Climate Policy Memo #8

The Growth of Clean Energy Industries through Climate Legislation

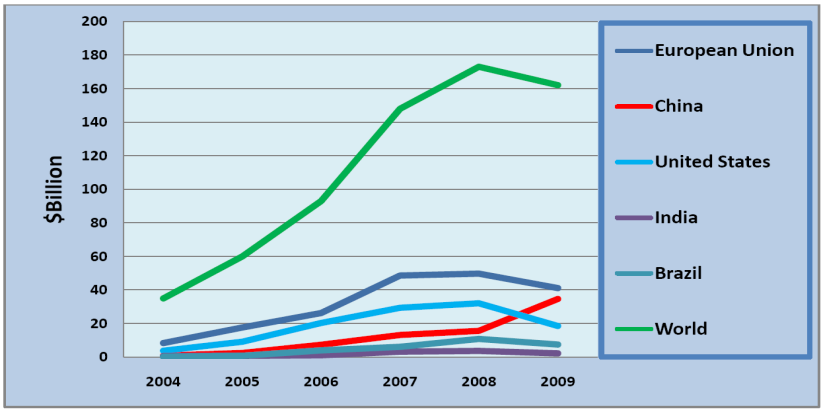
In the design of clean energy and climate legislation, careful attention is required to make sure competitiveness impacts—both positive and negative—on U.S. manufacturing firms are fully considered. Much of the attention to date has focused on seeking ways to avoid placing existing manufacturing firms, particularly those in energy-intensive, trade-exposed (EITE) sectors, at a competitive disadvantage to firms in the same sectors operating in countries without similar restrictions.[1]

This paper examines ways policies can be designed to encourage the rapid growth in markets for the clean energy technologies that will be critical to reducing our emissions of greenhouse gases, to expanding economic growth at home, and to enhancing our energy security.[2] Global demand for clean energy technologies will continue to expand as a result of a number of factors including increased demand for energy as global populations and economies grow, the need for lower-polluting sources of energy to ensure economic growth is environmentally sustainable, and the need to replace aging power plants in order to meet a wide range of air and water quality requirements. The magnitude of the challenge to develop and deploy technologies on the scale required to shift to a cleaner energy system is daunting.[3] We are now in the critical early stages of this shift, but the race is on to see which countries will become the global suppliers of these clean energy technologies. The policies put in place over the next few years will go a long way to determining whether clean energy technologies will become a major growth sector and job generator for the United States or whether we will become an importer of these technologies from other countries.

Growth in Clean Energy Technologies

Clean energy technologies include a wide range of products and services such as: wind, solar, hydropower, nuclear, and geothermal energy; biofuels; alternative vehicles and transportation efficiency technologies; carbon capture and sequestration; and a broad array of energy efficiency measures applicable to commercial, residential and industrial facilities. Driven in part by increased demand for alternatives to fossil fuels, between 2004 and 2009 clean energy investments grew at an average compound annual growth rate of 39 percent (see Figure 1), with the wind and solar markets having sustained annual growth rates above 30 percent for the last decade.[4]

Figure 1: Global New Investment in Clean Energy Technologies, 2004-2009



From 2004-2009, global cleantech investment averaged a CAGR of 39 percent, reaching $173 billion in 2008. This figure includes renewables, efficiency technologies, biofuels, CCS, nuclear power, and other low-carbon technologies. As this figure illustrates, for the first time China invested more in clean energy technologies than the United States in 2009.
Sources: United Nations Environment Program and New Energy Finance, "Global Trends in Sustainable Energy Investment 2009: Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency." 2009 and "Clean Energy League Tables." Bloomberg New Energy Finance. March 2010 and Pew Charitable Trusts. "Who's Winning the Clean Energy Race?" Pew Charitable Trusts. 2010.

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The downturn in 2008 and early 2009 reflects the global recession, but markets are already showing signs of rebounding. Many nations, including the United States, directed economic stimulus money toward clean energy technologies as a way of both spurring economic growth and generating jobs. Global investments in clean energy technologies could reach $200 billion in 2010.[5]

Actions by Other Countries to Spur Growth

Beyond showing the overall growth in investments, Figure 1 also highlights how the United States is now third behind both the European Union and China in investment in clean energy technologies. U.S. firms face serious competition in both the wind and solar power sectors. Of the top five largest wind turbine manufacturers globally, GE is the only U.S. company.[6] The Danish company Vestas is the largest global manufacturer, and the rest of the top five is rounded out by firms in Spain, Germany, and China. The story is similar in other industries; only one of the top 10 solar panel manufacturers is American, as are only two of the top 10 advanced battery manufacturers.[7]

The fact that companies from Germany, Spain, Denmark and China have leapt to the forefront can be directly linked to actions by those governments to encourage the growth of these sectors.

- **China** has announced a ten-year, $400 billion clean energy technology investment program;[8] has begun establishing "low-carbon centers" that will serve as regional hubs of clean energy technology manufacturing;[9] and has added a small surcharge to all consumer electricity bills (estimated to raise residential electricity bills by 0.25-0.4 percent and industrial bills by 0.8 percent) to raise revenue and offset the difference in cost between renewables and cheaper incumbent power generation (primarily coal).[10]

- The **European Union (EU)** has pledged to reduce its GHG emissions by at least 20 percent below 1990 levels by 2020.[11] The EU's core policy instrument for meeting this target is its emissions trading system (ETS).[12] The result is a price on carbon that helps drive investment in clean energy industries. The EU also has a mandatory target of deriving 20 percent its energy mix from renewable sources by 2020.

- **Denmark** now produces close to 40 percent of annual installed wind capacity.[13] Starting as far back as 1979, the Danish government provided a number of financial and regulatory incentives to spur wind development. Overall, Denmark's energy efficiency and renewable energy policies have helped keep its energy consumption stable even as its GDP has grown 56 percent since 1980.[14]

- **Germany** has a goal of generating 30 percent of its electricity from renewable energy sources by 2020 and a GHG emissions reduction target of 40 percent below 1990 levels by 2020.[15] Over 15 percent of Germany's gross electricity consumption already comes from renewable energy sources.[16] The German government estimates that, as of 2008, its renewable energy sector accounted for about 280,000 jobs (primarily in the wind, biomass, and solar power sectors) up from 160,000 in 2004; about two-thirds of these jobs are attributed to the effects of Germany's renewable energy policies.[17] If worldwide growth in these markets remains strong, investments in German-made renewable electricity-generating systems could be in the range of $18 billion to over $27 billion a year by 2020, with about $15 billion coming from exports.[18]

Advantages of Being an Early Mover

Countries are embracing policies to encourage growth in clean energy technologies both to meet domestic needs but also in recognition of potentially rapidly expanding future global markets. Early movers in these industries will have achieved economies of scale and the benefits of clustering research centers, manufacturers and suppliers that form a critical mass in support of continued growth by the sector. Just as Seattle grew as an important hub in the formative years of the aviation industry and Silicon Valley was the home for the rapid growth of the semiconductor industry, clean energy centers are likely to cluster in an area and achieve early mover advantages.[19]

Policies to Encourage Clean Energy Innovation and Growth in the United States

The United States has taken some initial steps toward encouraging investments in clean energy technologies, but significant uncertainty exists as to what future policies may look like and that uncertainty has dampened investments to date. The CEOs of many large corporations have gone on record as saying that if climate and clean energy legislation is passed it will unleash significant new investments in these technologies.[20]

Current efforts to promote clean energy technologies in the United States have included: investment incentives such as the Production Tax Credits for renewable energy; a range of programs totaling $63 billion included in the American Recovery and Reinvestment Act; the creation of and funding for the Advanced Research Projects - Energy (ARPA-E) program to support high-risk investments in clean energy technologies; and renewable portfolio standards adopted by 31 states that require electricity from increasing amounts of renewable and alternative energy sources.

These initial efforts are significant, but fall far short of putting in place a comprehensive plan to support the development of a competitive, world-class clean energy industry. But the time to act is now or we risk falling further behind and facing the more difficult task of playing catch up.

Putting a price on carbon is a critical element of any legislation aimed at spurring investment in clean energy technologies. But to create a shift in our energy systems of the magnitude required and in the timeframe needed, the widespread use of complementary polices aimed at spurring innovation and facilitating the deployment of these new technologies will also be critical.[21] For example, policies should be aimed: at more closely linking federal research and development programs with deployment initiatives; at engaging a wider range of federal agencies in efforts to spur innovation along multiple pathways using a variety of public and private institutions; and at using government procurement policies (e.g., the Department of Defense, NASA, and USDA) to serve as first purchasers of late-stage demonstration projects for innovative technologies.[22]

Examples of policies that could be helpful in supporting the development and deployment of clean energy technologies include: the use of standards to achieve reductions in sectors that are less responsive to carbon price increases (e.g., fuel efficiency standards in the transportation sector);[23] support targeted for expanded development and deployment of commercial-scale demonstration projects for key technologies including carbon capture and storage;[24] and the creation of new institutions like the proposed Clean Energy Deployment Administration to support critical financing of deployment of capital-intensive technologies such as nuclear power plants. In addition, the American Energy Innovation Council recently released a report recommending the creation of a national energy strategy board, centers of technology excellence, and expanded funding for ARPA-E.[25] Finally, an international agreement limiting emissions of greenhouse gases would also create substantial new opportunities for expanded markets for clean energy technologies.

Conclusion

The race is on to spur further innovation and deployment of clean energy technologies and to see which countries become the leading exporters of these technologies in the 21st century. With our exceptional expertise, entrepreneurial skills, and industrial base and the proposed policies, this is a race the United States should lead. Yet we risk falling behind other nations by failing to provide our industry with the proper incentives and a clear set of rules that allows them to invest and innovate. Comprehensive clean energy and climate legislation, including a price on carbon and complementary policies aimed at spurring innovation, would go a long way to creating the investment regime that would benefit our future economic prosperity and our environmental well being.

[1] This concern is often referred to as "leakage" with production reduced in one country subject to controls but increased in another country subject to less stringent requirements. Recent research has found these effects to be modest, and well-designed policies – including free allowance allocation and an eventual international climate agreement – can moderate their impacts and help these industries transition to a low-carbon future. For a more in-depth discussion of the extent of these impacts, see Aldy, Joseph and William Pizer. "The Competitiveness Impacts of Climate Change Mitigation Policies," Pew Center on Global Climate Change, 2009. See also, "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade- Exposed Industries: An Interagency Report Responding to a Request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown," United States Environmental Protection Agency, December 2009.

[2] This brief summarizes a more detailed paper on this topic prepared by the Pew Center on Global Climate Change, "Clean Energy Markets: Jobs and Opportunities" available at: http://www.pewclimate.org/docUploads/Clean_Energy_Update__Final.pdf

[3] America's Energy innovation problem, Richard K. Lester, Industrial Performance Center, MIT, November 2009.

[4] Overall clean energy investment growth estimates are derived using data from United Nations Environment Program (UNEP) and New Energy Finance, "Global Trends in Sustainable Energy Investment 2009: Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency," 2009 and Pew Charitable Trusts "Who's Winning the Clean Energy Race" Pew Charitable Trust 2010. This figure includes total financial investment (including venture capital, private equity expansion capital, public markets, and asset finance) as well as government research and development (R&D), corporate R&D, and small projects. Wind and solar market growth estimates are from Makower, Joel and Ron Pernick and Clint Wilder. "Clean Energy Trends 2009," Clean Edge Inc., March 2009.

[5] Pew Charitable Trusts. "Who's Winning the Clean Energy Race?" Pew Charitable Trusts, 2010.

[6] "Wind Turbine Market Share Revealed," Environmental Leader: Energy and Environmental News for Business, March 5, 2009.

[7] Testimony of Dan Reicher, Director, Climate and Energy Initiatives, Google. United States Senate Committee on Environment and Public Works full committee hearing. "Legislative Hearing on S.1733, Clean Energy Jobs and American Power Act," Wednesday, October 28th, 2009.

[8] Bonvillian, William B. "Looking at Technological Innovation in Energy." Presentation to members of the Information Technology and Innovation Foundation, July 20th, 2009.

[9] Oster, Shai. "World's Top Polluter Emerges as Green-Technology Leader," Wall Street Journal, December 15th, 2009.

[10] Bradsher, Keith. "China Leading Global Race to Make Clean Energy," The New York Times, January 30th, 2010.

[11] 50 European Commission, 2008. "Climate Action and Renewable Energy Package."

[12] 51 The scope of the ETS will expand at the commencement of its third phase in 2013.

[13] Engel, Ditlev et al. "Green Jobs and the Clean Energy Economy," Thought Leadership Series, Copenhagen Climate Council, May 2009.

[14] Ibid.

[15] German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety. "Report on implementation of the key elements of an integrated energy and climate programme adopted in the closed meeting of the Cabinet on 23/24 August 2007 in Meseberg," 2007.

[16] "Renewable Energy Sources in Figures: National and International Development." German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, June 2009.

[17] German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, June 2009.

[18] German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, June 2006. Estimates are in year 2000 dollars.

[19] For more on the potential benefits of business clustering, see Porter, Michael. "Clusters and the New Economics of Competition," Harvard Business Review, Vol. 76, Issue 6, November- December 1998. Additional examples are noted in Burtis, P.R., B. Epstein, and N. Parker. "Creating Cleantech Clusters: 2006 Update. How Innovation and Investment Can Promote Job Growth and a Healthy Environment," National Resources Defense Council and Cleantech Venture Network LLC, 2006.

[20] Hearing before the House Committee on Energy and Commerce Committee, January 15, 2009.

[21] See Four Policy Principles for Energy Innovation and Climate Change: A Synthesis; by Clean Air Task Force and CSPO at Arizona State University, June 2010.

[22] Ibid.

[23] See, http://www.pewclimate.org/federal/congressional-policy-brief-series/policies-reduce-emissions-transportation-sector

[24] See, http://www.pewclimate.org/federal/congressional-policy-brief-series/technology-policies-address-climate-change

[25] A Business Plan for America's Energy Choices, American Energy Innovation Council, June 2010.

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