trucks.⁵⁵

Alternatives to driving

Even if we increase the fuel economy of our cars and trucks, America won't wean itself off foreign oil if we continue to drive more and more miles each year. One silver lining in the recent spike in gasoline prices is that – for the first time in decades – Americans are driving less. Through August, vehicle travel in 2008 was down by 3.3 percent from the year before.⁵⁶ The drop in driving in August 2008 alone was the largest monthly decline since World War II.⁵⁷

The number of Americans cutting back on driving would likely be even higher if more Americans had good transportation alternatives. At the same time that driving has been falling, public transportation ridership has shot through the roof. Transit ridership is the highest it has been in 50 years, and boomed by 5.2 percent in the second quarter of 2008 alone.⁵⁸

But America's transit systems are still hampered by a legacy of decades of federal underinvestment. A survey released during the transit ridership boom in 2008 found that 85 percent of transit systems were experiencing capacity problems and that 65 percent lacked the revenue they needed to increase service.⁶⁰ Ironically, many transit agencies have been forced to consider fare hikes at precisely the same time that Americans are reconsidering their driving habits.

Cities across the country are eager to expand their transit networks and provide more service to drivers tired of congested commutes and high gas prices. The American Public Transportation Association has identified more than 550 transit projects around the country that could be started within 90 days – if federal funding were to be made available.⁶¹ More buses, expanded park-and-ride lots, more trains – all of these investments could alleviate crowding on our roads and enable more Americans to forego driving.

There are other ways to reduce driving as well. For nearly two decades, Washington state has had an effective law designed to reduce the number of single-passenger commuters traveling to and from worksites.

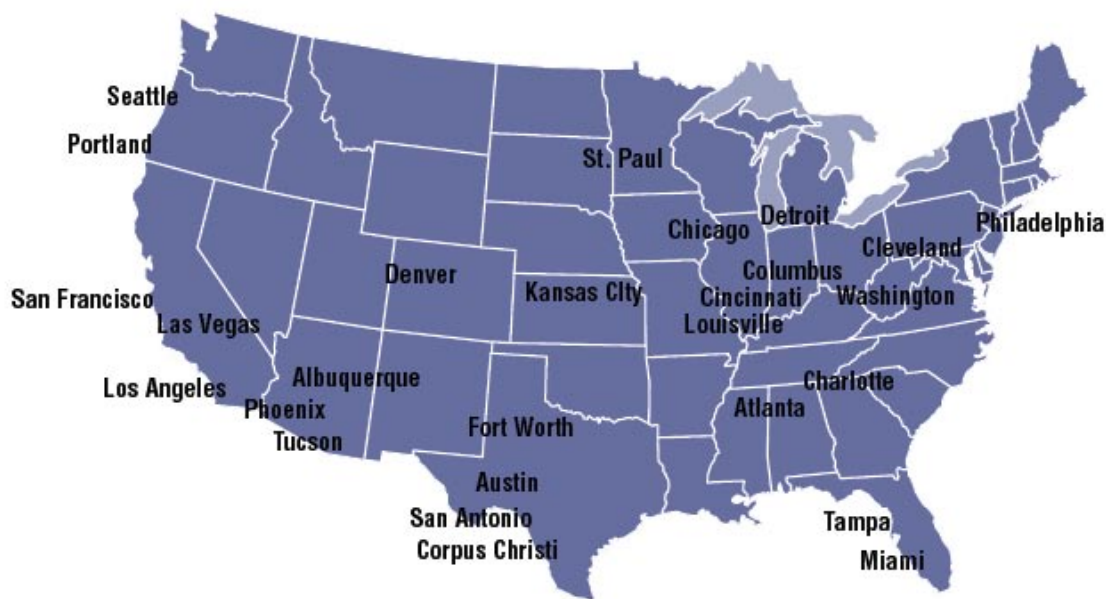


Figure 3. Cities across the country are planning to build or expand commuter rail or light rail systems to meet increased demand for transportation options. The cities pictured above are just some of those hoping to expand transit systems – greater federal investment would help.⁵⁹

The number of commuting miles traveled at facilities covered by the law would have been 5.9 percent higher were it not for the program.⁶² Employers have many tools available to help reduce the number of automobile trips – they can help employees organize carpools, provide discounted transit passes, provide compressed work weeks so that employees only travel to work four times a week, and allow more workers to telecommute.

America can also take concrete steps to encourage two forms of transportation that save energy and make us healthier: walking and biking. Simple steps, such as designated bike lanes on city streets, secure bike racks on buses and at transit stations, and safe crosswalks can go a long way toward encouraging walking and biking. For example, by dedicating just 1 percent of transportation funding to bicycling, Portland, Oregon, has made bicycling a major form of transportation. Bicycle trips now represent more than 11 percent of all vehicle trips on the city's four bike-friendly bridges, up from 5 percent in 2000.⁶³ Bicycle traffic in the city increased by more than 18 percent in a single year from 2006 to 2007, the third consecutive year of double-digit percentage increases.⁶⁴

Transit, carpools, telecommuting, biking and walking – put them together, and add in measures to build our future communities in ways that don't require the use of an automobile for every daily task, and America can have real hope of reducing the number of miles driven on our roads. That's not just good news for promoting energy independence, but also for relieving traffic congestion, reducing the need for expensive new highways, and cleaning up our air.

Planes and trains

Jet fuel accounts for about 8 percent of the petroleum products supplied in the United States.⁶⁵ Unfortunately, flying – particularly for short trips of less than a few hundred miles – is one of the most energy-inefficient ways to travel. If America is to cut its dependence on oil, we need to fly less and fly smarter. Trains – especially high-speed trains – can serve short to medium-haul trips (under a few hundred miles) about as quickly as flying and with far better energy efficiency. A high-speed rail

line proposed in California, for example, is estimated to consume approximately 42 percent of the energy per passenger-mile of intercity car travel and 30 percent of the energy per passenger-mile of plane travel.⁶⁶

America should finally invest significant resources in its passenger rail system. Building a high-speed rail network on a par with those in Europe or Japan – a worthwhile investment for our future – will take decades. But there are many incremental improvements we can make in the nation's rail network in the meantime. In Pennsylvania, for example, Amtrak and the state government recently invested \$145 million to electrify the rail line between Harrisburg and Philadelphia – a move that reduced travel times, led to a 20 percent increase in ridership during a single year, and eliminated oil use from a critical transportation link within the state.⁶⁷ With more and steadier federal funding, America can upgrade and electrify more rail lines – creating a faster, more competitive and oil-free transportation option for more Americans.

Of course, there are some trips – such as intercontinental and transcontinental trips – for which rail travel will never be a substitute for flying. America should find ways to encourage airlines to replace their existing planes with more energy efficient models as they age. Boeing's upcoming 787 "Dreamliner," for example, is estimated to represent a 20 percent improvement in energy efficiency.⁶⁸

Alternative fuels

There are good reasons why America is dependent on oil – there is simply no better fuel for operating motor vehicles. Gasoline, diesel and other liquid fuels are easily transported, easily stored and packed with energy. With future oil supplies in doubt, however, and America's dependence on imported oil imposing a crushing burden on our economy and national security, we need to look for alternatives.

Electricity, whether it is used in plug-in hybrids or fully electric vehicles, is one such fuel. Electric motors are clean and efficient and electric cars cost less per mile

to fuel than gasoline-powered cars. As long ago as the early 1990s, major automakers such as GM and Honda manufactured full-function electric vehicles. Electric vehicles have limited range, but are perfect for city driving and could play a useful role in our transportation system.

Biofuels present another option – though not one without drawbacks for the environment and the climate. Corn ethanol and some other biofuels can substitute for oil, but may actually increase global warming pollution in the process.⁶⁹ New types of biofuels, such as cellulosic ethanol from crop wastes and energy crops grown on marginal agricultural land, could potentially substitute for a larger share of our oil consumption, and do so with less impact on the climate.

Adding it up

Reducing our oil consumption by 50 percent won't be easy. But there is a pathway to get there. Fuel economy improvements in cars and trucks could cut our use of oil for those purposes by a third within the next two decades – with new technologies such as plug-in hybrids helping to achieve even larger gains. Investing in transportation alternatives can help make sure those gains aren't eroded by rising vehicle travel. Shifting some truck trips and plane trips to rail – while at the same time reducing oil use on railroads through electrification – can reduce oil consumption further. And alternative fuels like biofuels, while not a big part of the solution, can make an important final contribution to meeting the goal.

Weaning America off foreign oil is a long-term project. But we have the tools to start that project right now.



Economic Recovery and Millions of New Jobs

Repowering America is an ambitious task. If we succeed, America will be more energy independent and more secure, with less pollution and a far smaller impact on the global climate.

Making it happen, however, will require a mobilization of effort and resources unseen in this country since World War II. But just as that mobilization left America as the world's industrial powerhouse – delivering unprecedented prosperity for the middle class for decades to come – so too can repowering America build a new economy for the United States, making us a world leader in the development and production of the clean energy technologies in demand throughout the world, and creating millions of new jobs in the process.

The seeds of an economic boom from clean energy are already being planted in communities from coast to coast. Investments in energy efficiency already support 1.63 million jobs nationwide.⁷⁰ The renewable energy industry in the United States directly employed about 200,000 people in 2006, with indirect employment accounting for another 246,000 jobs.⁷¹ Overall, the U.S. Conference of Mayors estimates that there were 750,000 “green jobs” in the American economy in 2006.⁷²

And that is only the beginning. Factories to manufacture solar energy equipment are currently under construction in Massachusetts, Michigan, Ohio, Oregon and Texas.⁷³ More than 50 new wind energy compo-

nent manufacturing plants have been opened or announced since 2007, contributing to the addition of 10,000 new domestic jobs by the end of 2008.⁷⁴

With a strong commitment to a clean energy future – and the investment to match – America can create millions of new jobs all across the country, revitalizing our economy and putting the nation on a solid economic path for the future.

All kinds of jobs ...

“Green” jobs aren't all that different from regular jobs. In fact, most of them are regular jobs.

Engineers and accountants work to plan and finance renewable energy projects. Skilled construction workers build renewable energy facilities and renovate homes and businesses to maximize energy efficiency. Manufacturing workers produce wind turbine towers, fuel-efficient cars, solar panels, energy efficient products and more. Agricultural workers produce energy crops. And behind those ranks of clean energy workers are many others who owe their jobs at least in part to the increased economic activity generated by renewable energy investment, whether they are truckers, producers of raw materials, service workers or employees at corporate headquarters.

An infusion of green jobs can change entire communi-

ties for the better. Take Lamar, Colorado, for example, a town of about 8,000 people on Colorado's wind-swept eastern plains. The installation of a wind farm in Lamar in 2004 had a broad economic impact on all aspects of the community's economy "from snack bars to rebar."⁷⁵ Among the benefits resulting from the project were:

- The employment of more than 400 people working for subcontractors at the height of wind farm construction.
- High occupancy rates for local housing rentals and hotels.
- Dramatic increases in business at local restaurants, movie theaters, hair salons, convenience stores and other establishments.
- Renewed interest in business development in the community.
- The creation of 15-20 permanent, well-paying jobs.⁷⁵

The economic impact of clean energy reverberates far from the towns where wind farms or solar generating stations are built. A study conducted in 2004 at the very beginning of the wind energy boom found 90 companies in 25 states were already involved in manufacturing components for wind turbines.⁷⁶

Countless American communities are now experiencing economic benefits from clean energy, whether in the form of property taxes from wind farms flowing into local government coffers, new manufacturing jobs, or construction workers keeping active amid a collapsing housing market by performing energy efficiency improvements for homeowners and businesses.

... all across the country

Lamar, Colorado, might not have much in common with the South Bronx. But both rural and urban communities share one thing: the opportunity for economic growth and revitalization from green jobs.

Just as the vast wind energy resources on the Great Plains or the solar energy resources in America's South-



Figure 4. Companies all across the country were engaged in making parts for wind turbines in 2004.⁷⁷ With the recent boom in wind energy, the number of such companies is certainly greater today.

west can spur job creation and bring new revenues to rural communities, so too can energy efficiency investments and small scale renewable energy bring new jobs to inner-city neighborhoods. Consider: in cities like New York, there are millions of homes and businesses that can be weatherized for better energy efficiency, millions of rooftops that could sport solar panels or plant-covered “green roofs,” and hundreds of manufacturing facilities that could be adapted to produce clean technologies. Who better to fill those jobs than the unemployed and underemployed people who have been left stranded in America’s 21st century economy?

The need for more skilled labor for green jobs creates an opportunity – but it also creates a challenge. The National Renewable Energy Laboratory, for example, has concluded that one of the barriers preventing the expansion of solar power is the lack of a trained workforce.⁷⁸ Workforce development must be a key part of any transition to a cleaner energy system.

Investing in clean energy is investing in our communities. Instead of sending more and more money each year abroad to build new shopping centers in Dubai or enrich the stockholders of ExxonMobil, repowering America will plant the seeds of economic growth and revitalization across the country. And by creating the world’s largest market for renewable energy and energy efficient technology, we will give American companies a leg up in the most important economic competition of the 21st century – the race to supply environmentally sound technologies to the rest of the world.

Millions of new jobs

Just how many clean energy jobs can we create? It depends on who you ask, but several recent studies suggest that America can create millions of new jobs in clean energy industries. For example:

- The Center for American Progress estimates that an investment of \$100 billion in clean energy fields over just two years could create 2 million green jobs nationwide.⁷⁹

- The Renewable Energy Policy Project estimates that there are currently between 70,000 and 110,000 firms nationwide that are active in industries that could supply component parts for renewable energy projects. Over 10 years, a commitment to stabilizing carbon dioxide emissions through renewable energy would create as many as 2 million full-time equivalent jobs in those fields.⁸⁰

- A 2006 analysis by researchers at the University of Tennessee estimated that an effort to get 25 percent of America’s electricity and transportation fuels from renewable sources by 2025 would create 5.1 million new jobs.⁸¹

- The U.S. Conference of Mayors forecasts that with aggressive investment in renewable energy, energy efficiency and biofuels, the U.S. could create as many as 4.2 million green jobs by 2038.⁸²

- A 2004 analysis by the Union of Concerned Scientists projected that a national effort to get 20 percent of our electricity from renewable energy by 2020 – a fairly limited and readily attainable goal – would create 355,000 new jobs, nearly twice as many jobs as obtaining that electricity from fossil fuels.⁸³

- The American Public Transportation Association estimates that every \$1 billion federal investment in public transit creates about 35,000 new jobs.⁸⁴

The numbers may differ from study to study, but the overall conclusion is clear: investments in clean energy can create millions of new jobs all across the United States.

Making it Happen

Renewing America brings with it the potential to ensure both America's economic prosperity and a healthy future for our environment. But we can't count on the usual market forces to get us there – particularly at a time when private-sector credit is hard to come by.

The painful fact is that, at any time over the last three decades, our political leaders could have made a commitment to changing the energy system that has left us dependent on unfriendly nations and big oil companies for petroleum, shackled to a polluting and increasingly costly electricity grid, and without good transportation options for too many of us and our families. Thirty years ago, Jimmy Carter promised that “beginning at this moment, this nation will never use more foreign oil than we did in 1977 – never.” We did manage to cut imports for a while, but the commitment of our nation's leaders lagged, leaving us right back in the same predicament three decades later.

Today, we have a new opportunity – an opportunity to right the mistakes of the past and achieve a new energy future for America. It will take vision and commitment from all sectors of American society. But it is up to the new president and the new Congress to show the way by making clean power and energy independence our top national priority.

The sooner we begin the better. The next president and Congress can do a great deal to make that happen, starting in the first 100 days of the new administration.

Among those steps should be the following:

- 1 **Announcing ambitious clean energy goals for America.** Those goals should include a commitment to 100 percent renewable electricity and cutting America's oil consumption in half.
- 2 **Investing the necessary resources** to meet those goals. A commitment to invest between \$50 billion and \$100 billion per year in energy efficiency, renewable energy, clean transportation, green jobs training and other clean energy fields would give America a strong boost in our effort to achieve clean power, energy independence and economic renewal.
- 3 **Making appliances and equipment more efficient,** by speedily developing and implementing stronger federal energy efficiency standards for products.
- 4 **Making America's buildings more efficient** by leading the charge for adoption of advanced building energy codes and committing resources to the construction of green buildings.
- 5 **Reducing oil consumption in transportation,** by working to double federal fuel economy standards by 2020, creating new incentives for plug-in electric vehicles, and adopting a federal low-carbon fuel standard to increase the use of clean, environmentally friendly alternative fuels.
- 6 **Increasing renewable energy** through the adoption of an aggressive renewable electricity standard for America and other policies to speed the implementation of clean energy technologies.

- 7 **Making solar power a cornerstone of our energy future** by extending tax credits for solar power installations and setting a national goal of 10 million solar roofs.
- 8 **Investing in clean energy R&D** to find the next promising clean energy technologies.
- 9 **Prioritizing efficiency and renewables at utilities** by working with state and federal regulators to ensure that utilities are tapping all available energy efficiency and renewable energy resources.
- 10 **Reducing global warming pollution** by making immediate stabilization of emissions, short-term pollution reductions sufficient to avoid catastrophic climate change and meeting a target of 80% reductions by mid-century a central consideration in energy, economic and environmental policies moving forward.

These steps are just the beginning. Achieving a new energy future will require many other actions, big and small, public and private, as well as a thorough reexamination of public policies in many different areas, from energy to housing to transportation to economic development.

But if we succeed, the payoff will be huge. Clean power for our future. Energy independence. An economic recovery that creates millions of new jobs and builds a strong energy system to sustain our nation's future growth.

We have the technology, the know-how, and the committed workforce to repower America. The need is obvious. The opportunity is there.

Let's get started.

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