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Protecting and Profiting from Intellectual Property in President Obama's Clean Energy Economy



A Hot, Flat, Crowded World

As Thomas L. Friedman points out in his latest bestseller, the world has a serious problem:

It is getting hot, flat, and crowded. That is, global warming, the stunning rise of middle classes all over the world, and rapid population growth have converged in a way that could make our planet dangerously unstable. In particular, the convergence of hot, flat, and crowded is tightening energy supplies, intensifying the extinction of plants and animals, deepening energy poverty, strengthening petro-dictatorship, and accelerating climate change.¹

The inauguration of President Barack Obama creates an opportunity for dramatic changes in U.S. energy and environmental policy, which could position our country to lead the charge in solving the world's "hot, flat, and crowded" problem. As Friedman notes, tackling this challenge presents a tremendous opportunity, and taking it on "will revive America at home, reconnect America abroad, and retool America for tomorrow."²

President Obama recognizes the "hot, flat, and crowded" problem, and the opportunity for the U.S. to be the leader in taking it on. He has stated consistently that creating a clean energy economy is going to be a top priority of the Obama Administration, and if he follows through on his vow – and to date he already has taken a number of concrete steps indicating he has every intention of doing so – the next four years and beyond will be the beginning of dramatic growth for the clean energy, or cleantech, industry. As the old industrial, fossil fuel-driven era is replaced by the new clean energy economy, it will be critical for cleantech companies to understand the power of intellectual property rights and how they can be used in spurring innovation, attracting financing, capturing and defending growing markets, and increasing revenues.

A Sound Investment

The current economic crisis unquestionably has cast a slight cloud over cleantech. With credit markets frozen, financing for capital-intensive projects has become much harder to secure, and venture capitalists are asking companies they are financing to cut back on costs in an attempt to ride out the storm. For example, Think Global and Tesla Motors are delaying their much-anticipated rollouts of electric cars in the U.S..³ Even billionaire T. Boone Pickens is postponing his plans to build the world's largest wind farm.⁴

Cleantech start-ups nevertheless were able to raise \$1.7 billion worldwide in the fourth quarter of 2008,⁵ representing only a 4 percent decrease from the same quarter a year ago.⁶ American cleantech start-ups raised a record \$5.8 billion in 2008, up 56 percent from 2007.⁷ This resilience in the face of an unprecedented financial crisis bodes well for the future of the cleantech industry, particularly in view of the Obama Administration's commitment to creating a clean energy-powered economy.

Venture capitalists and other financiers are excited about the clean energy economy. John Doerr of venture capital firm Kleiner Perkins Caufield & Byers in Silicon Valley, which backed Google and Amazon in their early days, describes cleantech as "the biggest economic opportunity of the 21st century."⁸ A November 2008 Merrill Lynch study calls cleantech the "Sixth Technology Revolution," and predicts it will usher in a "golden age" rivaling the impact of the Industrial Revolution, and the Information and Telecommunications Revolution.⁹

While other industries are floundering, the current recession has actually triggered fast-tracked legislation and government programs that will ensure immediate opportunities and long-term growth in the cleantech sector, as President Obama highlighted recently when signing the American Recovery and Reinvestment Act of 2009¹⁰ in Denver:

Because we know we can't power America's future on energy that's controlled by foreign dictators, we are taking a big step down the road to energy

independence, and laying the groundwork for a new, green energy economy that can create countless well-paying jobs. It's an investment that will double the amount of renewable energy produced over the next three years, and provide tax credits and loan guarantees to companies like Namaste Solar, a company that will be expanding, instead of laying people off, as a result of the plan I am signing.

In the process we will transform the way we use energy. . . . The investment we are making today will create a newer, smarter electric grid that will allow for the broader use of alternative energy. . . . And it's an investment that takes the important first step towards a nationwide [energy transmission] superhighway that will connect our cities to the windy plains of the Dakotas and the sunny deserts of the Southwest.¹¹

Obama's Plan

President Obama recognizes the important role government can play in leading the country into the new clean energy economy:

[T]hink of what's happening in countries like Spain, Germany and Japan, where they're making real investments in renewable energy. They're surging ahead of us, poised to take the lead in these new industries. This isn't because they're smarter than us, or work harder than us, or are more innovative than we are. It's because their governments have harnessed their people's hard work and ingenuity with bold investments—investments that are paying off in good, high-wage jobs—jobs they won't lose to other countries. There is no reason we can't do the same thing right here in America.¹²

The Obama Administration therefore intends to move forward quickly with implementing and investing in an energy plan that will allow the U.S. to lead in transforming the way the world generates, distributes, and uses energy. The President emphasized this recently before a Joint Session of Congress:

We know the country that harnesses the power of clean renewable energy will lead the 21st century. And yet, it is China that has launched the largest effort in history to make their economy energy efficient. We invented solar technology, but we've fallen behind countries like Germany and Japan in producing it. New plug-in hybrids roll off our assembly lines, but they will run on batteries made in Korea. Well I do not accept a future where the jobs and industries of tomorrow take root beyond our borders—and I know you don't either. It's time for America to lead again.¹³

The President's "New Energy for America" plan and budget calls for the federal government to invest at least \$150 billion in clean energy over the next 10 years.¹⁴ The budget will build on efforts in the Recovery and Reinvestment Act to direct tens of billions of dollars toward creating a new, smarter electric grid having the capacity for transmitting clean energy from where it is generated to where it is needed.¹⁵ The President plans on raising fuel efficiency standards, providing tax rebates for plug-in hybrid vehicles, requiring 10 percent of electricity to come from renewables by 2012, and implementing an economy-wide cap-and-trade program to reduce greenhouse gas (GHG) emissions.¹⁶

Also exciting are the Obama Administration's proposals for research and commercialization. The President plans on doubling federal science and research funding for clean energy projects,¹⁷ and making the Research and Experimentation Tax Credit permanent, so companies embracing the move toward alternative energy can rely on the credit when making decisions to invest in domestic R&D over long periods of time.¹⁸ To ensure that clean energy innovations progress

beyond the laboratory, Obama proposes creating a \$50 billion Clean Technologies Deployment Venture Capital Fund (CTDVCF).

Successful implementation of the President's energy plan will depend on bringing all Americans onboard as stakeholders in the new energy economy. A biofuel initiative will help bring agricultural communities on board. Proposed federal grant and job training programs are designed to create jobs in states hit hard by the loss of manufacturing jobs, building upon success stories like that of Cardinal Fastener in Ohio. President Obama has pointed to this company as an example of how focusing on opportunities in clean energy can have real, tangible benefits:

The story of this company—which began building wind turbine parts just two years ago, and is now poised to make half its earnings that way—is that a renewable energy economy isn't some pie-in-the-sky, far-off future. It's happening all across America right now. It's providing alternatives to foreign oil now. It can create millions of additional jobs and entire new industries if we act right now.¹⁹

Land Of Opportunity

The U.S. is the ideal location for clean energy innovation. A June 2008 study from the RAND Institute found that 40 percent of the world's spending on scientific research and development comes from the U.S. alone.²⁰ America employs 70 percent of the world's Nobel Prize winners, and is home to 75 percent of the world's top 40 universities.²¹ "The United States is still the world leader in science and technology," says the study's coauthor, James Hosek.²² A 2008 Deloitte LLP survey of venture capitalists from around the world echoes this belief, finding that the U.S. remains an unmatched leader in innovation across technology sectors, from software to cleantech.²³ President Obama appears committed to ensuring the U.S. maintains this leadership position, offering words of encouragement and promises of support to a group of clean energy entrepreneurs visiting the White House recently:

. . . innovators like you are creating the jobs that will foster our recovery — and creating the technologies that will power our long-term prosperity. So I thank you for your work. It's said that necessity is the mother of invention. At this moment of necessity, we need you. We need some inventiveness. Your country needs you to create new jobs and lead new industries. Your country needs you to mount a historic effort to end once and for all our dependence on foreign oil. And in this difficult endeavor -- in this pursuit on which I believe our future depends -- your country will support you. Your President will support you.²⁴

The U.S. is also the ideal location for commercialization of clean energy technology. American cleantech companies currently account for almost 70 percent of worldwide cleantech venture capital investment.²⁵

Most importantly, the U.S. provides the strongest intellectual property protection for the largest and most prosperous market in the world for energy consumption. Indeed, one of the reasons for the relatively limited investment of venture capital in cleantech in rapidly developing countries like China and India is the lack of robust and tested intellectual property protection.²⁶

The Clean Energy Patent Landscape

The clean energy patent landscape is now relatively open and collaborative, with little patent litigation compared to more mature industries like the software or semiconductor industries. As the market for clean energy technology grows, however, and the financial stakes increase, companies are likely to move away from this open and collaborative mind-set, looking for ways to

grow market share or revenues in an increasingly competitive environment. This is where adapting and following-through on intelligent strategies to develop and protect intellectual property becomes critical to success.

The Importance of a Strong Patent Portfolio

Generally, a strong patent portfolio will be a clean energy company's main asset because the company is focusing on developing innovations and ideas, rather than tangible products.²⁷ Even where actual products are being developed, cleantech companies regularly focus on R&D, partnering with larger companies to get the products manufactured under license.

A well-developed portfolio of patents or pending patent applications can be key to securing financing for an emerging cleantech company. Compared to other sectors, clean energy innovations often require a larger amount of capital and a longer time for development. For instance, a software start-up may require only hundreds of thousands of dollars for computer equipment and a handful of developers to develop a working product in a year or less. By contrast, a solar start-up's thin film technology for laying silicon on a substrate may require hundreds of millions of dollars and many years for prototyping and manufacturing before a viable product ever reaches market. Because of these different stakes, venture capitalists in other sectors can afford to be focused on time-to-market, but venture capitalists in the cleantech sector must be certain the essence of their investment—the intellectual property of the company—is protected properly.²⁸

Fostering a Culture of Innovation

To thrive in the clean energy economy, cleantech companies must develop and encourage a culture of innovation. Employees should be motivated to think creatively, and be educated about the importance of innovating and obtaining patents. Companies of all sizes should consider establishing programs that recognize and reward creativity—particularly where it results in inventions and patents. A recent survey published by ipPerformance Group finds that companies having incentive programs for employee inventions are home to far more innovative work than companies without such programs.²⁹

Regular employee innovation brainstorming sessions also should be encouraged. Since cleantech innovations often involve the melding of principles from traditionally separate areas of science and engineering, clean energy companies should make every effort to include employees with diverse technical backgrounds in brainstorming sessions. Someone with a background in chemistry or biology, for example, may offer fresh insights and ideas to a team of electrical engineers and computer scientists struggling to come up with an innovative solution to a problem a smart grid start-up is struggling to solve. If possible, patent attorneys should be invited to attend or review the results of every brainstorming session. Invention company Intellectual Ventures does this, and reportedly generated 500 patent applications over the course of just 70 brainstorming sessions.³⁰

Incremental Inventions

As Secretary of Energy Steven Chu said in a recent interview, solving the world's "hot, flat, and crowded" problem is going to require revolutionary, Nobel-level breakthroughs in science and technology.³¹ Every cleantech company therefore needs to be "thinking big" when innovating. When formulating a patent strategy in the clean energy sector, however, it is important to remember that not only groundbreaking or revolutionary inventions are patentable; incremental innovations based on existing technology may also be patentable and commercially valuable.³² Thomas Edison understood this principle, and many of his most valuable patents were for incremental inventions. His patented light bulb, for example, was an incremental improvement upon an incandescent electric lamp developed 20 years earlier by another inventor, Joseph Swan.³³

Failing to obtain patent protection for merely incremental improvements is risky, and may result in lost opportunities of tremendous value. In the clean energy sector, for example, it has long been known that a wind turbine consists of a rotor, gearbox, generator, and blades. A variable-speed generator may be an incremental improvement over a fixed-speed generator. Swept blades may be an incremental improvement over linear blades.³⁴ While the basic idea of a wind turbine itself is not patentable, having been known and used for years,³⁵ new and related incremental inventions should not be overlooked.

Patents directed at incremental improvements in efficiency and profitability of existing energy technologies are a good example. As Carl Horton, Chief Intellectual Property Officer at General Electric, notes, “anyone can go out and make a basic turbine. That can be done freely. It’s the things that are making them more efficient, more profitable that are on patent.”³⁶ Jesus Alonso, a Research and Development Director at Isofoton, one of the world’s leading photovoltaic companies, similarly says, “[a]ny good scientific book will tell you how to make a solar cell. What is complex [and valuable] is the know-how required to make it more efficient, cheaper, in higher quantities, and better quality.”³⁷

A collection of incremental inventions together may represent an important and strategic value chain. Consider the previous example of variable-speed generators and swept blades for wind turbines. Even if each incremental invention alone only slightly improves performance, the efficiencies of the improvements combined could allow wind power in a particular region to reach “grid parity,” i.e., the point where electricity from the wind (or the sun or any other clean energy source) meets or beats the price of using carbon-based fuels like coal or natural gas.

Enabling and Interface Technologies

How diverse technologies work together at particular interface points may be separately patentable, beyond any protection available for the core technologies associated with a given clean energy innovation.³⁸ With the Obama Administration committed to modernizing America’s power grid, there may be many opportunities to develop valuable inventions at the interface between generating clean energy and transmitting it to the end users.

For example, a wind turbine company may own many core inventions associated with wind power. However, the company’s most valuable invention could be one for interfacing with other technologies, and not one specifically associated with wind power. Consider an invention connecting a wind farm’s fluctuating power output to an electric grid without causing frequency and voltage-related problems. Valuable patent claims to this invention conceivably could be written to transcend wind power by covering the interface between an electric grid and any fluctuating clean energy source (whether that source is wind, solar, geothermal, or wave power).

As another example of interfacing technology, consider an auto company or a biofuel producer. At low temperatures, engines can have biofuel gelling problems.³⁹ An innovation solving the viscosity problem at this juncture between biofuel and engine technologies could be a key enabling technology. Inventions relating to technological interfaces may give rise to some of the most valuable patents in the clean energy sector.

Energy Storage Technologies

Energy storage will be a fundamental enabling technology in the clean energy economy.⁴⁰ Powering hybrid electric vehicles, smoothing out fluctuations in electricity supply and demand, and extending appliance functionality all require energy storage technology.⁴¹ Of particular importance are high-power storage technologies directed at achieving grid parity. Energy management applications implementing these technologies improve price performance by making electricity more dispatchable, and by addressing load leveling, peak shaving, and arbitrage issues. Innovations addressing energy storage and management issues will become particularly valuable as the Obama Administration follows through on its plan for investing in the development of a modern, smart electric grid.

Carbon Capture and Sequestration

Many countries, including the U.S., China, and India, are likely to continue for years relying on coal for base-load electrical power. Developing increasingly efficient and effective carbon capture and sequestration technologies, therefore, will be critical if we are to meet our goals of restricting and reducing carbon dioxide emissions. Clean energy innovators should be seeking out opportunities for developing and patenting inventions in this field.

Emissions Measuring and Trading

Innovations in trading emissions credits or measuring GHG emissions also represent areas of opportunity. Under a carbon cap-and-trade system, lower emissions companies may sell carbon credits to higher emissions companies that would otherwise exceed their emission caps. President Obama has promised to implement an economy-wide cap-and-trade program aimed at reducing GHG emissions, and a number of studies predict the value of the carbon trading market in the U.S. will reach \$1 trillion per year by 2020.⁴² A recent report finds a significant upward trend in inventions relating to methods for trading emissions, with patents issuing to, among others, U.S. mortgage finance company Fannie Mae, who patented a system for trading GHG reduction credits earned by homeowners.⁴³ Clean energy companies should be focused on developing and staking out claims for measuring emissions and for trading emissions credits.

Reviewing the Patents of Others

A wealth of information can be obtained by studying clean energy patents owned by others. Such patents can be springboards for patentable improvements or design alternatives. For years, many companies refused to look at patents owned by others, fearful of possibly triggering liability for willful patent infringement in a U.S. lawsuit. These fears should be less of a concern now, since the Federal Circuit in *Seagate* made it harder to establish willful infringement.⁴⁴

Being aware of the patent landscape will help an innovative company avoid investing time and money developing technology only to later learn that the technology has already been patented by a competitor. One must keep in mind, however, that many pending patent applications are unavailable to the public until they are published, or in some cases until they issue as patents, so one can never assume having total knowledge of the landscape.

Prosecution Strategies

There are several important strategies for clean energy companies to consider when turning to the particulars of patent prosecution.

Where To File

Decisions on where to file a patent application should take into account which countries will have significant markets for products embodying the invention, and which countries will produce the products. In cleantech, a likely answer on both counts is the U.S., particularly in view of President Obama's commitment to leading the country into the 21st century clean energy economy, and to ensuring that the green collar jobs associated with that economy stay within our borders.

Filing for patent protection first in the U.S. gives applicants opportunities for excluding potential prior art by taking advantage of our "first to invent" system, which is different from the "first to file" system used in most other countries. In a "first to file" system, prior art includes all art existing prior to the filing date of a patent application. By contrast, in the U.S. "first to invent" system, prior art includes all art existing prior to the date of invention claimed in a patent application.⁴⁵ Because an applicant's invention date may occur well in advance of the filing of a patent application, the scope of potentially invalidating prior art may be narrowed significantly. In an environment where many clean energy companies around the globe are likely working on closely related innovations, this narrowing of the scope of potential prior art could be invaluable.

The location of key clean energy competitors should also be a factor in deciding where, in addition to the U.S., to file patent applications. William Pledger, Chief Engineer at fuel cell company IdaTech in Oregon says, “[w]e look at where our competitors are and we may try to get patent protection outside the U.S. You try to get as much patent protection as you can, whether it’s simply for protection or as a potential bargaining chip.”⁴⁶

Filing for patent protection in China is critical because of its fast-growing demand for clean energy. China’s cleantech sector continues to grow and enjoy steady capital inflow despite the current global economic crisis.⁴⁷ The Chinese government has set a renewable energy budget of at least USD\$293 billion for the next 12 years and is on track to obtain 15 percent of its energy from renewable sources by 2020.⁴⁸

Term Extensions

A cleantech company should consider ways for increasing the chances that the U.S. Patent and Trademark Office (USPTO) will grant a term extension upon issuing a patent. Clean energy product development cycles typically are long, and many clean energy patents may not have true commercial value until decades after the filing of the underlying patent applications. Because the 20-year term of a U.S. patent starts running the day the patent application is filed,⁴⁹ any term extension will extend the life of the patent into the future when the market for the patented invention hopefully will be huge.

Cleantech’s multidisciplinary nature may increase the chances of being granted a valuable term extension. The USPTO is divided into various divisions according to technology, with different divisions processing patent applications at widely varying rates. An applicant might consider characterizing his or her cleantech innovation to correspond with the technology associated with the slowest processing USPTO division because, under certain circumstances, a slow examination may result in the granting of a term extension.⁵⁰

Accelerating Examination

There may be situations where the market for a cleantech invention already is so robust that the owner will want a patent to issue as quickly as possible. The term of a U.S. patent is 20 years from the date the application is filed.⁵¹ Therefore, shortening the time between filing the application and issuance of the patent can effectively extend the useful life of the issued patent. On average, it takes nearly 32 months to obtain a U.S. patent.⁵² Reducing this time could lessen the cost of prosecuting the patent and enable a clean energy patent owner to start earning money sooner from market exclusivity or from licensing the issued patent. One option for reducing the prosecution time is taking advantage of the USPTO’s Accelerated Examination Program, which allows certain types of patent applications (including applications relating to clean energy innovations) to get moved forward in the examination queue. The program’s target examination time is 12 months.⁵³

Defensive Publication

If a cleantech company cannot afford to patent every one of its inventions, it should instead consider publishing the inventions to establish them as prior art. Publication should prevent competitors from patenting the inventions themselves and then using the patents down the road to interfere with the business of the cleantech company that decided not to seek patent protection.

Keeping Related Applications Pending

Companies seeking patent protection for their innovations always run the risk of competitors trying to design around the patent. Any patent applicant, cleantech or not, should try keeping related applications pending long after an original application issues as a patent. Related

applications are those filed after an original application is filed, but before the original application issues as a patent, and that involve similar or related technologies.⁵⁴ The benefit is that if a competitor somehow successfully designs around the issued patent, the claims of the related application may be modified during prosecution in a way that covers the competitor's design-around.

Strategic Acquisition

Clean energy companies should also consider reinforcing their intellectual property portfolios by strategically acquiring patents from others. Universities and research institutes can be sources of valuable inventions and patents. Invention company Intellectual Ventures recognizes this, having in recent years acquired rights to a myriad of inventions and patents spanning the technological spectrum from more than 80 universities around the world.⁵⁵ Attending patent auctions organized by intellectual property brokerage companies like Ocean Tomo, or participating in an online auction of "green" patents like those offered by LynxStreet.com, may also be time well spent as patent owners unable or unwilling themselves to commercialize their own clean energy inventions take advantage of the increasingly thriving marketplace for patents.

Licensing

A broad and deep portfolio of clean energy patents can lead to significant revenue from licensing. Ernst & Young expects worldwide revenue from patent licensing to reach \$500 billion by 2015, up dramatically from \$110 billion in 2000.⁵⁶ Cleantech companies also should proactively use their patent portfolios as leverage to share in the technical innovations of others via cross-licensing deals.⁵⁷ Companies using their portfolios in this collaborative manner will be rewarded with a greater freedom to operate and innovate, while remaining competitors are left in the position of trying to design around a wall of cross-licensed patent portfolios.

Manufacturing cleantech products is particularly capital intensive. Clean energy start-ups focusing on innovating should consider licensing arrangements with larger companies to help bring the inventions to market. Larger companies have greater financial, marketing, distribution, and manufacturing resources, and often more extensive regulatory knowledge. Another reason for considering licensing arrangements with a larger firm is because it will give the larger company a financial interest in protecting the invention.⁵⁸ Would-be infringers may be deterred, and enforceability of the patents is effectively strengthened, because the expense of a patent infringement suit filed by the cleantech owner could be subsidized by the larger company.

Trade Secrets

In some situations, keeping innovations as trade secrets may be preferable to patenting or publishing them. When a company has taken reasonable steps to protect its innovations, trade secret protection can prevent exploitation by others of illegally obtained information regarding the innovations. This protection can potentially extend indefinitely (the recipe for Coca-Cola, for example, has successfully been kept a trade secret for more than 120 years),⁵⁹ offering an advantage over patent protection, which normally lasts only 20 years from the date of filing a patent application.⁶⁰ Bruce Girvan, Director of intellectual property at U.K. fuel cell company CeresPower, for example, will not file a patent for inventions that cannot be reverse-engineered. He notes, "[w]ith our patenting process, we use it to protect our crown jewels—our core technology—when it can be reverse-engineered. If a competitor cannot see how we have done it, we generally do not patent that technology. That's a trade secret."⁶¹

A decision not to patent a cleantech invention, however, comes with risks and should be considered carefully, because trade secret protection can be lost easily by inadvertent disclosure or reverse-engineering. If another person independently discovers the innovation, any trade secret protection is lost.⁶² This risk should not be overlooked, especially in an environment where many companies are likely to be simultaneously attempting to solve the same energy problem, and in doing so may be discovering and using similar internal processes. Opting for trade secret

protection over patent protection also limits licensing opportunities because trade secrets can only be licensed under carefully drafted nondisclosure agreements.⁶³

Conclusion

The convergence of forces giving rise to the increasingly “hot, flat, and crowded” world described by Thomas L. Friedman is here to stay. With the Obama Administration committed to making a clean break from the past and taking the country in a new direction, the U.S. at last appears poised for transition to a 21st century clean energy economy. Companies in the clean energy sector will thrive by fostering a culture of constant innovation and adopting and following through on intelligent strategies for protecting their intellectual property.

¹ Thomas L. Friedman, *Hot, Flat, and Crowded* 5 (Farrar, Straus and Giroux 2008).

² *Id.* at 6.

³ See Katie Fehrenbacher, *Green Investing is Tops in Silicon Valley*, BusinessWeek, Nov. 12, 2008, http://www.businessweek.com/technology/content/nov2008/tc20081111_194666.htm?

⁴ See Elisabeth Rosenthal, *Slump May Limit Moves on Clean Energy*, N.Y. Times, Nov. 25, 2008, <http://www.nytimes.com/2008/11/25/world/25climate.html?scp=1&sq=&st=nyt>.

⁵ See *id.*

⁶ See *id.*

⁷ See Press Release, Cleantech Group LLC, *Clean Technology Venture Investment Reaches Record \$8.4 billion in 2008 Despite Credit Crisis and Broadening Recession* (Jan. 6, 2009), available at <http://cleantech.com/about/pressreleases/010609.cfm> [hereinafter *Clean Technology Venture Investment*].

⁸ *Get Ready for the Clean Tech IP Boom*, Managing Intellectual Property, Sept. 2008, <http://www.managingip.com/Article.aspx?ArticleID=2003009> (last visited March 12, 2009).

⁹ Steven Milunovich & Jose Rasco, Merrill Lynch, *Cleantech: The Sixth Industrial Revolution* (2008), available at http://www.responsible-investor.com/images/uploads/resources/research/21228316156Merril_Lynch_the_coming_of_clean_tech.pdf.

¹⁰ American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5 (2009).

¹¹ President Barack Obama, The White House, *Remarks of President Obama at Signing of American Recovery and Reinvestment Act in Denver* (Feb. 17, 2009), transcript available at http://www.whitehouse.gov/the_press_office/Remarks-by-the-President-and-Vice-President-at-Signing-of-the-American-Recovery-and-Reinvestment-Act/.

¹² President-elect Barack Obama, Office of the President-Elect, *Remarks of President-elect Barack Obama, Cardinal Fastener & Specialty Co., Bedford Heights, Ohio* (Jan. 16, 2009), transcript available at http://change.gov/newsroom/entry/president-elect_obama_speaks_on_an_american_recovery_and_reinvestment_plan/ [hereinafter *Remarks at Cardinal Fastener*].

¹³ President Barack Obama, The White House, *Remarks of President Barack Obama—Address to Joint Session of Congress* (Feb. 24, 2009), transcript available at http://www.whitehouse.gov/the_press_office/Remarks-of-President-Barack-Obama-Address-to-Joint-Session-of-Congress/.

¹⁴ See The White House, *The Agenda: Energy and the Environment*, http://www.whitehouse.gov/agenda/energy_and_environment/ (last visited March 12, 2009) [hereinafter *Energy and the Environment*]. See also The White House, *Jumpstarting The Economy And Investing For The Future*, p. 21 (2009), http://www.whitehouse.gov/omb/assets/fy2010_new_era/Jumpstarting_The_Economy.pdf.

¹⁵ See *Jumpstarting The Economy and Investing For The Future*, *id.* at p. 23.

¹⁶ See *Energy and the Environment*, *supra* note 14. See also *Jumpstarting The Economy and Investing For The Future*, *id.* at p. 21.

¹⁷ See Barack Obama, *Barack Obama's Plan to Make America a Global Energy Leader* (2008), http://obama.3cdn.net/4465b108758abf7a42_a3jmvya5.pdf.

¹⁸ See The White House, *Fact Sheet, Investing In Our Clean Energy Future* (March 23, 2009), http://www.whitehouse.gov/the_press_office/Fact-Sheet-Investing-in-Our-Clean-Energy-Future (last visited March 24, 2009).

¹⁹ *Remarks at Cardinal Fastener*, *supra* note 12.

²⁰ See Titus Galama & James Hosek, RAND National Defense Research Institute, *U.S. Competitiveness in Science and Technology* (2008), available at http://www.rand.org/pubs/monographs/2008/RAND_MG674.sum.pdf.

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- ²¹ See *id.*
- ²² *Id.*
- ²³ See Deloitte LLP, *Global Trends in Venture Capital 2008 Survey* (2008), available at http://www.deloitte.com/dtt/cda/doc/content/us_tmt_globalvc_062408.pdf.
- ²⁴ See President Barack Obama, The White House, *Remarks of President Barack Obama On Investments In Clean Energy And New Technology* (March 23, 2009), transcript available at http://www.whitehouse.gov/the_press_office/Remarks-by-The-President-on-Investments-in-Clean-Energy-and-New-Technologies-3-23-09/.
- ²⁵ See *Clean Technology Venture Investment*, *supra* note 7.
- ²⁶ See Massie Santos Ballon, *Think Different About Cleantech in India and China, Say Experts*, Cleantech Group, Feb. 27, 2008, <http://cleantech.com/news/2518/cleantech-india-china-vinod-khosla> (last visited March 12, 2009).
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