

The New Apollo Program

Clean Energy, Good Jobs:

A National Economic Strategy for the New American Century

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A new clean energy era is unfolding in the United States. Just as wood powered the 18th century, coal the 19th, and oil the 20th, clean energy – renewable power, energy efficiency, and low-carbon transit and transportation – is gaining an ever more significant hold on the economy and culture of the 21st.

The Apollo Alliance, a coalition of labor, business, community and environmental leaders, proposes this national economic development strategy to accelerate the development of America's vast clean energy resources. This New Apollo Program builds on and updates the original Apollo 'ten point plan' for energy independence and good jobs released in 2004. An update is warranted. Technology has changed. The policy debate has advanced. The urgency of our energy crisis has grown.

The 14 steps outlined in this plan provide a roadmap to prosperity and a challenge to American economic ingenuity and dynamism. Embracing the New Apollo Program's clean energy, good jobs strategy will create millions of high quality, family-supporting jobs while simultaneously curbing global warming pollution and enhancing our nation's energy security.

Now is the time for a bold clean energy, good jobs strategy for America. Addiction to oil ties the nation's security to the world's most politically unstable regions. Pollution from oil, coal, and gas undermines the stability of the climate. Soaring energy and gas prices pour salt into the economic wounds of a country already suffering from growing income inequality and stagnant wages.

The elements may be different, but the enormity of the challenge now confronting the United States is not. Time and again in our history, periods of great risk have also prompted innovation and opportunity. Each time America mobilized its wealth, leadership, skills, natural resources and irrepressible spirit to emerge from crisis better and stronger.

The World War II industrial mobilization made America the world's dominant power, producing half the world's economic output. The National Highway System expanded the suburbs, which delivered the American Dream of home ownership to millions of people. And it was the Apollo space program that gave

the nation the advances in computer sciences and digital communication that drove the vigorous economic expansion of the 1990s.

We did it before. We can do it again.

The New Apollo Program sets the nation on a different path to prosperity. It is a national economic strategy that reduces pollution, increases efficiency, promotes research and development, provides good jobs, and expands opportunity for all.

The New Apollo Program will:

Rebuild America Clean and Green. A massive commitment to rebuild the nation's infrastructure with clean and efficient energy technologies will provide a quick economic stimulus – a building can be renovated in less than a year – while making a major dent in our nation's long-term energy bills and greenhouse gas emissions. We propose a range of solutions, including an Energy Smart Fund to upgrade the energy efficiency of all buildings by 40 percent by 2025; consistent long-term public support for renewable energy projects with the ultimate goal of producing 25 percent of our nation's power from these sources by 2025; new environmentally- and logistically-sound transmission corridors and smart grids to bring new clean power to market; efficiency measures on existing utility and industrial power systems including mass recycling of waste heat and investments in carbon capture and storage (CCS) demonstration projects; and affordable and convenient transit access for the 80% of Americans who live in metropolitan areas.

Make It in America. Retooling our nation's energy systems will require new manufactured inputs, from commodities like cement and steel to durable equipment like advanced heating and cooling systems, biofuel refinery boilers, next-generation cars and trucks, efficient transmission lines, and wind towers and solar panels. To capture the low-carbon markets of the future and lower the carbon footprint of our manufacturing sector, we propose a program to retool and retrofit America's factories, including a requirement that wherever public money is directly invested into clean energy production, those projects must contain 85% American-made component parts.

Restore America's Technological Leadership. The new energy economy will be built on innovation. We propose an aggressive energy innovation

agenda that includes restoring the annual federal investment in energy research and development to the nearly \$8 billion per year seen in the 1970s and investing \$10 billion per year in public-private partnerships to demonstrate the most promising new technologies at commercial scale. Priority should be given to demonstration projects in “smart grid” technology, cellulosic ethanol and sustainable biodiesel, and carbon capture and storage.

Tap the Productivity of the American People. Our plan addresses the shortage of trained workers for the clean energy economy by expanding federal investment in state and local green-collar workforce training initiatives to \$5 billion per year. We propose that Congress prioritize training programs for skilled workers across the spectrum from low-skill, entry-level jobs all the way up to high-skill, high-wage jobs in the clean energy economy. We also recommend that money be allocated specifically to fund specialized programs to create green pathways out of poverty for low-income job seekers, so they may better access these green-collar job career ladders. Finally, we propose investing \$1 billion per year in expanded national service opportunities for Americans from all walks of life to serve their country by working for clean energy independence.

Re-Invest in America. Establish a new market-based mechanism to generate and strategically re-invest the hundreds of billions of dollars necessary to build the new clean energy economy. At one time, Americans understood that great public undertakings required serious public investments. We spent the equivalent of \$70 billion per year (measured as a share of GNP) on the original moon launch program and we did it without borrowing from our grandchildren. Surely, our energy security challenges are serious enough to warrant a similar level of national commitment. To accomplish the goal, the next Congress should put in place either a well-designed carbon tax or a new “cap & invest” mechanism, establishing a new Clean Energy Investment Corporation to ensure accountability in spending scarce public dollars on building a new energy future.

Implicit in our plan is an economic strategy that is qualitatively different from – and vastly superior to – the strategy that has driven American economic policy for the last generation. Instead of more deregulation, less national leadership, and faster globalization, we propose reinvesting American wealth in our own technology, natural resources, infrastructure, and workforce. As a result, our nation will capture the new clean energy markets of the 21st Century; curb the pollution and inefficiency that hamper our economic productivity; boost our beleaguered technology, manufacturing and

construction sectors; rebuild America's infrastructure clean and green; and restore the American dream to millions.

Some might argue that the New Apollo Plan relies too heavily on the federal government. But the truth is that the federal government is noticeably missing from the clean energy conversation. Business is there. Agriculture is there. Citizens are there. Cities and states are there – in fact they're the ones leading the conversation. The federal government has been largely missing, but it is a key player. Only the federal government can provide the level of support necessary to move clean energy technology from design to commercialization at a scale where it can compete with highly subsidized and regulated conventional energy, and truly anchor a new energy economy. And only the federal government can put a price and a cap on carbon, thus allowing the market to begin correcting history's largest market failure – the uncontrolled emission of greenhouse gases into our planet's atmosphere.

As we move together toward the clean energy future, we must ensure that a core set of American values and standards are embedded in the new energy economy. Absent such standards, large numbers of Americans could be inadvertently left behind in the technological transition. We must:

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- Respect the dignity of work by ensuring that jobs in the new energy economy provide family-supporting wages and benefits through prevailing wage standards and other workforce protections.
 - Ensure equal opportunity by providing pathways out of poverty and into green-collar career tracks for low-income Americans.
 - Provide a level playing field for energy-intensive industries so carbon reduction policies do not inadvertently drive more jobs and carbon pollution offshore to countries with weaker environmental and labor standards, undermining our core economic, national security, and environmental objectives.
 - Ensure regional equity for the parts of America most dependent on extracting and using fossil fuels and therefore most likely to suffer worker, community, and industrial dislocations in a new energy economy.

In the spirit of the American frontier, the future we propose is one not of limited horizons, but one of expanding possibilities. The solutions we propose will not only curb global warming and make our country and the world more secure, they also will create vast new industries, unimaginable new business opportunities, and millions of good, new jobs.

To accomplish these goals, here is what we must do:

Rebuild America Clean & Green

1. Establish a new federal commitment to improve the energy efficiency of America's existing and new buildings, with the goal of reducing energy use 40 percent by 2025. Expanding public and private investment in energy efficiency and distributed power is the cheapest, fastest way to reduce rising energy costs, curb greenhouse gas emissions, and create a new generation of green-collar jobs.

The 40 percent goal represents the most aggressive outer limit for cost-effective energy savings available in America's buildings, as estimated by the authoritative National Action Plan for Energy Efficiency. Under that plan, the anticipated \$1 trillion in energy efficiency upgrades would pay for themselves with energy savings, while creating up to 400,000 high-quality, permanent jobs for skilled tradespeople such as electricians, sheetmetal workers, engineers and architects.¹ Coupling efficiency retrofits with renewable energy, such as solar and geothermal systems, creates even more jobs in manufacturing and installation while providing clean power back into the grid.

We recommend establishing an Energy Smart Fund that would make grants to state or local *Energy Smart Centers* – run by utilities, states, local governments, public-private partnerships, or other qualified entities – to provide one-stop energy efficiency, green building, and renewable energy services and financing to every household, business, industrial firm, and public entity in America. The bulk of the program's financing would be targeted at large-scale (neighborhood-wide or multi-building) energy efficiency projects focused on the combined goals of reducing energy costs and providing career ladders into the construction and building trades.

The Fund would be accessible only to states or utilities that have adopted rate decoupling, which separates utility profits from sales volume and thus makes energy conservation as financially attractive to utilities as new energy production.²

State or local Energy Smart Centers would be free to experiment with any of a variety of mechanisms to reduce well-known market barriers for energy

¹ The following calculation is based on the spreadsheet provided by Stacy Angel, U.S. Environmental Protection Agency, March 2008. In 2018, ten years from now, NAPEE estimates that efficiency programs to reach 20 percent savings by 2025 would cost roughly \$39 billion per year (spreadsheet lines 6 and 18). Assuming that labor represents 1/3rd of project costs – based on an estimate provided by Don Gilligan, President, NAESCO – spending on wages and benefits would equal \$13 billion. At \$70,000 per job in wages and benefits, \$13 billion would create 186,000 jobs per year; 40 percent energy savings would therefore create at least twice the number of jobs, or close to 400,000 per year.

² A similar decoupling provision is found in the Climate Security Act, S. 2191 Title III, Subtitle D, section 3401.

efficiency. In allocating funds, we propose that the federal Energy Smart program target projects that:

- Reduce risks to building tenants and owners by certifying the work of energy auditors and contractors.
- Reduce risks to potential investors by aggregating customers and providing a means to amortize debt by capturing energy savings.
- Utilize energy service companies to provide resources to communities through performance service contracts.
- Provide opportunities for low-income, under-served, and displaced workers to get on the job experience in the construction trades, along with formal connections to union apprenticeships or other long-term training programs.
- Are coupled (where the grantee is a public entity) with complementary policies such as mandatory building audits, performance contracting, and regular improvements to building codes and appliance efficiency standards.

Assuming these broad conditions are met, the Energy Smart Fund would award financing to launch new programs on a competitive basis based on the number of kilowatt-hours saved per dollar invested.³

We further recommend that the federal government adopt an ambitious goal for energy savings in new buildings, requiring that all new buildings be designed to use half of the fossil-fuel energy and emit half the greenhouse gases of the average for similar buildings in their regions. The standard would increase over time so that by 2030, all new buildings would be required to emit zero carbon dioxide.

These targets could be met by implementing sustainable design strategies, generating on-site renewable power and/or by purchasing (20 percent maximum) renewable energy and certified renewable energy credits.

2. Provide the consistent, long-term public support necessary to produce 25 percent of the nation's power from renewable and recycled energy resources by 2025.⁴ America's renewable energy industry has suffered badly from stop-and-go public incentives. This inconsistency has contributed to foreign competitors eclipsing American companies in the manufacture, sale, and

³ The demand for energy is expected to grow 30 percent by the year 2030 and the United States will need to build 151 gigawatts of new generation by that time, according to the Brattle Group that performed a study for the Edison Electric Institute. Toward that end, energy conservation is critical.

⁴ The American Council on Renewable Energy believes that, with the right public supports, renewables alone could provide half of US generating capacity by 2030.⁴

installation of clean energy technologies, many of which were first developed in American laboratories.

Renewable power is, by definition, “American made” and comes free of charge, after installation. In contrast, all the conventional fuels – including coal, oil, and natural gas – are global commodities subject to sharp price increases in line with rising global demand. In the global economy, renewable power equals economic and energy security. Given the importance of renewable power to America’s clean energy future, it is time to level the playing field and provide a more predictable return on investment to the renewable power sector.

A few pennies-per-kilowatt-hour of public support is all that is required to make renewable power competitive with fossil fuel. In fact, the cost of generating electricity from wind is already competitive with generating power from new coal-fired power plants. And renewable energy creates more jobs than coal: Every \$1 million invested creates nearly 6 person-years of employment in wind or solar PV, and between 4-14 person-years of employment in biomass co-firing – but less than 4 person-years of employment in coal.⁵

To stabilize the market for renewable energy production, we recommend that Congress approve a 10-year extension of the Production Tax Credit (PTC) and the Investment Tax Credit (ITC), and dedicate some portion of carbon credits in any future cap and trade legislation to help finance renewable power production.

3. Create a transmission grid for the new energy economy by establishing environmentally-sound transmission corridors, upgrading the electrical grid, and investing in new “smart grid” technologies. The power grid is outmoded, overloaded and unsuited to the needs of America’s clean energy future. We need major investments to improve the grid and increase access, while respecting existing protective land use and environmental regulations. Without strong investments in this area, the United States stands little chance of accessing our nation’s vast stores of renewable energy.

We recommend that the federal government, working closely with state agencies, should establish new transmission corridors that take into account renewable energy resources, access to population centers, environmental considerations, and community concerns. These corridors should be developed with the input of all affected stakeholders and permitted on an expedited and coordinated basis.

⁵ Virinder Singh, *The Work that Goes Into Renewable Energy*, Renewable Energy Policy Project research report, November 2001.

In addition to new transmission lines, we recommend major investments to upgrade the existing electrical power grid. With few exceptions, investor-owned utilities are not willing to assume the risks and capital costs associated with upgrading the grid. As a result, the grid is congested and prone to blackouts, which cost consumers more than \$79 billion per year.⁶

The nation is overdue for a modernized grid, one that easily incorporates large and small power generators and multiple types of renewable power supply. The modern grid must also be “smarter,” allowing for communication between consumers (or their appliances) and power generators in order to manage power demand efficiently during peak hours. Bringing our power grid into the 21st century will not only make our nation more efficient and secure, it will also greatly facilitate the widespread deployment of renewable energy and electric vehicles, and will preserve and create hundreds of thousands of high-quality jobs for linemen and women, and other utility workers.

We recommend major investments in smart grid demonstration projects. These funds should be directed at projects incorporating the best available technology to make the grid as efficient, secure, environmentally-friendly and accessible as possible. Like the Internet, the power grid needs to be able to connect billions of devices and still operate reliably. Because of growing environmental concerns, the grid needs to become far more flexible than it is today, accommodating distributed power generation from renewable sources and making effective use of the latest energy efficiency techniques.

4. Encourage industry and utilities to generate cleaner power in existing plants by using recycled waste heat and carbon capture and sequestration technologies. Our energy systems will not be transformed overnight. Utilities and industrial power users will need to rely on existing power sources, including coal and natural gas, for years to come. But these systems must be made more efficient if we are to hope to achieve greenhouse gas reductions on the scale necessary to stabilize the planet.

We recommend that Congress encourage utilities and industrial power users to upgrade their power generation systems by incorporating combined heat and power systems, with the goal of achieving 20 percent improvement in industrial and utility efficiency by 2025. Combined heat and power (CHP) uses waste heat from power plants and industrial facilities to produce electricity and thermal energy that normally is cheaper than the energy otherwise purchased. A variety of industrial waste streams can be recycled into useful heat and power, as can many industrial processes, such as catalytic crackers at petroleum refineries and blast furnaces at steel mills. Conventional power plants

⁶ National Energy Technology Laboratory.

can also be converted so their waste heat is captured and used for heating homes and businesses close to the plant. Altogether, existing untapped CHP resources could generate up to 492,000 gigawatts of carbon-free power.

To encourage CHP systems at industrial sites and utilities, we recommend an investment tax credit for eligible systems – large and small – that produce at least 20% of their energy in the form of thermal energy, and that are at least 60% energy efficient. To encourage utilities to incorporate CHP into their electricity generation mix, Congress should require states to adopt standard interconnection policies that allow easy and consistent access to the power grid.

We also recommend targeted investments in demonstration projects using carbon capture and sequestration (CCS) technology at coal-fired power plants. Currently providing half of the nation's electricity, coal is likely to remain an important source of energy for the foreseeable future. Around the world, many industrial and emerging economies depend heavily on coal to meet growing power demand. The United States has the opportunity to invent tools and practices to reduce atmospheric emissions from carbon combustion, and then to export this technology to other coal-dependent nations.

Once carbon prices reach \$25 per ton under a future carbon cap, power companies should find it commercially viable to retrofit existing plants to capture their carbon emissions. They will not do so, however, unless we have already demonstrated the technological feasibility of CCS at commercial scale. We recommend that Congress invest in demonstration of carbon capture and storage technology at ten coal-fired power plants.⁷ We also recommend that the government map potential geological storage formations in all 50 states using a rigorous methodology, and develop clear regulations to ensure that waste CO₂ is injected safely.⁸

5. Build world-class metropolitan rapid transit systems and high-speed regional rail networks to give the 80 percent of Americans who live in metropolitan areas an attractive, affordable, and convenient way to get to shopping, school, and work. Today, more than half of U.S. households lack ready access to public transportation, which would take them off congested streets and highways. Transit options should include light rail, expanded bus service – including dedicated bus lanes and bus rapid-transit systems – inter-city and regional rail services, and bicycle lanes and services, all linked together so it is easy, pleasant, and inexpensive to ride transit.

⁷ See Senate passed HR6. Additionally, working group members agreed that funding should be technology neutral but achieve threshold operating efficiencies. We have picked IGCC plants as a baseline comparison because they represent the high water mark in thermal efficiency.

⁸ Pew Center

Good access to transit can put dollars back into the family budget. Transportation is the second largest cost (19%) of the American household budget, but this number drops to 9% or lower in areas near transit hubs.⁹ A lack of transportation choices also seriously harms American economic productivity: from 1982 to 2005, the annual cost of the extra time and fuel wasted in congestion rose from \$15 billion to \$78 billion per year in 2005 dollars. Each individual who commuted during peak periods in 2005 lost 38 hours – almost one week – sitting in traffic.

Unless the federal government takes action to increase transportation options, these trends will continue. Since 1980, the number of miles Americans drive has grown three times faster than the U.S. population, and almost twice as fast as vehicle registrations. If this trend continues, vehicle miles traveled will increase by nearly 60 percent from 2005 to 2030. These increases will wipe out any carbon savings from the improved fuel economy standards signed into law in 2007 by President George W. Bush.

On the plus side, transit programs create jobs. Transit projects tend to generate nine percent more jobs per dollar spent than road and bridge repair and maintenance projects, and nearly 19 percent more jobs than new road or bridge projects.

We recommend that Congress take two critical steps to drive the rapid expansion of transit nationwide. First, Congress should aggressively support transit expansion and maintenance through the federal Transportation Bill. Currently there is not enough money allocated to transit to fund the proposed projects of the regions that expand their transportation options. The next Transportation Bill should tip the balance toward transit by prioritizing those regional transportation plans that meet environmental, economic and equity needs.

Second, Congress should invest at least \$5 billion per year in a new “Transit Trust Fund”. The Transit Trust Fund should supplement funding provided through the Transportation Bill on the condition that the Transportation Bill’s funding allocation for transit only increases and is not diminished relative to other modes of transportation.

6. Adopt a “fix-it-first” highway policy that specifically embraces maintenance as the highest priority of American highway construction. Our roads are the backbone of our interstate economy, and they are falling apart. The National Surface Transportation Policy and Revenue Study Commission found that America needs to invest at least \$225 billion annually for the next fifty years to

⁹ Reconnecting America

upgrade our existing system to a state of good repair and create a more advanced surface transportation system to sustain and ensure economic competitiveness. We are spending less than 40 percent of this amount today.¹⁰

We recommend that Congress incorporate a “fix it first” policy into the Transportation Bill and all other transportation funding measures to prioritize maintenance of the nation’s highway infrastructure. This policy will not only make our roads safer, it will promote more efficient land use patterns by encouraging in-fill development in urban and suburban areas, discouraging sprawl, and improving traffic flow. It will also create enormous numbers of high-quality jobs: every \$1 billion spent on federally-aided highway resurfacing projects creates some 10,421 person-years of construction jobs (as compared to 9,316 person-years of work for a similar investment in new highway construction).¹¹

Make It in America

7. Invest \$20 billion over the next decade to manufacture advanced vehicles in the United States. The automobile industry will be required to invest more than \$100 billion to meet the fuel economy standards approved in the 2007 Energy bill. We recommend that Congress help mitigate this cost by enacting a variety of funding mechanisms to help the U.S. auto industry retool older plants and help consumers access a broad range of next-generation vehicles including flex-fuel cars and plug-in hybrids.

These investments in the long-term future of the U.S. auto industry will help to ensure the domestic production of next-generation vehicles and help to create or retain many thousands of U.S. jobs. Retooling older auto plants will help revitalize struggling manufacturing communities, make the best use of our existing skilled manufacturing workforce, and avoid wasteful duplication of transportation lines and supply chains. Congress should consider a variety of funding mechanisms for retooling, including tax credits, loan guarantees, and outright grants in exchange for concrete commitments on fuel efficiency, domestic content, and creation or retention of good jobs.

At the same time, Congress should provide funding to consumers – in the form of rebates or other incentives – to encourage the purchase of fuel-efficient vehicles and low-carbon fuels. This will allow consumers to hold down their gas bills while helping the country curb its addiction to oil.

¹⁰ National Surface Transportation Policy and Revenue Study Commission, *Transportation for Tomorrow* (January 2008)

¹¹ Good Jobs First

8. Develop a national low-carbon fuel infrastructure and invest in next-generation alternative fuels. Today, 96 percent of the energy for American cars and trucks comes from oil.¹² The cost of this over-reliance on oil is becoming more evident every day, as gas prices climb toward \$5/gallon. We must expand consumers' fuel options. To that end, we must radically expand the number of filling stations that carry and sell cellulosic ethanol, sustainably-produced biodiesel, and other low-carbon fuels. We recommend that Congress extend and increase the tax credit given to fueling stations for installing E85 pumps and tanks, and allow the credit to be used for bio-diesel pumps and tanks as well. These tax credits should be phased out over time. Consideration should also be given to providing incentives for consumers to purchase low carbon fuels.

Electricity is another important low carbon fuel. Widespread use of plug-in electric vehicles will reduce America's dependence on oil, and the greenhouse gas emissions associated with burning fossil fuels. The infrastructure investments we recommend to support expanded domestic use of plug-in vehicles are discussed elsewhere in this report. They include: investments in American auto plants, consumer rebates for the purchase of low-carbon vehicles, improvements to the transmission grid, and advances in battery technology.

We also must look forward to developing the next generation of efficient, sustainable, renewable fuels. A shift to home-grown, advanced biofuels could slash the country's oil trade deficit (\$29.3 billion in April 2008, and rising¹³), create competition and lower prices at the fuel pump, and reduce carbon emissions from our cars and trucks. Cellulosic ethanol, a biofuel derived from non-food perennial crops like switchgrass, and advanced biodiesel, a renewable fuel for diesel engines produced from sustainable sources of fats and oils such as algae and waste materials, have the potential to replace nine billion gallons of transportation fuels in 2025 and upwards of 100 billion gallons in 2050.

The renewable fuels sector is a major source of green-collar jobs. Conservative projections by the U.S. Department of Energy of future growth estimate that every 1 billion gallons of ethanol produced in the United States will generate 10,000 to 20,000 jobs. Cellulosic ethanol is even more labor-intensive because it requires the additional step of separating cellulose from sugars. Salaries at these plants are solidly middle-class: from \$48,000 to \$60,000 annually, according to newspaper accounts from around the country.

¹² Chuck Squatriglia. "How the Next President Can End Our Oil Addiction," interview with David Sandalow, *Wired Magazine*, January 9, 2008.

¹³ U.S. Department of Commerce, Trade Balance Report, June 10, 2008

We recommend that Congress fully fund incentives for the first 250 million gallons of cellulosic ethanol or biodiesel produced each year from sustainable alternative feedstock by 2013, as established in the 2005 Energy Bill. We further recommend investing in the building and operations phases of commercial-scale cellulosic ethanol and sustainable biodiesel plants, in order to move this technology forward to a point where it can seriously compete with petroleum and corn-based ethanol.¹⁴ Although there are several biodiesel and cellulosic ethanol plants in operation today, investors have balked at putting up funding for full-scale plants until the market viability of this type of fuel is proven.

In all cases, financing should be directed toward facilities that produce fuels with lifecycle greenhouse gas (GHG) emissions at least 50 percent lower than traditional petroleum-based fuels, including emissions associated with any changes in land use.¹⁵ It is critical that the impact of biofuel production on arable land be minimized, if not kept to zero. Extra weight should also be given to facilities that are farmer- or cooperatively-owned, as these provide greater local economic benefits than do absentee-owned facilities.¹⁶ Moreover, farmers who own a piece of the plant can hedge against fluctuating feedstock prices and may be less likely to need government crop subsidies as a result.

9. *Ensure the clean energy future is “made in America” by retooling and retrofitting the manufacturing sector to supply the component parts for the clean energy economy, and requiring that publicly-funded clean energy projects use at least 85 percent domestically-produced parts.* The U.S. has lost more than 7.2 million manufacturing jobs since 1998, due to mergers, bankruptcies, outsourcing, automation and globalization. These are some of the country’s best middle-class jobs, paying an average of \$25,000 more per year than service-sector jobs and often providing good benefits as well. Manufacturing is also a better engine of economic development than the service sector, because every dollar invested in manufacturing generates wider “multiplier effects” through finance, transportation, supply chains, installers and other businesses.¹⁷

U.S. manufacturers have tremendous potential to supply the growing domestic and international demand for the gears, bearings, composite materials, concrete, steel, glass, copper, computers, motors, and other components and durable equipment required to make the current economy more efficient and to build the emerging clean energy economy. The domestic market for solar panels, wind turbines, fuel cells, and biomass engines alone is projected to reach \$226 billion annually by 2016.¹⁸ An aggressive program to promote

¹⁴ Aspen Institute, *A High Growth Strategy for Ethanol* (March 2006)

¹⁵ Based on discussion with Natural Resources Defense Council and the National Wildlife Federation.

¹⁶ David Morris, *Driving Our Way to Energy Independence* (ILSR, April 2008)

¹⁷ California Performance Review Commission, October 2004.

¹⁸ Center For American Progress, *Capturing the Energy Opportunity*, November 2007.

domestic manufacturing of renewable energy products alone could help create or retain 85,000 permanent green-collar jobs and benefit up to 70,000 U.S. firms capable of making the required components, most located in the 20 states hardest hit by manufacturing job losses.¹⁹

We recommend that Congress encourage manufacturers interested in locating new plants, retooling existing plants, or expanding in the U.S. by offering awards that provide up to 30 percent of the costs to build or retool a facility or train workers for domestic clean energy or energy efficiency-related manufacturing. Awards could come through a combination of grants, tax incentives and credits, loans and guarantees, or seed capital. These awards would be available to foreign-owned firms so long as those firms maintain manufacturing operations in the U.S. for at least five years. Awards for retooling and training activities would be based on a set of preferences to ensure the maximum use of domestically-sourced parts, the best use of idled manufacturing facilities and skilled manufacturing workers, a market for finished products, and above-average pay and benefits.

In addition, we recommend that in this program as well as any other program where public money is *directly* invested into clean energy production (rather than through tax incentives or other indirect subsidies), Congress should require that 85 percent of the project's components are manufactured in the U.S.

Restore America's Technological Leadership

10. Double from \$4 billion to \$8 billion per year national spending on energy research and development, restoring R&D spending to the levels of the late 1970s. The rich scientific and technical resources of American universities, private-sector inventors, and national laboratories have been responsible for significant breakthroughs in building efficiency, solar panels, wind turbines, carbon sequestration, and other clean energy and environmental technologies. Yet funding for basic energy research and development has lagged badly.

Public investment in energy-related R&D has fallen from \$7.7 billion per year in 1979 to less than \$4 billion today. From 1993 to 2005, private sector energy R&D investments fell 50 percent. Indeed, from 1988 to 2003, the U.S. energy industry invested just one quarter of one percent of revenues in R&D, compared with pharmaceuticals, software and computer companies, which invest 15 percent of revenues in R&D. New energy-related patents – an indicator of the rate of innovation – have declined parallel with the decline in R&D investing for such critical technologies as wind and solar photovoltaics. Given that future

¹⁹ George Sterzinger and Jerry Stevens. *Component Manufacturing: Michigan's Future in the Renewable Energy Industries*. REPP. 2006. We define "permanent" as a job lasting ten years.

economic growth in an innovation-based economy depends on the continuous introduction of new technologies, the fall off in federal R&D bodes poorly for the long-term health of America's clean energy sector.²⁰

We recommend that Congress create a dedicated funding stream of \$8 billion per year for energy R&D. Funding for this program could come from the auction of carbon credits, if Congress should adopt a carbon trading system. Clean energy research and development should accomplish three goals: improve existing technology, develop cost-competitive energy storage for renewable generation, and develop high-risk, novel and revolutionary technologies, such as would be accomplished by the Advanced Research Projects Agency-Energy.²¹

We recommend Congress focus on the following priorities for investment: advanced energy storage systems for improved grid management and the widespread introduction of plug-in hybrid vehicles; smart grid technologies to reduce peak energy demand; nanotechnology and advanced materials science for new solar cells and ultra-light wind-turbines; and advanced cellulosic ethanol and sustainable biodiesel production. To ensure that public R&D spending yields commercially viable products, Congress should encourage more public-private partnerships (including with small businesses) and federal-state partnerships, provided that private partners commit to commercialize the most promising inventions domestically. We expect this public investment to spur private sector interest: in the medical and biotechnology field, a doubling of federal investment during the 1990s was accompanied by an 11x increase in private-sector investment. It is time for the federal government to "prime the pump" in the vital energy sector.

11. Establish a new non-profit, independently managed fund that partners with existing federal and state programs, our national and university laboratories, and private sector venture capitalists to invest in the most promising new technologies emerging from our nation's laboratories. While research and development lays the foundation for a competitive economy, the nation's economic success requires taking the most promising laboratory prototypes and demonstrating them at commercial scale. Commercial demonstration of unproven new technologies is, however, often seen as too risky by the private sector. The result has been a proverbial "Valley of Death," where promising technologies die for lack of adequate venture capital.²²

²⁰ Gregory F. Nemet and Daniel M. Kammen, "U.S. Energy Research and Development: Declining Investment, Increasing need, and the Feasibility of Expansion," *Energy Policy*, Vol. 35, 2007.

²¹ Based on discussions with Bay Bridge Strategies, Inc.

²² See, for instance, Michael Liebreich, U.S. Senate Testimony, *New Energy Finance*, 2007.

Too often, lack of consistent federal support has created the opportunity for foreign competitors to step in, achieving commercial success with technologies developed in America's laboratories. Solar photovoltaic technology, wind turbines, and compact fluorescent light bulbs are among the many advanced energy technologies invented in American laboratories with public dollars that have largely been commercialized abroad. The American economy is losing the competitive advantage that comes from deploying these advanced technologies.

The imperative for effective commercialization strategies has only grown more urgent with the pace of technological change. Advances in digital design and materials science mean that today's advanced technology could be out of date in four or five years. Current solar photovoltaic technology could, for instance, eventually be eclipsed in some applications by nano-solar or thin film alternatives produced in Europe or Asia. The pace of change requires an aggressive national policy to move new technologies quickly from the laboratory to market.

We recommend a new independently-managed fund for demonstration projects in cutting-edge clean energy technologies. The fund could be capitalized at \$10 billion per year through a stream of carbon credits for a period of 10 years, then finance its future operations through returns on investment. Funds could be leveraged through creative financing tools, such as loan guarantees or partnerships with state and local government or the private sector.

Demonstration financing should flow to carefully selected technologies of obvious strategic benefit to the nation's energy, climate, and national security goals. At the risk of ignoring other worthy technologies, we recommend investment in smart grid, cellulosic and sustainable biodiesel, and carbon capture and sequestration (CCS) demonstration projects – each of which is described in more detail in other recommendations.

Tap the Productivity of the American People

12. Address the shortage of trained workers in the clean energy economy by expanding federal investment in state and local green-collar workforce training initiatives and green service opportunities to \$6 billion per year for the next decade. The eleven recommendations we have outlined above will spur massive new demand for clean energy and energy efficiency systems, and will provide millions of high quality, family-supporting green-collar jobs. But, given that nearly half the existing energy sector workforce is slated to retire in the next 5-10 years, we must also invest in training workers to fill those jobs.

We recommend that Congress spend \$5 billion per year to expand the Energy Efficiency and Renewable Energy Workforce Training Program (the “Green Jobs Act”) created in the 2007 energy bill, which provides grants for national and state training programs to prepare skilled workers for the full range of jobs and emerging technologies clean energy economy. Eligible training entities would include partnerships involving industry, labor, vocational schools, community colleges, and community organizations.

Of this \$5 billion, Congress should spend at least \$2 billion per year over the next decade to create green pathways out of poverty training programs – based in high schools, vocational schools, junior colleges, prison reentry programs, and worker training centers – to give low-income workers the basic job readiness skills they need to enter and successfully complete traditional workforce training programs like the one described above.

Finally, Congress should provide \$1 billion per year for the next decade to expand national service opportunities in clean energy and energy efficiency. Americans understand the imperative of moving to clean energy technologies, of combating global warming, and overwhelmingly support national service. A clean energy service program would expand national service opportunities -- including AmeriCorps, Senior Corps, and Learn and Serve America – put Americans of all ages to work to build the new energy future. The \$10 billion commitment, ramped up over the course of the decade, would effectively double federal support for national service.

13. *Ensure the transition to America’s clean energy economy creates widely-shared economic opportunities.* With the proper foundation, the clean energy economy will lift many boats, and will provide a solid foundation for our country’s environmental and financial future. But some communities will suffer in the short term, whether from job losses in traditional energy sectors or from increased energy bills as new technologies go from niche products to commercial-scale, affordable alternatives.

We recommend that Congress dedicate resources to ensure the economic opportunities of the clean energy future accrue to communities that have suffered from heavy job losses, especially those communities and workers adversely affected by changes in national energy policy. Accordingly, we recommend that Congress provide “just transition” assistance for affected individuals and communities. This assistance should include retirement bridges, wage replacement and financial support during worker training and education programs, and investment in local economic development.²³

²³ Based on discussions with Jim Barrett and Redefining Progress.

At the same time, Congress should provide dedicated funding for low-income consumers disproportionately affected by higher energy costs. This funding should be administered in the way that will best reach the largest number of low-income households – for instance, through the state Electronic Benefit Transfer (EBT) systems that currently deliver food stamps and other benefits.²⁴

Re-Invest in America

Establish a new market-based mechanism to generate and strategically re-invest the hundreds of billions of dollars necessary to build the new clean energy economy. At one time, Americans understood that great public undertakings required serious public investments. We spent the equivalent of \$70 billion per year (measured as a share of GNP) on the original moon launch program and we did it without borrowing from our grandchildren. Surely, our energy security challenges are serious enough to warrant a similar level of national commitment.

The next Congress should put in place a new funding mechanism that accomplishes three goals: First, it must provide a powerful market stimulus to shift our entire energy economy toward low-carbon technologies. Second, it must raise significant levels of public funding to re-invest in the new energy future. Third, it must ensure that hard-won public dollars are invested in the transformation of our nation's energy systems, without funds being siphoned off on pork-barrel projects and waste.

Two mechanisms could fit the bill. A tax on the carbon content of energy would be simple to administer and might be well-received if a portion of the money raised were used to reduce payroll taxes. We believe the public would support the concept if most of the funds were set aside and strictly administered by a new Clean Energy Investment Corporation charged with building a new, more secure clean energy future for our country. Politics aside, a carbon tax also has certain limitations. In particular, we don't know precisely at what level the tax must be set to achieve necessary levels of carbon reductions. Moreover, a mechanism that does not set any cap on carbon emissions might just lead to a "pay to pollute" system, where carbon taxes would be calculated as a standard business cost and then routinely passed through to consumers.

Like a carbon tax, a cap on carbon emissions would send a powerful market signal to move toward low-carbon energy sources. Emission reductions could be achieved by reducing each year the number of carbon permits sold or allocated to the market. Trading emission permits would allow the market to achieve carbon reductions at the lowest cost. While a carbon cap would be

²⁴ CBPP recommendation.

more complicated to administer than a tax, the cap has the virtue of establishing certainty in the rate of emission reductions necessary to stabilize the earth's climate. Like a tax, a carbon cap could also generate substantial public funding – anywhere from \$50 to \$300 billion per year.²⁵ Funds for new energy technology could come either from the auction of carbon emission permits or from “free allocations” of permits to energy-intensive industries and power producers, with strict regulations on how the value of those permits is used. Again, we believe the public would support the concept so long as any funds generated were set aside and strictly administered by a new Clean Energy Investment Corporation dedicated to building a new, more secure clean energy future for our country.

At this point, a carbon cap is more politically feasible than a tax. We recommend that Congress explicitly embrace the following principles in the design of what we prefer to call “cap and invest” policy:

- Ensure that cap and invest provides a smooth adjustment period for carbon-intensive industries, and the workers and communities that these industries support. Any “free allocations” of emissions permits for this purpose should be the minimum required to achieve the goal.
- Invest in rapid deployment of low-carbon energy technologies to move the clean energy economy forward and hold down energy costs. The purpose of a carbon cap is to limit carbon emissions by attaching a price to those emissions. As a result, the price of carbon-based energy could rise. Given the economic hardships now facing American consumers, Congress should do everything it can to make sure that non-carbon power sources and energy efficiency come online quickly to avoid sharp increases in power prices.
- Shield the most vulnerable Americans from rising energy costs. Options include greatly expanded weatherization assistance to 20 million low-income households, and well-designed cash rebate programs– for instance through electronic benefit transfer cards – for the poorest Americans.
- Ensure that cap and invest legislation provides fair treatment for energy-intensive industries so that any rise in energy prices does not create pressure to move operations offshore to countries without carbon controls. In particular, Congress should provide incentives to encourage a global agreement among large emitters to reduce carbon emissions worldwide, thereby preserving a level playing field for American industry. Incentives should include financing to stimulate deployment of world-class clean energy technologies abroad.

²⁵ Congressional Budget Office

In case our trading partners do not limit their emissions in a reasonable time period, however, Congress should authorize a border adjustment mechanism to level the playing field for American industry. A level playing field makes environmental as well as economic sense; we'll make little headway on global warming if tight standards here simply displace industry – and pollution – to countries with lax standards.

- Ensure that cap and invest legislation avoids creating pollution hot spots. Under a carbon trading regime, high-polluting power plants, often located in low-income areas, would be allowed to buy carbon credits and continue operations indefinitely, creating pollution hot-spots. To remedy the problem, Congress should limit carbon credit purchases for especially egregious polluters. It might also consider giving utilities some incentives for low-carbon technologies in exchange for shutting their highest-polluting power plants.

Carbon taxes or cap and invest legislation are, of course, not the only policies Congress must pass to build the new energy economy. *All* relevant federal policy – including transportation, workforce training, housing, agriculture, public lands, or other major legislation – should be crafted to leverage progress towards America's clean energy, good jobs future. Other revenues sources should also be tapped, including cutting subsidies to the oil industry. These opportunities should be vigorously pursued, even in the absence of a carbon cap.

However, we believe that either a carbon tax or cap and invest are fundamental if we are to achieve the scale of changes necessary to build a new energy economy.

Conclusion

The New Apollo Program identifies the most critical steps needed to build the clean energy economy. More can and should be done. Consider these the booster rockets for the New American Century – the essential steps to launch our nation to a more prosperous, secure future.

Let's get started.

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