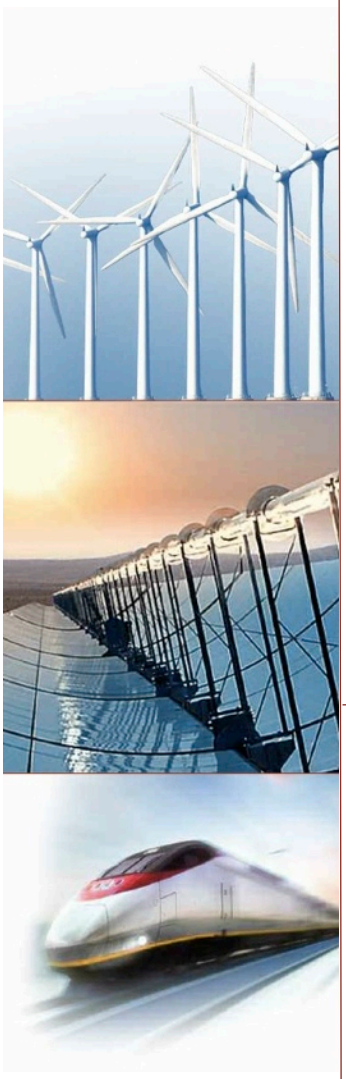

The Power to Compete?

Analysis of Key Clean Energy Technology and Competitiveness Provisions in the Kerry-Lieberman American Power Act of 2010

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Introduction

The May 2010 release of draft legislation known as the "American Power Act" marks the latest effort to enact "comprehensive" climate and energy reform in the United States Congress. Released by Senators John Kerry of Massachusetts and Joseph Lieberman of Connecticut, the legislation builds upon the Waxman-Markey "American Clean Energy & Security Act" (HR 2454) passed by the House of Representatives in June 2009 and the "Clean Energy Jobs and American Power Act" (S.1733) passed by the Senate Committee on the Environment and Public Works in November 2009.

The American Power Act (APA) comes amidst growing recognition that the United States faces intensifying global competition to secure the economic rewards associated with rapidly growing international markets for clean energy technologies and related products and services. Thus, in addition to reducing U.S. emissions of climate destabilizing greenhouse gases, one of the core objectives of the legislation is to enhance American competitiveness in clean energy technology markets. As Senator Kerry declared in the opening of the APA release press conference, "The bill that we are introducing today and revealing today, the American Power Act, will restore America's economy and reassert our position as a global leader in clean energy technology."

The purpose of this policy brief is to examine how the American Power Act (APA) would promote U.S. competitiveness in global clean energy markets. We review the bill's key clean technology provisions, providing a summary of measures supporting each of the three core components of an effective national clean energy competitiveness strategy – research and innovation, manufacturing, and domestic market demand – and detail support for particular clean technologies within each area. We also examine three other key policy components, including support for clean energy infrastructure, workforce development, and industry cluster development. We focus particularly on public investments through the Act's cap and trade allowance distribution and, where appropriate, highlight important authorizing provisions, tax measures, and loan programs contained in the legislation, while providing comparisons to the House-passed American Clean Energy Security Act (ACESA).

This policy brief finds that the American Power Act does not contain a comprehensive strategy for U.S. competitiveness in the global clean energy industry. While the legislation includes a number of measures with varying degrees of support, it falls substantially short in each core policy component of clean energy competitiveness. If U.S. energy reform is to secure the nation's leadership in this growing sector, the scale and scope of these provisions must be significantly improved in future legislative proposals.

The Clean Energy Competitiveness Imperative

Investments in the global clean energy industry are expected to grow 25 percent to $200 billion in 2010,[1] and according to World Economic Forum estimates, will reach $450 billion annually by 2012 and $600 billion by 2020.[2] Total market potential for clean energy products is even larger still, with one analysis estimating market potential in China alone at $500 billion to $1 trillion.[3] As such, the industry presents an important market opportunity for the United States, one that could lead to significant job creation and export potential. Government policy and public investment will be critical determinants of which countries emerge as leaders in the race to attract private sector clean energy technology investment and secure the employment, production, and tax benefits associated with this expanding economic sector.

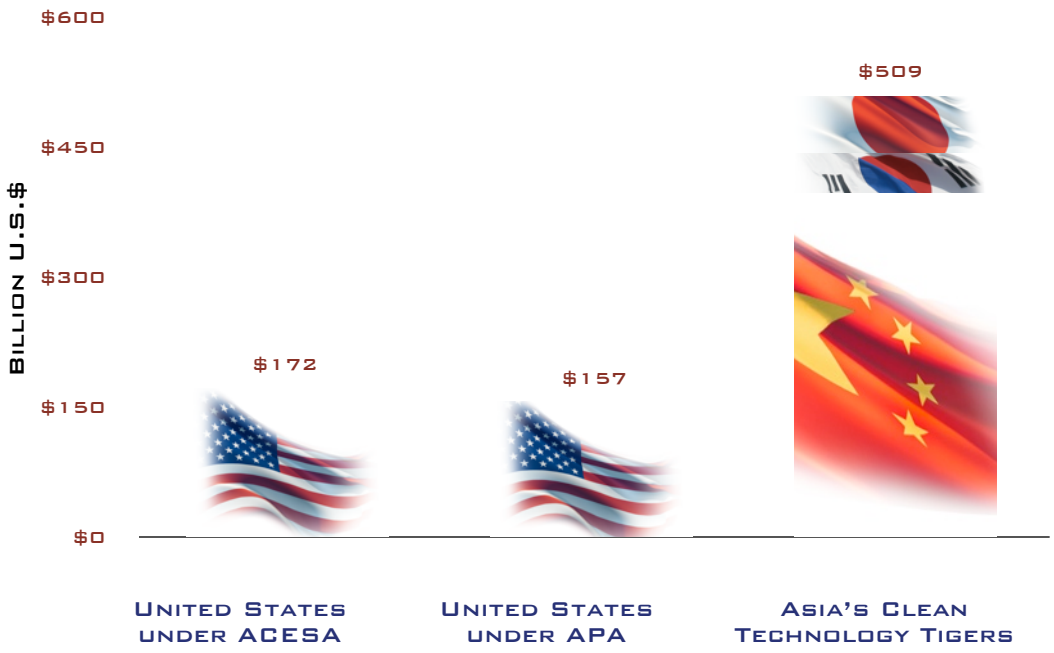
The United States currently lacks a comprehensive policy strategy for clean energy competitiveness, and unfortunately the nation is falling behind on a number of core metrics. As we documented in "Rising Tigers, Sleeping Giant," a November 2009 report published by the Breakthrough Institute and the Information Technology and Innovation Foundation, the U.S. already lags behind competitors in China, Japan, and South Korea in the manufacture and production of virtually all clean energy technologies, from solar, wind and nuclear power to hybrid and electric vehicles and the advanced batteries that power them.[4] Should this gap continue, the U.S. risks importing the majority of the clean energy technologies necessary to meet growing domestic demand. Already, the U.S. trade deficit for renewable energy products and services has soared 1400 percent in the past five years to nearly $6 billion, according to a December 2009 U.S. Senate report.[5]

Along with established clean energy leaders in Europe (e.g., Germany, Denmark, Spain), Asia's "clean tech tigers" (China, Japan, and South Korea) are poised to establish first-mover advantages over the United States. This lead will be established not due to any inherent competitive advantage, but rather due largely to a robust and comprehensive set of public investments and supportive incentives in the core components of an effective national clean energy competitiveness strategy: research and innovation, manufacturing, and domestic market demand support. To secure their competitive advantage, the governments of China, Japan, and South Korea are expected to collectively out-invest the United States by a more than three to one margin over the five-year period from 2009-2013, if current and proposed policies are fully enacted.[6]

This public investment gap, should it persist, will help Asia's clean tech tigers attract an even greater share of private sector investment in clean technology markets. A comprehensive and targeted set of public investments and supportive policies can remove key barriers to clean energy technology development and adoption and provide a stable and attractive environment for investment. A recent study by Deutsche Bank thus identified "generous and well-targeted

[clean energy] incentives" in China and Japan and credited the presence of a "comprehensive and integrated government plan, supported by strong incentives" as the key reason why these nations have established a low-risk environment for investors and successfully stimulated high levels of private investment in clean energy. In contrast, the investment firm noted, the United States is a "moderate-risk" country since it relies on "a more volatile market incentive approach and has suffered from a start-stop approach in some areas."[7]

Figure 1. Competing Public Investments in Clean Energy Technology, 2009-2013



Already, these national strategies are paying dividends. China has attracted more private investment in clean energy than the United States since 2008.[8] In 2009, China attracted $34.6 billion of private investment in clean energy sectors, nearly twice as much as the United States, in a distant second with just $18.6 billion.[9] In the realm of startups, the U.S. still leads in total venture capital (VC) investments in clean technologies, according to research from the CleanTech Group, which closely monitors the sector. But the North American share of VC funding fell from 72 percent in 2008 to 62 percent in 2009, a four-year low for the region, with North American clean tech startups raising $3.5 billion in VC funding that year, down 42 percent from 2008. It was Chinese firms that dominated initial public offerings (IPOs) in clean tech sectors, however, with 17 Chinese companies securing $3.4 billion, or 72 percent of global IPO proceeds in 2009.[10]

Competitive Strategy

Assessing the Kerry-Lieberman American Power Act

Securing the economic opportunity of the fast-growing clean energy sector and restoring U.S. leadership in these technologies will require a robust, comprehensive and well-targeted set of public policies and investments in U.S. clean energy research and innovation, manufacturing, and domestic market demand, as well as supporting investments in infrastructure, education and workforce development, and industry cluster formation. Each of these policy components are necessary for economic leadership in a range of clean energy technologies, including but not limited to solar photovoltaic and thermal, onshore and offshore wind, advanced geothermal, hybrid and electric vehicles and batteries, carbon capture and storage, nuclear, smart-grid, and high-speed rail.

This section describes the importance of each of these core components to a comprehensive clean energy competitiveness strategy, benchmarks U.S. competitiveness in each policy component relative to foreign competitors, and assesses the extent to which the American Power Act would impact each component. Given the urgency of America's eroding position in global clean energy markets, we focus on the impact of this legislation over the first ten years after implementation of the Act's central provision – a cap and trade program on greenhouse gases – from 2013-2022. For more details on the key clean energy provisions of the APA and a detailed breakdown of cap and trade allowance allocations (with comparisons to the House-passed ACESA), see Appendices A and B.

1 | Research and Innovation

Strategic Importance

Large-scale federal investment in the research, development, and demonstration (RD&D) of clean energy technology is necessary to establish and maintain a national competitive advantage in the clean energy industry. RD&D is necessary to invent new clean energy technologies, components, and manufacturing processes, improve the cost and performance of existing technologies and processes, and demonstrate proof of concept for new innovations. Without substantially greater investment in these activities, the U.S. risks seeing the next generation of clean technologies invented and commercialized overseas. Equally important to the level of investment is the institutional structure of the national energy innovation system, which should effectively translate basic research to applied development and onto prototype demonstration, and foster strong coordination between industry, academia, and government. Expanded RD&D will leverage America's comparative international advantage in science and technology innovation capacity, and attract more workers into science and engineering fields.

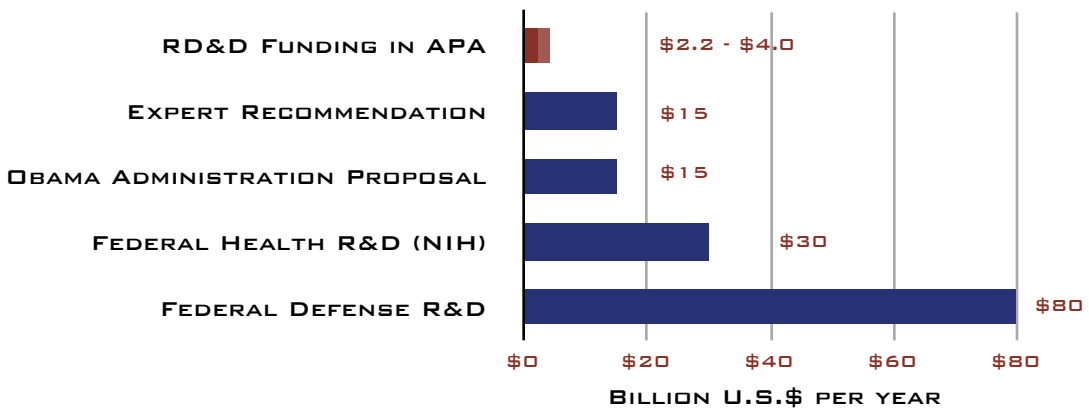
Setting the Bar

The United States' historical leadership in energy technology innovation is slipping as other nations implement aggressive national innovation strategies and increase their investments in energy R&D. As a percentage of GDP, Japan and South Korea outspend the United States on energy R&D by a factor of two-to-one, and the Chinese government has identified energy innovation as a strategic sector, dedicating significant new resources to increasing China's energy R&D capacity and accelerating technology transfer programs.[11] Despite a short-term increase in funding under the American Recovery and Reinvestment Act, total U.S. federal investment in energy R&D is poised to return to roughly $3-5 billion annually, nearly 50% less than the peak of federal energy R&D investment reached in 1980, and an order of magnitude less than federal investments in health care and defense-related research.[12] There is a broad expert consensus among energy scientists, technology experts, think tanks, and high-tech firms that the U.S. federal government should increase investment in energy research and innovation by at least $15 billion annually.[13] President Obama also called for an annual energy R&D investment of this magnitude to fill this energy innovation gap.[14]

Measuring Up

The Kerry-Lieberman APA would provide only modest direct support for clean energy technology research, development, and demonstration, and it does not contain a strategy for prioritizing these investments or improving the current federal energy R&D system. The core clean energy R&D program would receive approximately $1.2 to $2 billion dollars per year in cap and trade allowances from 2013-2021.[15] These funds would be distributed on a competitive basis to universities and colleges, companies, research foundations, industry collaborations, and/or consortiums, although the goals and criteria for these grants are relatively unclear in the legislation. No allowances are allocated to clean energy R&D after 2021. The bill also authorizes but does not fund a small nuclear research initiative. For demonstration, carbon capture and storage (CCS) technology would receive a $2 billion annually from 2011-2021 for commercial-scale CCS demonstration, with funding from a special small fee on all electricity generated at fossil fuel-fired power plants.

Figure 2. APA Clean Energy RD&D Funding, Comparisons



2 | Advanced Manufacturing

Strategic Importance

As the global clean energy market continues to grow, economic benefits will accrue to those nations that establish dominance in manufacturing the technologies that underpin the expanding industry. Manufacturing is a traditional and powerful engine of middle-class jobs and wealth creation, and a number of studies have shown that a large portion of clean energy jobs are created at the manufacturing level.[16] Moreover, high-tech clean energy manufacturing centers provide overall benefits to regional economies in the form of skilled jobs, new component part suppliers, services, and the development of major engineering centers that form the basis of future industries. Thus, the clean energy industry provides a unique opportunity to reverse part of the ongoing decline of the U.S. manufacturing sector, reduce the U.S. trade deficit, and achieve job creation objectives. Without a comprehensive manufacturing strategy, the U.S. will import the majority of clean energy technologies it deploys, a trend that has already begun.[17]

Setting the Bar

The United States now lags its economic competitors in Europe and Asia in the production of virtually all clean energy technologies.[18] Those nations have leaped ahead of the U.S. in clean energy manufacturing not as a result of inherent comparative advantages, but because foreign governments have provided direct and robust support for domestic manufacturers in the form of tax credits, cash grants, free land and industrial development zones, access to low-cost credit, and the public provision of infrastructure and high-value human capital. To make up for lost ground and to restore U.S. competitiveness in the global clean energy manufacturing sector, the federal government must respond with its own comprehensive and robust set of strategic initiatives to bolster domestic clean energy manufacturing, including low-cost financing, tax incentives, and technical assistance to retool the nation's industrial base to manufacture these technologies. Furthermore, a significant portion of U.S. research and development efforts should be located close to regional industry clusters and targeted to address manufacturing challenges.

Measuring Up

The Kerry-Lieberman APA would provide modest support for clean energy manufacturing, although it lacks a comprehensive national strategy and does not seek to improve existing policy mechanisms. It would support clean energy manufacturing by expanding the Advanced Energy Project Credit (the Section 48C credit) for advanced clean energy technology manufacturers by $5 billion, from $2.3 to $7.3 billion, and would for the first time allow nuclear power plant manufacturing to qualify.[19] For advanced hybrid and electric vehicles, the proposal would establish a separate "Clean Vehicle Technology Fund" that would

receive approximately $0.45 to $0.90 billion per year over the first ten years, or a cumulative total of $4.6 to $6.9 billion, which would end after 2021. Investments in natural gas vehicle manufacturing facilities would also be fully tax deductible under APA through 2015, and half of the value of such investments made between 2015-2020 will be tax deductible. Finally, the bill would help U.S. manufacturers adopt new process innovations to reduce costs associated with reducing greenhouse gas emissions, particularly in carbon-intensive sectors. However, this initiative would receive less than one percent of allowances over the first ten years, or approximately $0.5 to $1.0 billion per year, which would fall to zero after 2021. Absent from the APA is the Investments for Manufacturing Progress and Clean Technology (IMPACT) Act, which was adopted in the House-passed ACESA and would create a $30 billion revolving loan fund to provide low-cost financing to help small and medium-sized U.S. manufacturers retool for producing clean energy technologies and components.

3 | Domestic Market Demand

Strategic Importance

Providing robust market demand for clean technologies in the United States is another necessary component of a national clean energy competitiveness strategy. Reliable domestic demand will attract leading companies to locate parts of their manufacturing, supply chain, and R&D operations within the nation's borders; accelerate learning-by-doing and incremental innovation to achieve improvements in technology price and performance, as well as manufacturing processes; and provide a greater incentive for U.S. firms to invest in clean energy technology development and deployment.

Setting the Bar

Foreign competitors have provided robust and targeted deployment incentives along with ambitious targets for clean energy technology deployment. For example, Germany has become the world's leading solar power market by providing stable market demand through its feed-in tariff program. Similarly, China has built a world-leading wind energy industry in just five years with help from a targeted wind feed-in tariff, and the government expects to achieve over 100 GW of wind electricity generation capacity by 2020, 20 GW of solar, and up to 86 GW of nuclear power.[20] These incentives provide targeted support to overcome technology specific price gaps between fossil fuels and various clean energy technologies. While the clean energy investments in the U.S. stimulus package provided a set of incentives to accelerate the deployment of many clean energy technologies, these investments will soon expire.

Putting a price on carbon has an important role to play in creating market demand, but raising the costs of carbon-intensive energy sources through an economy-wide carbon price will not by itself provide the targeted support necessary to overcome technology-specific price gaps

and other key barriers that inhibit the deployment of a full suite of technologies at scale. An effective market demand strategy will necessarily include other deployment mechanisms such as power purchasing agreements, targeted incentives, and general low-cost financing. Federal deployment mechanisms should also be effectively linked with RD&D and manufacturing in order to accelerate cost reductions in emerging clean energy technologies.

Measuring Up

The primary mechanism intended to stimulate domestic market demand in APA is the carbon price established through the bill's central cap and trade program. Unfortunately, this program is unlikely to result in significant deployment levels, particularly in the near-term, due to the cost containment mechanisms that will keep carbon prices relatively modest, as well as the persistence of many non-price-related barriers to clean energy adoption.[21] According to projections by the U.S. Environmental Protection Agency, the broadly consistent cap and trade program under the House-passed ACESA would not significantly increase demand for clean energy technologies in the near-term. EPA analysis concluded that under ACESA, cap and trade "allowance prices are not high enough to drive a significant amount of additional low- or zero-carbon energy (including nuclear, renewables, and CCS) in the shorter-term, excluding the technologies with special financial incentives (e.g. CCS)."[22] Similarly, according to analysis by the Peterson Institute for International Economics, APA is likely to result in only 300 MW of additional renewable generation capacity above business as usual projections by 2020.[23]

Beyond establishing a modest carbon price, APA would invest only a small fraction of its cap and trade allowance revenue in technology deployment, along with some deployment tax incentives. For renewable energy and energy efficiency, APA would invest approximately $0.3 to $2.1 billion annually between 2013-2021 to support state renewable energy and efficiency programs, and after 2021 these investments would fall to zero. For advanced hybrid and electric vehicle deployment, the Act's cap and trade program would reserve approximately $75 to $225 million per year in allowance value between 2013-2021, which would also fall to zero thereafter.

CCS technology would receive the largest dedicated stream of cap and trade allowances for technology deployment. Beginning in 2017-2019, commercial deployment of CCS would receive allowances valued at roughly $580 million to $880 million annually, increasing to $5.5 billion to $8.3 billion by 2022. Incentives for CCS deployment would continue until 2035 or until 72 GW of CCS is installed. In contrast, nuclear energy technology would receive more indirect incentives without a dedicated cap and trade revenue stream: $35.5 billion in new nuclear power-plant loan guarantees; regulatory risk insurance of up to $500 million for up to 12 projects; an investment tax credit or direct grants to promote construction of new reactors, covering 10% of qualified construction costs; and accelerated depreciation for plants. Finally, consumers would receive tax credits for purchasing natural gas vehicles, and states would be authorized to issue tax credit bonds for natural gas vehicle projects.

Table 1. Clean Energy Deployment, United States and China

	China		United States		
	2008 (actual)	2020 (projected)	2008 (actual)	2020 (BAU)	2020 (Possible Additional Under APA)
Wind	12.2 GW	>100 GW	25 GW	66.6 GW	+0.4 GW
Solar	<0.2 GW	20 GW	1.2 GW	12 GW	+0.1 GW
Nuclear	9 GW	70-86 GW	100.5 GW	110.3 GW	+18.1 GW
CCS	0 GW*	--	0 GW*	2 GW	+5.9 GW

Sources - "Rising Tigers, Sleeping Giant" (Breakthrough Institute and ITIF, 2009) and "Assessing the American Power Act" (Peterson Institute for International Economics, 2010).
* - Commercial-scale deployment. Both the United States and China have demonstration-scale CCS pilot projects underway.

4 Supportive Components

Strategic Importance

Beyond the core components of research and innovation, manufacturing, and deployment, at least three other supportive mechanisms are necessary for a strong and competitive clean energy industry: enabling infrastructure, education and workforce development, and industry cluster formation. Comprehensive national strategies are needed on each of these fronts.

For infrastructure, developing a smart electricity grid is necessary to integrate and manage renewable power; electrical vehicle infrastructure, such as charging stations, is necessary to electrify transportation systems; and rapid mass transit like high-speed railways is necessary to improve transportation efficiency and reduce reliance on personal vehicles. Energy education and workforce development is necessary to replace the currently declining energy workforce, to train and develop the energy scientists and engineers needed to accelerate research and innovation, and to meet deployment and construction challenges. Finally, developing regional industry clusters is critical to accelerate clean energy innovation, from basic research to technology commercialization, and to enhance the competitiveness of U.S. manufacturers and suppliers. Industry clusters act as innovation "ecosystems" that foster collaboration among a dense network of actors, including researchers, investors, manufacturers, suppliers, universities, and local and state government officials, conferring lasting competitive advantages.[24]

Setting the Bar

Several key indicators suggest the United States is falling behind in clean energy infrastructure, workforce development, and industry cluster formation. In infrastructure, China will invest approximately $300 billion over the next ten years to develop a nationwide high-speed railway system – the largest railway expansion in history – and the State Grid Corporation will invest $44 billion through 2012 and $88 billion through 2020 in ultrahigh-voltage grid infrastructure. The nation will also devote $2.9 billion from 2009-2012 to establish electric vehicle charging infrastructure.[25]

U.S. competitors hold a well-known lead in STEM education. The United States ranks just 29th out of 109 countries in the percentage of 24-year olds with a math or science degree.[26] Even South Korea, with a population one-sixth the size of the United States, graduates more engineers annually.[27] Furthermore, up to half of the U.S. energy workforce could retire in the next five or ten years and demand for workers in renewable energy fields is expected to more than triple from 2006 to 2018,[28] but the majority of universities lack degree programs focused on energy.[29] While vocational green job training is underway, there is no national strategy for energy science and engineering education.

Other countries are also moving quickly to establish clean energy industry clusters ahead of the United States. Foreign competitors are providing generous subsidies in the form of free land, low-cost financing, tax incentives, R&D funding, to attract leading technology firms to locate within their borders. For example, the Chinese city of Baoding recently transformed from an automobile and textile town into the home of "Electricity Valley," the fastest growing hub of clean energy equipment makers in China composed of nearly 200 renewable energy companies.[30]

Measuring Up

The APA contains few provisions related to these key supporting components. It contains little in the way of a comprehensive strategy to lay the critical enabling infrastructure for a low-carbon national energy system. For example, there is no dedicated revenue stream for smart-grid infrastructure, although the proposal would authorize smart grid technologies as one possible recipient of cap and trade allowances for the renewable energy and energy efficiency deployment program. Overall funding from this source for smart grid infrastructure is likely to be relatively low. For advanced vehicle infrastructure, including electric vehicle charging stations, the Act would specifically dedicate less than 0.05% of total cap and trade allowances from 2013-2021. For general transportation infrastructure, 12% of allowances in 2013 (valued between $6.8 billion to $10.2 billion), dropping to 5.7% of allowances in 2022 (valued between $4.2 billion to 6.5 billion), are dedicated to highway, rail, and other large-scale transportation infrastructure, as well as state and metro-area transportation infrastructure that will reduce

greenhouse-gas emissions. An unspecified portion of this funding may be used to develop the nation's fledgling high-speed rail system.

APA does not include any provisions for science, technology, engineering, and mathematics (STEM) education related to clean energy technology, leaving a critical absence of programs to train the next generation of American energy innovators and engineers. The bill would authorize vocational training programs in clean energy deployment and building construction, but these programs receive no dedicate funding under the legislation.

Finally, the APA does not contain any explicit strategy to support clean energy industry cluster formation. It is possible that clean energy R&D grants could support collaborative, public-private energy research consortia that could help anchor clean energy industry clusters, but this is not an explicit directive of the legislation.

Conclusion

The United States currently lacks an effective national strategy for competitiveness in the rapidly growing clean energy industry, and as numerous reports have documented, the nation is falling behind in a number of core metrics compared to economic competitors. Restoring U.S. leadership requires a robust, comprehensive, and well-targeted set of public investments and policies to match and exceed those of competing nations. Core components of a national clean energy competitiveness strategy include research and innovation, manufacturing, and domestic market creation, as well as supporting investments in infrastructure, education and workforce development, and industry cluster formation.

Unfortunately, the American Power Act does not contain a comprehensive strategy for U.S. competitiveness in the global clean energy industry. While the legislation includes a number of measures with varying degrees of support, it falls substantially short in scale and structure for each of these core components. In research and innovation, the legislation would invest an order of magnitude less than the majority of energy experts recommend. In manufacturing, it would provide a modest expansion of existing programs, along with some targeted support for advanced vehicles and general manufacturing efficiency. Beyond a modest carbon price, APA would not provide robust and direct support for clean energy deployment and market creation besides carbon capture and storage, with largely insignificant results for renewable energy technology. Finally, it provides little support for clean energy industry cluster formation, clean energy workforce development, and infrastructure development.

The United States urgently needs an effective federal policy to strengthen the nation's competitiveness in this expanding global industry. If U.S. energy reform is to achieve this objective, each of the core components of a comprehensive competitiveness strategy must be substantially strengthened and expanded in future legislation. This includes much larger and more targeted technology investments and incentives, as well as improved institutional structure and policy mechanisms. Securing the economic opportunities associated with clean energy markets represents a national imperative, without which the U.S. risks losing out in one of today's largest growth industries and importing the vast majority of clean energy technologies it deploys in the future.

Appendix A

Summary of Key Clean Technology and Competitiveness Provisions

This appendix summarizes key provisions in the American Power Act related to research and innovation, manufacturing, market demand, and other supportive mechanisms.

| 1 | Research and Innovation

Energy Technology Research & Development

Dedicated Cap & Trade Allowances: The primary clean energy R&D provision would receive between $1.1 to $2.2 billion annually in cap and trade allowance value from 2013-2021 (2.0% of annual allowances), after which these investments would fall to zero. The cumulative investment in clean energy R&D programs during the first ten years of the cap and trade program (2013-2022) would total $12.3 to $18.5 billion.

Nuclear Energy Technology R&D

Authorization: Support for nuclear technology research and development includes authorization for a $50 million "Nuclear Energy Research Initiative" on small-scale modular reactors and other issues, and it would designate a National Laboratory Center of Excellence to lead R&D on spent fuel recycling.

Carbon Capture & Storage Technology Demonstration

Special Dedicated Fee: APA would establish a special fund to invest $2 billion/year in commercial-scale CCS demonstration projects, generated by a fee on fossil-fuel generated electricity (no less than $0.00145/kWh for coal-fired electricity, $0.00074/kWh for natural gas-fired, and $0.00108/kWh for oil-fired).

| 2 | Advanced Manufacturing

Clean Energy Technology Manufacturing

Tax Credits: APA would support clean energy manufacturing by expanding the Advanced Energy Project Credit by $5 billion, from $2.3 to $7.3 billion, and would for the first time make nuclear energy eligible.

Advanced Vehicle Technology Manufacturing

Dedicated Allowances: In addition to the expanded support for the 48c Advanced Energy Manufacturing Tax Credit, for which plug-in hybrid and electric vehicle technology manufacturers are eligible, APA would also support clean vehicle technology manufacturing through the allocation of cap and trade allowances by establishing a "Clean Vehicle Technology Fund." Approximately 80% of this fund would be reserved for manufacturing, between $450 to $900 million annually in cap and trade allowances from 2013-2021, after which these investments would fall to zero. The cumulative

investment in clean vehicle programs during the first ten years of the cap and trade program (2013-2022) would total $4.6 to $6.9 billion.

Natural Gas Vehicle Technology Manufacturing

Tax Credits: APA includes a 100 percent tax deduction for the cost of natural gas vehicle manufacturing facilities placed in service before 2015, and 50 percent for those placed between 2015 and 2020.

General Manufacturing Technology

Dedicated Allowances & Authorization: APA would establish a National Industrial Innovation Institute to research and develop technology that reduces the energy consumption and greenhouse gas emissions intensity of domestic manufacturers to help them remain competitive in a low-carbon economy. It would receive between $0.5-1.1 billion annually in cap and trade allowance value from 2013-2021 (1.0% of annual allowances), after which these investments would fall to zero. The cumulative value during the first ten years of the cap and trade program (2013-2022) would total $5.7-8.6 billion. It would not necessarily provide direct support for clean energy manufacturing, but it could help develop low-carbon manufacturing technologies.

3 | Domestic Market Demand

Renewable Energy & Energy Efficiency Technology Deployment

Dedicated Allowances: The renewable energy and energy efficiency deployment program would receive between $0.3-2.1 billion annually in cap and trade allowance value from 2013-2021, after which these investments would fall to zero. The cumulative value during the first ten years of the cap and trade program (2013-2022) would total $10.5-15.8 billion. A significant portion of this allowance value could go toward energy efficiency projects instead of renewable energy technology deployment.

Advanced Vehicle Technology Deployment

Dedicated Allowances: The "Clean Vehicle Technology Fund" would dedicate about 20% of its cap and trade allowances toward advanced vehicle deployment, between $75-225 million annually in cap and trade allowances from 2013-2021, after which these investments would fall to zero. The cumulative investment in clean vehicle programs during the first ten years of the cap and trade program (2013-2022) would total $1.1-1.7 billion.

Natural Gas Vehicle Technology Deployment

Tax Credits: The bill includes tax incentives for natural gas vehicle deployment, including an extension and doubling of the alternative fuels tax credit over a 10-year period for purchasing heavy natural gas vehicles or lighter commercial fleet vehicles. It also authorizes states to issue tax credit bonds to finance natural gas vehicle projects, up to $3 billion nationally.

Carbon Capture & Storage Technology Deployment

Dedicated Allowances: Beginning in 2017-2019, commercial deployment of CCS would receive allowances valued at approximately $580 million to $880 million annually, increasing to $5.5 billion to $8.3 billion by 2022. This allowance

allocation would ramp up to 10% of total annual allowances in 2030, at an annual value of around $5-10 billion per year, which would end after 2034 or once 72 GW of CCS is installed.

Nuclear Energy Technology Deployment

Tax Credits, Loan Guarantees & Other: APA includes $35.5 billion in new nuclear power-plant loan guarantees above the current $18.5 billion program, for a total of $54 billion, a value consistent with Obama Administration recommendations; regulatory risk insurance of up to $500 million for up to 12 projects; an investment tax credit or direct grants to promote construction of new reactors, covering 10% of qualified construction costs; and accelerated depreciation for plants. On the regulatory front, the bill includes expedited regulatory procedures, among other provisions.

4 Supportive Components

Smart Grid Infrastructure

Dedicated Allowances: APA does not contain a dedicated provision for smart grid infrastructure, however, it would authorize smart grid development as one possible use of cap and trade allowances for the renewable energy and energy efficiency deployment program (see above). Given the number of other potential uses for these allowances, smart grid infrastructure would most likely receive a small portion.

Advanced Vehicle Infrastructure

Dedicated Allowances: The APA contains modest dedicated support for advanced vehicle infrastructure. The electric vehicle infrastructure provision would receive 5% of the allowances reserved for advanced vehicle technology from cap and trade, or less than 0.05% of total allowances over the first ten years.

Authorization: The provision calls upon the Secretary of Energy to develop a national transportation low-emission energy plan projecting demand and needs for electric drive vehicle infrastructure and standards. Also authorizes "such sums as are necessary" for an unspecified number of pilot projects to demonstrate electrical drive vehicles and infrastructure.

Education & Workforce Development

Authorization: APA authorizes but does not provide funding for clean energy curriculum grants and the clean energy construction careers demonstration project, which would primarily focus on vocational training. It also directs the Secretary of Labor to establish an online information and resources clearinghouse for vocational education and job training in the renewable energy sector. APA does not include a provision for energy science and engineering education.

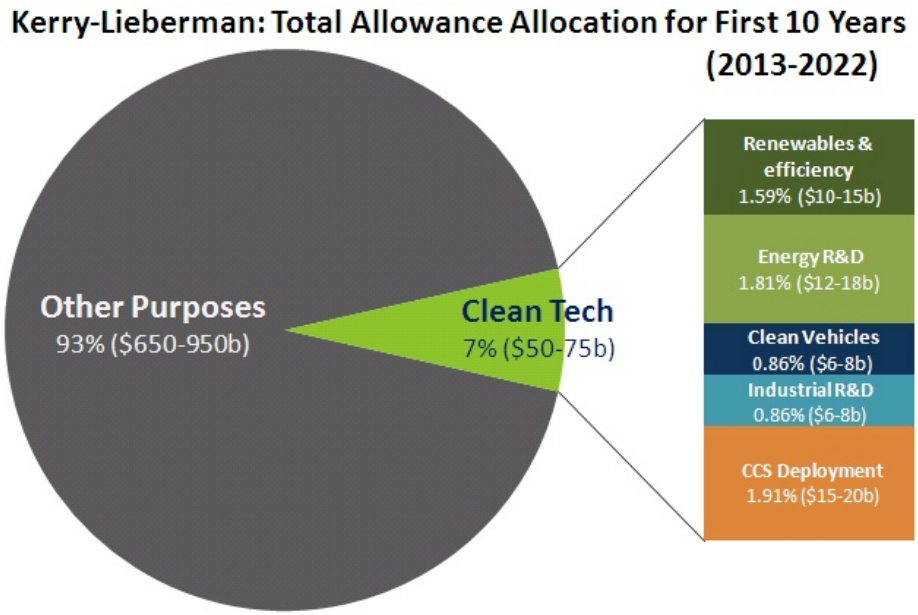
Other Transport Infrastructure

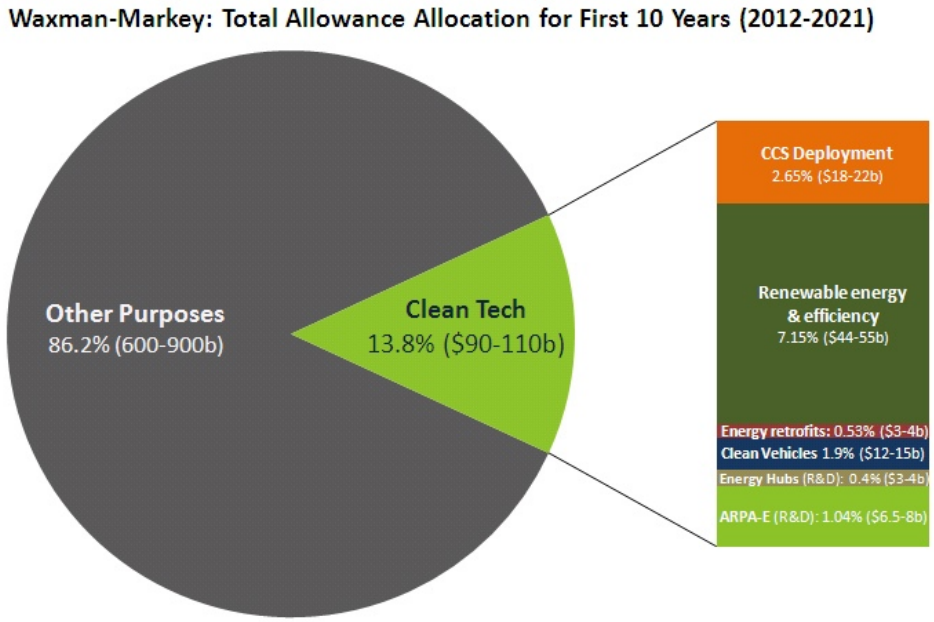
Dedicated Allowances: The general transportation infrastructure and efficiency provisions in APA receive nearly 9% of the allowances from the cap and trade program over the first ten years. One-third of these allowances would go toward the Highway Trust Fund; one-third toward federal grants for large-scale transportation projects in line with the American Recovery & Reinvestment Act of 2009; and one-third toward states and metropolitan planning organizations for approved greenhouse gas emission reduction programs. Some unspecified portion of these funds may be used to construct high-speed rail technology infrastructure.

Appendix B

Allowance Distribution and Value

Overview of Clean Technology Support in Cap and Trade Provisions - APA and ACESA





Allowance Distribution Tables - APA and ACESA

APA Allowance Distribution for First Ten Years	Allowance Distribution 2013-2022		ACES Allowance Distribution for First Ten Years	Allowance Distribution 2012-2021	
	Allowances	% of Total		Allowances	% of Total
Energy consumers and industry			Energy consumers and industry		
Electric location distribution companies	19,789	39.4%	Large electric utilities/LDCs (for consumers)	15,986	31.6%
			Merchant coal plants	1,865	3.7%
			Long-term power contracts	802	1.6%
			Small electric utilities/LDCs	250	0.5%
Industrial energy efficiency	70	0.1%	Industrial cogeneration facilities	16	0.0%
Natural gas distribution companies	3,265	6.5%	Natural gas distribution companies	2,775	5.5%
Home heating oil and propane consumers	808	1.6%	Home heating oil and propane consumers	800	1.6%
Low-income consumer assistance	5,920	11.8%	Low-income consumer assistance	7,487	14.8%
Trade-vulnerable energy-intensive industries	5,720	11.4%	Trade-vulnerable energy-intensive industries	6,307	12.5%
Refineries	1,958	3.9%	Refineries	919	1.8%
Subtotal for Energy Consumers/Industry	*37,530*	*74.8%*	*Subtotal for Energy Consumers & Industry*	*37,207*	*73.6%*
Clean technology investment			Clean technology investment		
Carbon capture and storage deployment	958	1.9%	Carbon capture and storage deployment	1,342	2.7%
Renewables and energy efficiency	800	1.6%	Renewables and energy efficiency	3,616	7.2%
			Renewables and efficiency early distribution	0	0.0%
			Building codes and efficiency retrofit programs	269	0.5%
Clean vehicle technology	429	0.9%	Clean vehicle technology	989	2.0%
Clean energy technology R&D	908	1.8%	Clean Energy Innovation Centers (R&D)	225	0.4%
			ARPA-E (R&D)	524	1.0%
Low-carbon industrial technologies R&D	429	0.9%			
Subtotal for All Clean-Tech Investment	*3,525*	*7.0%*	*Subtotal for All Clean-Tech Investment*	*6,965*	*13.8%*
Other purposes			Other purposes		
Domestic adaptation / Community protection	208	0.4%	Domestic adaptation fund	449	0.9%
			Climate change health protection and promotion	50	0.1%
			Wildlife and natural resources adaptation	499	1.0%
Int'natl adaptation and cleantech transfer	208	0.4%	International adaptation and cleantech transfer	499	1.0%
			Efficiency and renewable energy worker training	68	0.1%
			Worker transition assistance and retraining	250	0.5%
Credit for early action	139	0.3%	Credit for early action	46	0.1%
National surface transportation system	1,443	2.9%			
Transportation greenhouse gas reduction	1,443	2.9%			
Highway trust fund	1,443	2.9%			
			Supplemental emissions reductions funding		
			Supplemental forestry emissions reductions	2,496	4.9%
Unallocated permits used for...			Unallocated permits used for...		
Deficit reduction	3,441	6.9%	Deficit reduction	1,419	2.8%
Universal refund program	0	0.0%	Climate change consumer refund	0	0.0%
Cost Containment Reserve	801	1.6%	Strategic Reserve Auction Pool	605	1.2%
Subtotal, other purposes/supplements	*9,128*	*18.2%*	*Subtotal, other purposes/supplements*	*6,381*	*12.6%*
Total	**50,182**	**100.0%**		**50,553**	**100.0%**

APA Allowance Value for First Ten Years at Floor Price	Value at Floor Price 2013-2022		ACES Allowance Value for First Ten Years at Floor Price	Value at Floor Price 2012-2021	
	Total Value	Avg Annual Value		Total Value	Avg Annual Value
Energy consumers and industry			Energy consumers and industry		
Electric location distribution companies	$269,391	$26,939	Large electric utilities/LDCs (for consumers)	$199,554	$19,955
			Merchant coal plants	$23,285	$2,329
			Long-term power contracts	$10,013	$1,001
			Small electric utilities/LDCs	$3,147	$315
Industrial energy efficiency	$859	$86	Industrial cogeneration facilities	$160	$16
Natural gas distribution companies	$46,735	$4,673	Natural gas distribution companies	$38,110	$3,811
Home heating oil and propane consumers	$11,054	$1,105	Home heating oil and propane consumers	$9,983	$998
Low-income consumer assistance	$81,179	$8,118	Low-income consumer assistance	$94,421	$9,442
Trade-vulnerable energy-intensive industries	$81,328	$8,133	Trade-vulnerable energy-intensive industries	$82,326	$8,233
Refineries	$26,862	$2,686	Refineries	$12,070	$1,207
Subtotal for Energy Consumers/Industry	*$517,409*	*$51,741*	*Subtotal for Energy Consumers & Industry*	*$473,069*	*$47,307*
Clean technology investment			Clean technology investment		
Carbon capture and storage deployment	$14,459	$1,446	Carbon capture and storage deployment	$18,444	$1,844
Renewables and energy efficiency	$10,558	$1,056	Renewables and energy efficiency	$44,201	$4,420
			Renewables and efficiency early distribution	$0	$0
			Building codes and efficiency retrofit programs	$3,391	$339
Clean vehicle technology	$5,786	$579	Clean vehicle technology	$11,735	$1,173
Clean energy technology R&D	$12,323	$1,232	Clean Energy Innovation Centers (R&D)	$2,833	$283
			ARPA-E (R&D)	$6,609	$661
Low-carbon industrial technologies R&D	$5,786	$579			
Subtotal for All Clean-Tech Investment	*$48,913*	*$4,891*	*Subtotal for All Clean-Tech Investment*	*$87,212*	*$8,721*
Other purposes			Other purposes		
Domestic adaptation / Community protection	$3,149	$315	Domestic adaptation fund	$5,665	$567
			Climate change health protection	$629	$63
			Wildlife and natural resources adaptation	$6,295	$629
Int'natl adaptation and cleantech transfer	$3,149	$315	International adaptation and cleantech transfer	$6,295	$629
			Efficiency and renewable energy worker training	$698	$70
			Worker transition assistance and retraining	$3,147	$315
Credit for early action	$1,719	$172	Credit for early action	$458	$46
National surface transportation system	$19,451	$1,945			
Transportation greenhouse gas reduction	$19,451	$1,945			
Highway trust fund	$19,451	$1,945			
			Supplemental emissions reductions funding		
			Supplemental forestry emissions reductions	$31,474	$3,147
Unallocated permits used for...			Unallocated permits used for...		
Deficit reduction	$47,321	$4,732	Deficit reduction	$15,020	$1,502
Universal refund program	$0	$0	Climate change consumer refund	$0	$0
Cost Containment Reserve	$11,117	$1,112	Strategic Reserve Auction Pool	$7,881	$788
Subtotal, other purposes/supplements	*$124,805*	*$12,481*	*Subtotal, other purposes/supplements*	*$77,563*	*$7,756*
Total	$691,127	$69,113		**$637,844**	**$63,784**

APA Allowance Allocation 2013-2022 (Value at Price Floor in Million 2009 $)										
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Energy consumers and industry										
Electric location distribution companies	$28,899	$29,217	$29,529	$25,352	$25,607	$25,854	$26,088	$26,318	$26,288	$26,238
Industrial energy efficiency	$283	$286	$289	$0	$0	$0	$0	$0	$0	$0
Natural gas distribution companies	$0	$0	$0	$6,519	$6,585	$6,648	$6,708	$6,768	$6,760	$6,747
Home heating oil and propane consumers	$1,077	$1,088	$1,100	$1,087	$1,097	$1,108	$1,118	$1,128	$1,127	$1,125
Low-income consumer assistance	$6,970	$7,046	$7,122	$8,909	$8,999	$9,086	$9,168	$7,971	$7,962	$7,947
Trade-vulnerable energy-intensive industries	$1,133	$1,146	$1,158	$10,865	$10,974	$11,080	$11,181	$11,279	$11,266	$11,245
Refineries	$2,437	$2,463	$2,490	$2,716	$2,744	$2,770	$2,795	$2,820	$2,817	$2,811
Clean technology										
Carbon capture and storage deployment	$0	$0	$0	$0	$585	$591	$596	$3,384	$3,755	$5,548
Renewables and energy efficiency	$1,417	$1,432	$1,447	$1,449	$1,463	$1,477	$745	$752	$376	$0
Clean vehicle technology	$567	$573	$579	$724	$732	$739	$745	$752	$376	$0
Clean energy technology R&D	$1,133	$1,146	$1,158	$1,449	$1,463	$1,477	$1,491	$1,504	$1,502	$0
Low-carbon industrial technologies R&D	$567	$573	$579	$724	$732	$739	$745	$752	$376	$0
Other public purposes										
Domestic adaptation / Community protection	$0	$0	$0	$0	$0	$0	$559	$564	$826	$1,199
Int'natl adaptation and cleantech transfer	$0	$0	$0	$0	$0	$0	$559	$564	$826	$1,199
Credit for early action	$567	$573	$579	$0	$0	$0	$0	$0	$0	$0
National surface transportation system	$2,267	$2,292	$2,316	$2,224	$1,997	$2,017	$1,886	$1,504	$1,502	$1,447
Transportation greenhouse gas reduction	$2,267	$2,292	$2,316	$2,224	$1,997	$2,017	$1,886	$1,504	$1,502	$1,447
Highway trust fund	$2,267	$2,292	$2,316	$2,224	$1,997	$2,017	$1,886	$1,504	$1,502	$1,447
Unallocated permits used for…										
Deficit reduction	$3,966	$4,010	$4,053	$4,882	$5,092	$5,141	$5,262	$5,000	$5,220	$4,693
Universal refund program	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cost Containment Reserve	$850	$859	$868	$1,087	$1,097	$1,108	$1,118	$1,128	$1,127	$1,874
Total	*$56,664*	*$57,289*	*$57,900*	*$72,435*	*$73,163*	*$73,869*	*$74,538*	*$75,194*	*$75,109*	*$74,967*

APA Allowance Allocation 2013-2022										
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Energy consumers and industry										
Electric location distribution companies	51.0%	51.0%	51.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%
Industrial energy efficiency	0.5%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Natural gas distribution companies	0.0%	0.0%	0.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Home heating oil and propane consumers	1.9%	1.9%	1.9%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Low-income consumer assistance	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	10.6%	10.6%	10.6%
Trade-vulnerable energy-intensive industries	2.0%	2.0%	2.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Refineries	4.3%	4.3%	4.3%	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%	3.8%
Clean technology										
Carbon capture and storage deployment	0.0%	0.0%	0.0%	0.0%	0.8%	0.8%	0.8%	4.5%	5.0%	7.4%
Renewables and energy efficiency	2.5%	2.5%	2.5%	2.0%	2.0%	2.0%	1.0%	1.0%	0.5%	0.0%
Clean vehicle technology	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.5%	0.0%
Clean energy technology R&D	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	0.0%
Low-carbon industrial technologies R&D	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.5%	0.0%
Other public purposes										
Domestic adaptation / Community protection	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.8%	1.1%	1.6%
Int'natl adaptation and cleantech transfer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.8%	1.1%	1.6%
Credit for early action	1.0%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National surface transportation system	4.0%	4.0%	4.0%	3.1%	2.7%	2.7%	2.5%	2.0%	2.0%	1.9%
Transportation greenhouse gas reduction	4.0%	4.0%	4.0%	3.1%	2.7%	2.7%	2.5%	2.0%	2.0%	1.9%
Highway trust fund	4.0%	4.0%	4.0%	3.1%	2.7%	2.7%	2.5%	2.0%	2.0%	1.9%
Unallocated permits used for…										
Deficit reduction	7.0%	7.0%	7.0%	6.7%	7.0%	7.0%	7.1%	6.7%	6.9%	6.3%
Universal refund program	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cost Containment Reserve	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	2.5%
Total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

About the Authors

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About the Breakthrough Institute

The Breakthrough Institute is a leading, independent think tank developing climate and energy policy solutions for America and the world. Since 2002, Breakthrough has been a pioneering advocate of an innovation-centered approach to national and global energy and climate challenges, calling for major federal investments to make clean and low-carbon energy technologies cheap and abundant, strengthen America's economic competitiveness and energy security, and slow global warming. For more information about the Breakthrough Institute, please visit: http://thebreakthrough.org.

About Americans for Energy Leadership

Americans for Energy Leadership is a project to advance U.S. leadership in the clean energy industry and foster the next generation of energy innovators. Americans for Energy Leadership believes the global clean energy race represents one of today's greatest opportunities for American leadership -- including greater economic strength, improved national security, and renewed international respect -- and it is committed to securing the nation's position in this sector through strategic research, advocacy, and education. For more information, please visit: http://leadenergy.org

Endnotes

1 Pew Charitable Trusts, "Who's Winning the Clean Energy Race?" March 2010, http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Global_warming/G-20%20Report.pdf

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4 See Breakthrough Institute and Information Technology and Innovation Foundation, Atkinson et al, "Rising Tigers, Sleeping Giant: Asian Nations Set to Dominate Clean Energy Race by Out-Investing the United States," Nov. 2009, http://thebreakthrough.org/blog/2009/11/rising_tigers_sleeping_giant_o.shtml .

5 Office of U.S. Senator Ron Wyden. "Major Opportunities and Challenges to U.S. Exports of Environmental Goods," December 9, 2009, http://wyden.senate.gov/newsroom/120809jw_enviro_goods_report.pdf.

6 Breakthrough Institute and ITIF, "Rising Tigers, Sleeping Giant."

7 Deutsche Bank Group. Global Climate Change Tracker: An Investor's Assessment. October 2009.

8 Ibid.

9 Pew Charitable Trusts, "Who's Winning the Clean Energy Race?" March 2010, http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Global_warming/G-20%20Report.pdf

10 The Cleantech Group, 2010, http://cleantech.com/about/pressreleases/20090106.cfm .

11 Breakthrough Institute and ITIF, "Rising Tigers, Sleeping Giant."

12 Energy R&D estimate based on analysis of DOE Budget documents. http://www.energy.gov/about/budget.htm Comparisons from Third Way and Breakthrough Institute, "Jumpstarting a Clean Energy Revolution with a National Institutes of Energy, Sept. 2009, http://thebreakthrough.org/blog/Jumpstarting_Clean_Energy_Sept_09.pdf .

13 Jesse Jenkins, The Energy Collective, "the Innovation Consensus: $15 Billion for Clean Energy R&D," http://thebreakthrough.org/blog/2009/10/the_innovation_consensus_15_bi.shtml .

14 Executive Office of the President, Energy & Environment (Administration Platform), http://www.whitehouse.gov/issues/energy-and-environment .

15 Throughout this policy brief, allowances prices are reported ranging between the value of the allowance price floor specified in the APA and a higher-range value calculated at 150% of the price floor. Actual allowances prices under the legislation will be determined by a number of factors, notably the availability of low-cost emissions offsets. EPA analysis of the broadly similar House-passed ACESA projected allowances prices close to the floor established by the bill, with other analysis projecting moderately higher prices roughly consistent with the range provided herein.

16 Blue Green Alliance and Renewable Energy Policy Project, "Building a Clean Energy Assembly Line," Nov. 2009, http://www.bluegreenalliance.org/press_room/private_publications?id=0019 .

17 Office of U.S. Senator Ron Wyden. "Major Opportunities and Challenges to U.S. Exports of Environmental Goods," Dec. 2009, http://wyden.senate.gov/newsroom/120809jw_enviro_goods_report.pdf .

18 See Breakthrough Institute and ITIF, "Rising Tigers, Sleeping Giant" and Center for American Progress, "Out of the Running: How Germany, Spain, and China are Seizing the Energy Opportunity and Why the United States Risks Getting Left Behind," March 2010.

19 Initially authorized in the American Recovery and Reinvestment Act of 2009 (ARRA), the credit, known as the 48c, or Advanced Energy Manufacturing Tax Credit, authorizes the Department of Treasury to award a 30% tax credits for qualified investments in new, expanded, or re-equipped domestic manufacturing facilities used to produce advanced clean energy technologies, including components or systems for: renewable energy technologies; energy storage technologies, fuel cells and microturbines; advanced transmission technologies that support renewable generation; renewable fuel refining or blending technologies; energy efficiency and conservation technologies; plug-in hybrid and electric vehicle technologies; carbon capture and storage technologies; and other technologies designed to reduce greenhouse gas emissions.Initially authorized in the American Recovery and Reinvestment Act of 2009, the credit, known as the 48c, or Advanced Energy Manufacturing Tax Credit, authorizes the Department of Treasury to award a 30% tax credits for qualified investments in new, expanded, or re-equipped domestic manufacturing facilities used to produce advanced clean energy technologies.

20 Breakthrough Institute and ITIF, "Rising Tigers, Sleeping Giant."

21 For example, cost containment mechanisms include the authorization of 2 billion tons of international and domestic carbon offsets per year, an allowance price ceiling, and other mechanisms. According to analysis by Point Carbon, the carbon price established by the Kerry-Boxer "Clean Energy Jobs and American Power Act" (the previous counterpart to APA in the Senate which provides a good benchmark) would remain at the minimum price floor at least through 2019, averaging only $15 per ton through that period.

22 U.S. Environmental Protection Agency, "EPA Analysis of the American Clean Energy and Security Act of 2009 – Appendix," June 2009, http://www.epa.gov/climatechange/economics/pdfs/HR2454_Analysis_Appendix.pdf

23 Peterson Institute for International Economics, "Assessing the American Power Act: The Economic, Employment, Energy Security, and Environmental Impact of Senator Kerry and Senator Lieberman's Discussion Draft," Houser et al, May 2010.

24 See Karen G. Mills et al. "Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies," Brookings Institution, 2008, www.brookings.edu/reports/2008/04_competitiveness_mills.aspx. Perhaps the most famous such cluster is Silicon Valley, although other notable examples include Detroit's historic leadership in automotive technology, biomedical firms clustered around the Philadelphia and San Francisco Bay areas, the "Research Triangle" region of North Carolina, the "Route 128 Corridor" near Boston, and defense related firms in the Virginia and Washington D.C. area, and many others. In fact, much of America's cutting edge innovation and economic activity occurs within these regional clusters.

25 Breakthrough Institute and ITIF, "Rising Tigers, Sleeping Giant."

26 Rob Atkinson, "8 Ideas for Improving the America COMPETES Act," Information Technology and Innovation Foundation, March 2010, www.itif.org/files/2010-america-competes.pdf.

27 Science and Engineering Indicators, National Science Foundation, 2008, www.nsf.gov/statistics/seind08/pdfstart.htm.

28 "Current and Potential Green Jobs in the U.S. Economy," U.S. Council of Mayors, 2008, www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf.

29 FY2010 Budget Proposal for RE-ENERGYSE, Energy Efficiency and Renewable Energy, U.S. Department of Energy, 2009, www.thebreakthrough.org/blog/RE-ENERGYSE_Initiative_DOE_Description.pdf.

30 Breakthrough Institute and ITIF, "Rising Tigers, Sleeping Giant."