



A Survey of Company Perspectives on Low-Carbon Business Innovation May 2011

Background

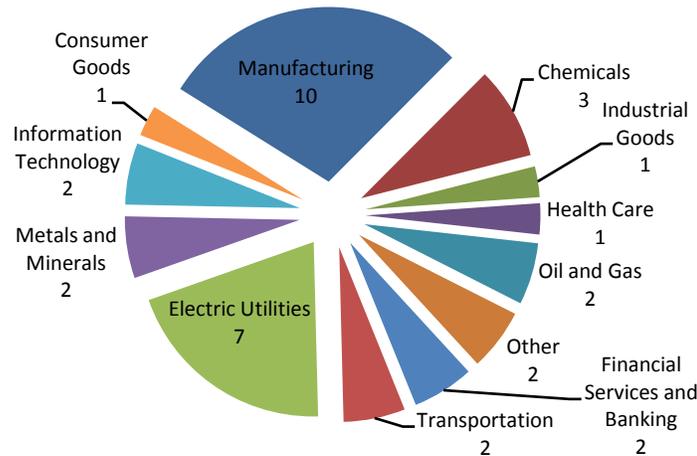
The Pew Center on Global Climate Change conducted a survey of low-carbon business innovation in winter 2010-11. Thirty-five companies, ranging in size from \$600 million to \$285 billion in annual revenues and with an average annual R&D expenditure of \$1.4 billion, completed the survey. This paper provides a summary and brief analysis of the survey results.

The survey's principal objectives were to gather key quantitative information and gauge business strategies for low-carbon innovation activities, with a particular focus on how companies perceive the associated risks and uncertainties. It is one element of a broader Center study on the most effective methods used by companies today to develop and bring low-carbon technologies and solutions to market. The aggregated results will be combined with a set of four in-depth case studies in a report, *Business of Innovating: Bringing Low-Carbon Solutions to Market*, to be published in October 2011.

A confluence of factors makes the issue of low-carbon innovation particularly relevant today. As the U.S. recovers from a deep and prolonged recession, many economists and analysts view innovation, particularly in low-carbon energy, as a key pathway toward sustained economic growth. The Center's study will distill insights from leading companies on advancing the innovation we need to achieve greenhouse gas (GHG) reductions while maintaining economic growth. The report and related communications activities are being funded with a generous grant from Hewlett-Packard.

Survey Sample and Response Rate. The survey sample is a purposive sample and not a randomly-selected sample of businesses: the survey was deliberately aimed at companies known to be active in business innovation and climate policy. To explore best practices among industry leaders, the sample was drawn largely from Fortune 500 companies with a demonstrated commitment to climate and energy issues through, for example, membership in business-NGO partnership programs on climate change such as the U.S. Climate Action Partnership and the Business Environmental Leadership Council ([BELC](#)). Respondents represent a variety of economic sectors—from information technologies to electric utilities, extractive industries to heavy machinery manufacturers—and a range of annual R&D expenditure from \$500,000 to \$5.82 billion. The survey was primarily sent to the government relations or sustainability offices within companies. Thirty-five companies completed the survey out of 68 invited, representing a response rate of 51.5%. Figure 1 provides a breakdown of the number of companies responding by industry sector.

Figure 1. Industry Sectors Represented by Respondents



Survey Instrument. Dr. James Witte, Professor of Sociology and Director of the Center for Social Science Research at George Mason University, programmed the questionnaire into an on-line survey instrument which the Center distributed via e-mail to companies in winter 2010. The 27 survey questions were approved before distribution by the George Mason University Human Subjects Review Board to ensure data collection processes met all Federal guidelines. The survey for the electric power and banking/financial services sectors included additional questions to capture the unique characteristics of investment and technology adoption in those sectors; thus, the number of questions asked of each company depended on the industry affiliation selected at the beginning of the survey. Participants received a link to the survey with unique user names and passwords.

Definition of Terms. For the purposes of this survey, “innovation” describes the development and deployment of novel, valuable and non-obvious solutions; “low-carbon innovation” describes those new inputs, products or services that emit significantly less carbon dioxide per equivalent output than the products or services they replace; and “low-carbon technologies” are those that produce fewer GHGs than other technologies that perform the same function.¹

More information about this project, including the [survey questionnaire](#) and other project activities, can be found on the Center’s low-carbon innovation project [web-page](#).

Highlights of Key Findings and Analysis

This survey highlights several interesting insights into corporate strategies for low-carbon innovation.

- ⇒ ***Importance of Low-Carbon Innovation.*** According to the survey results, respondents believe that low-carbon innovation will only become more important for the growth of their companies and the U.S. economy as time passes, ranking (on a 10-point scale from least to greatest level of importance) the importance of low-carbon innovation to their business growth an average 7.5 over the next 5 years, an 8.2 over the next 10 years and an 8.7 over the next 20 years.
- ⇒ ***Role of Public Policy.*** Respondents emphasized the need for long-term, transparent climate and energy policies as critical to establishing a business environment that would allow for greater certainty and stability for decision-making and investment in low-carbon innovations. Among the nine policy tools listed in the survey, putting a price on carbon was by far the most important action that respondents think the U.S. government could take to advance low-carbon innovation:

¹ These include, for example, low-carbon energy sources such as wind, solar, geothermal and nuclear power; natural gas, biofuels, and hydrogen; more energy-efficient energy supply and demand technologies; and chemicals that can substitute for GHGs, e.g., in industrial applications. These technologies can be used in a number of economic sectors including electricity generation, transportation, buildings, agriculture and heavy industry.

nearly half (47%; 16 companies) chose establishing a carbon price while the second-most selected tool, with 4 responses, was establishing national low-carbon performance standards, for example, for fuels and/or electricity. Only one respondent believes that low-carbon innovation would be encouraged by the government getting out of the way or doing nothing. The absence of clear policy signals in the United States makes it difficult to anticipate and adapt to regulatory changes, derails low-carbon business innovation strategies or redirects them to markets with more policy certainty.

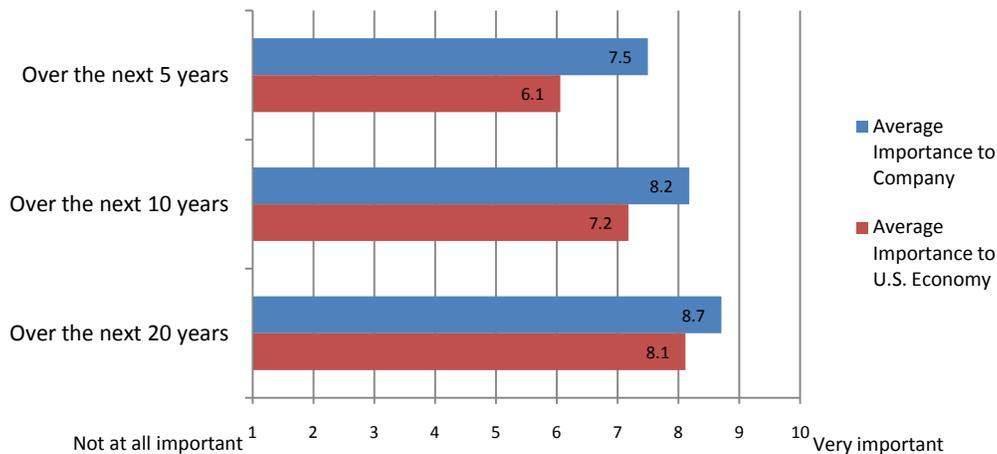
- ⇒ **Business Drivers.** The survey results suggest that bringing low-carbon innovations to market is a strategic decision to enhance financial growth and respond to customer demand, and is less about the public relations benefits of promoting environmental solutions. All of the five drivers for pursuing low-carbon innovations listed in the survey ranked as important (in the 6.7 to 7.3 range) except for the reputational benefits of “going green” which ranked as only somewhat important to respondents (ranking an average 5.0). Financial growth, anticipating or shaping regulatory changes, establishing expertise in emerging technologies or markets, and current customer demand received approximately equal weighting—on average ranking 7.3, 7.2, 6.9, 6.7, respectively.
- ⇒ **Beliefs about Customer Adoption.** Respondents believe that the most important factor for their customers’ adoption of new low-carbon innovations is the energy or total lifecycle cost reduction afforded by the solution (ranking an average 8.6). Moreover, companies find that customers look for solutions that have a lower total cost of ownership *without compromising* on the product’s reliability or performance, suggesting that customer expectations are quite high when moving from a more traditional, energy-intensive solution to a low-carbon solution. Often, the customers want the new product to cost less and perform as well as, if not better, than the previous solution. Customer concerns about a product’s environmental performance (6.8) and an ability to have a distinctive competitive advantage (7.0) in their market also ranked on average relatively high as drivers for adoption.
- ⇒ **Risks and Uncertainties.** Reflecting these survey findings about the importance of public policy and customer expectations to low-carbon innovation, the majority of respondents (65%) believe that the most significant uncertainty is policy (regulatory changes, tax/subsidy changes) and nearly one-quarter believe that market uncertainty (customer adoption, competing technological standards) is the most significant.
- ⇒ **Conducive Business Environments.** Public policy also played a strong role in respondents’ beliefs about the country or region with the best business climate today for domestic low-carbon innovation. A large majority of respondents find that China and the European Union (EU) have the best overall business climate—representing 45.8% and 37.5% of the responses, respectively—primarily due to supportive government policies and, in China’s case, a strong domestic market. Some of the views on selecting China as the best environment for low-carbon innovation specified that, while the United States has the best business climate for low-carbon innovation, China has a stronger level of investment in low-carbon technologies and supporting public policies.
- ⇒ **Functional Expertise.** Respondents believe that the CEO, Business Unit Leadership, Strategy, and R&D groups are relatively more important than other functions to be involved in all innovation, including low-carbon innovation. Perhaps not surprisingly, given findings about the importance of public policy to bringing low-carbon innovations to market, the companies believe that the Government Relations group is relatively more important for low-carbon innovation than for other types of business innovation. This finding suggests the need to better incorporate policy considerations, opportunities and challenges into the strategy and R&D activities within companies.

Summary of Findings

I. Business Perspectives on Low-Carbon Innovation

The survey respondents believe that low-carbon innovation will only become more important to the growth of their company and to the U.S. economy over the next twenty years. On average, the companies ranked the importance of low-carbon innovation to their business growth as a 7.5 on a ten-point scale within five years, an 8.2 within ten years, and an 8.7 within twenty years (Fig. 2). Similarly, the companies ranked the importance of such innovation to the growth of the U.S. economy as at least somewhat important in the near-term, with an average rank of 6.1 over the next five years, and as relatively more important in the longer term with a rank of 8.1 over the next twenty years.

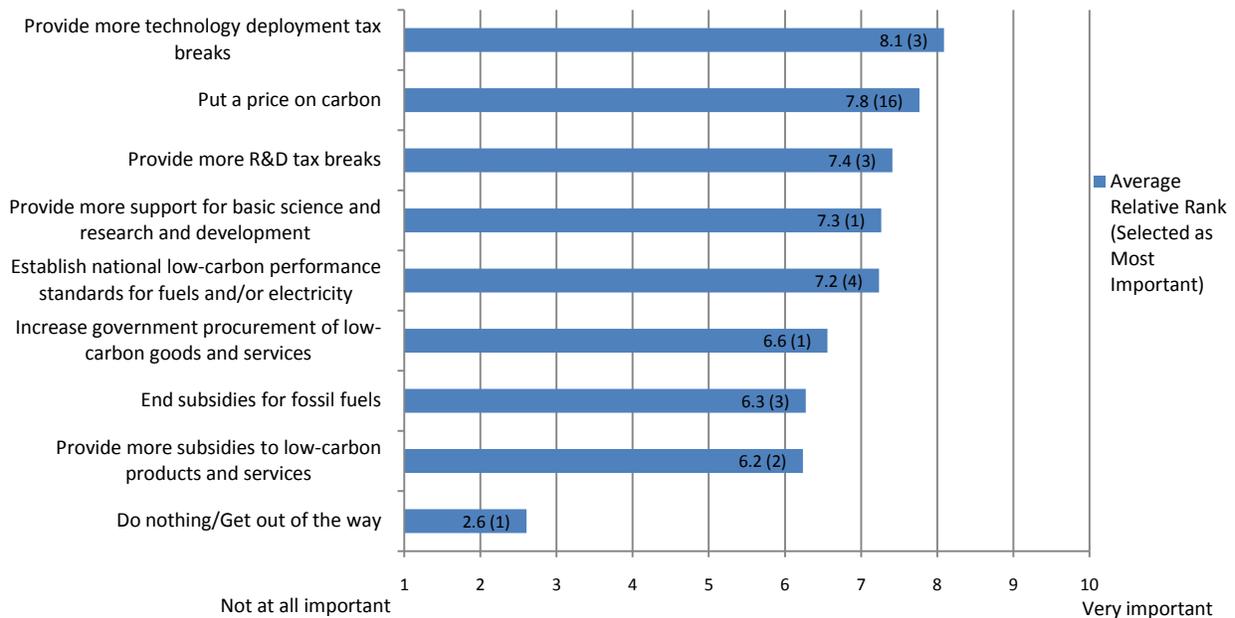
Figure 2. Relative Importance of Low-Carbon Innovation to Growth of the Company and to the U.S. Economy



The survey sought to ascertain the companies' beliefs about the role—if any—that the government should play in advancing low-carbon innovation by asking respondents to rank the importance of certain actions that the U.S. government could take and which of those they believe would be the most important. The results indicate that nearly half of respondents (16 companies) believe that putting a price on carbon emissions is the most important action that the U.S. government could take to advance low-carbon business innovation. Although providing technology deployment tax breaks was rated with the highest average level of importance, when asked to rank *the most* important measure the government could take, more respondents selected putting a price on carbon (Fig. 3). Putting a price on carbon was selected as the most influential policy tool by a fairly wide margin, with the next most-selected action—establishing national low-carbon performance standards for fuels and/or electricity—receiving only 4 responses.

On average, respondents believe that all of the government actions listed are at least somewhat important (with a minimum rank of 6.2) to advancing low-carbon innovation except for the U.S. government doing nothing. In fact, very few (1 respondent) believe that innovation would be encouraged by the government getting out of the way or doing nothing. Companies also ranked tax breaks for technology deployment as relatively more important on average than other policy actions.

Figure 3. Relative Importance of Actions the U.S. Government Could Take to Advance Low-Carbon Innovation

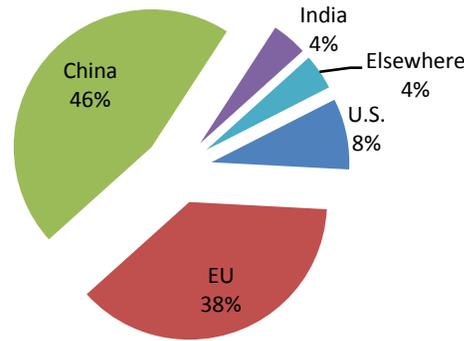


Respondents were provided the opportunity to select “other measure” and explain what they find to be important. Many of the fourteen “other measure” responses described more specific aspects of the policy tools listed in the question, i.e., a national cap-and-trade system for large emitters, a national energy or demand reduction policy, a national renewable portfolio standard, loan guarantees, and tax-free clean tech zones. Several other tools noted include government-sponsored energy efficiency programs; the government’s role in educating customers to make more informed purchasing decisions; defending U.S. exports against foreign carbon border tariffs; and supporting cross-industry, systemic changes through clear and long-term energy rules and standards that align with international actions regarding climate change.

Public policy also played a strong role in respondents’ selection of the country or region with the best business climate today for domestic low-carbon innovation. A large majority of respondents find that China and the European Union (EU) have the best overall business climate—representing 45.8% and 37.5% of the responses, respectively (**Fig. 4**)—primarily due to supportive government policies (**Fig. 5**).² Some of the views on selecting China specified that, while the U.S. has a strong *business* climate for low-carbon innovation, China has a stronger *level of investment* in low-carbon technologies and is increasingly “making things happen.” The two countries within the EU that were most frequently cited were the United Kingdom and Germany, with Sweden and France also mentioned. Outside of this region, Japan and Ontario were also mentioned.

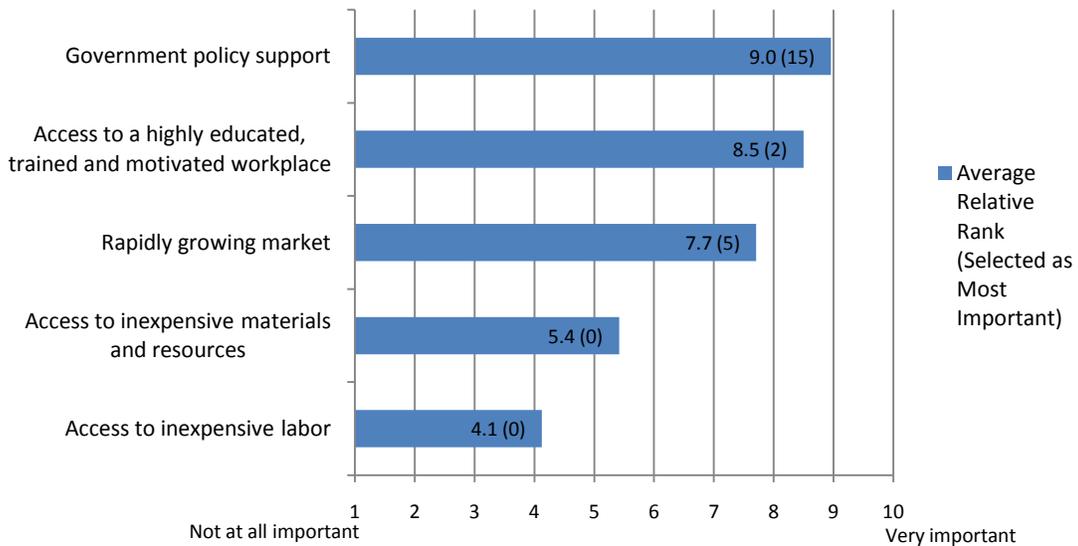
² This series of questions was not asked of the electric power sector respondents. For the banking/financial services sector respondents this question was modified to read “best investment climate today” rather than “business climate.”

Figure 4. Country or Region with Best Business Climate Today for Domestic Low-Carbon Innovation



As mentioned, of the aspects listed in the survey question, the majority of respondents (65%) find that government policy support is the most important reason for their country or region of choice having the best business climate today for low-carbon innovation (**Fig. 5**). This aspect was selected as the most important by a fairly wide margin, with the next most-selected aspect—having a rapidly growing market—receiving just 22% of the responses. Of the 12 respondents that chose China as the best country for low-carbon innovation, seven believe this is due to government policy support and four attribute their selection to having a rapidly growing market. Of the nine companies that selected the EU as the best business environment, seven indicated this is due to government policy support, one to a rapidly growing market, and one to a highly educated, trained and motivated workforce. On average, access to inexpensive labor, materials and resources ranked as relatively less important with a rank of 5.4 and below. When it came to ranking the relative importance of these five aspects, in addition to government support, access to a highly educated, trained and motivated workforce ranked relatively more important.

Figure 5. Relative Importance of Aspects Making this Country or Region Have the Best Overall Business Climate Today for Domestic Low-Carbon Innovation

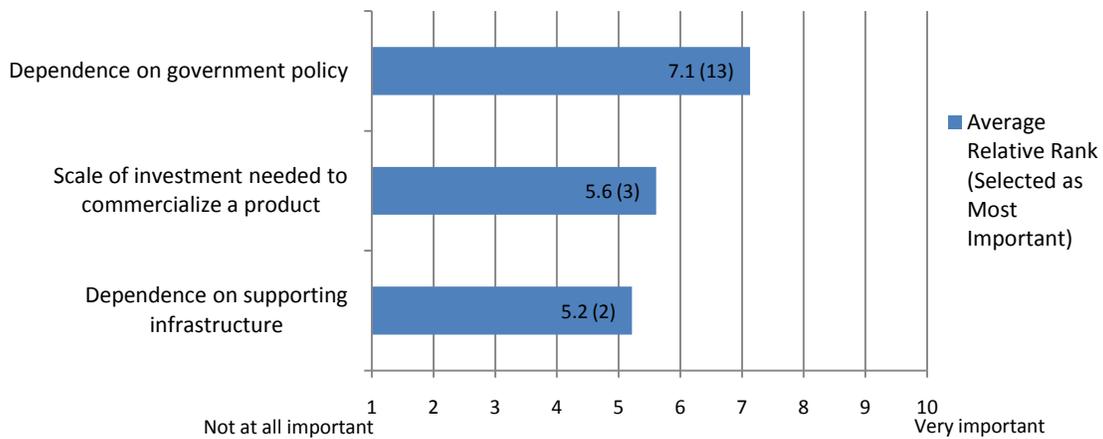


Many of the “other aspects” responses specified government policy support as the establishment of a national cap-and-trade system, a long-term and transparent integrated energy policy, ease of permitting, and protection from foreign competition. Several companies noted additional country or regional aspects important as well. These relate to a customer base educated about new

technologies or demonstrating stronger environmental attitudes, the availability of historical performance data, and access to innovative financing and investment mechanisms such as low-cost loans, government equity positions, and venture capital with government support.

The survey also sought to examine how companies think about and approach low-carbon innovation in ways that may be different from other types of business innovation. The majority of respondents (67.6%) believe that low-carbon innovation is indeed different from other types of innovation, with 60% of companies responding that dependence upon government policy is the most important reason for this difference (Fig. 6). While dependence on supporting infrastructure was ranked a relatively less important difference, a few of the responses provided in the “other differences” response category do refer to the need for complementary technologies, materials or infrastructure as a reason that low-carbon innovation is different from other types. All of the differences were ranked on average as at least somewhat important with a minimum rank of 5.2.

Figure 6. How Low-Carbon Innovation Is Different from Other Types of Innovation

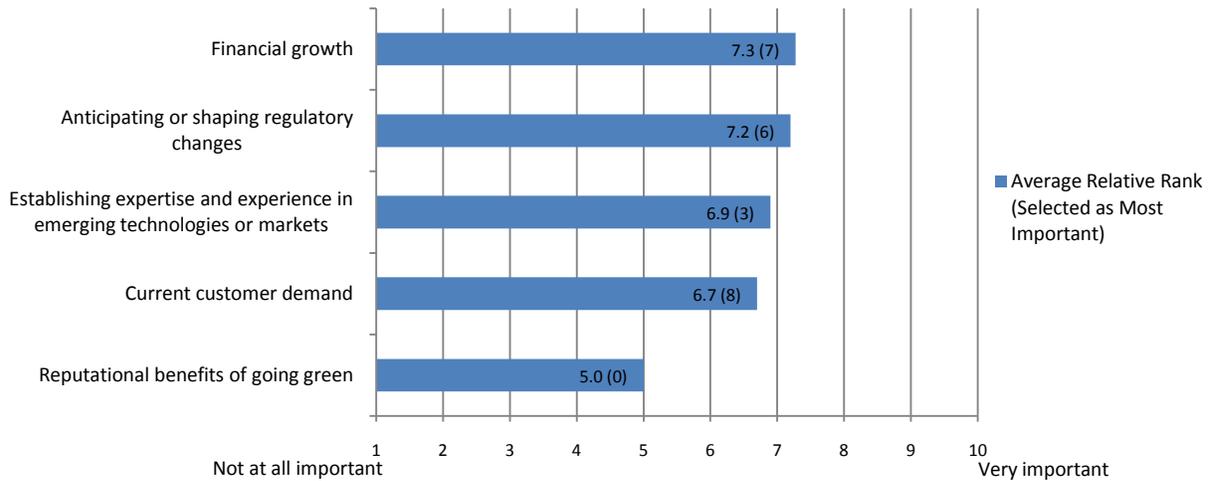


Other differences not covered in the aspects listed were important as well; these include uncertain customer adoption or market development (especially without a carbon price), the availability of low-carbon partners (including regulators), a lack of advanced carbon accounting methods, and the long time horizons over which innovations are commercialized.

Respondents were also asked to share their views on the drivers leading their company to pursue low-carbon innovations.³ Almost all the business drivers listed in the survey question ranked as important (in the 6.7 to 7.3 range) except for the reputational benefits of “going green” which ranked as only somewhat important to respondents (Fig. 7). There was not a clear majority selecting the most important driver, with most responses distributed among current customer demand (27.6%), financial growth (24.1%) and anticipating or shaping regulatory changes (20.7%). Other drivers that companies found important include the influence of a high-level internal champion for low-carbon innovation, of stakeholders or institutional investors, the need to anticipate future customer demand and competitive advantage opportunities, and to hedge against policy risks.

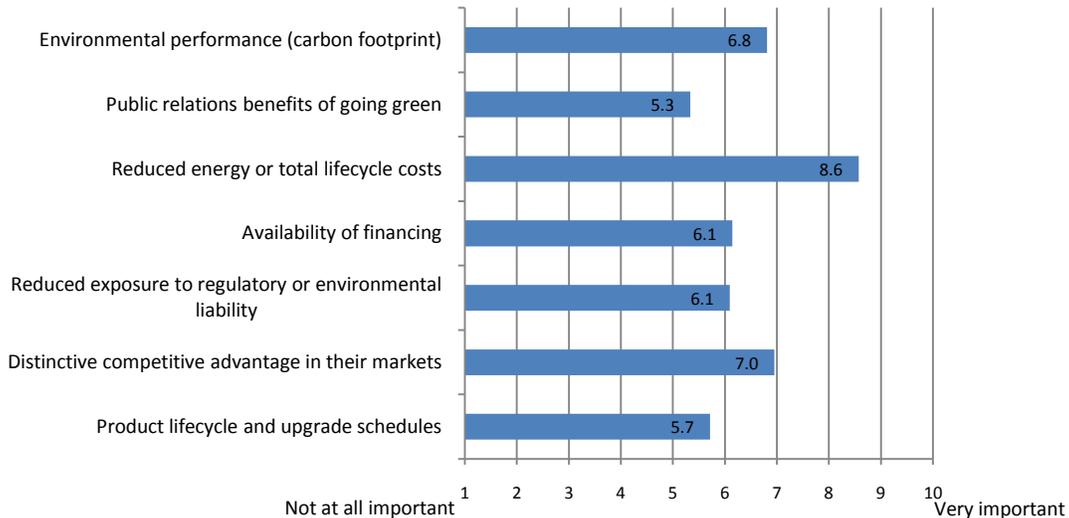
³ This question was not asked of the banking/financial services sector. For electric power sector respondents this question was modified to read “drivers leading your company to adopt” rather than “to pursue.”

Figure 7. Relative Importance of Drivers for Pursuing Low-Carbon Innovations



Companies were also asked to share their views on the drivers for *their customers'* adoption decisions regarding low-carbon innovations.⁴ All of the drivers listed were considered as at least somewhat important to customer decision-making with the lowest average rank at 5.3 for public relations benefits. Respondents believe that cost reduction is the most important reason for their customers' adoption of low-carbon innovations (**Fig. 8**). Customer concerns about environmental performance and having a distinctive competitive advantage in their markets ranked on average relatively high as drivers for adoption as well. Many of the "other driver" responses reiterated customer concerns about a product's total cost of ownership, without compromising on performance, as a key driver, suggesting that customer expectations of low-carbon innovations are quite high.

Figure 8. Relative Importance of Drivers for Customers' Adoption of Low-Carbon Innovations



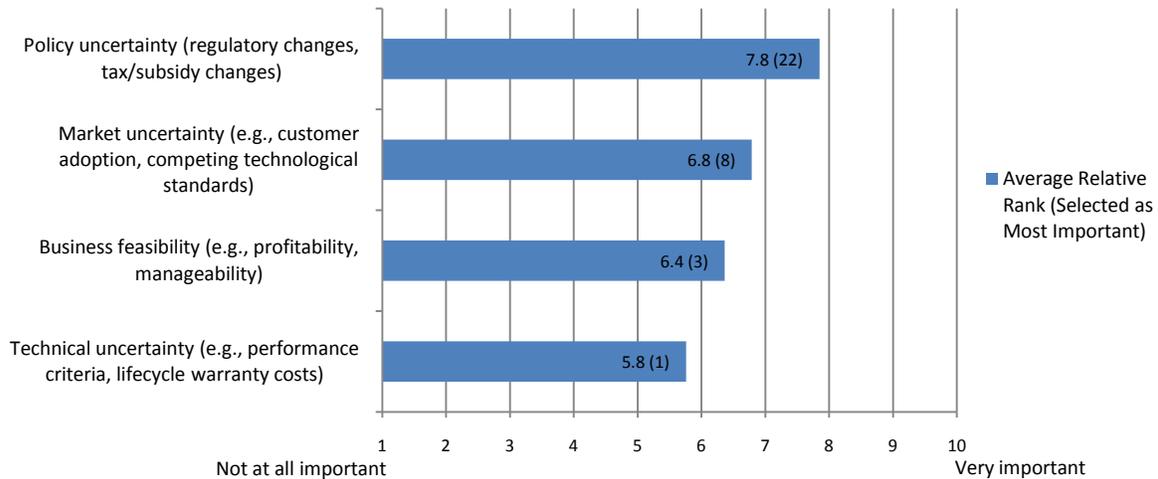
The survey then assessed respondents' views on the degree of risk or uncertainty associated with certain aspects of low-carbon innovation.⁵ Reflecting some of the findings above about the importance of public policy support and customer expectations, in this question the majority of

⁴ This question was not asked either of the banking/financial services or the electric power sectors.

⁵ For the electric power sector, this question was modified to read certain aspects of "adopting" low-carbon innovations and for the banking/financial services sector, aspects of "investing in" low-carbon innovations.

respondents (64.7%) believe that the most significant risk or uncertainty associated with low-carbon innovation is policy uncertainty and nearly one-quarter believe that market uncertainty is the most significant (Fig. 9).

Figure 9. Relative Importance of Risks or Uncertainties Associated with Low-Carbon Innovation



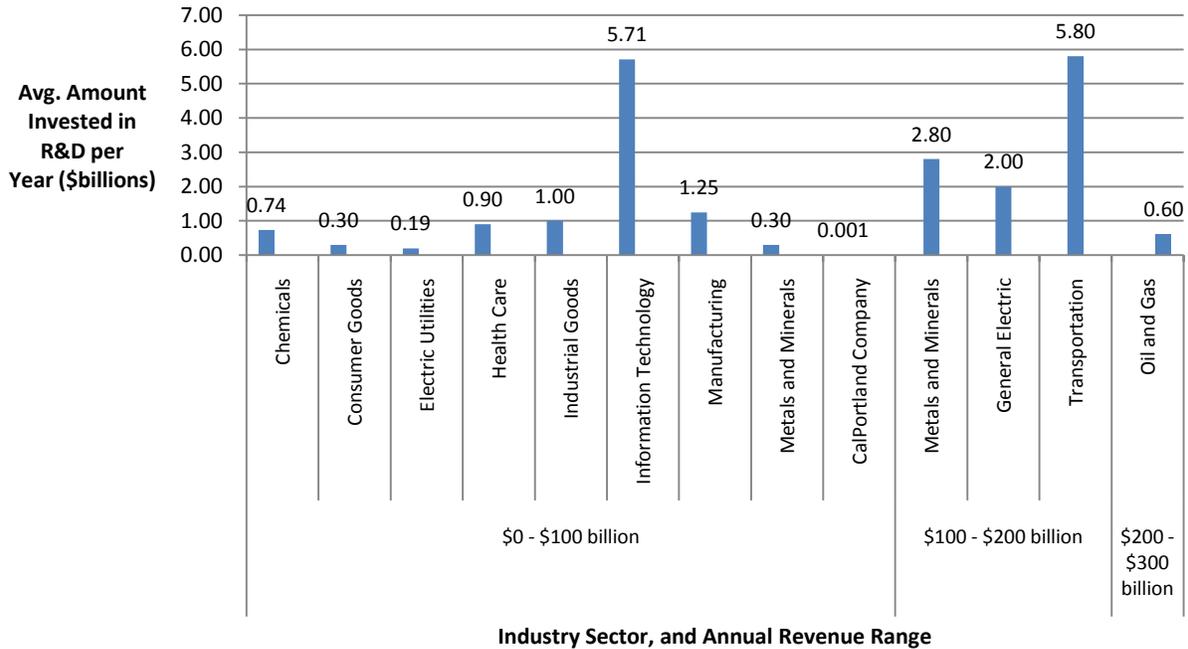
All of these aspects of low-carbon innovation ranked as at least somewhat important with an average rank between 5.8 and 7.8. Companies find additional risks or uncertainties as important: commodity price fluctuations, regulatory or legislative changes, shifts in market perception of the value of low-carbon technologies, and the opportunity cost of investing in low-carbon innovation versus other business opportunities.

II. Company Innovation Activities

One of the survey’s objectives was to collect information about companies’ low-carbon innovation research and development (R&D) investment and associated strategies. Respondents were first asked how much money (including any internal staffing and related resources) they devote to R&D activity in a typical year.⁶ Of the 25 companies that responded to this question, the estimated amount ranges from \$500,000 to \$5.82 billion with an average annual R&D expenditure of \$1.4 billion. When these average estimates are compared against the respondents’ industry sector and annual revenues, it is clear that the estimated expenditure varies somewhat by company size but more significantly by industry sector (Fig. 10) with IT and transportation spending relatively more than other sectors on average.

⁶ For the electric power sector this question was modified to ask how much they devote to “purchasing or investing in low-carbon innovations” and for the banking/financial services sector, how much they “invested in low-carbon innovations in 2009,” i.e., “the amount of money invested in companies and ventures developing low-carbon products and services.”

Figure 10. Average Amount Invested in R&D Activities per Year, Represented by Respondents' Industry Sector and Annual Revenues



Respondents were then asked to select a range that reflects the percentage of their R&D budget that is devoted specifically to low-carbon innovation.⁷ About half of respondents (55%) indicated that no more than 25% of their annual R&D budget is devoted to low-carbon innovation (**Table 1**).

Percentage of R&D Budget Invested in Low-Carbon Innovations, Broken Down by Company Revenue Groups

Range of Respondent's Annual Revenues	Percentage of R&D Budget Devoted to Low-Carbon Innovation			
	1% - 25%	26% - 50%	51% - 75%	76% or more
\$0 - \$100 billion	10	6	1	
\$100 - \$200 billion			1	1
\$200 - \$300 billion	1			
Percent of Total Respondents	55%	30%	10%	5%

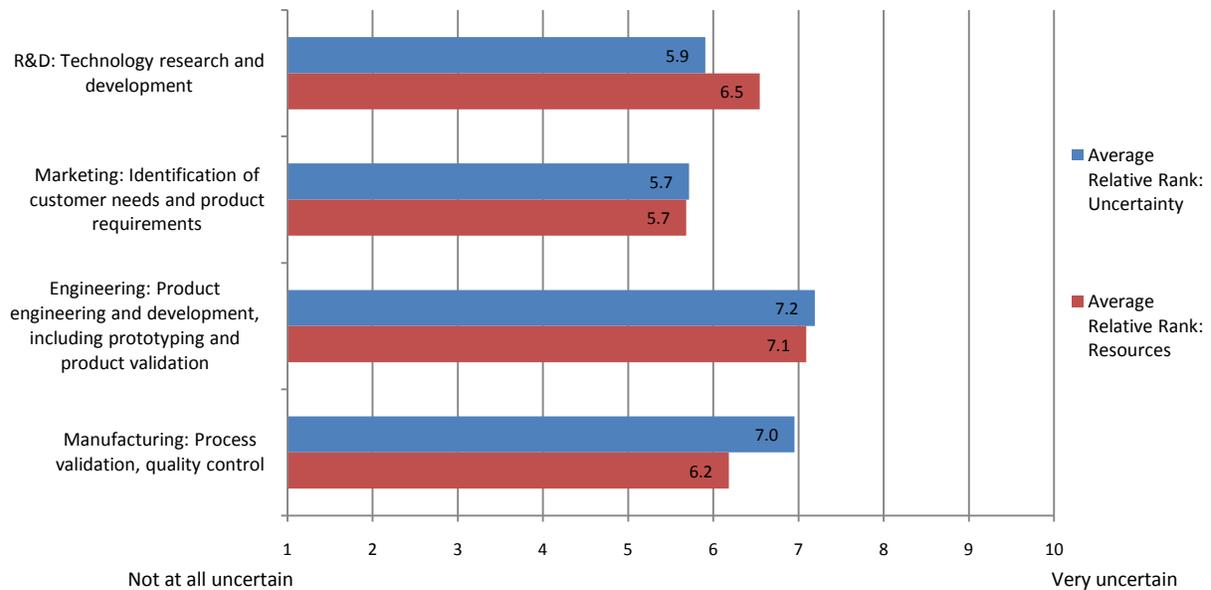
Focus on the Electric Power Sector

To explore trends among a key customer segment for low-carbon technologies, electric power companies were asked to indicate whether their investments in low-carbon innovation had gone up, gone down or stayed the same over the *previous* five years. Of the six responses to this question, two-thirds (four companies) indicated that their investment had increased while the remaining one-third (two companies) indicated that their investment had stayed the same. Two companies estimated their investment had gone up by 100% and 50% each. These companies were then asked to estimate whether they anticipate investing more, less or about the same amount on low-carbon innovation over the *next* five years. Of the six responses to this question, two companies anticipate investing more—one by 10% and the other as much as 200%, one company indicated it would be investing less, and the remaining three companies expect to invest about the same.

⁷ Follow-up questions about the nature of investment in low-carbon innovations were asked differently of banking/financial services and the electric power sectors. See focus boxes below.

Companies were then asked to rank the relative degree of uncertainty assigned to each of four specific stages in the low-carbon innovation process—R&D, marketing, engineering and manufacturing—and the relative level of resources dedicated to each of these stages.⁸ While all four stages were ranked as exhibiting moderate uncertainty or risk, the engineering and manufacturing stages were assigned relatively greater levels of uncertainty (**Fig. 11**). Respondents indicated that resources are dedicated commensurate with the assigned level of uncertainty or risk.

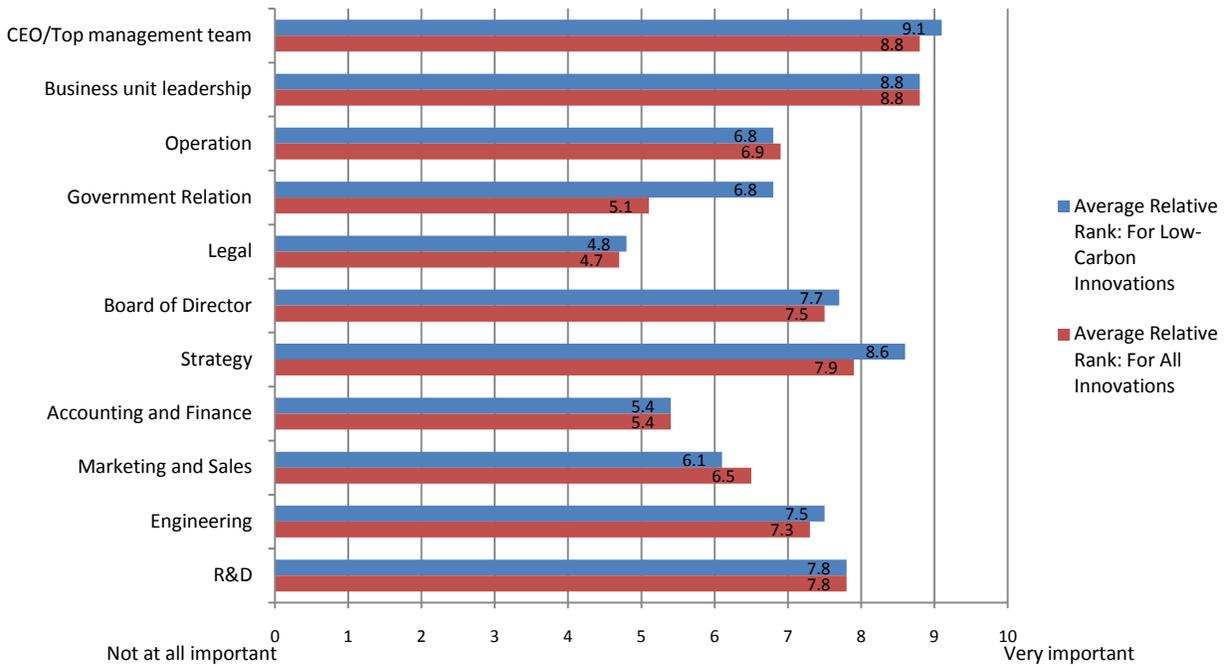
Figure 11. Relative Uncertainty and Relative Resources Assigned to Each Stage in the Low-Carbon Innovation Process



Another purpose of the survey was to understand the functional expertise involved in the innovation process within companies. To that end, respondents were asked to rank the importance of the perspective or involvement of certain key functions within the company both for low-carbon innovation and for all types of innovation. Perhaps not surprisingly given the responses to previous questions indicating the importance of public policy to low-carbon innovation, the respondents find that largely the same company functions are important to both types of innovation *except* for government relations being relatively more important for low-carbon innovation (**Fig. 12**). Of the eleven functions listed, the CEO, Business Unit Leadership, Strategy, and R&D groups ranked as relatively more important than other functions for both types. Respondents also highlighted other people as important to innovation, including internal groups with responsibility for corporate sustainability or environmental, health and safety (EHS), innovation, production, procurement, design, human resources and technology.

⁸ This question was not asked either of the banking/financial services or the electric power sectors.

Figure 12. Relative Importance of Functions to Low-Carbon Innovation



Respondents were also asked to reflect on whether there are incentives or disincentives to participating in low-carbon innovation as opposed to other business activities within their company and, if so, the nature of those incentives or disincentives.⁹ About half of respondents (51.7%) reported that, from the perspective of employees, there are incentives to participating in low-carbon innovation within their company and 76.9% replied that there are not any disincentives.

Descriptions of the nature of those incentives have been collected into summary categories and presented in **Table 2**. Responses that elicited a categorization of “core to the job function” were those companies that described participating in low-carbon innovation not as a distinct activity but as an integral part of the company’s mission or “DNA.” Some companies explicitly link participating in low-carbon innovation to employee performance reviews and/or variable compensation.

Incentives relate to	Frequency	Percent*
Management recognition	5	33.3%
Compensation	4	26.7%
Job satisfaction	3	20.0%
Core to job function or corporate culture	3	20.0%
Professional growth opportunities	2	13.3%

*Percentage of responses provided. In a few cases, here and in the below tables, percentage totals more than 100% because some responses pertained to more than one category.

Less than one-quarter (23.1%) of respondents find that there are disincentives to participating in low-carbon innovation as opposed to other business activities within their company; their responses have been collected into summary categories and presented in **Table 3**.

⁹ This question was not asked of the banking/financial services sector.

Disincentives relate to	Frequency	Percent
Greater cost management pressure	3	50.0%
Taking on greater risk or uncertainty	2	33.3%
Limitations to professional growth	2	33.3%

It appears that the impact of taking on low-carbon innovation within a company can cut both ways for one’s career: respondents indicated both a positive and negative effect on professional growth. Joining a newer area within a company like low-carbon innovation can mean joining a “passionate” and “more entrepreneurial culture” and receiving top management attention in a “hot area.” But it can also introduce a degree of uncertainty as these projects are more susceptible to changes in government policy and company priority; as one respondent put it, “The high risk, high reward incentives might be seen as disincentives to some.”

III. Successful Low-Carbon Innovation

A primary objective of the survey was to explore how leading companies bring successful low-carbon innovations to market—how product lines or technologies are developed, the metrics used for success, the nature of inevitable setbacks, and lessons learned. Responses to these open-ended questions elicited longer answers and have been summarized and presented below in the major categories into which they fall.

Respondents were first asked about the biggest successes their companies have achieved in their pursuit¹⁰ of low-carbon innovations. These responses are summarized in **Table 4**. By a wide margin, reported successes relate to the success of a specific new product or technology, or an improvement on an existing one, that is significantly more energy efficient than previous models or solutions. Examples given range from high-efficiency transformers and jet engines to lower-carbon product formulations and advanced biofuels. A subset of these successes relate specifically to very large, capital-intensive projects such as demonstration of carbon capture and sequestration (CCS) or the development of advanced natural gas power plants.

Greatest successes relate to	Frequency	Percent
New or modified products or technologies	18	58.1%
Operational changes and associated cost savings	12	38.7%
Collaborative demonstration project	3	9.7%
Meeting new industry standards	2	6.4%
Developing corporate culture or understanding	2	6.4%

Other successes reported by respondents relate not to a new product or service but to innovative approaches to managing—or applying new technologies to—the up- or downstream carbon impacts of their business, leading to operational changes and cost savings. This describes, for example, a healthcare company adopting advanced transportation technologies to reduce the carbon footprint of its fleet or a cement or paper company installing renewable energy generation at its facilities. At least two companies cited their successes as the less tangible benefits of developing an internal corporate culture that better understands the economics behind low-carbon innovation and that recognizes such technologies and investments as productivity enhancers. The successes that relate

¹⁰ This question was modified for the electric power sector as “adoption of” low-carbon innovations and for the banking/financial services sector as “successes you have observed investing in” low-carbon innovations.

to meeting industry standards cited products that incorporate Design for the Environment (DfE)¹¹ criteria or other EPA standards.

Respondents were then asked to reflect on the key characteristics of the low-carbon innovations that their company has successfully commercialized (**Table 5**).¹² Most respondents quite simply identified being “valued by our customers” as the key characteristic of their successful low-carbon innovations, described as being “technological leaders in the[ir product] category,” meeting a “market demand for a low-carbon alternative,” and innovations that are “new solutions with a positive financial return” with “no compromise in underlying product performance.”

Key characteristics of successful innovations	Frequency	Percent
Have success in marketplace and/or meet projections of customer demand	11	39.3%
Are energy efficiency improvements upon existing products or competencies	10	35.7%
Receive top management support	3	10.7%
Are government or policy-dependent	2	7.1%
Need good information or data	2	7.1%

A few companies noted the crucial role of current and future customer needs, emphasizing that engaging with and listening to customers (and stakeholders) early in the concept or design phase helps to assess the market and technical feasibility of a low-carbon innovation early on. A few respondents expanded upon market acceptance to link to the associated environmental benefits; as one company characterized it, the key characteristic of a low-carbon innovation is when the “economic benefit (reduced cost for energy [or] resources) goes in line with the ecological benefit.”

As noted in **Tables 4** and **5**, most respondents characterize their successful low-carbon innovations as those that improve upon the energy consumption or efficiency of existing products. This includes leveraging core competencies to grow into new applications or markets, or to identify and invest in start-up companies with promising low-carbon technologies. The role of public policy in mitigating risk through guarantees or incentives was cited by two companies as a key characteristic of successfully innovating low-carbon products and services. Finally, two companies described the availability of data in order to adequately measure, identify and optimize low-carbon opportunities.

The survey then asked companies to describe the metrics they use to define success in low-carbon innovation. Two of the three metrics most cited relate directly to business growth (the same as other types of innovation) but slightly more often cited was the product’s energy and/or carbon footprint (**Table 6**). Most responses that indicated the energy/carbon savings also included financial performance as a key metric.

¹¹ Created in 1992, Design for the Environment (DfE) is a program administered by the U.S. Environmental Protection Agency (EPA) that works to consider the potential environmental impacts of a product and the process used to make that product, including components and raw materials across its life cycle. DfE is an engineering perspective in which the environmental characteristics of a product, process or facility are optimized for energy efficiency, amount and type of materials used, and recyclability.

¹² For the banking/financial services sector this question was modified to read “invested in” rather than “commercialized.” The electric power sector was not asked this question.

Table 6		
Metrics for success relate to	Frequency	Percent
Carbon or energy footprint	13	34.2%
Sales or top-line revenue generated	10	26.3%
Profitability or ROI	9	23.7%
Progress against corporate GHG target or other goal	3	7.9%
Recognition as a leader by stakeholders (customers, regulators)	3	7.9%

The “carbon footprint” metric referred to the company’s operations (e.g., carbon reductions per tonne of product) and the carbon performance of the product itself, but also in several cases to the carbon emissions savings that companies are calculating across their value chain—from the emissions in their supply chain, fleet and logistics, to the customer use and disposal of the product. These calculations are compared against the company’s previous product models as well as against competitors’ performance.

Half of the responses indicated financial value as a core metric defining success in low-carbon innovation: 24% indicated that “profitability” or “an acceptable ROI” are core metrics while 26% described top-line “revenue generated,” “sales,” “market share,” or “transaction volume” as a primary metric for success. These financial metrics—profitability/ROI vs. absolute sales/revenue—are considered here separately: “profitability” can differ based on how a company defines the “return” associated with the low-carbon innovation (does the investment have intangible benefits of a strategic advantage with regulators?) or can fluctuate based underlying expectations about cost, resource efficiency, regulatory certainty or “market/social acceptance” of the value of low-carbon innovations. As one respondent put it, “Profitability is [the] main metric for all [low-carbon innovation] projects, yet sustainability issues are constantly changing the rules for [that] calculation. Long-term investments [for low-carbon innovation projects] are often needed.” Other key metrics identified include regulatory compliance, public awards, and meeting voluntary industry standards such as Design for Sustainability.¹³ Only one company indicated they have “no specific metrics” for defining success in low-carbon innovations.

The greatest lessons learned from these successes are widely distributed among primarily six themes (**Table 7**). “Bridging language/understanding gaps within organizations” was cited as a key learning, for example between “facilities management and [the] CFO” within a financial services company, or the need to “convey the purpose of conservation and efficiency to the workforce” in a manufacturing business. As one company put it: “significant opportunities for low-carbon innovation within industrial operations can be hidden behind inertia, history, fear of change, [or] other priorities.” Respondents also learned that a high-level champion at the company can help overcome barriers: “top management recognition of the strategic importance of managing carbon risk is essential to identifying...opportunities” and “it takes significant top-down support with bottom-up passion, time and money to create a truly game-changing product.”

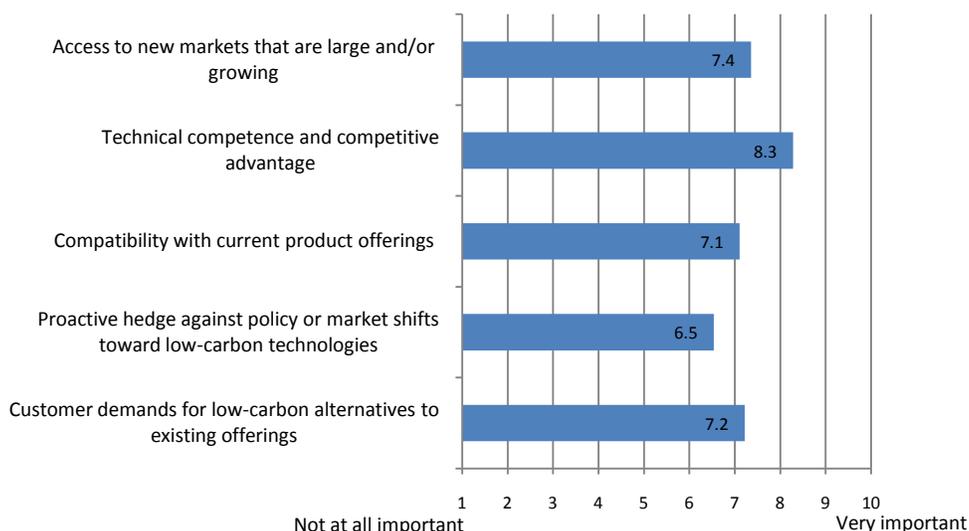
¹³ The term Design for Sustainability (DfS) indicates that considerations for environmental or social impacts across the life of a product are included in its design. DfS considerations, relative to alternatives, aim to be less harmful, more sustainable or better for people and the environment.

Lessons learned relate to	Frequency	Percent
Inter-department communication or corporate culture gaps need addressing	3	27.3%
Need for top management support	2	18.2%
Need for good partners (companies, government, stakeholders)	2	18.2%
Need an understanding of dynamic markets and technologies	2	18.2%
Need for policy certainty	1	9.1%
Need for better accounting methods for GHGs emissions and reductions	1	9.1%

The need for strong partners was also cited as an important lesson learned from successes, especially partners that can bring competencies that the company does not have. Companies also noted learning that “first movers pay [a] penalty” and a respondent highlighted that you need to “know your market...and keep a good eye on disruptive technologies that can change the whole game.”

Respondents were also asked to reflect on how their company selects low-carbon innovations to pursue by rating the importance of five possible factors.¹⁴ All of the factors were considered important or very important (with a minimum rank of 6.2) (Fig. 13). A few respondents highlighted other factors as important including the product’s affordability, the demands of the overall technical solution (i.e., supporting infrastructure) and whether the solution would be cost effective and competitive under a carbon price.

Figure 13. Relative Importance of Factors in Selecting Low-Carbon Innovations to Pursue



Respondents were then asked three follow-up questions about their corporate low-carbon innovation strategies. First, of the low-carbon innovations currently being pursued, an average 69.6% of new product lines originated internally within the company and an average 33.2% came about externally through acquisitions, corporate venture capital, and/or joint ventures.¹⁵ Further, many more respondents indicated that their company’s low-carbon innovation strategy is primarily market-driven than technology-driven: 91.3% develop new technologies to serve particular markets while only 8.7% (2 respondents) find they develop a technology first and then look for markets to apply it to.¹⁶ These two respondents are both consumer-branded companies. Finally, most companies (88.9%) reported

¹⁴ This question was not asked of the banking/financial services sector.

¹⁵ This question was not asked either of the banking/financial services or the electric power sectors.

¹⁶ This question was not asked of the electric power sector.

that their low-carbon innovation strategy primarily seeks to develop products that serve existing markets versus 11.1% (2 respondents) reporting that their strategy primarily seeks to enter into new markets.¹⁷ These two respondents are in the manufacturing and in the industrial goods industries.

Respondents were also asked to share their views on the most significant setbacks in their company’s pursuit¹⁸ of low-carbon innovations and the lessons learned from these setbacks (**Tables 8 and 9**). Again reflecting responses to questions earlier in the survey, the top two most-cited setbacks relate to (a) uncertain customer acceptance, and (b) a lack of regulatory support, for example in the form of establishing a carbon price or maintaining long-term energy policies and incentives. As one large manufacturer summarized it: “Lack of regulatory adoption has threatened schedules for commercialization and investment” in low-carbon innovations. Specifically for a utility, the greatest setback was an inability to get rate recovery for investments in low-carbon innovations.

Table 8		
Setbacks relate to	Frequency	Percent
Lack of regulatory support	13	43.3%
Lack of or uncertain customer or market demand	11	36.7%
Tight capital / trade-offs with other priorities	2	6.7%
Change of internal champion in senior management	1	3.3%
Technical setbacks	1	3.3%

Over one-third of responses indicated customer expectations as a barrier to commercializing new technologies which must “deliver considerable cost benefits through energy/resources savings at the same time” as addressing carbon emissions. A metals and minerals company succinctly stated that there is “strong preferencing of readily available, highly reliable, readily maintainable technologies over alternatives with additional technological risk.” An industrial goods company noted that “customers specify one thing and then base their purchasing decisions on other criteria, primarily cost or performance metrics.”

Other responses—primarily from manufacturers—highlighted that aligning the timing of product development with that of the relevant market is a difficult challenge: the “timing of development” is uncertain and, in turn, a setback can be experienced when “markets develop slower than forecast.” Another manufacturer noted that “customers sometimes expect shorter paybacks for efficiency/clean energy investments than other investments.”

The lessons learned from these setbacks primarily relate to the need to better understand or anticipate short- and long-term policy expectations and different political scenarios. According to one respondent, “the potential and perceived value of new energy technologies can change quickly, and is significantly impacted by domestic and global public policy.” While “government policy is often not sufficient to create market demand...its absence can definitely stifle demand.” And being “too far ahead” of anticipated public policy actions can significantly reduce the value of your investments: it is “good to be a leader but sometimes you can move too early.”

¹⁷ This question was not asked either of the banking/financial services or the electric power sectors.

¹⁸ For the banking/financial services sector this question was modified to read “that you have observed investing in” rather than “pursuit.”

Table 9		
Lessons learned relate to	Frequency	Percent
Risks associated with political scenarios or policy expectations	13	72.2%
Challenging length of development and investment time horizons	3	16.7%
Challenging project economics and IRR	1	5.5%
The need for top management support	1	5.5%

Another company noted that “new technologies require time and often financial support to reduce risk to the point where decision-makers are comfortable to select them.” And another highlighted that “this [subject] is a long-term issue that requires a patient and extended outlook, approach, and commitment.”

Conclusion and Project Next Steps

This survey shed light on business strategies and activities in low-carbon innovation, with a particular focus on how companies perceive the associated risks and uncertainties. While the survey was deliberately aimed at companies known to be active in business innovation and climate policy, it produced responses that help articulate a few elements for success in low-carbon innovation. These include:

- ⇒ Recognizing that low-carbon innovations are an increasingly important factor for business and economic growth over the next decade
- ⇒ Setting a clear direction and commitment from top management
- ⇒ Considering customer adoption concerns early in the innovation process to focus on both carbon and non-carbon performance improvements and cost concerns

This survey is one element of a broader Center study on the most effective methods used by companies today to develop and bring low-carbon technologies and solutions to market. The aggregated results will be combined with insights from three workshops and a set of four in-depth case studies in a report to be published in October 2011.